



The Metropolitan Transportation Authority

**NEW YORK CITY TRANSIT
Materiel Department**

NEW FARE PAYMENT SYSTEM

CONTRACT A-34024

TECHNICAL SPECIFICATIONS

Technical Specifications for the MTA's New Fare Payment System

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INTRODUCTION

These Technical Specifications contain the functional requirements of the Metropolitan Transportation Authority, New York City Transit (NYCT), MTA Bus Company, Manhattan and Bronx Surface Transit Operating Authority (MaBSTOA), Staten Island Rapid Transit Operating Authority (SIRTOA), Metro-North Railroad (MNR), and Long Island Rail Road (LIRR) (collectively, the “**NFPS Agencies**”) for their planned New Fare Payment System (NFPS). A functional approach was chosen to allow maximum flexibility in the design of a next-generation payment system best suited to the needs of the NFPS Agencies and their customers. Design is envisioned as an iterative and phased process that will enable the NFPS to scale over time and better meet customer expectations at time of deployment, rather than those expectations when these Technical Specifications are issued. Further, the NFPS Agencies expect the System Integrator (SI) to suggest innovative methods for implementing the NFPS. Simultaneously, the NFPS Agencies also expect support from the broader payments and retail industries to maximize the opportunity for convergence.

These Technical Specifications have also been organized around a set of core principles fundamental to the NFPS Agencies’ vision. The NFPS Agencies envision an innovative payment solution that is based on well-established payment practices using Open Architecture, Open Standards and Open Payments.

The NFPS must deliver the following features for the NFPS Agencies and their customers:

- Provide an innovative broad range of convenient payment and service options for customers
- Offer the best value to the NFPS Agencies
- Be highly available, scalable, robust and secure
- Contain state of the art risk management, data collection and reporting capabilities

These themes of expanded customer convenience, security and accessibility, combined with a service-proven system that reduces cost and infrastructure, form the basis of the NFPS Agencies’ vision for the NFPS. Software and Hardware design shall build-upon the MTA’s tradition of design excellence, and provide a world-class experience to customers.

Best-in-class Architecture

An Open Architecture design will allow procurement and operational flexibility with reduced risk through a strong preference for Commercial-Off-The-Shelf (COTS) components, applications, and systems wherever possible, and published system interfaces that allow for the integration of new equipment and suppliers in a seamless and cost-effective manner. The NFPS Agencies recognize that vendor innovation requires a certain amount of proprietary technology; however such technology shall be utilized only when necessary and not in ways that will limit the MTA Group’s ability over time to maintain and make system changes to a modern electronic fare payment system in a cost-effective manner.

The NFPS Agencies recognize the value of leveraging industry expertise regarding retail payments and security, and believes that approaches utilizing industry-proven solutions are an important aspect of meeting the robust payments needs of the NFPS Agencies. The NFPS shall also be based on industry standards, and allow for multiple suppliers, to the extent feasible, so that the NFPS Agencies can realize lower ownership (purchasing, operating, and maintenance) costs.

An important aspect of the Open Architecture design for the NFPS Agencies will be the potential ability to support the Business Rules of each of the NFPS Agencies and multiple regional transit providers with independent configurations and settlements, and the ability to make system changes (based on business needs or technology advances) incrementally and in a cost-effective manner.

The NFPS Agencies are committed to providing customers choice in the Media used to access the transit system and allow for additional options (emerging technologies) to be added with relative ease and without a major rework to the core system.

The NFPS must also include cost-effective means to manage risk of processing payment transactions in the transportation environment; such means shall carefully balance customer experience (e.g., throughput), revenue protection, and system reliability and security, leveraging architectures and applications proven in the retail payments space where appropriate. Robust back-end reporting capabilities should support the NFPS Agencies' role in North America as both the largest transportation network and a top-tier retail payments merchant.

Open Payments Commitment

Although the NFPS Agencies recognize the likelihood of ultimately providing NFPS Agency-issued Extended-Use Media and Limited-Use Media to be able to serve all customers, a primary objective of the NFPS will be to enable customers to pay fares using a range of open payment devices, such as Contactless Bank Cards and smartphones. The focus on a "bring your own infrastructure" approach to fare payments will allow customers to benefit from the convenience and security of payment technology advancements, while reducing the NFPS Agencies' costs associated with production and distribution of Smart Cards. In part as a mitigation strategy for lack of sufficient payments industry support for cost-effective, secure and convenient means to use bank Media in transit and rail, the NFPS Agencies envision the ability for robust mobile payments using NFPS Agency-issued payment credentials. Mobile applications, providing payments and other non-payments capabilities, must be deployed to offer a modern travel experience at time of implementation, not of at initial contract award.

Diverse Sales Channels

The NFPS Agencies will also expand sales and service channels, where possible, to make them more convenient and accessible. These expanded channels, which include web, mobile, interactive voice response as well as call center and customer service support, and a comprehensive integrated retail network will provide customers maximum flexibility and access to Fare Products and account management. The NFPS Agencies require a best-in-class digital experience (mobile and web) for their customers. This includes supporting a "One Transportation Agency" experience when using the NFPS Agencies' diverse transportation options as well as those of other providers in the region.

Retail Experience for Customers

Changing customer behaviors to significantly push sales out of the system is an essential component of the NFPS Agencies' plans. The projected minimum Hardware quantities for vending machines in these Technical Specifications should be considered as a necessity for procurement and planning purposes. The NFPS Agencies prefer to reduce in-station sales infrastructure as much as possible and focus on customer-friendly approaches to dramatically expand out-of-system sales. Without robust out-of-system sales the foundational goals of the NFPS cannot be achieved. The NFPS Agencies also must provide for convenient, cost-effective choices for customers seeking to pay with cash. It is essential that the NFPS provide broad support for all of the NFPS Agencies' customer segments and that no customer groups are left behind in the transition to the NFPS. The retail network must significantly expand and improve upon the current retail experience, and focus on innovative, holistic approaches to meet overall NFPS goals as reflected in the functional requirements of these Technical Specifications.

Transition that Makes Sense

Changing customer behavior towards usage of Open Payment Media and out-of-system sales and service is critical to the project's success, and the NFPS Agencies have determined that a phased,

progressive go-live (PGL) approach is the best way to achieve this. This approach will provide the NFPS Agencies with the ability to evaluate NFPS performance at each stage, gradually build the skill sets needed to support the NFPS, gauge customer acceptance in order to make adjustments, and gradually shift customers to use of the NFPS.

Further, once ultimately decided on the need, deploying Vending Machines at the tail end of the phased implementation and transition is intended to allow for a delayed design process that also enables the NFPS Agencies, and the SI, to make an informed decision on the necessary level and feature set of in-station sales devices. A phased transition will allow customers to rely on the well-established Legacy Equipment while introducing and incentivizing the expanded functionality of the NFPS. As an example, introducing Open Payments first will help to migrate customers to preferred payment options in advance of offering new NFPS Agency-issued Media. This initial transition to open payments acceptance shall not only allow for continued existing Legacy Media acceptance but also occur without the need to integrate to Legacy Equipment. While it is envisioned that the Legacy Equipment will operate side-by-side with the NFPS throughout the customer transition period, the NFPS Agencies are not requiring the SI to operate or maintain the Legacy Equipment.

The NFPS Agencies will continue to explore means to accomplish this even potentially before broader NFPS deployment.

CHAPTER 1: PROJECT FOUNDATION

1 Acronyms & Abbreviations

The following acronyms and abbreviations may appear in these Technical Specifications:

AC – Assistant Conductor	CSC – Contactless Smart Card
ACH – Automated Clearing House	CSS – Central Support System
ACI – ACI Worldwide, Inc.	CVM – Configurable Vending Machine
ADA – Americans with Disabilities Act of 1990	CSC – Card Security Code
ADAAG – ADA Accessibility Guidelines	DC – Depot Computer
AFC – Automated Fare Collection	DCU – Driver Control Unit
AGS – Ethernet Aggregation Switches	DDA – Dynamic Data Authentication
AN – Access Node	DIB – Design Information Bulletin
ANSI – American National Standards Institute	DMS – Device Monitoring System
API – Application Programming Interface	DPM – Deputy Project Manager
AR – Accounts Receivable	DSU – Data Service Unit
ATM – Automated Teller Machine	EAMS – Enterprise Asset Management System
ATP – Account-Based Transaction Processor	EBT – Electronic Benefit Transfer
BAMS – Bank of America Merchant Services	EC - End Cabinet
B2B – Business-to-Business	ECR – Engineering Change Request
BLE – Bluetooth Low Energy	ECU – Electronic Control Unit
BU – Beneficial Use	EMI – Electromagnetic Interference
BV – Bus Validator	EMV – Europay, MasterCard, Visa
BRS – Bus Radio System	EPROM – Erasable Programmable Read Only Memory
CAD – Computer-Aided Design	ESN – Electronic Serial Number
CAD/AVL – Computer-aided Dispatch/Automatic Vehicle Location System	EU – Extended Use (Media)
CCTV – Closed-Circuit Television	EV – Earned Value
CDA – Combined Data Authentication	EVM – Earned Value Management
CDR – Conceptual Design Review	FAI – First Article Inspection
CDRL – Contract Data Requirements List	FAT – Factory Acceptance Testing
CEM – Communications Expansion Module	FPB – FCALAN PullBox
CFC – Coin Fare Collector	FCA – Fare Control Area
CIC – Customer Information Center	FCALAN – Fare Control Area Local Area Network
COTS – Commercial-off-the-Shelf	FCSS – Financial Clearing and Settlement System
CPM – Capital Program Management	FDR – Final Design Review
CRF – Consolidated Revenue Facility	FIT – Factory Integration Testing
CRM – Customer Relationship Management System	FMI – Field Modification Instructions
	FMTAC – First Mutual Transportation Assurance

Company

FON – Fiber Optic Network

FTA – United States Department of Transportation, Federal Transit Administration

GCT – Grand Central Terminal

GUI – Graphical User Interface

HEET – High Entry Exit Turnstile

HPEM – High Production Encoding Machine

ICD – Interface Control Document

IEEE – Institute of Electrical and Electronics Engineers

IFU – Integrated Farebox Unit

IIN – Issuer Identification Number

IMCS – Incident Management System

IMEI – International Mobile Equipment Identity

iOS – Operating System for Apple products

IP – Internet Protocol

IRS – Internal Revenue Service (US)

ISO – International Standards Organization

IVN – Intelligent Vehicle Network

IVR – Interactive Voice Response system

KPI – Key Performance Indicator

LAN – Local Area Network

LCD – Liquid Crystal Display

LCM – Lifecycle Maintenance

LIRR – Long Island Rail Road

LLRC – Lowest-Level Replaceable Component

LLRU – Lowest-Level Replaceable Unit

LRU – Line Replaceable Unit

LU – Limited-Use (Media)

LU-R – Limited Use-Roll

LU-S – Limited Use-Stacker

MaBSTOA – Manhattan and Bronx Surface Transit Operating Authority

Magstripe – Magnetic Stripe

MCBF – Mean Cycles Between Failures

MCR – MetroCard Reader

MDM – Mobile Device Management

MEID – Mobile Equipment Identifier

MEM – MetroCard Express Machine

MFC – MetroCard Fare Collector

MIFARE – Widespread Contactless chip family

MIL – Master Issues List

MIL-STD – U.S. Military Standard

MMS – Maintenance Management System

MNR – Metro North Railroad

MOW – Maintenance of Way

MS – Microsoft

MSD – Magnetic Stripe Data

MTA – Metropolitan Transportation Authority (NY)

MTACC – MTA Capital Construction Company

MTA/IT – Consolidated MTA Information Technology Department

MVM – MetroCard Vending Machine

M/WBE – Minority/Women's Owned Business Enterprise

NEC – National Electric Code

NFC – Near Field Communication

NFPS – New Fare Payment System

NIST – National Institute of Standards and Technology

NJT – New Jersey Transit

NRE – Non-Recurring Engineering

NTP – Notice to Proceed

NYC – New York City

NYCT – New York City Transit Authority

OBTIM – Onboard Ticket Issue Machine

OEM – Original Equipment Manufacturer

OSVD – Onboard Sales and Validation Device

PAN – Primary Account Number

PAYGO – Pay As You Go

P2PE – Point-to-Point Encryption

PC – Personal Computer

PCI – Payment Card Industry

PDF – Portable Document Format

PDR – Preliminary Design Review

PGL – Progressive Go Live

PIC – Photo Identification Card System

PII – Personally Identifiable Information

PIO – Public Information Office
 PM – Preventative Maintenance
 PMBOK – Project Management Book of Knowledge
 POP – Proof of Payment
 POS – Point of Sale system
 PRAS – Passenger Revenue Accounting System
 PSLAN – Passenger Station LAN
 PV – Planned Value
 QA – Quality Assurance
 QSA – Qualified Security Assessor
 RCC – Rail Control Center
 RFI – Radio Frequency Interference
 RFID – Radio Frequency Identification
 SAE – Society of Automotive Engineers
 SAM – Secure Access Modules
 SAS – Statement on Auditing Standards
 SBS – Select Bus Service
 SCCW – Smart Card Certification Workstation
 SG – Service Gate
 SI – System Integrator
 SIRTOA – Staten Island Rapid Transit Operating Authority
 SIT – System Integration Testing
 SLA – Service Level Agreement
 SMS – Short Message Service
 SNM – Station Network Module
 SOC – Service Organizational Control
 SONET – Synchronous Optical Network
 SQL – Structured Query Language
 SRED – Secure Reading and Exchange of Data
 SRT – Single Ride Ticket
 SSAE – Statements of Standards for Attestation Engagements
 SSL – Secure Socket Layer
 STIM – Station Ticket Issue Machine
 SV – Subway Validator
 TBE – Token Booth Equipment
 TBT – Token Booth Terminal
 TCH – Transit Control Head

TDEA – Triple Data Encryption Algorithm
 TIM – Ticket Issue Machine
 TLS – Transport Layer Security
 TOM – Ticket Office Machine
 TS – Turnstile
 TSM – Ticket Selling Machine
 TTY – Teletypewriter
 TVM – Ticket Vending Machine
 UID – Unique Identification Number
 UL – Underwriter Laboratories
 UPS – Uninterrupted Power Supply
 USB – Universal Serial Bus
 VEP – Value Engineering Proposal
 VLU – Vehicle Logic Unit
 VPN – Virtual Private Network
 VRF – Virtual Routing and Forwarding
 WAN – Wide Area Network
 WBS – Work Breakdown Structure
 Wi-Fi – Wireless LAN
 WVM – Wayside Validator Machine

2 Glossary

A set of defined terms is included as Appendix 1 (Definitions) to these Technical Specifications. Additional terms are defined in context.

3 Existing System Description

The NFPS will eventually replace New York City Transit's (NYCT's) current MetroCard System, which has been in place since 1994, as well as Metro-North Railroad (MNR) and Long Island Rail Road's (LIRR's) current ticket sales and fare collection systems, which have both been in place since 2001.

The current features and functions of the systems in place at the NFPS Agencies are detailed in this Technical Specifications Section 3 (Existing System Description) to provide an operating context for the NFPS.

3.1 New York City Transit

The MetroCard is accepted for fare payment on NYCT subway and bus services, Staten Island Railway, and Metropolitan Transportation Authority Bus services, as well as MetroCard Affiliates. It is critical to maintain and enhance the fare collection functions provided by the MetroCard System. The features and functions of the MetroCard System are detailed below to provide an operating context for the NFPS, and illustrate the scale and scope of the current MetroCard System.

While some of the MetroCard System can be leveraged in providing the NFPS, it is important to note that the MetroCard System is a proprietary Cubic system that is becoming increasingly difficult to maintain.



3.1.1 Description of Current System

NYCT currently operates a closed-loop magnetic stripe (magstripe) system for fare payment, using the 10 mil polyester MetroCard shown above. The MetroCard can provide stored value (pay-per-ride) and period pass (7-day or 30-day, unlimited ride) functionality, all of which are pre-funded by the customer at purchase or reload. The Fare Products are activated through magstripe read/write technology at a swipe read/write block or a transport unit, which have been incorporated into various devices across the MetroCard System. The existing MetroCard System equipment counts and the field offices in charge of each are detailed below in Table 3.1 (Subway MetroCard System Equipment Counts) for the NYCT subway.

Table 3.1: Subway MetroCard System Equipment Counts¹

Field Office	AG-E	AG-X	CFC	EC	HEET	MCR	MEM	MFC	MVM	SG	TBT	TS	Total
Atlantic Ave	75	75	36	257	179	275	147	70	519	523	211	908	3,275
Fordham Rd	37	37	89	128	45	137	82	1827	276	246	110	525	1,894
14 th St	68	66	48	262	242	292	240	94	632	477	135	1,429	3,985
74 th St	28	28	13	86	109	112	86	21	226	194	166	453	1,522
Total	208	206	186	732	575	816	555	367	1,653	1,440	522	3,315	10,676

Note: AG-E – AutoGate – Entry, AG-X – AutoGate-Exit, CFC – Coin Fare Collector, EC – End Cabinet, HEET

¹ May 8, 2014 Equipment Counts

– High Entry Exit Turnstile, MCR – MetroCard Reader, MEM – MetroCard Express Machine, MFC – MetroCard Fare Collector, MVM – MetroCard Vending Machine, SG – Service Gate, TBT – Token Booth Equipment, TS – Turnstile

Subway customers use the MetroCard at a reader mounted on top of the turnstile or in front of a HEET, or at a transport unit in an ADA AutoGate device at a gate which deducts value and/or notes the time of the transaction (depending on the product type on the card). A paper non-serialized Single Ride Ticket with a magnetic stripe, good for two hours, can also be vended at subway stations for a single entry into the transit system. There are 469 subway stations, with 989 entry/exit points in the NYCT subway system. With the equipment counts above, the MetroCard System has an average of two vending machines (MetroCard Vending Machines, MVM, and MetroCard Express Machines, MEM) per fare control area and one full-time agent booth per station.

On a bus, customers have the choice of using MetroCards or paying in coins with exact change, or a combination of both. The on-board farebox, called the Integrated Farebox Unit (IFU), will deduct the appropriate fare from a MetroCard or note the time for Fare Products. There are approximately 5,700 IFUs in operation currently at NYCT and MTA Bus Company. A paper non-serialized transfer with a magnetic stripe is issued from the IFU for bus-to-bus transfers upon request when paying in cash. Select Bus Service is a service offered on certain highly-traveled routes. It is designed to reduce travel time by allowing passengers to pay fares using wayside machines on most routes prior to boarding using either MetroCard or coins and allowing all-door boarding. These machines provide a paper receipt as proof of payment which may be inspected upon request by the Eagle Team. MetroCards are not accepted on paratransit vehicles.

MetroCards are also used to provide non-revenue access, i.e., security access, to NYCT employees, contractors, police, fire and district attorney staff. When a MetroCard is issued, it can be programmed to provide various types of access. The vast majority of MetroCards are refillable. Notable exceptions, include, but are not limited to: EasyPay, One- and Two-trip, Premium TransitChek, Joint Commuter Rail ticket with an Unlimited Monthly MetroCard Pass, Reduced Fare Round Trip MetroCards, security access, employee passes and school passes.

LIRR and MNR support sales of a joint MetroCard ticket, with a commuter rail commutation pass printed on the back of a triplex² MetroCard.

The MetroCard System primarily uses Card-Based Media, with the Fare Products stored on the card itself. The EasyPay Program is the only component of the MetroCard System that is Account-Based. This program is one of many Special Programs offered by NYCT for fare payments and security access, described in detail in these Technical Specifications.

High Production Encoding Machines are used for the encoding, verifying, printing and stacking of MetroCards. Each MetroCard is assigned an eight-digit batch number and a unique, permanent ten-digit serial number when it is encoded. The Fare Product purchased is directly written onto magstripe and, when value is deducted on use, the reader writes the new value on the magstripe.

Each MetroCard's transaction history is held centrally in a mainframe computer called the Area Controller. All data tied to MetroCard usage and sales and credit/debit authorization requests are transmitted via a station controller which stores the information locally if communications are not available, in batched transmissions at timed intervals from vending machines, station booth terminal or

² Triplex refers to the specialty ticket stock used for the joint MetroCard and commuter rail tickets, which are comprised of a layer of plastic between two layers of paper. This format was devised for these products to conform to the same dimensions as the polyester MetroCards while allowing for printing of the commuter rail tickets directly onto the stock.

turnstiles. Several key data components have higher priorities in the MetroCard System and are uploaded as soon as they arrive. These include authorization requests associated with credit/debit sales at vending machines and the backend portion of the MetroCard System that tracks credit/debit confirmations. Device maintenance messages are also prioritized for transmission to the MetroCard System.

Since transactions are processed locally at the subway turnstile or IFU, whenever the MetroCard is swiped for entry to the subway or dipped for entry on to a bus the value of the MetroCard is read and the new value is written, but swiped or dipped cards are not validated in real-time against the central database. Several functions are performed at the individual readers, including risk management via storage of a Negative List, MetroCard authorization, application of fare rules (e.g., recognizing transfers, unlimited ride passes), additions of value or time and reduction of a value-based card's available balance.

3.1.2 Operational Environment

Front-End MetroCard System equipment operates in a number of different environments.

3.1.2.1 Subway

The fare control area of each station contains a fare array, including a combination of Faregates. Each fare array includes at least one end cabinet that houses the station controller and communications equipment and has an internal heater to protect from extreme cold. These arrays are generally near the station entrance underground or in a building structure for above-ground stations. Vending machines, MVMs and MEMs are generally positioned near the fare arrays and have internal heaters to protect them from extreme cold. In each staffed station booth there is also a Token Booth Terminal (TBT) that allows the station agent to sell, reload, trade/combine or provide information on Media to customers. This piece of equipment is located in the station booth, which is temperature controlled.

Equipment in stations is protected from precipitation, but not from extreme heat. Equipment may be subject to power washes depending on their location in the transit system. Fare collection equipment is subject to periodic vandalism in stations. The most common vandalism is jamming the bill acceptor unit on MVMs in order to "sell" swipes into the transit system to customers who would otherwise have refilled their Media.

Underground stations contain significant quantities of steel dust generated by the braking of subway cars. While power sufficiency is rarely a problem at stations (above or below ground) the power is often not clean enough for sensitive electronic equipment. All current MetroCard System entry and sales devices have inline input voltage filters that condition input power. End cabinets and MVMs have an internal UPS that further conditions input power. Network communication equipment, such as switches and routers, is located in communication rooms in stations as well as throughout the station. This will include network access nodes (switches) that are located in fare control areas as well as along platforms in ruggedized enclosures. Often these rooms are extremely hot and they are subject to the same environmental conditions as the rest of the station, including steel dust.

3.1.2.2 Bus

The IFU is located near the front door of buses for ease of passenger loading. Fare collection equipment on the bus is subject to more environmental variability than rail equipment, as on-board temperatures vary and extreme physical shocks and vibrations occur while en-route.

SBS routes are a unique service within NYCT which allow for off-board fare payment and validation on most routes. SBS is a discrete service with limited routes. However, NYCT expects to expand SBS service

to additional routes in the near future. SBS stops utilize two separate devices placed on sidewalks:

- A MetroCard Fare Collector to read/write (deduct), verify and issue receipts for MetroCard fare payment or pass validation.
- A Coin Fare Collector machine to accept payment in coins. These units are solar and do not require AC power. These Parkeon machines are not connected to the MetroCard System network.

Both devices print a receipt for Proof of Payment purposes on the buses, which are randomly inspected by fare enforcement officers on the Eagle Team. The MFC devices used for SBS services communicate via a Verizon cellular connection to an SBS Controller. SBS fare collection equipment is typically exposed to the elements or may be located under a bus shelter. Nonetheless, all equipment is still subjected to all of New York City's weather conditions although MFCs have internal heaters to protect against extreme cold, and supplying dependable AC power to the MFCs on the streets can be a challenge. Equipment is also subject to periodic vandalism in addition to damage related to traffic accidents and extreme weather events.

3.1.3 Fare Technology and Fare Policy Overview

This Technical Specifications Section 3.1.3(Fare Technology and Fare Policy Overview) provides a summary description of important fare technology and policy. The NYCT Tariff, or Local Rates of Fare and Regulations Governing the Furnishing of Passenger Transportation on Regular Scheduled Service is included as reference in Appendix A for a full record of MetroCard Affiliates products and services.

MetroCard System technology can support 126 fare codes which differentiate between Fare Products within the MetroCard System. Although not all fare codes can be used for Fare Products, currently, 93 fare codes are either in use or are reserved for future use and 33 are not used. The MetroCard System provides a high degree of flexibility in Fare Products but may require Software and hardware modifications to support distance-based or time-of-day based fare payments. Currently, NYCT can do peak-period pricing where the peak period can be configured by station for each first half and/or second half of each hour. It should also be noted that the Public Authorities law prohibits NYCT from charging distance-based fares, though affiliates and potential regional partners are not subject to the same restriction.

The MetroCard System also supports a variety of Special Programs, including an Account-Based Autoload feature and a reduced fare program for senior citizens and persons with qualifying disabilities. Other fare programs for students and groups are also available. In addition to the Standard Gold full fare MetroCard, there are many variations in cards for the range of Special Programs. The MTA MetroCard Guide contains photos and descriptions of each, and is included in Appendix B.

3.1.3.1 Fare Products

MetroCard accommodates the NYCT fare structure which is based on a flat fare per ride. Free transfers are supported for most subway/bus and bus/bus linked trips, as long as the same MetroCard is used within two hours of the initial swipe/dip. Transfers that require a step-up fare to be paid, based on different fare pricing, are also supported on MetroCard. Customers also have the option to pay with coins on NYCT and MTA buses in which case they receive a paper non-serialized transfer with a magnetic stripe upon request, currently valid for bus-to-bus transfers only.

MetroCards can be purchased as either value-based (pay-per-ride) or time-based (unlimited ride period passes). NYCT customers choose between two time-based fares, 7-day and 30-day Unlimited Rides. Customers also have eleven percent bonus value added to their card if they load more than \$5.50 in stored value for the pay-per-ride option.

NYCT has two standard fares for a single ride – one for subway, local bus and SBS buses and another for express buses. The express bus fare is higher, which means that the time-based Fare Product for express buses (7-Day Express Bus Plus) costs more than those that are accepted on local services only. Currently, the fare for a subway or local bus ride is \$2.75; a \$0.25 surcharge applies when a single ride is purchased at the MVM. The fare for an express bus ride is \$6.50. If a passenger qualifies for reduced fare, that passenger travels for half the standard fare. Up to three children 44 inches tall and under ride for free on subways and local buses when accompanied by a fare paying adult. Infants (under two years of age) ride express buses free if the child sits on the lap of the accompanying adult. A \$1.00 Green Fee for the purchase of a new MetroCard from an in-station MVM, MEM or station booth went into effect March 3, 2013. By refilling and reusing a current MetroCard or purchasing a Fare Product through a Retail Merchant or Transit Benefits provider, passengers can avoid this additional fee.

Following purchase, MetroCards can be reloaded with either type of Fare Product, and MetroCards can hold both types concurrently. Time-based Fare Products will always be used first for paying a fare and only one time-based Fare Product can be active on a MetroCard at a time. Refills are activated on the first swipe only after the current Unlimited Ride period ends. On PATH, AirTrain and Express buses, a MetroCard with both time and value will deduct the value-based portion of the MetroCard (as these services do not accept 7- and 30-Day Unlimited Ride MetroCards). Ride-based MetroCards are also possible and used by AirTrain.

Buying pay-per-ride in bulk or time based cards provides a discount to riders. NYCT charges an additional 25 cents per ride when a passenger buys an SRT.

Most MetroCard Affiliates accept MetroCards containing the Fare Products described above. In addition, there are unique Fare Products for affiliates, including an AirTrain 10-Trip and PATH 2-Trip. However, other Fare Products are offered to provide interoperability with some other regional transportation agencies:

- Joint monthly Long Island Rail Road (LIRR) pass and calendar-based Unlimited Ride MetroCard, and value-based joint MetroCard option via Mail&Ride. In addition, value-based joint ticket options from Ticket Vending Machines and Ticket Office Machines.
- Joint monthly Metro North Railroad (MNR) pass and calendar-based Unlimited Ride MetroCard, and value-based joint MetroCard option via Mail&Ride. In addition, value-based joint ticket options from Ticket Vending Machines and Ticket Office Machines.
- Joint ticket for combined LIRR/JFK fare for the Port Authority's AirTrain System.
- UniTickets are also offered by both commuter railroads to allow for transfers with connecting services. These tickets are visually validated on certain buses and include:
 - LIRR UniTicket for transfers to certain buses in the NICE, Long Beach, NYCT and MTA bus systems.
 - MNR UniTicket for transfers with nearly 20 connecting transportation services.
- 30-Day AirTrain Unlimited Ride MetroCard

The commuter railroads, LIRR and MNR, both operate under zone-based fare structures for their Fare Products.

3.1.3.2 Validity/Refunds

MetroCards produced at HPEM are valid for 15 months and will physically expire on the expiration date printed on the MetroCard. The MVM will inform a customer when the MetroCard expiration date is coming up, and will issue a new MetroCard at no charge with all of the customer's current Fare Products encoded on the new MetroCard within one month (31 or 32 days) of its expiration or less than one year (366 days) after the MetroCard has expired. Damaged MetroCards are also replaced with no fee.

MetroCards can be redeemed for up to two years of time after the expiration on the MetroCard. MetroCards with value expired less than one year can have their funds transferred to a new MetroCard at a station booth or after that time by sending the card to MetroCard Customer Claims.

NYCT provides a Balance Protection Program for its 30-Day Unlimited Ride and a 7-Day Express Bus Plus MetroCards. The program protects customers from loss or theft of the MetroCard as long as the purchase or most recent refill was made with a credit or debit card at an MVM or MEM. Lost or stolen 7-Day and 30-Day Express Bus Plus MetroCards purchased with bank cards can be canceled and the remaining portion of the MetroCard refunded. Such refunds can be requested twice a year. The first time the transaction is free, the second time the transaction costs \$5.

3.1.3.3 Special Programs

In addition to the standard Fare Products described above, the Metro Card System supports a variety of Special Programs, described below.

3.1.3.3.1 Reduced Fare Program

Discounted fares are available to seniors (over 65 years of age) and persons with qualifying disabilities on NYCT at all times for all types of fares. Reduced fares are half the full fare. Customers can apply for the program through the mail or in-person at the Customer Service Center or the Mobile Sales Unit. If a customer qualifies, they receive a MetroCard with a photo ID included on the MetroCard.

3.1.3.3.2 EasyPay Program

The EasyPay Program is an Autoload program initially implemented for reduced fare customers only. Currently both reduced fare and full fare customers can enroll and receive an EasyPay-branded MetroCard, pictured at right for both reduced and full fare customers.

EasyPay is an Account-Based System where the MetroCard is used as an identifier for an account hosted in the backend by ACS/Xerox (the program vendor). ACS/Xerox processes the payments and hosts the web portal for customers to pay and manage their account. EasyPay MetroCards transactions are unique in the method used during a swipe therefore value cannot be added at the station equipment without destroying the link between the MetroCard and the account.

For full fare customers using pay-per-ride on their EasyPay account, they receive the same eleven percent bonus for amounts of \$5.50 or more added which is available at vending machines. The account will then replenish automatically with \$30 when the balance falls below \$20.

For reduced fare customers the account will replenish when it falls below \$10. In addition, reduced fare pay-per-ride customers automatically have their fares capped at the same cost as a 30-Day Reduced Fare Unlimited pass. The account automatically converts to unlimited rides whenever the required number of subway and/or local bus rides has been fulfilled in a 30-day billing cycle.

Full fare EasyPay customers can also choose to Autoload a 30-Day Unlimited pass, which is activated on first use. Near the end of 30 consecutive days, the primary credit or debit card associated with the account will be charged for a new 30-Day pass. This Fare Product requires two payment options linked to the account to ensure that anyone using a transit benefits card, which may only replenish once a



month, can cover the cost of the reload. Before this happens though, the customer will be sent a notification e-mail which will also give the option to change to pay-per-ride.

3.1.3.3.3 Students

School children at eligible schools can receive a free or half-fare student Fare Product for rides on NYCT. This program is administered by the New York City Department of Education. The Department of Education is responsible for qualifying schools, distributing MetroCards and managing the bulk orders with NYCT. Currently this program provides free or half-fare Fare Products to approximately 900,000 NYC students, and distributes nearly four million student MetroCards per year.

Student MetroCards are only valid for one semester of the school year, though the timing of each school's semester varies. There are 14 types of Student MetroCards, based on the number of trips provided per day or week and the time of day that those trips are allowed. These MetroCards are pre-encoded with the various ride limitations and cannot be refilled by the student. Schools then distribute the free or half-fare Fare Products.

3.1.3.3.4 Security/Access Programs

NYCT provides MetroCards for non-revenue access to the transit system for employees and to provide free access to the transportation system and some MTA buildings. All of the following MetroCards are color coded to indicate the type of card-holder for inspection purposes:

- Employee Passes are issued to active NYCT employees and pensioned employees. They are photo ID MetroCards.
- Contractor badges are also photo ID MetroCards.
- Police, Fire and District Attorney MetroCards are issued for system access to every NYPD officer, select DA staff and each NYFD fire truck.

The photo ID MetroCards for employees are also used for timekeeping purposes, where a barcode is printed onto the MetroCard and scanned by the Kronos system. The magstripes are also used to swipe at Lenel turnstiles for entry into NY MTA facilities. Another use of employee MetroCards is that clerks use them to log-in to the TBT. Finally, employee ID are used for controlled access to keys for MVMs.

3.1.3.3.5 Other Special Programs

The Transit Benefits Annual Premium Card is a MetroCard that is paid for by automatic payroll withdrawal. The card functions like a 30-Day MetroCard but is good for a full year, eliminating the need to reload the MetroCard. The Paratransit Access-A-Ride MetroCard is a MetroCard that can be used for access to fixed route bus and subway services.

3.1.4 Sales Channels

NYCT has progressively added options for customers to purchase and reload MetroCards. Each has been rolled out to provide either a unique service or a more efficient one. MetroCards can be purchased in subway stations, at Retail Merchants, at some Customer Service locations—including vans and a bus that circulate throughout New York City and Westchester—and online via the EasyPay Program. In addition, MetroCards can be refilled at station booths and at vending machines, as well as at a Mobile Sales Unit.

In total, NYCT has a network of approximately 2,250 vending machines, over 4,000 authorized MetroCard sales/distribution points outside the subway system, and numerous Transit Benefit

providers. Each of these options is explained in more detail below and summarized in Table 3.2 (MetroCard Sales Channel Summary), with sales transactions and revenue broken down in Figures 3.1 and 3.2. Sales at MetroCard Affiliates, LIRR, and MNR are also included.

Table 3.2: MetroCard Sales Channel Summary

Channel	Fare Products Available	Functions & Payments	Location
Station Booth	<ul style="list-style-type: none"> • MetroCard: Time-based (7 & 30-Day Unlimited) & Value-based (Pay-Per-Ride w/ bonus) • 7-day Express Bus Plus • Round-trip for Seniors 	<ul style="list-style-type: none"> • Card issue & reload • Cash only accepted • Consolidation of multiple cards, replacement of damaged cards, transfer of expired card value 	All NYCT Subway Stations, Westchester County Center
MetroCard Vending Machines	<ul style="list-style-type: none"> • MetroCard: Time & value-based • Single Ride Tickets 	<ul style="list-style-type: none"> • Card issue & reload • Cash, credit/debit & EBT accepted 	All NYCT Subway Stations, Some Staten Island Rail Stations, one NICE station, PATH stations (excluding time-based MetroCards), AirTrain stations, Roosevelt Island Tram Stations, Staten Island Eltingville Transit Center
MetroCard Express Machines	<ul style="list-style-type: none"> • MetroCard: Time & value-based 	<ul style="list-style-type: none"> • Card issue & reload • Credit/debit & EBT accepted 	All NYCT Subway Stations, LaGuardia Airport station, PATH stations (excluding time-based MetroCards)
Mobile Sales (1 Bus, 3 Vans)	<ul style="list-style-type: none"> • MetroCard: Time & value-based • Reduced fare MetroCard • Temporary 90-Day MetroCard 	<ul style="list-style-type: none"> • Card issue & reload • Apply for Reduced Fare MetroCard • Cash only accepted 	Various locations scheduled
EasyPay Program	<ul style="list-style-type: none"> • EasyPay Reduced-fare: PPR with fare capping, 30-Day • Full-fare EasyPayXpress <ul style="list-style-type: none"> ○ 30-Day Unlimited only ○ PPR with 11% bonus 	<ul style="list-style-type: none"> • Card issue • <i>All Autoload</i> • Checks and ACH (no new accounts) • Credit/debit accepted 	Online
Customer Service Center	<ul style="list-style-type: none"> • Reduced fare MetroCard • Temporary 90-Day MetroCard 	<ul style="list-style-type: none"> • Card issue only (no refunds) • Apply for Reduced Fare MetroCard • No payments accepted • Resolve full fare card problems 	3 Stone Street New York, N.Y. 10004
Onboard farebox ³	<ul style="list-style-type: none"> • Singleride fare 	<ul style="list-style-type: none"> • Issue paper bus transfer • Coin only with exact fare 	On all NYCT and MTA buses
Retail Merchants	<ul style="list-style-type: none"> • Pre-encoded MetroCard: Time & value-based 	<ul style="list-style-type: none"> • Card issue only 	Over 2,000 locations
Social Services/ NYC Agencies	<ul style="list-style-type: none"> • Pre-encoded MetroCard: Time & value-based 	<ul style="list-style-type: none"> • Card issue only 	Over 2,000 locations
Transit Benefits Providers	<ul style="list-style-type: none"> • Pre-encoded MetroCard: Time & value-based 	<ul style="list-style-type: none"> • Card issue only 	Employer-based, pre-tax Programs

³ Although not a traditional sales channel, this refers to a customer's ability to pay their fare in coins at the farebox, and is maintained in the list because it is a source of fare sales revenue.

Figures 3.1 and 3.2 below show a breakdown of 2014 MetroCard transactions by category. Note that Retail Sales figures include Metro-North and Long Island Rail Road joint tickets; Transit Benefits do not include MetroCards purchased with prepaid debit cards; and the Customer Service Center does not currently perform any sales transactions.

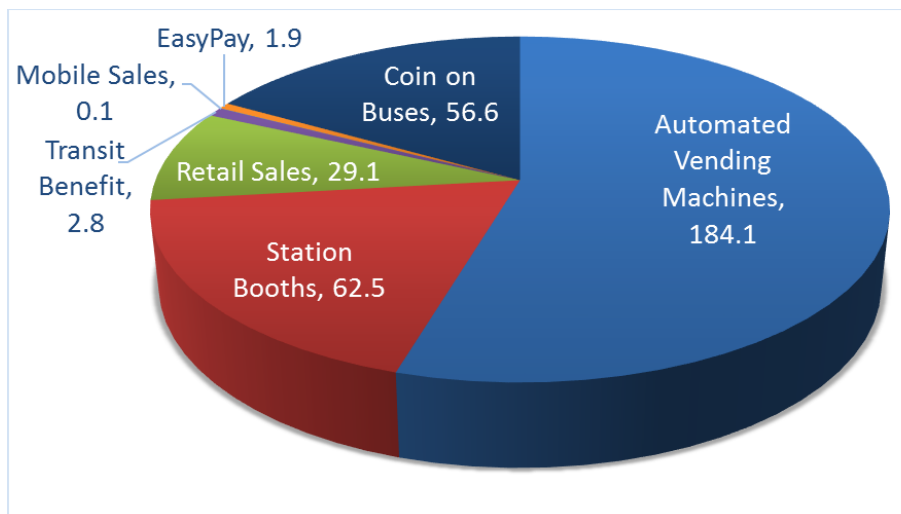


Figure 3.1: 2014 Transactions by Channel (millions)

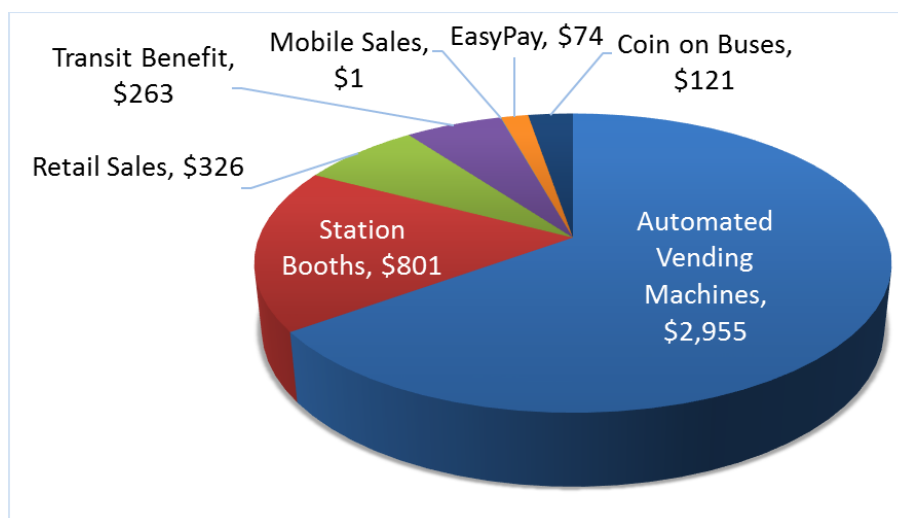


Figure 3.2: 2014 Sales Revenue by Channel (millions)

3.1.4.1 In Station

All NYCT stations currently have multiple locations for purchasing MetroCards. Other than the EasyPay program for Autoload, MetroCards can only be reloaded at vending machines and at staffed station booths.

3.1.4.1.1 Station Booths

Station booths are located in all subway stations and are staffed by station agents — all but five stations have booths that are staffed 24/7 and 14 stations have a part-time booth in addition to the 24/7 booth. All types of MetroCards are available for purchase at the booths, with the exception of student passes, SRTs, EasyPay and reduced fare MetroCards. However, reduced fare MetroCards can be refilled at booths. MetroCard value can also be transferred to a new MetroCard in the case of damage, consolidation of multiple MetroCards, or MetroCards with value expired less than one year. Currently, station booths account for about 18.5 percent of sales transactions.⁴

Station booths also offer a few unique Fare Products and services for fare payment. Senior citizens can purchase a round-trip reduced fare MetroCard only at station booths. In addition, station agents provide block tickets in the event of a service disruption. Block tickets are single-trip paper tickets that provide a means to continue a trip on other NYCT routes/services. Finally, station agents currently provide access to the transit system for group ticket holders — essentially unlocking the service gate to admit the appropriate number of people in the group.

Only cash is accepted at station booths, and agents use TBT machines to perform fare sales. To encourage customers to keep and reload their MetroCards, the MTA instituted a \$1 Green Fee for the purchase of a new MetroCard at a subway station which includes booth sales. LIRR and MNR station offices also sell certain values of pre-encoded MetroCards. Commuter rail station offices accept cash, personal checks, major credit cards, bank-issued debit cards, as well as certain Transit Benefits cards. MetroCards are also available for sale at the Westchester County Center (White Plains).

3.1.4.1.2 Automated Vending Machines

NYCT Vending Machines

Automated Vending Machines are located in all subway stations, including full-function MVMs and limited-function MEMs. MetroCards are also available at the Eltingville Transit Center (Staten Island), Hempstead Transit Center (Long Island) and LaGuardia Airport Terminals B, C, & D (Queens). All vending machines allow a customer to purchase MetroCards through a touch screen menu. Most types of full fare MetroCards can be purchased at NYCT vending machines. EasyPay MetroCards, reduced fare MetroCards and student MetroCards cannot be purchased at vending machines; though nearly all full fare and reduced fare MetroCards (with the exception of the reduced fare round trip ticket) can be refilled.

MVMs accept cash, credit/debit cards and Electronic Benefit Transfer cards for purchasing or loading value. MEMs only accept credit, debit or EBT cards. In addition, the SRT is only sold at a MVM and accounts for approximately one percent of all rides taken. Since the implementation of vending machines in stations, MVM and MEM use has steadily increased and now accounts for a majority of MetroCard sales transactions.

The aforementioned \$1 Green Fee for the purchase of a new MetroCard at a subway station also applies to new sales at vending machines.

Debit/credit card purchases account for about three-quarters of total vending machines revenue, and half of the transactions at vending machines. The average credit card sale is more than three times the average cash sale and the average debit sale is more than double the average cash sale.⁵

⁴ 2014 Annual MetroCard Sales_UL.

⁵ MetroCard Market Report, December 2013.

Commuter Rail Vending Machines

LIRR has four types of Ticket Machines that sell MetroCards at their stations:

- Gray "Tickets" machines are full-service machines, selling most LIRR ticket types and pre-valued MetroCards. The following options are available: separate \$25 MetroCard (\$1 Green Fee applies), \$5.50 MetroCard printed on the reverse side for Round Trip rail tickets and \$50 MetroCard printed on the reverse side for Monthly rail tickets. These machines accept cash as well as ATM/debit and credit cards.
- Red "Daily Tickets" machines sell One-Way and Round-Trip tickets and a separate \$25 pre-valued MetroCard (\$1 Green Fee applies) only. These machines accept cash as well as ATM/debit and credit cards.
- Blue "Tickets - Credit/Debit/ATM Cards" machines sell most LIRR ticket types and pre-valued MetroCards. The following options are available: separate \$25 MetroCard (\$1 Green Fee applies), \$5.50 MetroCard printed on the reverse side for Round Trip rail tickets, and \$50 MetroCard printed on the reverse side for monthly rail tickets. These machines accept ATM/debit and credit cards only.
- Green, "Tickets - AirTrain" machines sell most LIRR ticket types, and offer \$5 AirTrain MetroCards. These machines accept cash as well as ATM/debit and credit cards.

MNR has three types of Ticket Machines that sell MetroCards at their stations:

- Gray "Tickets" machines are full-service machines, selling most MNR ticket types and pre-valued MetroCards. The following options are available: separate \$25 MetroCard (\$1 Green Fee applies), \$5.50 MetroCard printed on the reverse side for Round Trip rail tickets and \$50 MetroCard printed on the reverse side for Monthly rail tickets. These machines accept cash as well as ATM/debit and credit cards.
- Red "Daily Tickets" machines sell One-Way and Round-Trip tickets and a separate \$25 pre-valued MetroCard (\$1 Green Fee applies) only. These machines accept cash as well as ATM/debit and credit cards.
- Blue "Tickets - Credit/Debit/ATM Cards" machines sell most MNR ticket types and pre-valued MetroCard. The following options are available: separate \$25 MetroCard (\$1 Green Fee applies), \$5.50 MetroCard printed on the reverse side for Round Trip rail tickets and \$50 MetroCard printed on the reverse side for Monthly rail tickets. These machines accept ATM/debit and credit cards only.

3.1.4.2 Mobile Sales Unit

One MetroCard Bus and three MetroCard Vans circulate in the service area, essentially operating as traveling station booths. At scheduled stops, these vehicles offer purchasing or reloading options for nearly all types of MetroCards. Only cash is accepted at this time, as the vehicles use the same TBT as the station booths. Their TBT and station controller equipment stores the information until the end of the day, at which point it is downloaded to a host for the transmission of revenue/data recording and reporting.

Mobile Sales account for less than one percent of MetroCard sales transactions, but they serve an important function for NYCT and the community. Mobile Sales Units can address surges in sales needs related to special events or disasters, such as Hurricane Sandy. They also provide flexibility in issuing MetroCards to populations potentially underserved by fixed sales channels. Finally, Mobile Sales Units can verify the eligibility of reduced fare customers and issue MetroCards to vulnerable populations who may not be able to get into the Customer Service Center. They can also issue a temporary 90-Day MetroCard

which cannot be refunded and is meant to provide temporary access while a customer who has signed up for a reduced fare MetroCard waits to receive his/her MetroCard.

3.1.4.3 Online Sales

There are two online options for purchasing MetroCards which are delivered through the mail: the EasyPay program and interoperable tickets offered via the commuter rail Mail&Ride programs, and pre-encoded MetroCards offered via the MNR and LIRR WebTicket program. The Green Fee does not apply to these purchases.

3.1.4.3.1 EasyPay Program

EasyPay is an online account management option that provides an Autoload feature for two full-fare Fare Products (EasyPayXpress 30-Day Unlimited Ride and EasyPayXpress Pay-Per-Ride with five percent (5%) bonus) and one reduced Fare Product (Reduced Fare EasyPay Program).

Full-fare customers can open an EasyPay account online. Eligible reduced fare customers must establish an account by mail or in person. EasyPay customers may then pay with automatic deductions from bank cards or checking accounts. Multiple MetroCards can be linked to an account, and are required for the full fare 30-Day Unlimited Fare Product. EasyPay purchases are balance protected, although customers do not need to enroll in the Balance Protection program.

Participation in this program is low, less than 1 percent (1%) of 2013 sales transactions. However, EasyPay enrollment is steadily increasing with greater customer awareness. Customer service for the program is handled by Xerox/ACS, who administers it. Xerox/ACS also provides the back-office support and a web portal that has been incorporated into the MTA website for account management.

3.1.4.3.2 Commuter Rail Mail&Ride

Both LIRR and MNR have Mail&Ride services that allow customers to purchase tickets by cash, check or credit/debit, using an online account. Mail&Ride is currently the only way to purchase the joint monthly commuter rail ticket with an unlimited calendar-based MetroCard. The Mail&Ride program is further detailed in Technical Specifications 3.2.4.3.2.4.3 (Mail&Ride).

All Mail&Ride tickets have a MetroCard on the reverse side. The following options are available:

- \$0 Option: \$0 MetroCard value and LIRR or MNR fare. MetroCard value can be added at any NYCT station booth.
- \$50.00 Option: \$55.50 MetroCard value and LIRR or MNR fare. MetroCard value can be added or transferred to another MetroCard at any NYCT station booth. This MetroCard is valid for 6 months.
- \$116.50 Option: Unlimited Monthly MetroCard and 2% discount on LIRR or MNR fare (CT customers get a 4% discount on MNR fare). Expires at the end of the month. MetroCard value cannot be added or transferred to another MetroCard. Unlimited MetroCards cannot be used on Express Buses, JFK AirTrain or PATH systems.

3.1.4.4 Onboard Sales

With the exception of SBS routes, NYCT allows onboard sales in cash for a one-way fare on its bus routes. The IFUs installed on buses take coins only and can issue non-serialized transfer with a magnetic stripe for bus-to-bus transfers. A transfer to the subway or bus is encoded only when full payment of the bus fare is made with a value-based MetroCard. SBS passengers on most routes can purchase a fare

in cash or use a time- or value-based MetroCard off-board at a wayside machine which prints a receipt to be used as proof of payment onboard the bus.

Cash fare payments can only be made in coins and no change is dispensed for overpayments. While there is no added fee for paying onboard, customers who require a follow-on bus transfer must request the transfer at the time of fare payment. Customers paying with coin cannot receive a transfer to the subway. Currently cash payments on buses accounts for just under 10 percent of all bus fares.⁶

3.1.4.5 Out-of-System Sales

NYCT provides bulk pre-encoded MetroCards to various types of Third Parties: Retail Merchants, social service/government agencies and Transit Benefits providers. Together these sales channels account for about 13 percent of MetroCard sales revenue.⁷

The Third Parties that sell MetroCard are not linked to the host server and are treated as a bulk sales channel. Once the MetroCards are purchased in bulk, the purchases of individual MetroCard at these outlets and the retail customers' methods of payment are not visible to NYCT.

3.1.4.5.1 Retail Merchants

NYCT has contractual relationships with a network of well over 2,000 over-the-counter Retail Merchants that are authorized to sell MetroCards throughout the five boroughs, northern New Jersey, Westchester, Nassau and Suffolk counties. The retail network provides additional coverage in areas where there are few or no automated vending machines. Beyond supplementing station sales, there is a geographic strategy aimed at having a sales location within five blocks of most bus stops. Customers who are unbanked also benefit from the inclusion of check cashing locations in the retail network. Retail Merchants account for about 45 percent of all out-of-system sales.

The \$1 Green Fee for buying a new MetroCard does not currently apply at retail locations. Retail Merchants can only sell pre-encoded MetroCards which they order from a set list of options and must sell the MetroCards at face value. They do not have MetroCard encoding equipment and therefore cannot offer reload capabilities. Retail Merchants pay for stock up front, and receive a commission on sales. The commission is small (see Table 3.3 (MetroCard Retail Sales Commission Structure 2015) below), but participation in the program increases foot traffic to the Retail Merchants. Commission is deducted at the time of bulk purchase from NYCT.

Retail Merchants place their orders based on their customers' needs. New Retail Merchants generally get initial guidance from NYCT staff when they join the program. The retail network is very mature with little to no ongoing recruitment. Usually Retail Merchants reach out to NYCT to join the program. Applications are available on the MTA website.

Table 3.3: MetroCard Retail Sales Commission Structure 2015

MetroCard Type/Price Paid by Customer	Retail Sales Commission
\$5.50 MetroCard	No commission is given with these MetroCards and it is not counted in batch totals for discounts.
\$5 AirTrain	

⁶ 2014 Revenue Ridership Market Share

⁷ 2014 Annual MetroCard Sales_UL.

\$19.82 MetroCard	2.5% for 1 batch
\$31 7-Day Unlimited Pass	2.7% for any 2 to 4 batches 3% for any five or more batches
\$9.91 MetroCard	1.5% for 1 batch
\$39.65 MetroCard	2.5% for any 2 batches
\$57.25 7-Day Express Bus Plus	2.7% for any 3 to 9 batches 3% for any 10 or more batches
\$58.56 MetroCard	
\$116.50 30-Day Unlimited Pass	
\$25 10-Trip AirTrain MetroCard	
\$40 30-Day AirTrain Unlimited	

A contractor, Palm Coast Data, manages the current retail ordering and distribution, with delivery of the orders provided by a sub-contractor, Rapid Armored. Once MetroCards are distributed, the value of unused MetroCards can only be refunded to a Retail Merchant's account when MetroCards expire or if a fare change renders the pre-encoded MetroCard values obsolete. In both cases, the MetroCards must be returned to NYCT before a credit can be issued.

To find a Retail Merchant, customers can use the Merchant Locator feature on the MTA's website at: <http://tripplanner.mta.info/metrocardmerchants/Default.aspx>

3.1.4.5.2 Social Services/Government Agencies

Some social service and government agencies provide their patients or clients with MetroCards. The social service agency pays for the MetroCards, and is typically reimbursed by either the Federal or State government. MetroCards are provided to clients based on the eligibility requirements of the particular social service program. Generally, social service and government agency programs provide a one- or two-trip MetroCard. Most of these services provide MetroCards for free to participants as a benefit of their program. External sales by government and social service agencies accounts for about 10 percent of all out-of-system sales by revenue.

3.1.4.5.3 Transit Benefits

Pre-tax transit benefit providers also distribute MetroCards through employers taking advantage of the IRS Section 132(f) commuter benefit program. Currently they account for about 45 percent of out-of-system sales by revenue, and have shown increasing sales percentages in recent years. Providers purchase sealed, pre-valued MetroCards in bulk and sell them at the standard NYCT price, or issue pre-funded debit cards that can be used to purchase MetroCards at vending machines.

There are a number of transit benefit providers working in NYC. Bulk deliveries of pre-encoded MetroCards are made to these providers via a Third Party vendor (Rapid Armored).

3.1.4.6 MetroCard Affiliates

Other non-MTA Group transit agencies have arrangements with the MTA Group for the sale of MetroCards, and/or the acceptance of MetroCards (each, a "**MetroCard Affiliate**"). For example, NYCT has operating agreements in place with a number of government entities which use or accept some form of MetroCard for fare payment. The list of MetroCard Affiliates includes as of the date of this publication:

- Westchester County Department of Transportation Bee Line System

- Nassau Inter-County Express Bus System
- Logan Bus Company (Hudson Rail Link)
- Academy Express Staten Island Express Buses
- Port Authority of New York and New Jersey (PANYNJ) PATH System
- PANYNJ JFK Air Train System
- Roosevelt Island Tram

PATH allows value-based MetroCards to be used on PATH services and offers MetroCard sales at their ticket vending machines. Currently, PATH credit/debit processing from their TVMs also connects through and follows the NYCT flow to the Merchant Acquirer and card-issuing companies. AirTrain also sells MetroCards at its vending machines and accepts value-based MetroCards at its turnstiles.

MetroCards are the only Fare Products accepted for the Roosevelt Island Tram, which has vending machines available at its stations. Bee Line, NICE, Academy and Logan are regional bus companies that accept MetroCards, but do not sell NYCT Fare Products. However, NYCT has four vending machines at the Hempstead Transit Center that support NICE customers.

The MTA has memoranda of agreement with each of the MetroCard Affiliates to govern the use of MetroCard and the revenue reconciliation process.

3.1.5 Interfaces

There are a number of internal and external interfaces in the current MetroCard System as seen in in Figure 3.3 (Current NYCT AFC System Architecture) are described below.

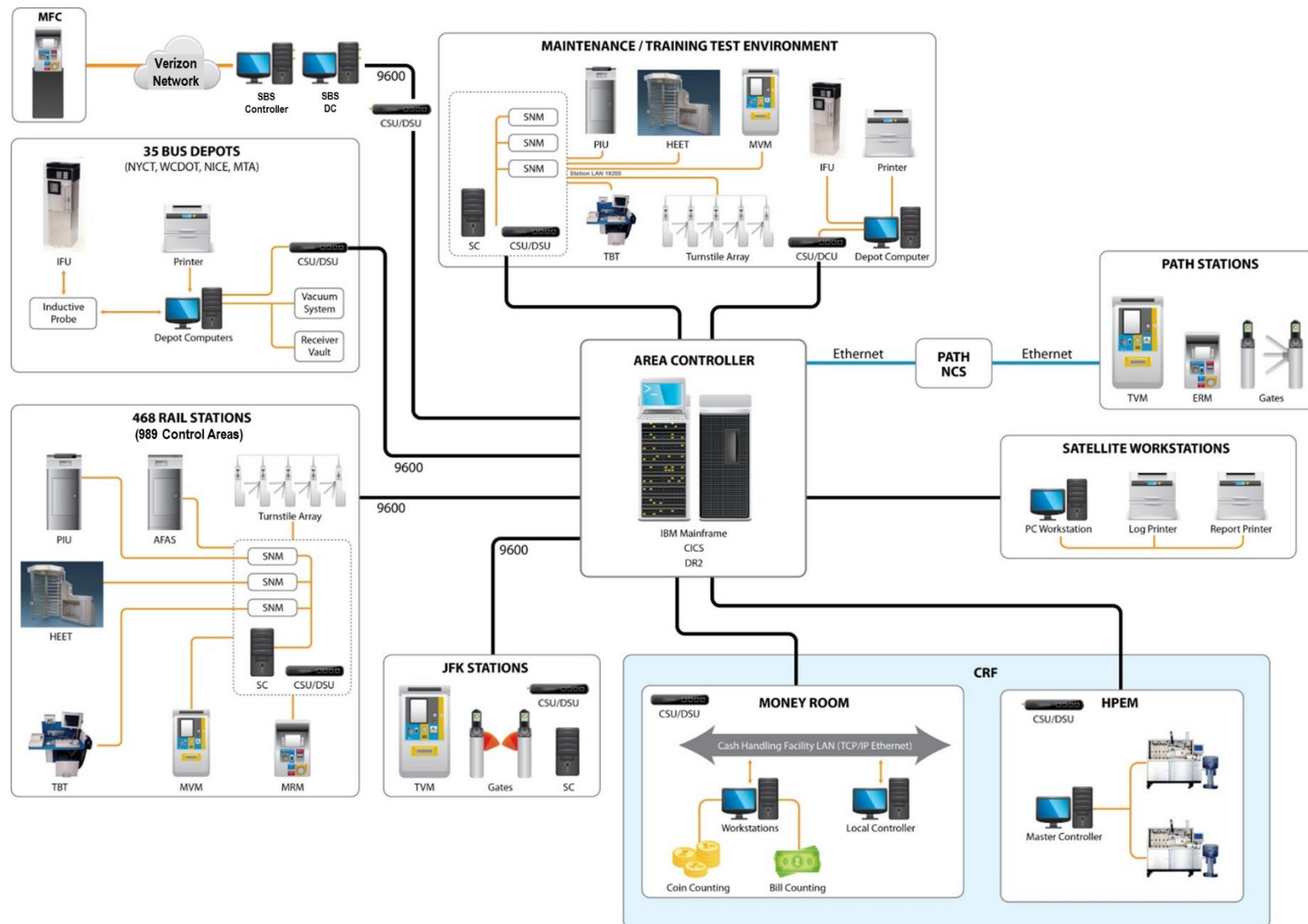


Figure 3.3: Current NYCT AFC System Architecture

3.1.5.1 Servers

NYCT maintains a sophisticated data management infrastructure to serve internal customers. The central computer for the fare collection system is the Area Controller, an IBM mainframe at the 2 Broadway Data Center that stores fare collection data and MetroCard System applications. It is the *backend* of the MetroCard System. The database is DB2. This mainframe-based system is used to serve the data needs of the MetroCard System. The backend MetroCard System contains ridership, sales, maintenance and other data. It also provides for configuration and control of MetroCard System devices and fare tables. Additionally, there are a variety of credit/debit related data files that are transmitted to and from NYCT's acquirer, via the mainframe.

A Data Mart at the 130 Livingston Plaza Data Center is used for a variety of back-office sales-related functions. Sales data, and information on credit/debit transactions, is provided from the mainframe. The Data Mart network environment is firewalled from the MetroCard System networks. This Data Mart is an Oracle database. In addition to the Data Mart, there are several other systems used for back-office functions, including:

- An Office of Management and Budget back-office developed by NYCT's in-house staff for revenue and ridership
- Fraud and Negative List analysis tools, developed internally by NYCT
- The MTA/IT back-office reporting on MetroCard System equipment audits and usage information

The Cash Settlement System at the Consolidated Revenue Facility is also a server based system running on a closed LAN used for a variety of cash processing, reconciliation reporting, inventory control systems and revenue servicing and material tracking functions. Register data and servicing requirements are provided from the mainframe. It is an Access database.

3.1.5.2 Non-MetroCard System Interfaces

- Spear is a server based Maintenance Management System (MMS) that receives messages from the MetroCard System backend, i.e., the Area Controller. MetroCard System devices communicate events on a near-real-time basis through the Station Controller back to the Area Controller. If a relevant failure event is received by the Area Controller and a failure reset event is not received in 30 minutes then a work order is generated on the Area Controller. The Spear system retrieves these work orders on a regular basis from the Area Controller and creates corresponding work orders in Spear so that the Electronics Maintenance Division can follow up on the issue.
- The EasyPay program is currently administered by a Third Party. Customer and payment information is communicated via two-way file exchanges over secure file transfer protocol.
- The PeopleSoft system provides information about station agents, such as pass numbers and work shifts, through to the Passenger Revenue Accounting Systems (PRAS) for revenue reconciliation purposes.
- Customer Service receives information on MetroCard usage through a direct connection to a Third Party system for claims management called Internet Claim Exchange System. This same information feed is accessed by the Oracle customer relationship management module.
- The Photo Identification Card System was developed by CA Technology specifically for use by

NYCT's Corporate Communications Department/Customer Relations Division. The PIC System uses a Visual Basic interface and Oracle database to capture information on employees and customers using four kinds of photo ID MetroCards – all of which fall under Special Programs:

- Employee MetroCards for NYCT, SIRTQA, MTA Headquarters, MTA Police, etc., totaling approximately 52,000 employees and 18,000 pensioners. This MetroCard allows employees to gain non-revenue access to various work locations as well as provides transportation privileges. This includes system employees that require PIN number access to token booth computers or the like.
- Temporary transportation MetroCards for contractors, consultants and interns, totaling about 29,000. These MetroCards allow restricted access to NYCT locations, facilities and the transportation system.
- Reduced Fare MetroCards, totaling over 900,000. These PPR or time-based MetroCards are encoded with special class codes that deduct half of the normal fare during usage or purchase.
- Paratransit MetroCards which qualify customers with permanent or temporary disability for four to eight free rides with a companion, totaling 160,000.

Employee data, which is also entered into PeopleSoft, is provided by HR on a paper form for entry into the PIC System. The employee data is utilized to print MetroCards utilizing NISCA PR5350 card printers and NISCA PR5302 laminators on specially designed 10 mil photo receptive MetroCards. The MetroCard System number from the printed MetroCards is echoed back to PIC System and stored. The PIC System's functionality allows for re-issuance of expiring MetroCards by running queries that capture those MetroCards by their MetroCard System expiration date. This bulk processing is referred to as batch printing or mass re-issuance.

The MTA's Enterprise Identity Access Management System, known internally as I-Vault, currently uses NETIQ Identity Manager. NETIQ Identity Manager is in the process of being replaced with SalePoint IdentityIQ. Both NETIQ Identity Manager and SalePoint IdentityIQ have the ability to support single sign-on and multi-factor authentication.

PIC System data is utilized by other NYCT Departments. For example, if a lost employee pass currently on the "pending file" is still being used in the MetroCard System, MetroCard security personnel may request access to the associated employee information to investigate. The PIC System provides a real-time data feed into the I-Vault System for employee data used for accessing NYCT systems. The data from the PIC System is matched with data from PeopleSoft within the I-Vault System to validate employee records. The PIC System also has an interface with the Lenel system, which provides security access information to the security readers used in NYCT facilities. This data feed provides pass numbers for temporary transportation MetroCards, i.e., contractor badges, into the Lenel system. The I-Vault System provides a data feed into Lenel with the pass numbers of employees. Security access rights associated with those pass numbers are then provided to Lenel via paper forms which are filled out at the Pass Office for contractors and at HR for employees.

The Customer Service Center located at 3 Stone Street, New York also uses the PIC System database and printers to provide new reduced fare MetroCards to qualified customers. That office handles roughly 5,000 reduced fare issues per month, inclusive of new enrollments into the program, and 4,000 requests for claims due to damaged or malfunctioning MetroCards.

3.1.5.3 Stations

The customer facing fare collection equipment in stations includes the turnstiles, HEETs, AutoGate devices, MCRs to check MetroCard balances, MVM and MEM vending machines and the TBT in the station booth.

Each piece of customer facing fare collection equipment has a memory board that stores the Negative List; remaining fare tables are stored on the controller board. There is at least one station controller in each of the 469 stations, which allows individual devices to be queried. The Station Network Module is the device that connects the individual front-end devices (at the primary and secondary fare control areas) to the station controller. Data is gathered from the individual devices and is sent from each station controller to the Area Controller. Requests for debit/credit authorizations from vending machines are transmitted to the Area Controller in real-time. Device status and error messages are also sent in real-time. Sales data is sent in real-time from the TBTs, but every 6 minutes from the MEMs and MVMs; turnstile, HEET, and AutoGate data is sent every 15 minutes. The data from the MetroCard System equipment is sent to the Area Controller through the Station Controller. It is not sent directly to the Data Mart. Data is later extracted and sent to Data Mart by back-office programs on the Area Controller on a regular basis.

In the end cabinet, the station controller is connected to a central computer (host) for transmission of revenue/data recording and reporting. Transaction processing for cash payments stop at the Area Controller, but credit/debit transactions continue on to the Merchant Acquirer for online authorizations.

3.1.5.4 Buses & Depots

The current IFUs do not communicate with the Area Controller during service, or directly. When a bus comes into the depot, a depot computer establishes communications with the IFU via a tethered inductive data probe. The depot computer is online with Area Controller. Data (fare card usage, coin usage, etc.) is uploaded and Negative List updates are downloaded, as described in Technical Specifications Section 3.1.6.2 (Bus) below. At most depots, probing occurs on the fuel line when buses pull in. IFUs can also be probed with a portable data probe. The portable data probe can then be probed by the depot computer. The information from the farebox is stored on the depot computer until it is successfully transmitted to the Area Controller.

3.1.5.5 Merchant Acquirer & Card Issuers

Figure 3.4 (Standard Four-Party Payment Transaction (Merchant) Model) shows the transfer of data for credit and debit transactions between the vending machines and NYCT's Merchant Acquirer. In turn, the Merchant Acquirer transmits transaction data for further processing by the financial institution which issued the customer's credit/debit card (card issuer). This transaction processing allows the card issuer to authorize the transaction, which ultimately results in a successful purchase by the customer at a vending machine.

There is a separate daily process by which the funds are transferred from the customer's account to NYCT's account. The card issuer will send funds to NYCT's Merchant Acquirer, who in turn transfers those funds to NYCT. An exception to this is for certain brands of credit/debit cards, such as those from American Express, for which the funds are transmitted directly to NYCT.

The transaction process is reconciled using sales data from the vending machines—down to the transaction level—to confirm the Merchant Acquirer's transaction data.

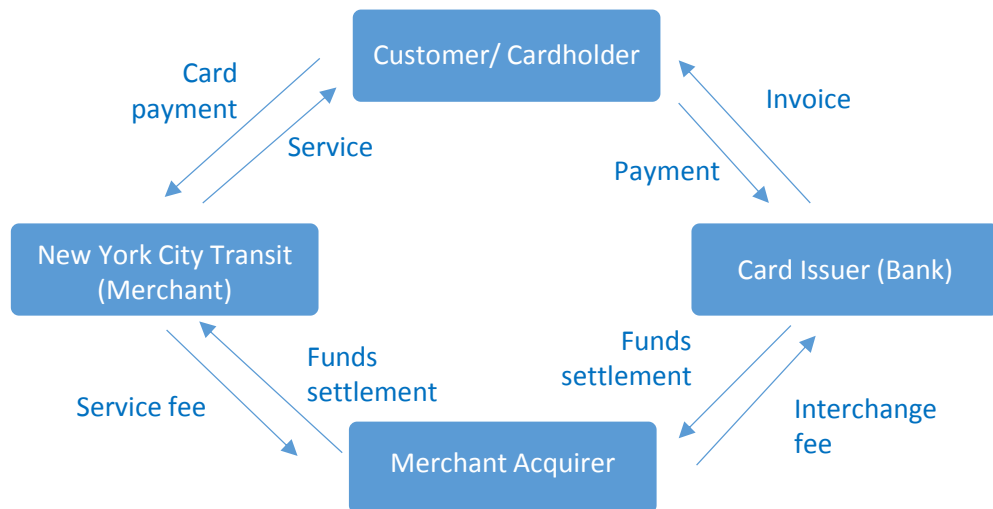


Figure 3.4: Standard Four-Party Payment Transaction (Merchant) Model

In addition to data for purchase transactions, there are a variety of other types of information, such as customer disputes (chargebacks) and other support files/data that are transmitted between NYCT and the Merchant Acquirer.

The MTA currently has their Merchant Acquirer contracted as a “Third Party switch” to handle all credit/debit processing. The credit/debit transaction messages from/to the MVM and MEM pass through the Area Controller to Bank of America Merchant Services (BAMS) via Enterprise Extenders. The Area Controller has ACI Base24-es Software resident for formatting the transaction information.

3.1.6 Communications Network Description

The current MetroCard System's communications network handles communications between the subways, buses, SBS and the Consolidated Revenue Facility (CRF, or money room). All vending machines are connected to the backend host for network management, transaction processing, security, revenue/data capture and reporting, as well as interfacing with the Merchant Acquirer. A credit/debit transaction is processed at the data center and, if the transaction passes a variety of internal validity checks, is transmitted for further processing. All credit/debit card transactions are encrypted per PCI standards and transmitted to the Merchant Acquirer for online authorizations over dedicated Third Party network communication lines; for this authorization process, the Primary Account Number (PAN) is not encrypted on the SNA portion and it is transmitted in the clear. However, it is encrypted when it goes over IP. In conformance with PCI, it is not stored.

NYCT maintains two in-house 100 MB circuits between the data centers at 2 Broadway and 130 Livingston Plaza for transfer of operational MetroCard System data to the Data Mart and connection is maintained from Livingston plaza to the Sterling Forest center, via Verizon transparent LAN services, for disaster recovery.

3.1.6.1 Subway

Fare collection devices in the subway system include the various gating devices, MVMs and MEMs, and the Token Booth Equipment (TBE). Each station is designated as a primary control area for the MetroCard System equipment. Each MetroCard System device processes MetroCard System transactions and sends them to a communications expansion module (CEM)/station network module via RS422 half-duplex using a multi-drop link protocol. The communication rate is 9600 baud. The Station

Network Module (SNM) is a device that connects the individual front-end devices (at the primary and secondary fare control areas) to the Station Controller. Messages proceed through the Station Controller, which acts as a store and forward device, to the Area Controller. There is at least one Station Controller in each of the 469 fare control areas, and large stations with multiple fare control areas may have up to three Station Controllers. A Station Controller may also be connected to a secondary fare control area via a communications breakout box and fiber optic link. The secondary fare control area also uses a SNM for communications with additional fare collection devices. There may be more than one secondary fare control area. Data is gathered from the individual devices and is sent from each station controller to the Area Controller. Device status, error messages and requests for debit/credit authorizations from vending machines are transmitted to the Area Controller in real-time. Sales data is sent in real-time from the TBTs, but every 6 minutes from the MEMs and MVMs; turnstile, HEET and AutoGate data is sent every 15 minutes. That data eventually passes through the Data Mart (if Livingston Plaza should go down, there is a back-up data transmission network to the Rail Control Center (RCC). Data can be stored on the station controllers for up to 7 days or longer in the event of a network outage.

A Data Service Unit (DSU) routes information over conditioned 4-wire digital leased lines, operating at 9,600 baud for most stations, from the station controller to a Third Party-provided communication network, using IBM Systems Network Architecture (SNA)/ Synchronous Data Link Control (SDLC) protocols. There are over 75 key stations that communicate over NYCT fiber network at 19,200 baud. This information then goes to the 2 Broadway 9th Floor Data Center Area Controller. The communications network is being upgraded and all circuits may ultimately be owned by NYCT rather than leased from a Third Party.

Currently (as of November 2015), 147 subway stations have wireless voice and data communications. This service, provided by Transit Wireless, is free to customers. Plans call for Wi-Fi to be provided in all remaining subway stations by 2017.

3.1.6.2 Bus

Bus MetroCard System devices, or IFUs, process all current MetroCard and cash transactions onboard each bus. No IFU is connected to a communications network outside of the bus depot. When a bus comes into the depot, the IFU is physically connected to the MetroCard System via a depot computer located at each depot and probed. Data (fare card usage, coin usage, etc.) is uploaded and Negative List updates are downloaded via inductive probe. The information from the farebox is stored on a depot computer until it is successfully transmitted to the Area Controller. As in the subway system, the messages from/to the Depot Computer are routed to a DSU using SNA protocol at 9,600 baud.

Bus depots currently have Wi-Fi communications for several purposes including downloading IVN (Intelligent Vehicle Network®) information. Some of the depots also have WiMax which is used to download closed-circuit television (CCTV) video footage from buses while in the fuel lane.

The MTA has implemented a service known as MTA Bus Time, which provides real-time data on bus location and arrival times to MTA customers. To implement this, the MTA partnered with VeriFone. This hardware solution uses Open Standards implemented by COTS products. These include the VeriFone TransitPay MX-700, a small, rugged and highly secure on-board computer terminal to record and process the data. The VeriFone device communicates to a central server using a Sierra Wireless AirLink GX400 cellular gateway to transmit the data over Verizon's 3G wireless data network. The VeriFone devices are used on bus routes in Staten Island and the Bronx.

In keeping with the MTA's policy to have at least two suppliers, for bus routes in Manhattan, Brooklyn, and Queens, the MTA has partnered with Cubic Transportation Systems to supply an alternate set of

hardware. This includes Cubic's "Mobile Validator" and the CradlePoint IBR-600 cellular gateway to transmit the data over Verizon's 4G wireless data network.

3.1.6.3 Select Bus Service

On most SBS routes, passengers pay their fares in cash or via MetroCard using wayside machines at SBS stops before boarding. The MFC devices used for SBS services communicate via a Verizon cellular connection to an SBS Controller. This server connects to the Area Controller via a Depot Computer (DC), within the NYCT telecommunications network. The Parkeon devices for SBS coin payments are not part of the MetroCard System described above; they are connected via cellular to Parkeon's backend system. These connections are managed by Parkeon and access to this data is provided as a service to NYCT.

3.1.6.4 Consolidated Revenue Facility (CRF)

The CRF houses and operates the Cash Settlement System in the money room which counts, reconciles, controls inventories and reports cash and coins processed from booths, vending machines, fare boxes and mobile sales units (POS) and operates the HPEM. The HPEM is used for initialization and bulk encoding of MetroCards. Similar to the subway system architecture, the CRF communicates to the Area Controller via a DSU as described in Technical Specifications Section 3.1.6.1 (Subway) above.

3.2 Metro-North Railroad and Long Island Rail Road

3.2.1 Train Service

MNR and LIRR are the two largest and busiest commuter railroads in North America. With combined average weekday ridership of more than 575,000 customers, they provide essential services for the daily commutes and leisure travel of many people in New York, New Jersey, and Connecticut. Both MNR's and LIRR's train service are critical to the economic vitality of the New York metropolitan region. Operating statistics for both MNR and LIRR are shown in Table 3.4 (MNR and LIRR Operations).

Table 3.4: MNR and LIRR Operations

	MNR*	LIRR
2014 Operating Budget	\$1.4 billion	\$1.8 billion
2014 Ridership	84,659,126	85,868,246
2014 Average Weekday Ridership	289,340	298,448
Number of Rail Lines	5	11
Number of Rail Cars	1,266	1,161
Track Miles	787	594
Number of Rail Stations	122	124
2014 Employees	6,136	6,906

*Note: these figures include East- and West-of-Hudson service for MNR

Metro-North Railroad provides service between Grand Central Terminal in NYC and northern towns in New York State and in Connecticut, and in Westchester, Putnam, Dutchess, Orange, and Rockland counties. There are three lines east of the Hudson River that are operated by MNR: Hudson, Harlem, and New Haven. The New Haven line has three branches in Connecticut and is operated through a service agreement in partnership with the Connecticut DOT. These lines are comprised of 13 fare zones in New

York State (numbered 1-10 and 12-14) and 11 fare zones in Connecticut (numbered 15-21, 31, 41, 42 and 51). There are also two lines west of the Hudson River which are owned by MNR but operated through service agreement by New Jersey Transit (NJT); fares for West-of-Hudson service are collected using NJT staff, ticketing systems and processes.

LIRR operates between New York City and the eastern end of Long Island along eleven passenger branches in Queens, Brooklyn, Nassau, and Suffolk counties. There are two major NYC⁸ terminals (Penn Station and Atlantic) and 8 distinct fare zones (numbered 1, 3, 4, 7, 9, 10, 12, and 14). LIRR operates 24 hours a day, seven days per week.

Traditionally, commuter railroads in the U.S. cover 50% or less of their operating cost through the fare box, although LIRR's adjusted 2014 farebox recovery ratio was 55.6%;⁹ MNR's was 60.9%.¹⁰ Since MNR and LIRR are subsidized by taxpayer dollars, it is critical that the fare systems are effective in collecting revenue.

3.2.2 Ridership

2014 ridership figures and the change from 2013 for both MNR and LIRR are shown in Table 3.5 (2013 and 2014 Ridership):

Table 3.5: 2013 and 2014 Ridership

	2014 Ridership	2013 Ridership	Variance	% Change
MNR*	82,975,115	81,804,943	1,170,172	+1.4%
LIRR	85,868,246	83,384,106	2,484,140	+3.0%

* Note: MNR figures are for East-of-Hudson service only

3.2.3 Current Systems

3.2.3.1 Fare Structure Overview

A wide range of tickets and fares is offered by both MNR and LIRR to meet the needs of their customers. Both MNR and LIRR operate on a zone-based fare system in which fares are calculated based on trip origin and destination, including intermediate fares which do not begin or end at a major terminal zone. Several other factors also figure into fare pricing, including time of day, passenger information (e.g., Senior, Child, Person with Disability, Military), and where fares are purchased. Time-based (i.e. monthly and weekly) and ride-based (i.e. one way, 10-trip) tickets are also available depending on passenger needs. Finally, combined service between MNR, LIRR, and other regional service (e.g., a monthly LIRR commutation ticket combined with a 30-day unlimited MetroCard) add another level of complexity to

⁸ LIRR is scheduled to have a third terminal (Grand Central Terminal) with East Side Access (ESA) in December 2022.

⁹ http://web.mta.info/mta/news/books/pdf/150223_0830_MNRLI.pdf. "Adjusted Fare Box Operating Ratio and Cost Per Passenger indicators have been adjusted for comparability between the Long Island Rail Road and Metro-North Railroad and are being presented only at the railroad operating committees. These adjustments are not being used MTA-wide. Adjustments have been made to reflect all operating revenue and significant financial impacts that are outside management's control. These adjustments include: Inclusion of Other Operating Revenue, Removal of OPEB Current Payment expenses for retirees, and Removal of the UAAL associated with LIRR's closed pension plan..."

¹⁰ http://web.mta.info/mta/news/books/pdf/150223_0830_MNRLI.pdf. "Adjusted Fare Operating Ratio and Cost Per Passenger indicators have been adjusted for comparability between Metro-North and LIRR and are being presented only at the railroad operating committees. These adjustments are not being used MTA-wide. Adjustments have been made to reflect all operating revenues and significant financial impacts that are outside management's control. These adjustments include: Inclusion of Other Operating Revenue, Removal of OPEB retiree expenses, and Inclusion of estimated farebox revenue from an equalization of the Connecticut fare structure."

ticket types that are offered. Each of these fare types and tickets are combined into a complex tariff for each of MNR and LIRR that is published any time fares or offerings change.

Full-fare paying customers can purchase one-way, round-trip, 10-trip, and weekly and monthly commutation tickets; all of these products are also offered at a reduced fare for customers who qualify for discounts including senior citizens, persons with disabilities, Medicare recipients, military personnel, groups, children and students. MNR and LIRR offer a fixed price family fare when traveling with a full fare-paying adult.

CityTickets are available for \$4.25 for one-way Saturday or Sunday travel within the New York City limits (i.e., between zones 1 and 3 for LIRR and between the Bronx and Manhattan on the Hudson or Harlem lines for MNR). These tickets cannot be purchased onboard trains and must be purchased the same day as travel.

Peak travel is defined for MNR as weekday travel on trains arriving at Grand Central Terminal between 5 AM and 10 AM or departing Grand Central Terminal between 4 PM and 8 PM. Peak fares are also charged for travel on any weekday train that leaves GCT between 5:30 AM and 9 AM. Because many MNR customers commute to cities and towns in other areas such as Connecticut, MNR defines this as “reverse peak” service during these hours. Peak fares apply to LIRR customers during weekdays on trains that arrive at NYC terminals between 6 AM and 10 AM, and for trains leaving NYC terminals between 4 PM and 8 PM. Off-peak fares are charged at all other times during weekdays and all day Saturdays, Sundays, and holidays.

A Via Ticket is for customers traveling across multiple branches which require a “zigzag” transfer and allows for payment based on the shortest distance rather than purchasing two separate tickets for each leg of their trip. This is offered by LIRR for many origin-destination combinations because of the large number of branch lines; MNR offers Via Tickets for customers traveling between Yankees-E. 153rd Street and Harlem and New Haven Line stations. Via fares are calculated by adding the appropriate increment to the corresponding fare to/from Manhattan (e.g., the one way peak fare is calculated as the one way peak fare to Manhattan plus \$1.25 and the one way off-peak fare is calculated as the one way off-peak fare to Manhattan plus \$1.00).

A list of available ticket types and fares is shown below:

Table 3.6: Ticket Types and Fares

Fare	MNR	LIRR
One-way	✓	✓
Peak	✓	✓
Off-peak	✓	✓
Intermediate	✓	✓
Senior Citizens/Persons with Disabilities/Medicare Recipients	✓	✓
Special Discount Fares	✓	✓
With UniTicket	✓	✓
Family fare	✓	✓
Child fare	✓	✓
CityTicket	✓	✓
Round trip tickets	✓	✓
Round trip tickets with MetroCard	✓	✓
Special Event	✓	✓
Ten-trip	✓	✓

Fare	MNR	LIRR
Peak	✓	✓
Off-peak	✓	✓
Intermediate	✓	✓
Senior Citizens/Persons with Disabilities/Medicare Recipients	✓	✓
Weekly Commutation	✓	✓
Weekly Commutation with UniTicket	✓	✓
Monthly Commutation	✓	✓
Monthly Commutation with MetroCard	✓	✓
Monthly Commutation with UniTicket	✓	✓
Monthly Commutation with MetroCard and UniTicket	✓	✓
Monthly School ticket	✓	✓
Monthly School ticket with MetroCard	✓	✓
Bike Permit	✓	✓
Group Tickets - Adult	✓	✓
Group Tickets - Youth	✓	✓
Getaway Tickets	✓	✓
Via Tickets	✓	✓

3.2.4 Current Sales Channels and Equipment

Customers can purchase tickets through several channels, including from a ticket seller at a ticket window (using a Ticket Office Machine (TOM)), at a Ticket Vending Machine (TVM), from staff onboard a train, or through the Mail&Ride program, summarized in high level below. MNR and LIRR also have an existing mobile ticketing application, which acts as another sales channel, but was launched after the data below was compiled. For more information on the mobile ticketing application, see Technical Specifications Section 3.2.4.4 (Mobile Ticketing).

Detailed fare and channel information is described in the tariffs as well as at the following sites: <http://web.mta.info/mnr/html/fares.htm>, and <http://web.mta.info/lirr/about/TicketInfo/>. All of these channels are described in more detail in these Technical Specifications.

Table 3.7: Sales Channels and Sample Products

Fares	Mail&Ride	Ticket Window	Full-Service TVM* (Gray)	Express TVM (Red)	Credit-Debit only TVM (Blue)	Onboard
One-Way		✓	✓	✓	✓	✓
Round-Trip		✓	✓	✓	✓	
10-Trip		✓	✓		✓	
Weekly		✓	✓		✓	
Monthly	✓	✓	✓		✓	
Reduced Fares		✓	✓	✓	✓	✓
Joint MNR/LIRR monthly/unlimited 30-	✓					

Fares	Mail&Ride	Ticket Window	Full-Service TVM* (Gray)	Express TVM (Red)	Credit-Debit only TVM (Blue)	Onboard
day MetroCard						
\$25 MetroCards		√	√	√	√	
UniTicket	√	√	√		√	
Bike Permit		√				√

*Contactless TVMs (STVMs) are full service TVMs with Contactless bank payment features

The volume, revenue, and relative percentages of each of these types of tickets by sales channel in 2014 is summarized in Table 3.8 (2014 Tickets and Revenue by Sales Channel). Note that WebTicket sales ended at LIRR in October 2015, and at MNR in 2016:

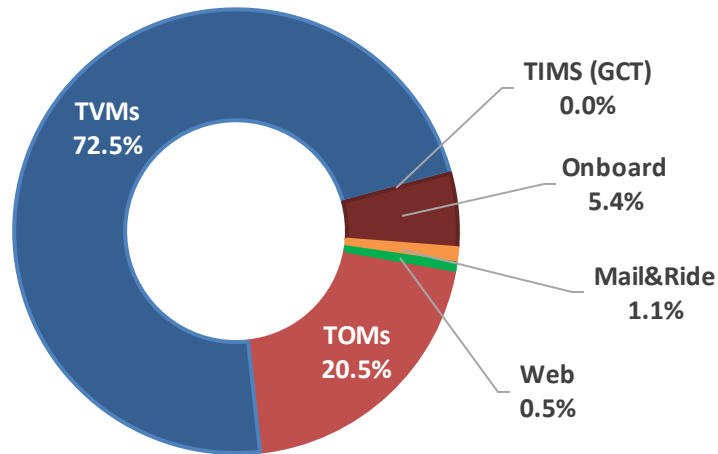
Table 3.8: 2014 Tickets and Revenue by Sales Channel

2014 Tickets and Revenue by Sales Channel				
Sales Channel	MNR			
	Tickets (#)	Tickets (%)	Revenue (\$)	Revenue (%)
TOMs	6,376,558	20.5%	\$ 115,463,052	17.8%
TVMs	22,503,553	72.5%	\$ 417,134,945	64.2%
TIMS (GCT)	5,291	0.0%	\$ 63,138	0.0%
Onboard	1,685,621	5.4%	\$ 13,119,272	2.0%
Mail&Ride	341,989	1.1%	\$ 90,566,432	13.9%
Web	143,089	0.5%	\$ 13,037,069	2.0%
Total	31,056,101	100.0%	\$ 649,383,912	100.0%

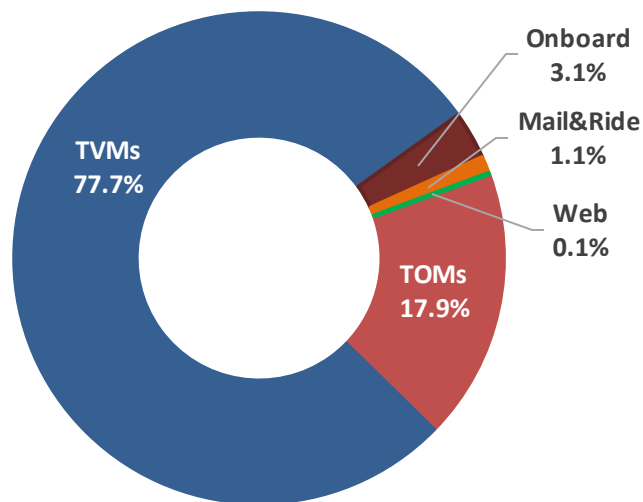
LIRR				
Sales Channel	Tickets (#)	Tickets (%)	Revenue (\$)	Revenue (%)
TOMs	5,893,552	17.9%	\$ 105,083,596	16.0%
TVMs	25,601,519	77.7%	\$ 436,870,893	66.3%
Onboard	1,036,597	3.1%	\$ 13,799,540	2.1%
Mail&Ride	367,673	1.1%	\$ 100,611,557	15.3%
Web	32,943	0.1%	\$ 2,456,624	0.4%
Total	32,932,284	100.0%	\$ 658,822,213	100.0%

Relative volumes by tickets sold for MNR and LIRR by sales channel are shown in the figures below:

2014 MNR Tickets by Sales Channel



2014 LIRR Tickets by Sales Channel



3.2.4.1 Stations

3.2.4.1.1 Ticket Vending Machines

As shown in the figures above, the most frequently used sales channel for both MNR and LIRR is the TVM. Both MNR and LIRR have several different types of TVMs that perform different functions for customers at stations. Each type is described below and the total number of machines in both systems is shown in Table 3.9 (Ticket Vending Machines):

- Full-Service TVMs, or Gray "Tickets" machines are full-service machines, selling all LIRR and MNR ticket types on Paper Media as well as joint rail/MetroCard tickets using pre-valued MetroCards. The following MetroCard options are available: separate \$25 MetroCard (\$1 Green Fee applies), \$5.50 MetroCard printed on the reverse side of Round Trip rail tickets and \$50 or \$0 MetroCard

printed on the reverse side for Monthly rail tickets. These machines accept cash as well as debit and credit cards.

- “Contactless” TVMs (STVMs), or Gray "Tickets" machines are full-service machines which have a Contactless card reader for Contactless Bank Card payment. These machines sell all LIRR and MNR ticket types on Paper Media and joint rail/MetroCard tickets defined above. These machines accept cash as well as debit and credit cards.
- Express TVMs (ETVMs), or Red "Daily Tickets" machines sell One-Way and Round-Trip LIRR and MNR paper tickets and a separate \$25 pre-valued MetroCard (\$1 Green Fee applies) only. These machines accept cash as well as debit and credit cards.
- Cashless TVMs (CTVMs), or Blue "Tickets - Credit/Debit/ATM Cards" machines sell all LIRR and MNR ticket types on Paper Media and pre-valued joint rail/MetroCard tickets as offered in the full-service TVMs and accept debit and credit cards only.
- AirTrain TVMs or Green, "Tickets - AirTrain" machines are only located at LIRR Penn and Jamaica stations. They sell most LIRR ticket types on Paper Media, and offer \$5 AirTrain MetroCards. These machines accept cash as well as debit and credit cards.

Table 3.9: Ticket Vending Machines

		MNR	LIRR
Full Service TVM	TVM	112	144
Contactless TVM	STVM	19	7
Express TVM (Daily)	ETVM	122	108
Cashless TVM	CTVM	25	15
AirTrain TVM	AirTVM		4
Total Ticket Vending Machines		278	278

LIRR has seven stations without TVMs; MNR has 18 stations (primarily Connecticut branch line stations and hiking stops) without TVMs.

Most MNR and LIRR stations have TVM(s) and major terminals and large stations have Ticket Window(s). At Grand Central Terminal (MNR) and Penn Station (LIRR) there are dedicated TVM rooms. In order to provide adequate coverage for redundancy and convenience, the practice is to have at least two TVMs per station where possible; however, today six MNR stations have only one TVM.

Revenue servicing is done through regular “close downs” of TVMs so that coin modules can be exchanged, bill vaults removed, and ticket stock replenished. MNR performs revenue collection for Grand Central Terminal (GCT - 37 TVMs) with GCT TVM staff when the terminal is closed between 2:30 AM and 4 AM. MNR revenue servicing staff operate from the North White Plains facility and are supported by a Third Party armored car service.

MNR revenue servicing is supported by TVM staff along with Third Party armored vehicle service. Staff perform the exchange of revenue modules while armor service provides transport of devices to and from both the revenue servicing facility and individual vending machines. MNR uses their North White Plains facility for revenue processing.

LIRR revenue servicing is done by TVM staff on an as-needed basis, and for security purposes it is completed on an irregular schedule. LIRR vehicles are used to pick up cash boxes and revenue at each station as well as for maintenance. LIRR uses NYCT armored car service for four terminals and hubs

(Bethpage, Penn Station, Atlantic Ave. and Jamaica) and a dedicated trailer at Jamaica is used for Conductor remittance. LIRR uses the Consolidated Revenue Facility for revenue processing.

3.2.4.1.2 Station Windows – Ticket Office Machines

Ticket Office Machines for both MNR and LIRR were designed and manufactured by Scheidt & Bachmann (S&B) and have been in service for over 15 years. TOMs enable ticket sellers to offer any type of ticket and accept cash, credit and debit cards, and checks for payment. Most of the TOM modules are identical and swappable with TVM modules, including the card stackers and ticket rolls.

Major stations and terminals at both MNR and LIRR have ticket sellers available who can sell fare Media using TOMs. LIRR has 30 ticket offices available mostly between the hours of 6 AM and 2 PM; in addition there are five stations that operate TOMs on a seasonal basis due to increased passenger flow. Larger stations have extended hours including weekend hours, and Penn Station and Jamaica are open 24 hours a day, seven days per week. 18 MNR station ticket offices have ticket windows with extended hours at Grand Central Terminal from 5 AM to 2 AM, New Haven and Stamford from 6:10 AM to 10:10 PM, and White Plains and Fordham from 6:10 AM to 9:10 PM. These ticket offices accept cash, debit and credit cards and checks.

Table 3.10: Active Ticket Office Machines

	MNR	LIRR
No. of Active Ticket Office Machines	45	87

Assistant and Conductor remittance for MNR can be done at the Ticket Windows listed in Technical Specifications Section 3.2.4.5.2 (Remittance and Reconciliation). The Ticket Window clerk counts the cash before the Conductor leaves and provides a receipt. Data reconciliation is performed by Passenger Revenue Accounting.

LIRR Conductor, AC, and Ticket Collector remittances can be done at any LIRR Ticket Window. The ticket window clerk counts the cash before the crew member leaves their window providing them with a receipt. Data entry in Revenue Accounting will check reconciliation of the report and the cash collected.

3.2.4.1.3 Ticket Selling Machine Maintenance

All TVMs for both MNR and LIRR were manufactured by Scheidt & Bachmann (S&B) and are directly connected to each of MNR's and LIRR's respective backend CSS (see Technical Specifications Section 3.2.5.1 (Information Technology (IT))). Maintenance activities, prioritization and scheduling for MNR TVMs are coordinated through MNR's TVM helpdesk. Issues and procedures are tracked through a system called the Incident Management System (IMCS). For both Remedial Maintenance (RM) and Preventative Maintenance (PM) on TVMs, MNR's TSM Operations Department performs First-Call Maintenance only; if further maintenance is required, S&B is called to assist with Second- and Third-Call Maintenance. A PM schedule is provided annually by S&B and reviewed and approved by MNR prior to the start of each year. This schedule is subject to modification by MNR based on weather or other cancellations. RM tasks are recorded in the IMCS as they occur and are scheduled by the TVM helpdesk. If S&B is required, the TVM helpdesk coordinates with them as well. For both RM tasks and PM tasks, the helpdesk compares information entered into the IMCS to the CSS to see if the applicable TVM has returned to service. Once the applicable TVM is returned to full service, the MNR tech must close the incident. If the IMCS is unavailable, technicians must record maintenance activities on manual sheets.

For maintenance activities that cannot be completed by MNR technicians, S&B is required to arrive

within 4 hours after they are contacted if needed. As part of the TSM lifecycle maintenance program that ensures continued high performance and availability to customers, spare parts are kept at North White Plains for replacement purposes as needed; S&B picks up broken items and replaces on a weekly basis.

The LIRR Stations Department oversees the overall operations and maintenance of vending machines and TOMs in stations. Remedial Maintenance on TVMs is performed by LIRR first and, if required, S&B is called to assist. LIRR can swap components and/or use small tools, but LIRR technicians do not perform Software or Software-related parts activities. Preventative Maintenance and Lifecycle Maintenance (LCM) are set up on a schedule every two years with S&B where cycles are based on volume (cycles are currently scheduled through 2020). Banknote Acceptors (BNAs) are marked during LCM and are pulled in for LCM due to technical work required to be performed in the back office. PM tasks are done five days per week, and consist of a full cleaning of components. All PM tasks are done at TVM locations by S&B staff with an LIRR attendant present.

An instance of the Maximo Asset Management System tracks LIRR component maintenance history by serial number, but is not connected to the larger LIRR Maximo Enterprise Asset Management System (EAMS). Issues are tracked using CSS status and an M6 report which shows errors with the subsystems. MNR currently uses an in-house developed asset management system; however, both MNR and LIRR will be participating in a common MTA-wide Enterprise Asset Management System replacement for all of their asset management activities.

Some issues can be fixed remotely (for example resetting a printer) but many repairs need to have someone on site to assess and repair. S&B is required to arrive within four hours if needed. Spare parts are kept at Hillside and are replaced with malfunctioning units as they are swapped. S&B picks up broken items and replaces the inventory on a weekly basis.

LIRR is going through a change in infrastructure for PCI 3.0, which includes a pin pad change out and a change to the bill note system. LIRR is looking at possible point-to-point encryption, which will simplify the compliance process.

With respect to EMV compliance, both MNR and LIRR are in the process of evaluating their current positions and gathering cost information for becoming compliant at Ticket Selling Machine (TSM) level.

Technical Specifications Sections 35.14 (MNR and LIRR NFPS Equipment Spare Parts/Modules Service and Repair) and 35.15 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services) describe optional future maintenance that MNR and LIRR may consider outsourcing to the SI.

3.2.4.2 Special Events – Gating Programs

Although both MNR and LIRR are completely “open” systems without any physical gates or barriers, for high-volume special events both MNR and LIRR periodically employ a temporary “gating” program. MNR and LIRR currently use gating (offboard sales and validation) for a few stations during high volume events where additional assistance is needed with sales and fare collection. Extra ticket selling locations are provided at these stations during these events.

MNR “gates” the Yankees E 153rd Street station during games, concerts, and other special events. Yankees 153rd street station has physical barriers. During events, these gates are staffed and tickets are collected at the gates. During the Thanksgiving Day Parade, both Grand Central Terminal (GCT) and Harlem 125th Street are gated. Several Hudson line stations are also gated during the St. Patrick’s Day Parade. For GCT, gating means the “gates” to the platform are closed and staff is present at each departing train to collect tickets. At other outlying stations gating means managing customer entry through barriers, lines, police assistance, and so forth. There are no special fares for these special events

except for a ride extension for customers traveling to Yankees E 153rd Street Station from the New Haven or Harlem Line, who only purchase a ticket as far as Harlem 125th Street.

Multiple times per year, LIRR conducts “gating” programs where physical gates and crew members protect revenue prior to boarding or exiting trains. These take place at Penn Station for Thanksgiving, and at Mets-Willets Point, Penn Station, Forest Hills, Belmont Stakes, etc. for concerts, parades, and sporting events.

3.2.4.3 Mail&Ride

Mail&Ride is a program that allows customers to create their own accounts online or by completing and mailing in a paper application, and automatically sends monthly commutation tickets directly to the homes of subscribers. Mail&Ride is currently the only way to purchase a joint monthly commuter rail ticket combined with an unlimited 30-day MetroCard. Subscribers can fill out their account and payment information, and tickets are then purchased by check, credit/debit or pre-authorized ACH debit, using an online account. Payment is required by the third of the month, although tickets are mailed prior to the start of each month.

Most MNR and LIRR Mail&Ride customers who purchase a joint monthly/30-day unlimited MetroCard receive a two percent discount on the commuter rail portion of the ticket. Those MNR customers traveling to/from Connecticut stations receive a four percent discount on a joint Monthly Ticket/30-day unlimited MetroCard Mail&Ride ticket for the MNR portion of the fare, which is a policy set and subsidized by the state of Connecticut. Transit Benefits issued to customers on prepaid cards (debit products linked to accounts that have been funded through payroll deductions) may be used for travel purchases although they may not be sufficient to cover the cost of a monthly ticket. Both MNR’s and LIRR’s Mail&Ride programs allow two forms of payment for ticket purchase, including two credit cards, one credit card and a check, and also one-time online payment such as PayPal.

All MNR and LIRR Mail&Ride tickets have a MetroCard on the reverse side although customers must choose from the following three options:

- \$0 Option: \$0 MetroCard value and LIRR or MNR fare. MetroCard value can be added at any NYCT station booth. CT customers get a 2% discount on the MNR fare. 87% of MNR and 68% of LIRR Mail&Ride customers chose this option in 2014.
- \$50.00 Option: \$55.50 MetroCard value and LIRR or MNR fare. MetroCard value can be added or transferred to another card at any NYCT station booth. The MetroCard is valid for 6 months. CT customers get a 2% discount on the MNR fare. 3% of MNR and 8% of LIRR Mail&Ride customers chose this option in 2014.
- \$116.50 Option: Unlimited Monthly MetroCard and 2% discount on LIRR or MNR fare (CT customers get a 4% discount on MNR fare). Expires at the end of the month. MetroCard value cannot be added or transferred to another card. Unlimited MetroCards cannot be used on Express Buses, JFK AirTrain or PATH systems. 11% of MNR and 24% of LIRR Mail&Ride customers chose this option in 2014.

UniTickets which provide access to connecting service are also available to MNR and LIRR Mail&Ride customers with additional service described below:

MNR

- Hudson Rail Link – Buses to and from Riverdale (Routes A, B, C, and D) and Spuyten Duyvil (Routes J, K, L, and M) MNR stations in the Bronx
- Haverstraw-Ossining Ferry – Buses to and from ferry terminals and MNR stations
- Newburgh-Beacon Ferry – Buses to and from ferry terminals and MNR stations

- Shore Line East – connecting train service to and from several Connecticut Stations along the MNR New Haven Line

LIRR

- NICE - All Nassau Inter-County Express Buses.
- Long Beach Bus - All Buses
- NYCT - Q5, Q12, Q13, Q15, Q16, Q17, Q20, Q26, Q27, Q28, Q31, Q44, Q48 and Q85 (at Rosedale, Bayside & Flushing LIRR Station Only)
- MTA Bus - Q19, Q25, Q34, Q50, Q65 and Q66 (at Flushing LIRR Station Only)

The Mail&Ride tickets are produced and mailed by a Third Party vendor. Pre-encoded MetroCards on special triplex stock are sent to the vendor for printing of the monthly commuter rail portion of the joint ticket. Unused stock has to be reconciled, sent back or destroyed, and reported back to MNR and LIRR.

3.2.4.4 Mobile Ticketing

Both MNR and LIRR began a joint program in 2012 to design and implement a mobile ticketing application for each of MNR and LIRR, with such program supported by a backend system developed, hosted and supported by a Third Party vendor. Rollout of mobile ticketing was completed for both MNR and LIRR in August of 2016; by the end of November 2016, approximately 12% of all transactions were using the eTix mobile ticketing application. Mobile tickets are visually validated at the present time, however both MNR and LIRR plan to implement electronic validation of tickets shortly to protect revenue and gather passenger information. For information regarding mobile ticketing integration, see Technical Specifications Section 0 (Mobile Ticketing Integration).

3.2.4.5 Onboard Sales

Tickets purchased onboard MNR and LIRR trains are sold at a higher or premium rate established by the onboard tariff (ranging from \$5.75 to \$6.50 more than the station fare), with the exception of customers who board trains at stations where neither a TVM nor ticket window is available. These stations are called “exception” stations and customers purchasing onboard the trains pay offboard fares.

Both MNR and LIRR allow customers to purchase single ride tickets onboard, as well as to “step up” or “extend” a ticket by the customer paying the difference between the ticket they purchased and the one of higher value. This higher onboard fare does not apply to senior citizens, people with disabilities or Medicare customers. Onboard tickets can be purchased using cash, but bills larger than \$50 are not accepted. MNR and LIRR now accept credit/debit card payments onboard trains with the system-wide deployment of handheld Ticket Issue Machines (TIMs) and Onboard Ticket Issue Machines (OBTIMs).

MNR and LIRR both use a three-tier tariff structure that encourages use of prepaid tickets. The first tier is the station fare which is offered at station windows and TVMs; the second is the fare sold onboard which is the highest; the third refers to discounted fares for joint ticket products and other purchases. The advent of the higher onboard tariff has drastically reduced onboard sales and cash handling as a result; currently onboard sales (including step ups and ride extensions) represent 3.1% of transactions and 2.1% of revenue for LIRR; onboard sales (including step ups and ride extensions) for MNR represent 5.4% of tickets and 2.0% of revenue.

The current onboard fare collection for both MNR and LIRR is for an ungated system and is performed manually by train crews (by a combination of visual and physical lift) with a goal of 100% inspection of tickets. Every MNR and LIRR revenue train is required to have at least one Conductor and every LIRR revenue train is required to have one Conductor and one Assistant Conductor to oversee the operation of the train doors and passenger safety. That Conductor will also perform revenue collection tasks when

possible. MNR Assistant Conductors (AC) and LIRR Ticket Collectors are assigned based on a staffing plan based on ridership for each scheduled train developed for each schedule. Typically there is at least one AC and additional ACs and Ticket Collectors are added to crews as required to support ridership. The Conductors' and ACs' duties are to ensure safe operation of the train service while also performing ticket servicing/collecting and sales; onboard LIRR staff designated as Ticket Collectors for their tour have fare collection and validation as their primary responsibilities. At MNR the Transportation Department is responsible for 889 Conductors and ACs, of which approximately 670 are responsible for fare collection; at LIRR there are approximately 1,1500 Conductors and ACs, of which 970 are responsible for fare collection. Conductors and ACs are issued a pouch for change, fare cards, Duplex Tickets, and other reference information. At MNR, Conductors and ACs are also issued a TIM device. For fares purchased onboard, customers are issued a receipt/ticket from this TIM and Duplex Tickets are carried for backup only. Commutation tickets (monthly and weekly passes) are visually inspected daily onboard MNR and LIRR trains; other non-commutation tickets are lifted, inspected and punched. Historically MNR and LIRR have performed random monthly ticket inspections referred to as "punch days" when all tickets (including commutation tickets) are lifted and inspected for validity by train crews. At LIRR, due to budget cuts in 2009, train crews are currently expected to physically check commutation tickets upon initial presentation and one other randomly designated day within the month.

3.2.4.5.1 Fare Evasion

Customers who do not have a ticket and do not have means to purchase one on the train are issued an IOU which is a written "promise" to remit payment to MNR or LIRR through the mail. At MNR these IOU forms are called PA61s and are issued through the Ticket Issue Machine, which can scan information from customer driver licenses and expedite issuance of the forms. Currently, MNR collects about 50% of PA61s issued. Since the introduction of TIMs, PA61 IOU issuances have decreased by 50%, which could be attributed to the onboard credit card payment option, while improved data collection has improved the efficiency of the PA61 IOU. At LIRR, IOU forms are called ADL6009s, and are issued through a similar process with Onboard Ticket Issue Machines which electronically gather information from customer driver licenses. Currently, LIRR collects about 35% of IOUs issued.

3.2.4.5.2 Remittance and Reconciliation

Fares collected must be reconciled for every tour for every crew member for both MNR and LIRR. Records of the days' sales as well as cash collected must be remitted at the end of the tour for processing and reconciliation. Cash Fare Reports and Train Collection Envelopes must be submitted for each MNR and LIRR tour even if no cash fares were collected.

Onboard sales data is transmitted using a Third Party wireless network through the TIM and OBTIM devices. Cash collected during a shift must be turned in within 48 hours of the end of the shift with some exceptions, such as if the employee is not on duty when the remittance is due. There is a dedicated window for remittance at Grand Central Terminal, or Conductors can go to an open ticket window any of the following stations:

- New Haven
- Stamford
- Brewster
- North White Plains
- Poughkeepsie

- Croton Harmon

Onboard LIRR staff complete a written sales form at the end of the day with common practice to fill it out throughout their tour. The form includes an accounting of which duplex, voids and ADL6009 forms are sold on each train as well as total sales. This must be turned in with their cash collected within 48 hours of the end of their shift. There is a dedicated window for remittance at Penn Station or Conductors can go to an open ticket window at any other station. Crew members are issued a pouch for change, fare cards, Duplex Tickets, and other reference information.

Onboard MNR and LIRR crew remittance activities are periodically reviewed by undercover observers on trains. There is a spotter program run by MTA Audit Services, and auditors ride trains posing as customers to review fare collection and ticket sales performed by staff. These auditors can issue four possible reports in the event of an issue: fare not collected but trainman has been seen; crew not seen; fare collected, but incorrect fare; and no hat or no badge. Transportation managers follow up on reports of noncompliance.

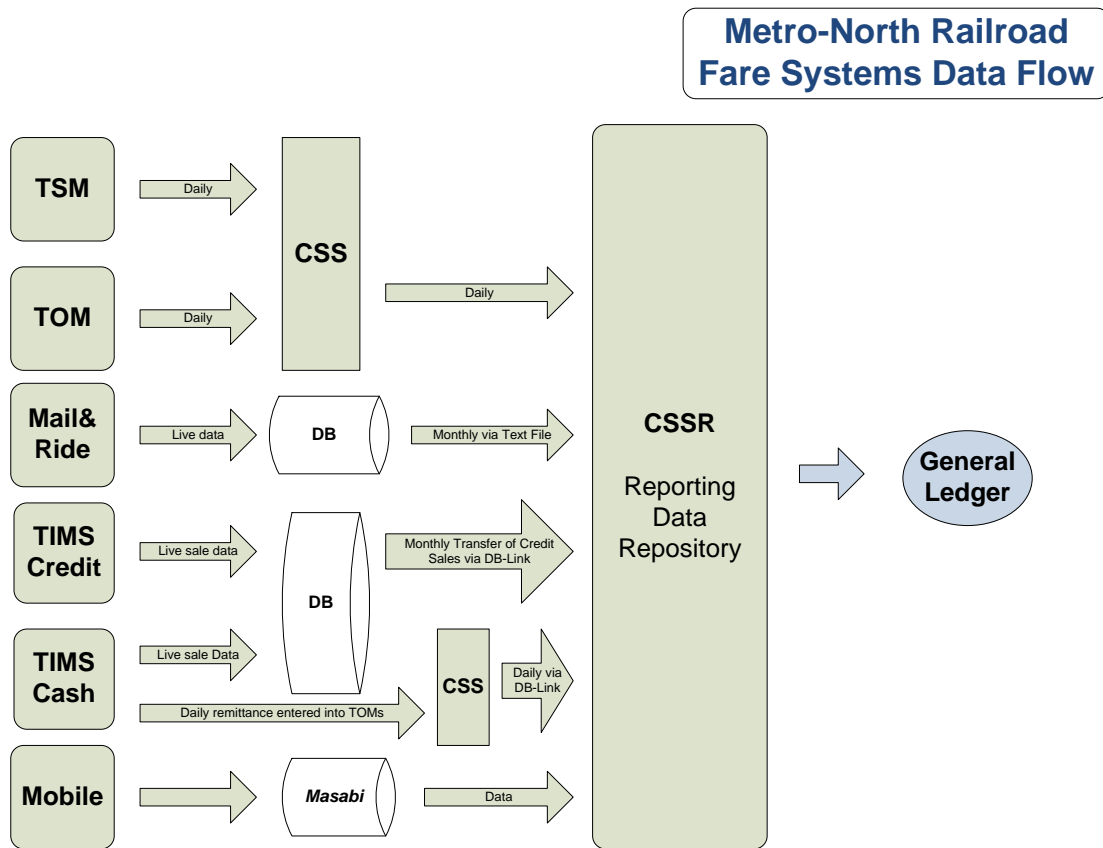
3.2.5 Ticket Sales and Fare Collection Support

3.2.5.1 Information Technology (IT)

The IT Departments at both MNR and LIRR were recently transformed and are now part of the larger Metropolitan Transportation Authority IT organization ("**MTA/IT**"). MTA/IT oversees the hardware, Software, and networks that comprise both MNR's and LIRR's separate fare collection systems. MNR and LIRR have separate backend systems from Scheidt & Bachmann (S&B), called the Central Support System (CSS). These systems were implemented at the same time, but each was implemented differently, and each has been customized for MNR's and LIRR's needs, respectively. Data flows through various sales channel systems are similar, but there are some differences to note described below.

At MNR, ticket sales and fare collection data goes into a data repository which is fed from several sources depending on the channel, as shown in Figure 3.5 (MNR Fare Systems Data Flow) below.

Figure 3.5: MNR Fare Systems Data Flow



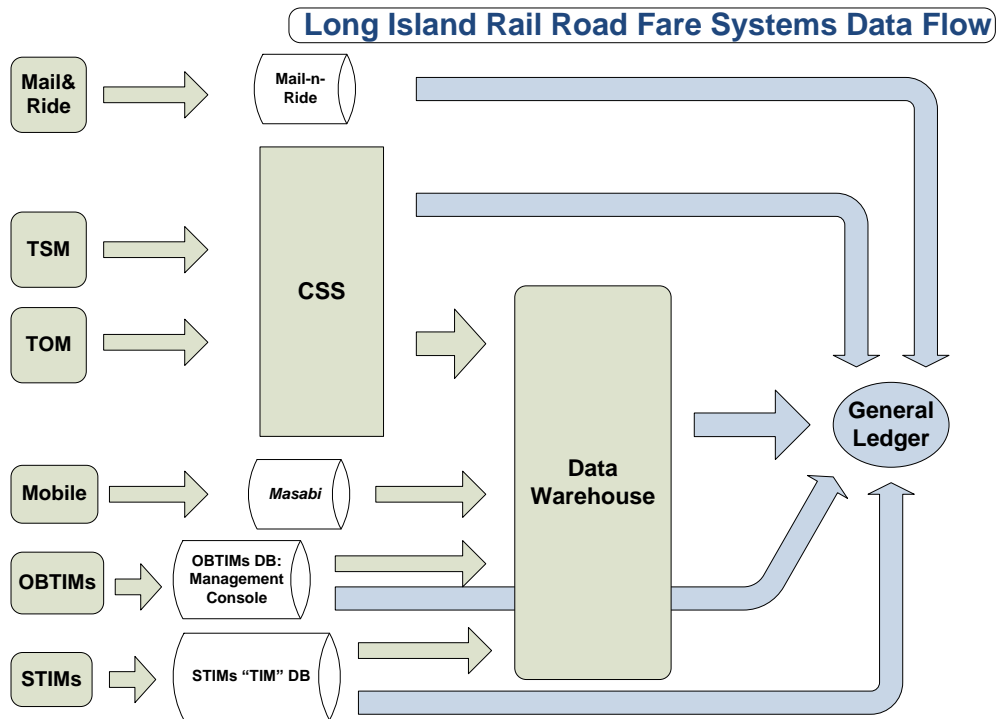
Data from TVMs, TOMs, and North White Plains operations is collected in the S&B CSS. All fare transaction data from the CSS is then transmitted into the General Ledger (GL) for overall settlement and reconciliation. For debit/credit processing, MNR uses Element as a gateway provider to First Data and then Chase.

CSSR (CSS-Reporting) is a data warehouse repository for all data gathered from all sales venues, and the CSSR is connected to the GL. Data flows from the CSS to CSSR, and from other systems (WebTicket, Mail&Ride, and credit/debit processing) through a database. Although mobile ticketing information resides in the Third Party provider's backend, it is also captured in the CSSR.

The LIRR CSS is located in two sites - Jamaica as the primary, and Hillside as the backup. Two Software updates are performed per year – first at the back office and then pushed out to all devices automatically (usually by machine class). The Stations Department performs a standard set of tests, and other departments perform additional testing cycles at the Hillside test facility. This takes about 10 days if there are no issues, and MTA/IT coordinates the testing cycle.

LIRR's sales and ticket information is gathered in a data warehouse from various sources including the CSS as shown in Figure 3.6 (LIRR Fare Systems Data Flow) below. Mail&Ride data is manually entered and goes through PeopleSoft, and OBTIM information goes from its backend database into PeopleSoft. Similar to MNR, LIRR's future mobile ticket information backend will be hosted by Masabi, and data will flow from there into the Data Warehouse.

Figure 3.6: LIRR Fare Systems Data Flow¹¹



¹¹ The TOM data flow includes current onboard sales since OBTIMs at LIRR currently represent only a very small pilot group.

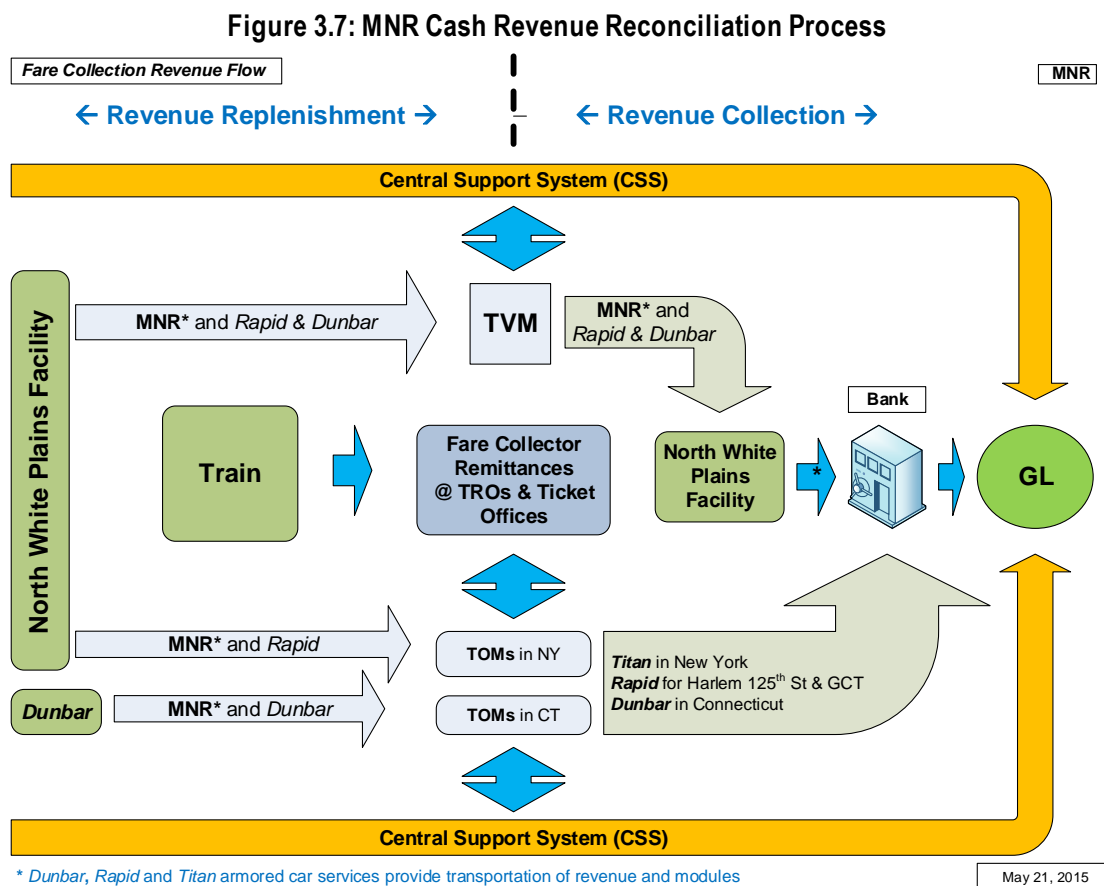
3.2.5.2 Revenue and Reconciliation

Revenue and reconciliation for MNR and LIRR vary because of their organizational structures and processes. These are described separately below:

3.2.5.2.1 MNR

Revenue information is compiled on an ongoing basis by Passenger Revenue Accounting. For MNR service East-of-Hudson, data is gathered from the CSSR data warehouse for revenue reporting (see Figure 3.5 (MNR Fare Systems Data Flow)). Onboard sales information, Mail&Ride, and mobile ticketing information go through separate systems. Refund and chargeback information is also maintained separately. All data is combined into Excel and manually loaded into the PeopleSoft General Ledger.

MNR's cash revenue reconciliation process flow is shown in Figure 3.7 (MNR Cash Revenue Reconciliation Process), below:



MNR has a number of special arrangements due to operating relationships with other States and their governing bodies, including the Connecticut Department of Transportation (CTDOT) and New Jersey Transit (NJT). These arrangements are outlined in the service agreements with MNR (there are separate agreements for CT and NJ that are legally binding). Fare increases occur on different schedules in New York and Connecticut as well as with NJT for West-of-Hudson service. In addition, operating/service agreements exist between MNR and each of CTDOT and NJT, which include formal mechanisms to address reconciliation and reimbursement arrangements according to the service contracts. These

impact both the control of the fares within each state as well as several fare policy-related revenue/subsidy adjustments:

- 1) The provision of a “fare credit” on the New Haven Line (whereby the state with the higher fare structure receives 100% of the revenue resulting from the higher fare structure)
- 2) Reimbursement for fare “hold-downs” to avoid having the fares from the closer-in stations in one state exceed the fares at adjacent stations in the other state. This impacts both the New Haven Line (e.g., where MNR currently constrains certain Rye/Port Chester fares to not exceed the Greenwich fares) as well as the Port Jervis and Pascack Valley Lines (where fare hold-downs are required for the northernmost NJT stations)
- 3) Reimbursement for the higher existing Connecticut Mail&Ride discounts

These adjustments go through a separate accounting process between MNR and CTDOT for the New Haven Line, and between MNR and NJT for West-of-Hudson. For the New Haven Line, all of the required calculations are made by the Operations Planning & Analysis Department and transmitted to the Subsidy Accounting Department. For the West-of-Hudson services, NJT prepares the calculations which are initially transmitted to Subsidy Accounting and then reviewed by the Operations Planning & Analysis Department.

Refunds are also processed by PRA. Transactions can also be refunded at a Ticket Window within 30 minutes. Refunds are relatively stable, and MNR recently changed its policy to implement a \$10 fee after the 30 minute timeframe has passed. For mobile tickets, non-activated tickets may be self-refunded within 5 minutes of purchase for the full value; after 5 minutes the customer will receive a partial refund for the portion of ticket that is unused less a \$10 fee. Currently refunds are about \$90k per month.

MNR does not have a formal, regular cross-departmental committee for fare policy changes, but these are managed and overseen by the Operations Planning & Analysis Department. This Department performs all calculations for fare changes for approval by the MTA. The Operations Planning & Analysis Department oversees Title VI analysis and compliance as well.

3.2.5.2.2 LIRR

The LIRR Controller’s office is responsible for monthly revenue, tickets and ridership reporting and provides a number of different reports, including breakdowns by ticket types, by mode, by branch, and by payment type. As described below and in Technical Specifications Section 3.2.5.1 (Information Technology (IT)), revenue information comes in from a number of different systems, some of which may require entry into Excel or Access by the Controller’s office for analysis.

Reports are run from the CSS, which are extracted as a large text file. All transactions processed through a TVM or TOM are collected by the CSS. The data is gathered daily, and payments come in daily from credit card transactions. TOM audits are conducted daily, and the team reconciles 95% of tours (of the approximate 1,600 tours per month). TVM cash deposits are kept in spreadsheets and checked against bank deposits for verification purposes. OBTime information is received through a file from its management console database. All data is booked in the PeopleSoft General Ledger.

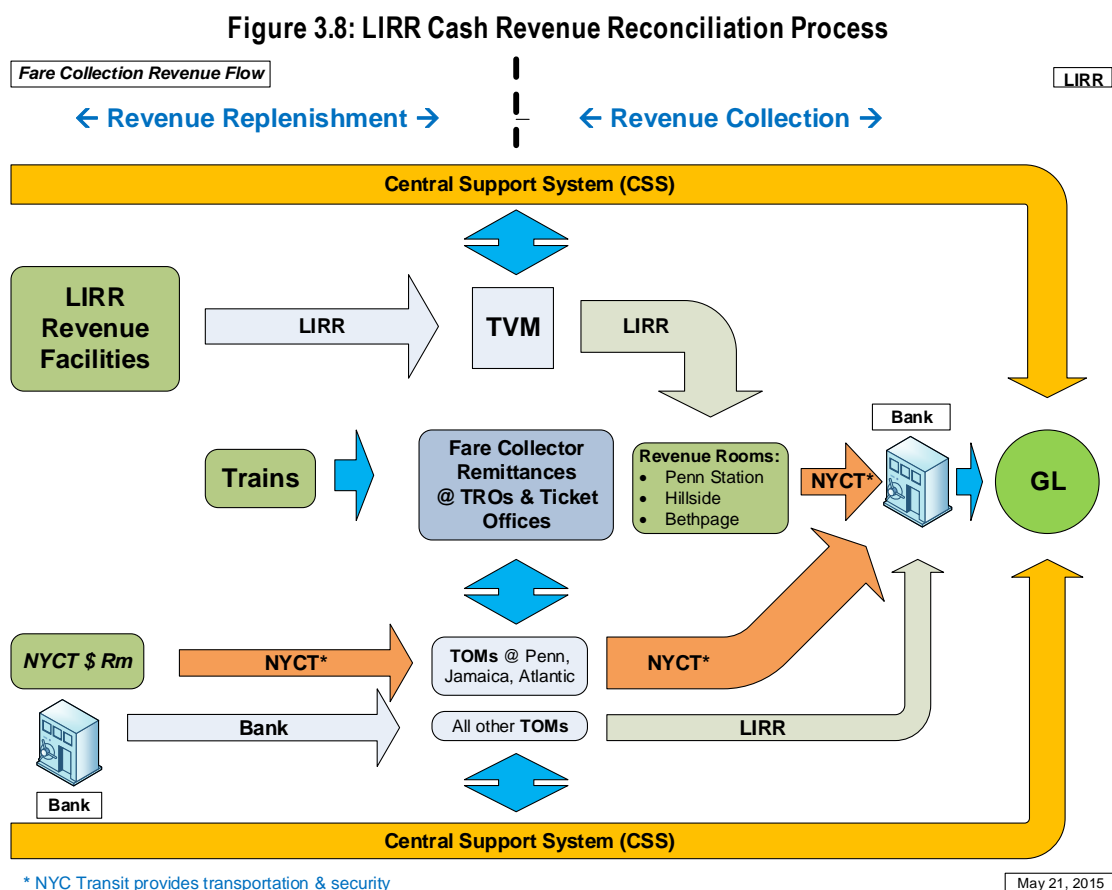
Group sales are reported separately, and PAYware performs credit processing for these.

Refunds in the back office are processed through a separate, Access database system, in which the Controller reviews and approves refunds before they are processed by MTA/IT. The total volume is about 100 refunds per day. Transactions can also be refunded at a ticket window within 30 minutes; after 30 minutes there is a \$10 fee and these are all sent to the back office. When the \$10 fee was

implemented there was a direct impact to the volume or refunds.

The Controller's office calculates the fares for each fare increase, and produces the tariff documents. After a fare policy change, the tariff is developed and an extensive testing process is performed. The Controller's office performs calculations using an established series of assumptions (such as the assumed number of rides per ticket), which depends on factors including work days per month. These assumptions are consistent with those used by MNR. Any change to these assumptions needs to be approved by senior management.

LIRR's cash revenue reconciliation process flow is shown in Figure 3.8 (LIRR Cash Revenue Reconciliation Process) below:



3.2.5.3 Service Planning

Service scheduling at MNR typically occurs at least twice per year, in early April and late October/early November. An additional schedule is typically done for the summer if major track work is planned. The Service Planning Department manages the planning for all trains, equipment, and crews, as well as timetabling for employees and customers. The Ridership Analysis and Marketing Team also performs passenger counts and issues annual ridership books. At a minimum, trains get counted at least twice each year. Train scheduling is done mostly manually using Microsoft Excel with input from various departments. Crew schedules are prepared in Hastus and Conductors and ACs select ("pick") their jobs for the six-month schedule periods.

LIRR uses TPSS, which is a desktop publishing software system for timetables. Work assignments are done manually and loaded into the GIRO software system. Most of the planning changes are included in two revisions each year. There are two crew picks and four timetable changes (usually in March, May, September, and November) annually. The LIRR Service Planning Department schedules special programs on an ongoing basis involving holidays, early release, sporting events, Citi Field events, and Belmont Raceway events.

3.2.5.4 Market Development

Both MNR and LIRR offer special travel packages to customers that vary seasonally and provide discounted access to events, tours, or destinations.

MNR develops special events that are offered to the public called “Getaways” – these are packages which combines train travel with tickets or tours. These programs are added to the tariff on a quarterly basis. Once Getaway packages are designed, they are submitted to Passenger Revenue Accounting who programs the packages into the TVMs/TOMs. These tickets are available for sale in ticket offices, and TVMs. Metro-North handles discounted group tickets through the Group Travel Department. Groups are defined as 10 or more individuals traveling together and there is a significant discount of 40-50% off regular one way fares. Group travel must be booked ahead of time. The Group Travel Department arranges approximately 1,200 group moves per year to many events across Metro-North territory. These are mostly school groups, but corporate and special groups have been increasing. Tickets are mostly sold through the TOMs on the date of travel, but larger groups can be pre-paid and picked up in advance if required. The Group Travel Department will also provide an escort for larger youth groups to ensure a fun and safe trip. Payments for group /excursion tickets accepted in cash, checks or credit cards; and are processed at ticket windows or via the Group Sales Department. Revenue Accounting reconciles the card payments for group sales as part of the daily settlement verification process as well as in the monthly system wide reconciliation.

LIRR’s Market Development Department runs programs, promotions, and partnerships designed to grow ridership. A main focus is on off-peak service based on available train seating capacity. Fare collection and policy for group sales are set apart from standard fares. The Market Development Department is involved in policy and selling where they act as a station office to sell tickets and collect revenue in conjunction with packages. Bulk tickets may be sold in advance and then packaged and distributed by a Third Party provider. Customers can also buy a package from a TVM, and then LIRR reimburses the other provider when invoiced. This method gives the passenger a ticket and provides a voucher, and these packages cannot be purchased onboard the train.

Some groups use a single group ticket with a final count rather than individual tickets, and will then be accompanied or directed by LIRR staff for their trip. Groups need to be pre-approved to use LIRR’s reservation system and may also be provided with additional customer service such as use of certain rail cars, LIRR staff escort, and/or MetroCard fares. Some groups may travel to an event together but return individually, in which case they require individual tickets. Group sales tickets have identifying wording on them.

Reconciliation for group tickets is performed monthly and bookkeeping happens daily. LIRR is currently updating its in-house developed reservation systems with MTA/IT. For group sales, LIRR allows a limited list of “bill-laters” who are allowed to pay later after receiving an invoice, which are collected within 45 days. Currently, sales transactions and payment occur in different systems, and LIRR is working to consolidate.

Packages can only be added to the system manually and this process takes place twice a year. For example, in order to sell summer packages, pricing needs to be prepared in March, approved, settled,

and tested, which can take approximately 3-4 months from beginning to end. The information then needs to be downloaded to each TVM.

3.2.5.5 Customer Service

Metro-North's Customer Relations Department is within the Customer Communications & Technology division of Customer Service & Stations. They receive customer complaints via emails, letters, and social media. In the case of complaints, they have the ability to issue a "comp" ticket to promote good customer service. Currently they issue about 500-600 comp tickets per year. These are pre-printed tickets and they are tracked and reconciled monthly. Passenger requests may come through the Refunds Department or they may come directly to Customer Relations. Customer correspondence is tracked in an Oracle-based system called RightNow which is used by the entire MTA Group. The Customer Information Center (CIC) utilizes an Interactive Voice Response (IVR) phone system with an Automated Call Distribution (ACD) to handle customer calls. The CIC handles all informational related calls and triages complaint and other MNR service calls. Customer assistance for Mobile Ticketing will be handled through the CIC.

LIRR Corporate Communications includes the Public Information Office. Customer complaints are received by emails, letters, and social media, and tracked in the RightNow system. LIRR is currently transitioning all correspondence from its current letter writing system, which is Access-based, to the RightNow system. They also have the ability to issue a "comp" ticket to promote good customer service, and a couple hundred of these are issued annually. Sales and Promotions provides these tickets upon request 20 at a time; they are issued from a TOM and logged. Passenger requests may come through the Refunds Department or they may come directly to Public Affairs.

3.2.5.6 Labor Relations

At MNR, the Transportation Department employs 889 Conductors and Assistant Conductors represented by the Association of Commuter Rail Employees (ACRE), of which approximately 670 are responsible for fare collection. The others are assigned to various, non-revenue related jobs. Minimum staffing levels for train service is part of the current labor agreement based on a minimum of one Conductor and one Engineer at a minimum per train; staffing is determined by the Planning Department based on train ridership. The helpdesk, TVMs and TOMs are supported by 118 employees represented by the Transportation Communications Union (TCU). These employees service and maintain the TVMs and TOMs deployed and are also the clerks and agents who sell tickets from the Ticket Offices.

At LIRR, there are approximately 1,150 Sheet Metal Air Rail Transportation (SMART) Conductors and ACs, of which 970 are responsible for fare collection. All train staff are hired as ACs for at least their first 2 years of experience and can also work as a Ticket Collector until they pass their Conductor qualifying exams. Minimum staffing levels of Conductor and ACs for train service are part of the current labor agreement. TVMs and TOMs are supported by technicians in the Transportation Communications Union (TCU) and staffing is based on the TVMs deployed and servicing needs. Ticket Offices are staffed by clerks and agents who are also represented by TCU. In total there are over 150 LIRR TCU employees involved with ticket selling.

4 Project Overview and Scope

4.1 Background

The NFPS specified in these Technical Specifications will replace NYCT's current MetroCard System, as well as MNR and LIRR's current fare systems, including both the CSS and the existing station equipment. It is critical that the NFPS maintain the fare collection functions provided by the current systems (including the MetroCard System), and improve those functions, in accordance with the Contract Documents, as selling tickets and collecting fares is an essential function for the MTA Group.

4.2 Project Goals & Objectives

4.2.1 Project Goals

The goals set out in this Technical Specifications Section 4.2 (Project Goals & Objectives) are intended as informative guides relating to the NFPS. The goals are divided into two categories: economic and non-economic.

4.2.2 Economic Goals

Priority	Goal	Description
High	Maintain or increase transit use without increasing net cost	Minimize annual costs, simplify operating and maintenance activities and improve operational reliability while maintaining or increasing revenue
High	Minimize implementation impacts and costs	Limit the changes required or disruptions to MTA Group operations during implementation, along with minimizing costs for equipment and infrastructure (i.e., capital costs)
High	Maximize system security	Meet compliance requirements while addressing fare evasion and fraud
Medium	Be cost-effective and maximize the ability to accommodate future fare policy and operational needs in a timely manner and at minimal cost	Accommodate current and potential future fare policies and structures with the appropriate level of system (Software) flexibility
Medium	Minimize the risk of unforeseen cost increases, technological obsolescence and restrictive business relationship requirements	Provide technology that is supportable over the long-term with the ability to accommodate future changes
Low	Facilitate potential non-transit business development and revenue opportunities to support the MTA Group's operating and capital budgets	Facilitate new opportunities or grow non-transit revenues and align sales strategies while minimizing risk to transit revenues

4.2.3 Non-Economic Goals

Priority	Goal	Description
High	Be convenient and easy to understand for customers	Encourage passengers to adopt the NFPS by providing clear communication and benefits to passengers, including greater access to transit
High	Maximize equity for all customer groups	Ensure customer equity and accessibility, including unbanked or under-banked customers

Priority	Goal	Description
High	Be adoptable, to the extent practicable, by all transit systems in the NY region	Maximize potential for adoption by Ancillary MTA Group Entities and integration with adjacent payment systems, while limiting costs and risks
High	Maintain or enhance operating standards	Maintain or improve existing operating conditions; do not decrease rail Faregate throughput or increase bus dwell times
High	Enhance data for use in operations and service planning, while maintaining customer privacy	Provide enhanced fare data via improved update times for both agency and customer benefit
Low	Identify opportunities to advance innovative fare payment initiatives	Facilitate improvements to operational processes, staff efficiency, bus speeds and customer queuing

The Preliminary and Final Design Reviews, discussed in Technical Specifications Section 26 (Design Reviews), shall include the MTA's review and assessment of the NFPS' compliance with the project design principles listed below.

4.2.4 New System Design Principles

In addition to capturing project priorities, the project goals shall be the basis for NFPS design principles.

4.2.4.1 Improved Customer Convenience and Service

A primary focus of any fare collection system will be customer convenience, and the service provided with that system. The NFPS will be designed with the end-user in mind, and provide new conveniences beyond the limitations of the current payment systems at the NFPS Agencies:

- Use of Media that is tapped or proximity-based instead of swiping
- Use of Media that supports visual and electronic validation
- Use of Media that is more durable and secure than existing Media
- Allow the use of Media that the customer already has (mobile phones, Contactless Bank Cards)
- Provide real-time or near-real-time access to account information and fare loading
- Provide mobile, web and telephone customer self-service tools
- Enable customer service staff to provide a variety of account management services
- Enhance the experience and efficiency of internal customers and stakeholders performing business and data analyses
- Provide several convenient channels to purchase, reload and service Media

4.2.4.2 Open Architecture Account-Based Approach

The MTA requires an Open Architecture, Account-Based approach that:

- Provides NFPS Agency control of system interfaces (both internal and external)
- Allows for procurement or replacement of system components individually, if desired
- Enables multiple Third Party options for procurement and operation
- Stores fare value and data at a central backend
- Provides, but does not solely rely on, real-time communications among all fare collection equipment
- Supports integration with other account-based systems
- Separates the core fare processing engine from Front-End devices

4.2.4.3 Reduce Cash and Increase Out-of-Network Sales

Reducing costs and improving cost-effectiveness of fare sales and collection is a top priority and captured in the economic project goals. The NFPS will be designed to:

- Encourage Open-Loop Media (not issued by the MTA Group) to be used for fare payment
- Allow customers to use devices already in their possession to reduce Media distribution costs
- Discourage use of cash payments, which is costly to collect and reconcile, while maintaining compliance with Title VI requirements
- Incentivize repeated use of electronic Media and limit benefits of cash
- Expand out-of-network sales channels and encourage customers to utilize them
- Make online and mobile fare loading convenient and reliable
- Encourage out-of-network reloading
- Expand Media ordering options for existing retail partners, social service agencies and schools
- Explore new retail sales channels options
- Leverage existing MetroCard usage to maintain/increase new electronic Media use

4.2.4.4 Leverage Existing Infrastructure

The NFPS Agencies will leverage existing and planned infrastructure to minimize additional costs associated with implementing the NFPS. The NFPS will make use of the network communications upgrade work throughout the NFPS Agencies' systems that is being performed outside the Project. In addition, there is extensive MetroCard distribution and payment processing infrastructure in place that will be maintained where applicable. While the fare distribution and equipment technology may change, the opportunities for reuse include:

- Enable new ISO 14443-compatible Contactless Readers to fit into and interoperate with current turnstile arrays in the field to support side-by-side operations with MetroCard for a period of time
- Operate existing Faregates where applicable
- Maintain existing farebox equipment where applicable
- Integrate future fare equipment with existing and planned bus systems for single bus operator sign-on and communications/geolocation where possible
- Leverage existing NYCT subways backbone communications infrastructure (SONET/Asynchronous Transfer Mode) in addition to the planned PSLAN infrastructure in all stations
- Make use of the existing MNR and LIRR network communications for the NFPS

4.2.4.5 Operation Performance and Data Enhancements

The NFPS must maintain the following operating standards and enhance data for use in operations and service:

- Fare payment or validation will not decrease existing throughput at rail turnstiles
- Fare payment or validation will not increase existing bus dwell times
- Fare payment or validation processes will not increase the time required by onboard crews at current staffing levels
- NFPS Equipment will be ruggedized for various environmental conditions, customer use and vandalism protection – particularly components for cash acceptance

- The NFPS will facilitate all ADA and special access needs for Faregates and other applicable fare collection equipment, including Ticket Vending Machines and other customer- and employee-facing equipment
- More granular fare data will be made available to relevant NFPS Agency staff and customers
- Fare data will be accessible in real-time (or near-real-time) for NFPS Agency operations, customer planning, ad-hoc reporting by various business groups and analytical reporting/dashboards utilizing historical data
- Modern data reporting and analytics will be inherent in the NFPS, and flexible in configuration for each of the NFPS Agencies, on an NFPS Agency-specific basis.

4.2.4.6 Maintenance and Monitoring Requirements

The NFPS shall provide on the ability to monitor and maintain the NFPS Equipment at all times. In order to operate such a system, the following design requirements are to be met in the NFPS:

- Provide remote monitoring tools that provide real-time device and component-level status
- Integrate with a Maintenance Management System (MMS) to manage maintenance issues and preventative maintenance schedules in accordance with the MTA's requirements
- Include ability to direct and control component alerts so that dispatching and repairs are made more efficiently
- Procure equipment with Line Replaceable Units (LRU) that are quickly and effectively replaced
- Update LRU/component configuration, Software and firmware remotely
- Provide for and incorporate testability functions and interfaces at the LRU level to support back shop maintenance repairs, if found necessary
- Provide field staff the ability to conduct basic maintenance and monitoring functions as appropriate
- Execute system self-diagnostics to minimize maintenance staff activities
- Provide ability for remote troubleshooting and control including device reset, disabling and "heartbeat" monitoring
- Provide monitoring and alerts for device consumables including Media stock, receipt paper and revenue levels
- Provide real-time tracking of all revenue handling devices such as coin/cash devices as they move throughout the NFPS, including barcodes on system components for automated tracking
- Provide audit trail of maintenance activities for security reasons
- Provide reports to indicate availability and KPI requirements for critical devices and components
- Provide module diagnostic interfaces (tools) to assist in modular and system troubleshooting

4.2.4.7 Serve All Rider Classes

The NFPS will be designed to improve the availability and equitability to all rider classes, including the ability to:

- Provide Media and payment options for the unbanked and under-banked
- Provide account management and service for customers with and without access to internet, telephone or smartphones
- Enable dynamic fare structures that can provide more equitable options for underprivileged rider classes, including fare capping where a passenger pays for single trips until a certain pre-defined threshold is reached, and the remainder of the trips within that time period would be "free"

- Maintain ADA compliance with bus fare equipment and all MNR and LIRR Ticket Vending Machines and Faregates. This includes both the physical aspects of ADA compliance (e.g., height requirements for equipment serving customers who use a wheelchair), as well as communication requirements (e.g., braille and audio for the visually impaired)
- Provide all fare payment information (including notifications and alerts at fare equipment) in multiple languages per the MTA's Limited English Proficiency Plan (to be made available) and in accordance with FRA and FTA guidelines

4.2.4.8 Project Management and Scope of Authority

The MTA is the sole contracting party to the Contract Documents and shall serve throughout the Project as the agency project manager on behalf of the NFPS Agencies. Unless expressly stated otherwise, the SI shall submit all Deliverables, Submittals, and other required materials to the MTA, and the MTA shall be responsible for disseminating the same to other NFPS Agencies, collecting and providing other NFPS Agency feedback, and providing that feedback to the SI. To this end, these Technical Specifications have been structured to reflect the MTA's oversight and management role. For example, although CVMs will be used by each NFPS Agency, req. # 16.6.7-7 states that the SI "shall submit conceptual designs of the CVM instructions and related graphics for the MTA's review and approval." Once the SI submits said conceptual designs to the MTA, the MTA shall then review the submissions with the other NFPS Agencies (to the extent that the MTA determines that doing so is necessary) and the MTA shall provide collective feedback to the SI regarding the conceptual designs. This structure is intended to facilitate project management and to better ensure that the SI is given consistent direction.

Notwithstanding the preceding paragraph, the MTA is entitled to delegate any of its decision-making authority set out in these Contract Documents to specific NFPS Agencies by providing written notice to the SI (each, a "**Delegation Notice**"). Each Delegation Notice shall include: (i) the specific decision-making authority being delegated (each, the "**Delegated Right**"); (ii) the specific NFPS Agencies to which the Delegated Right is being delegated (each, a "**Designated NFPS Agency**"); and (iii) the duration that the delegation shall remain in effect. Upon receipt of a Delegation Notice, the SI shall comply with the direction and decisions made by the Delegated NFPS Agencies, as if such decisions were made by the MTA, and the MTA shall be responsible for such decisions made by the Delegated NFPS Agencies as if the MTA had made the decisions itself. The MTA shall have the right to rescind or modify any Delegated Rights (and any Delegation Notice) immediately by notifying the SI of the same.

If either (i) the SI is uncertain as to whether an NFPS Agency is acting within the scope of a Delegated Right, or (ii) an NFPS Agency issues a direction or request to the SI that is reserved to the MTA under these Contract Documents, or otherwise exercises an MTA right established under the Contract Documents, then the SI shall request clarification and approval from the MTA prior to complying with the other NFPS Agency's direction, request, or exercise of an MTA right. The SI waives all claims for relief due to the actions of an NFPS Agency (other than the MTA) if the SI fails to obtain such clarification and approval, and the SI shall also be solely responsible for correcting (at the SI's sole cost and expense) any non-compliance with its obligations due to the unauthorized actions of an NFPS Agency. By way of clarification, if the SI acts on NYCT's approval of conceptual designs for CVM instructions that were submitted pursuant to req. # 16.6.7-7 and the MTA did not provide its own approval or otherwise delegate such approval rights to NYCT pursuant to a Delegation Notice, then such NYCT approval shall be invalid and the SI shall be solely responsible and liable for its reliance on such invalid NYCT approval.

4.3 Interoperability

The MTA Group is striving towards a goal of interoperability amongst its services, and a single, integrated fare payment system is one of the key elements in providing a unified customer experience. Many MTA customers use more than one service for their travel needs across the New York metropolitan area. Service expansions, combined with technology advancements, will create increasing opportunities to travel across various transportation modes, provide additional opportunities to reach out to customers and better facilitate information gathering and sharing.

Interoperability goals identified as part of the MetroCard System implementation in 1994 resulted in the creation of the joint MetroCard, with a visual commuter rail ticket on one side and a magnetic stripe (magstripe) MetroCard for New York City Transit on the other side. Although this joint product allowed customers to use one piece of Media for travel on both a commuter rail line and subway or bus services, there were limited joint products available, and information sharing among the MTA Group has been limited as a result of three separate fare payment systems. Under the Project, Joint Media will migrate to Contactless Smart Cards and smartphones enabling access to all systems.

Details of NFPS interoperability and a more unified customer experience will be determined during design reviews. However, due to operational variances among transit modes and the staged deployment of the NFPS, one of the key differences across NYCT, MNR, and LIRR at launch of the NFPS is likely to be the types of Media issued and accepted on bus/subway versus commuter rail. The table below describes *one possible approach* to those differences and is provided only as a reference to assist in the understanding of each NFPS Agency's operations; ultimate configuration and Media rules may utilize other capabilities described in the Contract Documents and differ significantly over the course of design and delivery.

Implementation of an NFPS Agency-shared NFPS will support a single customer account across the NFPS Agencies. This single account will provide a seamless experience for customers, as well as provide expanded data collection, access and reporting capabilities to the MTA Group and its staff. Because of the account-based nature of the NFPS, customers will be able to access and modify their accounts, as well as perform fare purchase and other customer service-related functions in real-time. Expanded web functionality and a native mobile application will provide expanded access to mobile ticketing, and will allow a seamless experience for accessing other MTA Group services, including trip planning and customer service. The NFPS will accommodate all fares and operations of the NFPS Agencies and the Linked NFPS Entities. The SI shall support full integration of all tariffs and policies of each NFPS Agency, including all joint and individual tickets and options, which are provided in Technical Specifications Appendix A (NYCT Tariff) and Appendix K (LIRR and MNR Tariffs).

It is contemplated that at launch, NYCT will largely focus on the issuance and acceptance of Contactless Media, but will also support barcode Media in various forms if the Optical Barcode Readers Option is exercised. Relatedly, it is contemplated that MNR and LIRR will largely focus on the issuance and acceptance of barcode Media in both paper and mobile forms, as well as Joint Media to support contactless acceptance on NYCT. All Closed-Loop Media, including barcode Media, will be linked to a Transit Account maintained in the NFPS Backend.

The Media issued and accepted by each of the NFPS Agencies is expected to change and expand over time, to support greater interoperability, future payment technologies, and enhancements to the customer experience. As such, the NFPS shall be designed and implemented in a manner that facilitates this future flexibility. For example, during design, MNR and LIRR may seek to implement validation/inspection of Open Payment Media using the provided OSVD Software while considering utilizing latent NFPS capabilities to deploy more significant changes to the commuter rail fare payment and validation process in the future.

The NFPS shall be architected on a foundation that can evolve over time to provide increasing types of interoperability at both the Media and account level, further enhancing a seamless customer experience. The requirements in the Contract Documents describe the full scope of functionality to be supported.

			Extended Use (EU) Smart Cards	Limited Use (LU) Smart Cards	Paper Media (Visual / Barcode)	Joint Media (LU + Barcode)	Mobile Contactless (Closed-Loop)	Mobile Visual / Barcode (Closed-Loop)	Open Payments (Validation)
MTA Group	Media Distribution	Customer Website	✓		✓*	✓*			
		B2B Portal	✓	✓	✓*	✓*	✓†	✓†	
		Mobile App					✓	✓	
New York City Transit (NYCT)	Media Distribution	Retail Network	✓				✓‡		
		NYCT Customer Call Center (IVR & CRM System)	✓						
		Configurable Vending Machine (CVM)	✓	✓					
		Customer Service Point of Sale (CS POS)	✓	✓					
	Fare Validation	Bus and Subway Validators	✓	✓	✓**	✓	✓	✓**	✓
		Wayside Vending Machine (WVM)	✓	✓	✓**	✓	✓	✓**	✓
Metro-North Railroad (MNR) & Long Island Rail Road (LIRR)	Media Distribution	RRs Customer Call Centers (IVR & CRM System)		✓	✓*	✓*			
		Configurable Vending Machine (CVM)		✓	✓	✓			
		Ticket Office Machine (TOM)		✓	✓	✓			
		Onboard Sales and Validation Device (OSVD)			✓				
	Fare Validation	Onboard Sales and Validation Device (OSVD)	✓	✓	✓	✓	✓	✓	✓

* Required to support railroad Mail&Ride program. Details of a Third Party fulfillment process to be determined during Design Review.

** Assumes execution of Optical Barcode Readers Option.

† Support remote load/reload only for B2B program participants

‡ Support load/reload only

To support interoperability prior to the full deployment of the NFPS, the NFPS Agencies may deploy Third Party dual interface (i.e., Contactless/NFC/optical) Validators at subway and bus points-of-entry. To the extent that such Validators are deployed, the SI shall incorporate these into the NFPS, ensure continuous acceptance of applicable Fare Products, and support integration of NFPS Data. The MTA anticipates additional information on this scenario would be provided as it becomes available (including within the Contract Documents).

4.3.1 Mobile Ticketing Integration

The SI shall integrate with the existing mobile ticketing solution deployed by MNR and LIRR. If the Optical Barcode Readers Option (see Technical Specifications Section 35.5 (Optical Barcode Readers)) is exercised, then the SI's integration efforts shall include acceptance of mobile barcode tickets, generated by the existing mobile ticketing solution, on all NYCT, MTA Bus Company, MaBSTOA, and SIRTOA buses and subways, and by MNR and LIRR via the OSVDs. The SI shall assume no expense from the existing mobile ticketing provider in order to support this integration.

While it is envisioned that initially the existing mobile ticketing solution, including the existing mobile ticketing backend, will continue to be used to support mobile ticketing on MNR and LIRR, the SI shall enable a customer-friendly phasing out of this solution through a transition to the new SI-provided NFPS Mobile Applications (see Technical Specifications Section 23.1 (NFPS Mobile Applications)). This transition will include transition of existing mobile users, and transition of all mobile ticketing functions to the NFPS Backend, as the single system of record. The SI shall work with the existing mobile ticketing solution provider to support the transfer of customer data wherever possible. At the time of transition, the NFPS Mobile Applications shall, at a minimum, have all of the customer-facing features of the existing mobile ticketing solution. Details on the timing of this transition can be found in Technical Specifications Section 4.9 (Project Schedule).

4.4 NFPS Agencies and Linked NFPS Entities

The NFPS will apply to all systems and equipment that permit the NFPS Agencies to collect funds from customers in exchange for riding NFPS Agency services, as further described in this Technical Specifications Section 4.4 (NFPS Agencies and Linked NFPS Entities). In addition, the NFPS shall (i) interoperate or be capable of interoperation with systems of Linked NFPS Entities and Ancillary MTA Group Entities, and (ii) otherwise be expandable for use by Ancillary MTA Group Entities and Linked NFPS Entities, both as further described below and elsewhere in these Contract Documents. Such interoperation and expansion shall permit the Ancillary MTA Group Entities and the Linked NFPS Entities to utilize the NFPS as further contemplated herein, including in Agreement Section 4 (Expanded Use of NFPS).

4.4.1 NFPS Agency Background

Systems and equipment that permit the NFPS Agencies to collect funds from customers in exchange for riding NFPS Agency services are owned or controlled by NFPS Agencies as follows:

- **New York City Transit:** The largest agency in the MTA Group regional transportation network as well as in North America, NYCT operates subways in four New York City (NYC) boroughs, buses and paratransit service in all five NYC boroughs, and SIRTOA. NYCT carried approximately 8.2 million customers on an average weekday in 2016, 5.8 million on subway and 2.4 million on bus. The subway system includes 24 lines (21 routes and 3 shuttles), 469 stations, and approximately 6,311 subway cars (the largest subway car fleet in the world). The NYCT bus system, and that of its subsidiary Manhattan and Bronx Surface Transit Operating Authority (MaBSTOA), includes more than 200 local and 30 express bus routes, utilizing a fleet of 4,431 buses. There are

currently 8 SBS or bus rapid transit routes in operation with additional service planned. Annually, the subway provides 1.7 billion rides and the buses 677 million rides. NYCT operates services 24 hours a day, 7 days a week.

- **MTA Bus Company:** MTA Bus Company consolidates operations of seven bus companies previously operated under separate Department of Transportation franchises. MTA Bus Company operates 46 local and 35 express bus routes in the Bronx, Brooklyn, Manhattan and Queens. MTA Bus Company operates a fleet of 1,264 buses carrying about 410,000 passengers on average each weekday. Annually, MTA Bus Company provides 125 million rides. These Technical Specifications include MTA Bus Company services in all discussions of bus operations.
- **Staten Island Rapid Transit Operating Authority (SIRTOA):** Operated under NYCT, SIRTOA provides train service along Staten Island's south shore 24 hours a day carrying an estimated 24,000 passengers on average each weekday. Currently, fares are collected at only two of the 22 total stations. Annually, SIRTOA provides 7 million rides along a single line using 63 subway cars.
- **Long Island Rail Road (LIRR):** Long Island Rail Road is both the largest commuter railroad and the oldest railroad in America operating under its original name. Chartered in 1834, it extends from three major New York City terminals — Penn Station, Flatbush Avenue, and Hunterspoint Avenue — through a major transfer hub at Jamaica to the easternmost tip of Long Island. LIRR operates 11 rail lines and in 2015 carried over 87 million riders.
- **Metro-North Railroad (MNR):** Metro-North Railroad is the second largest commuter railroad in the nation. Its main lines — the Hudson, Harlem, and New Haven — run northward out of Grand Central Terminal into suburban New York and Connecticut. MNR's ridership in 2015 was over 86 million and on weekdays averaged 289,596 passengers.

Additionally, as interoperability is a key project goal, the NFPS shall otherwise be capable of future interoperation with Ancillary MTA Group Entities as further contemplated herein.

4.4.2 Linked NFPS Entities

The following entities will require interoperability with the NFPS and the NFPS Agencies:

MetroCard Affiliates

MetroCard Affiliate	Sales	Validation
Westchester County Department of Transportation Bee Line System (bus only)	N/A ¹	Electronic validation using NFPS Validators.
Nassau Inter-County Express Bus System (bus only)	N/A ¹	Electronic validation using NFPS Validators.
SNT Bus (Hudson Rail Link) (bus only)	N/A ¹	Electronic validation using NFPS Validators.
Academy Express Staten Island Express Buses (bus only)	N/A ¹	Electronic validation using NFPS Validators.

Port Authority of New York and New Jersey (PANYNJ) PATH System	Sells NFPS Media via MTA CVM but with configured/modified GUI.	Has its own turnstiles that will need to accept NFPS Media. Non-recurring engineering for turnstile integration is considered out of scope of the NFPS project pricing.
PANYNJ JFK AirTrain System	Sells NFPS Media via MTA CVM but with configured/modified GUI.	Has its own turnstiles that will need to accept NFPS Media. Non-recurring engineering for turnstile integration is considered out of scope of the NFPS project pricing
Roosevelt Island Tram	Sells NFPS Media via MTA CVM.	Electronically validates using MTA turnstiles.

¹ Assume same general fare structure as NYCT (i.e. similar Fare Products, etc. but potentially with different fare amounts).

The NFPS implementation details for the MetroCard Affiliates will vary based on the services being provided and the level of NFPS integration. The SI shall assume that this Work with MetroCard Affiliates will not occur prior to the Engineer's issuance of a Beneficial Use Certificate for BU#3.

For bus-only MetroCard Affiliates, the SI shall assume that Bus Validators will be installed on buses in a similar fashion to those installed for NYCT. For the PANYNJ JFK AirTrain System, the SI shall assume the Software for applicable CVMs will be similar to that deployed for the MTA, but with the addition of AirTrain-specific Fare Products available on NFPS Media. For the PATH System, the SI shall assume the CVM software is similar to that deployed for the MTA, but with the addition of PATH-specific Fare Products available on NFPS Media. For the Roosevelt Island Tram, the SI shall assume the Tram locations are virtually identical to NYCT stations and the Tram will use the MTA's fare structure and NFPS Media.

The SI, leveraging the Open Architecture principles of the NFPS, shall perform all design, configuration, and, testing to support the issuance and/or acceptance of NFPS Media by the MetroCard Affiliates, as requested by the MTA. Fees for such integration shall be handled as follows:

- (i) all non-recurring engineering costs required for such configuration, testing, and implementation will be exercised on a per-MetroCard Affiliate basis, and the same shall be exercised pursuant to Agreement Section 21 (Optional Services) at the prices included in Price Form F2 (Additional Equipment, Integration Services, and Media); provided, however, that any non-recurring engineering costs associated with the integration of the existing PATH and AirTrain turnstiles shall be treated as Extra Work, but only to the extent that such Extra Work is not set out in Price Form F2 (Additional Equipment, Integration Services, and Media);
- (ii) all NFPS Hardware, including installation, required to support the implementation of the NFPS for these MetroCard Affiliates shall be exercised pursuant to Agreement Section 21 (Optional Services) at the prices included in Price Form F2 (Additional Equipment, Integration Services, and Media); and,
- (iii) any additional out-of-scope work to complete the integration of the MetroCard Affiliate that is not contemplated pursuant to Agreement Section 21 (Optional Services) or otherwise priced pursuant to price Form F2 (Additional Equipment, Integration Services, and Media), shall be treated as Extra Work using the labor rates included in Price Form G (Labor Rates for Additional Work), as the same may be updated pursuant to the terms of the Agreement.

If the MTA elects not to engage the SI and incur the costs for such work pursuant to this Technical Specifications Section 4.4.2 (Linked NFPS Entities), then the MTA shall notify the SI of the same and the SI and the applicable MetroCard Affiliate shall enter into a separate agreement regarding such work; provided, however, that the fees for such work shall be the same as if the MTA engaged the SI directly. By way of clarification, and not limitation, if the SI and a MetroCard Affiliate enter into a separate agreement relating to the design, configuration, and testing to support the issuance and/or acceptance of NFPS Media by the MetroCard Affiliate, then the fees to which the SI is entitled for such services shall be those amounts calculated pursuant to these Contract Documents as if the MTA engaged the SI directly pursuant to these Contract Documents to provide such services.

Commuter Rail Affiliates

MNR and LIRR sell Joint Media with the agencies listed below. These affiliates use visual validation for their portion of that ticket.

- Nassau Inter-County Express Bus System
- New Jersey Transit (NJT)
- Long Beach Bus
- Suffolk County Transit
- Huntington Area Rapid Transit
- Dutchess County Transit
- Hudson Rail Link
- Newburgh/Beacon Ferry
- Haverstraw/Ossining Ferry
- Westchester County Department of Transportation Bee Line System
- Ulster-Poughkeepsie LINK
- TAPPAN ZExpress
- Putnam Area Regional Transit (PART)
- Housatonic Area Regional Transit (HART)
- CT Transit (Stamford, New Haven and Waterbury divisions)
- Norwalk Transit
- Connecticut Department of Transportation (CT DOT) - CT RAIL (includes Shoreline East and Hartford Springfield service)
- Newburgh/Beacon Shuttle bus (Leprechaun Lines)
- Greater Bridgeport Transit Authority
- Milford Transit District

For the Commuter Rail Affiliates, the SI shall be responsible for all design, configuration, and testing to support the issuance of visually-inspected Joint Media by MNR and LIRR for acceptance by these agencies. No additional NFPS Hardware is required to support these functions.

Other Regional Agencies

Other Regional Agencies in the NYC region may choose, at a future date, to participate in the NFPS. While these Other Regional Agencies are not explicitly included in the Technical Specifications, the NFPS must be designed to accommodate future partnerships and interoperability through its use of Open Standards and Open Payment, as well as common data formats and fields and standard Application Programming Interfaces.

Although these Other Regional Agencies do not currently accept MetroCard for fare payments, they may choose in the future to participate in the NFPS or in fare collection using Media that is interoperable with the NFPS. The current list of Other Regional Agencies includes:

- Amtrak
- Transport of Rockland

4.4.3 Integration Services for Linked NFPS Entities and Ancillary MTA Group Entities

The NFPS shall interoperate or be capable of interoperation with systems of Linked NFPS Entities and Ancillary MTA Group Entities, and otherwise be expandable for use by Ancillary MTA Group Entities and Linked NFPS Entities, both as further described herein. The parties acknowledge that the NFPS will likely be utilized (either indirectly by interoperation with other systems currently in use or through direct use of the NFPS) by: (i) those Linked NFPS Entities that are explicitly identified in this Technical Specifications Section 4.4.2 (Linked NFPS Entities), including the identified MetroCard Affiliates and Commuter Rail Affiliates (collectively, the "**Identified Linked NFPS Entities**"); (ii) other Linked NFPS Entities and Other Regional Agencies that the MTA identifies during the Term that are not Identified Linked NFPS Entities (each, an "**Additional Linked NFPS Entity**"); and (iii) Ancillary MTA Group Entities. Except as otherwise set out in Technical Specifications Section 4.4.2 (Linked NFPS Entities), SI compensation for its provision of all services, including Option-Specific Integration Services, necessary to complete the interoperation or expansion contemplated herein shall be based on whether the Option-Specific Integration Services relate to Identified Linked NFPS Entities and Ancillary MTA Group Entities, or Additional Linked NFPS Entities, as follows:

- **Identified Linked NFPS Entities and Ancillary MTA Group Entities.** The SI shall perform throughout the Term all services, including Option-Specific Integration Services, requested by the MTA in connection with the interoperation or expansion of the NFPS to Identified Linked NFPS Entities and Ancillary MTA Group Entities, and all such services shall be provided by the SI in accordance with Technical Specifications Section 4.4.2 (Linked NFPS Entities), including the costs of installing physical components of NFPS Hardware. The MTA, on behalf of the Identified Linked NFPS Entities and Ancillary MTA Group Entities, shall have the right to purchase all NFPS Hardware used by any Identified Linked NFPS Entity and Ancillary MTA Group Entity as further set out in the Agreement. By way of clarification, and not limitation, the SI shall perform all development, integration, configuration, testing, and other services necessary to permit the interoperation of the Hudson Rail Link into the NFPS including the installation of physical components of NFPS Hardware for use in the Hudson Rail Link system.
- **Additional Linked NFPS Entities.** The SI shall perform throughout the Term all services, including Integration Services, requested by the MTA in connection with the interoperation or expansion of the NFPS to Additional Linked NFPS Entities, and all such Integration Services shall be treated as Extra Work pursuant to Agreement Section 32 (Changes in Work; Change Orders); provided, however, that if the MTA elects to purchase NFPS Hardware on behalf of Additional Linked NFPS Entities, then such purchase shall be governed by Agreement Section 21 (Optional Services).

Notwithstanding anything to the contrary, the SI agrees that (i) in no event shall it be entitled to (a) any lost opportunity costs in connection with any interoperation or expansion of the NFPS contemplated herein, including future interoperation of the NFPS with Additional Linked NFPS Entities, or for any other amounts that it does not directly incur in connection with its provision of those services necessary to

complete any requested interoperation or expansion, and (b) any additional compensation for the Linked NFPS Entities' and Ancillary MTA Group Entities' use of the NFPS throughout the Term, including after the completion of such interoperation or expansion, and (ii) in lieu of the MTA directly engaging the SI for the SI's provision of services for the interoperation or expansion of the NFPS pursuant to this Technical Specifications Section 4.4.3 (Integration Services for Linked NFPS Entities and Ancillary MTA Group Entities), the MTA shall have the right to notify the SI of the same and, upon such notice, the SI and the applicable Linked NFPS Entity (or Ancillary MTA Group Entity) shall enter into an agreement between each other with respect to such interoperation or expansion; and (iii) SI fees for such interoperation or expansion shall be the same as if the MTA engaged the SI directly. By way of clarification, and not limitation, if the SI and a Linked NFPS Entity enter into a separate agreement for the interoperation or expansion of the NFPS, then the fees to which the SI is entitled for such services shall be those amounts calculated pursuant to these Contract Documents as if the MTA engaged the SI directly pursuant to these Contract Documents to provide such services.

4.4.4 NFPS Flexibility

The NFPS shall be sufficiently flexible to meet the needs of each NFPS Agency, on an agency-specific basis, so that none of the NFPS Agencies will be required to modify its own operations to accommodate the NFPS – rather, the NFPS shall accommodate each NFPS Agency's operations. These Technical Specifications identify those requirements in which the NFPS must meet the requirements of each NFPS Agency. To this end, all references to an "NFPS Agency" or the "NFPS Agencies" shall mean and be interpreted as the NFPS Agencies and any combination of the NFPS Agencies, and all references to the "MTA Group" shall mean and be interpreted as the MTA Group and any combination of entities within the MTA Group. By way of clarifying example, req. # 21.9.1-12, which states:

The Reporting System will generate web-based dashboards to display NFPS Agency-defined data visualizations (on an NFPS Agency-specific basis), including system performance indicators or metrics.

shall be interpreted to mean that the NFPS Reporting System must be able to simultaneously generate separate web-based dashboards for each NFPS Agency, and each separately-generated dashboard will include data visualizations that are based on the applicable NFPS Agency's defined requirements (e.g., the MNR-specific dashboard can have visualizations "A," "B," and "C," and the MTA Bus Company-specific dashboard can have visualizations "1," "B," and "9."

The SI acknowledges that, unless an NFPS requirement or function explicitly states that it is limited to a specific agency (other than the MTA), then each and every NFPS requirement and function shall be interpreted as applying to all NFPS Agencies as if such requirement or function explicitly stated that it is applicable on an NFPS Agency-wide basis.

The SI further acknowledges that NYCT oversees the operations of SIRTOA, MTA Bus Company, and MaBSTOA. Accordingly, (i) all references to "NYCT" herein shall mean and be interpreted to include any combination of NYCT, SIRTOA, MTA Bus Company, and MaBSTOA, and (ii) NYCT shall have the right to exercise, on behalf of SIRTOA, MTA Bus Company, and MaBSTOA, any decision-making authority granted to SIRTOA, MTA Bus Company, or MaBSTOA set out in these Contract Documents.

4.5 Base NFPS Description

The NFPS will use an Account-Based, Open Payment architecture with Interfaces based on APIs provided by the SI (or its licensors). The NFPS shall include:

- Acceptance of Contactless Bank Cards, certain Third Party-Issued Media, NFPS Agency-Issued

Media, and other Media for fare payments via a range of channels, utilizing the appropriate security protocols.

- The NFPS Backend, an Account-Based Transaction Processor that manages Transit Accounts, calculates fare payments based on established Business Rules, handles all transaction processing (sales and usage) as appropriate, manages devices, provides Data for reporting to the Data Warehouse, and other such central data services.
- Real-time or near real-time communication Interfaces for all NFPS Equipment to the NFPS Backend.
- Extended-Use Smart Cards, operating as Account-Based Media.
- Limited-Use Smart Cards, operating as Account-Based or Card-Based Media.
- Bus Validators which shall accept all Media noted above and be mounted on vehicles as appropriate.
- Subway Validators which shall accept all Media noted above, and shall be installed within existing NYCT and SIRTOA Faregates along with any equipment needed to control all Faregate functions for non-MetroCard transactions during the transition period and post-MetroCard decommissioning.
- Wayside Validator Machines which shall print receipts, accept all Media noted above and coin payments, and shall be installed next to SBS bus stops.
- Configurable Vending Machines to provide self-service kiosks to purchase NFPS Agency-Issued Media, and to reload Fare Products in Closed-Loop Transit Accounts.
- Cash processing, reconciliation, reporting, inventory control and material handling cash settlement Software to support money room operations.
- A configurable Customer Service POS Terminal to provide sales, reload, registration, personalization (custom printing), and support and administrative functions for Transit Accounts and Media.
- Ticket Office Machines (TOMs) to provide sales, reload, registration, and support and administrative functions for Transit Accounts and Media.
- A Customer Relationship Management System that allows for the central management of all Customer Data, and cradle-to-grave tracking of customer service tickets, including creation, escalation and resolution.
- A robust Fare Control Area Local Area Network to support communications between station Frontend NFPS Equipment and the NFPS Backend and NFPS Back Office via the MTA network.
- The NFPS Websites to allow customers, institutions participating in Special Programs, Retail Merchants and NFPS Agency staff to interact with the NFPS Backend for account management and other purposes.
- The NFPS Mobile Applications available on a range of operating systems for Customer Account management and payment purposes.
- Software to enable and manage onboard sales, validation, and printing functions using COTS hardware and mobile wireless service provided by the MTA.
- Flexible and configurable reporting capability to provide comprehensive information to stakeholders in real-time or near-real-time as appropriate.
- Robust security, data redundancy, Risk Mitigation and fraud protection mechanisms.
- A Financial Clearing and Settlement System to provide revenue reconciliation and the settlement of funds between all NFPS Agencies.
- A Data Warehouse to store NFPS Data for reporting, NFPS Back Office processing and monitoring purposes.
- Other services and support systems as described herein and as necessary for a modern fare

collection system, including a Device Monitoring System and APIs to interface with other MTA applications and processes (through MTA-provided Interface Engines) as needed.

The NFPS shall support a variety of fare policies (as identified in Technical Specifications Section 7 (Fare Policies) and all existing NFPS Agency operations.

4.6 Future Capabilities to be Supported

As delivered, the NFPS shall support additional capabilities should the MTA (or other NFPS Agencies, as contemplated herein) choose to modify or configure the NFPS to use such additional capabilities, including:

- Support of different fare structures other than the then-current NFPS Agency fare structures, fare capping and/or changes to the fare incentive structures
- Integration of the BV with other vehicle systems, including Bus Radio System or future CAD/AVL Systems

4.7 Acceptability of Equipment

The award of this Contract does not imply the MTA's approval of any of the equipment or materials identified in the Proposal. The SI is responsible for furnishing a completely functional NFPS as defined herein and approved by the MTA.

Without prejudice to any other remedies, if, at any time during the design, testing, installation or other provision of Deliverables or Services pursuant to this Contract, the MTA determines that such Deliverables or Services do not meet the requirements and other criteria set out in the Contract Documents or fail to constitute a fully functional NFPS as described herein and the Final Design Documentation, the SI shall, at no additional cost to the MTA Group, take all steps necessary to provide an NFPS acceptable to the MTA.

4.8 Services to be Provided

The SI shall provide the following in compliance with MTA policies and the Contract Documents, as applicable:

- All design services necessary to develop NFPS Hardware and NFPS Software
- Software design and development services necessary to develop the NFPS Backend
- Testing services – in the SI's facilities, in Test Facilities and in the field – to verify that the designed NFPS satisfies all requirements
- Comprehensive program management services to ensure that the Project is completed on time to the MTA's satisfaction
- Installation services for all NFPS Hardware and NFPS Software
- Survey, design, installation, integration, testing and commissioning services for all FCALAN network infrastructure
- Remote Hosting Services for the NFPS Backend, including two geographically separate locations each able to support full operations seamlessly should one fail
- Web portals, and all associated central computer systems including NFPS Data redundancy and active disaster recovery
- On-site and on-call technical support as specified herein
- Warranty services as specified in the Contract Documents
- Documentation and Training Services as defined in the Contract Documents

If the MTA exercises relevant Options, then the SI shall also provide:

- Retail network management services for distribution and sale of Media, and reload of Transit Accounts
- Extended Technical and Software Support Services
- Extended Hosting Services for the NFPS Backend, NFPS Back Office and NFPS Customer-Facing Applications
- Extended Call Center Services
- Optical barcode readers
- Bus antennas
- Driver Control Units
- NFPS onboard system routers
- SBS pilot support
- Additional NFPS Equipment, Integration Services, and Media
- MNR and LIRR NFPS Hardware
- MNR and LIRR NFPS Media
- MNR and LIRR NFPS Equipment Spare Parts/Modules Service and Repair
- MNR and LIRR NFPS Preventative, Remedial, and Lifecycle Maintenance Services

See Technical Specifications Section 35 (Options) for more details on Optional Services.

4.9 Project Schedule

The SI shall complete all Work and provide an NFPS that satisfies all requirements herein to the MTA's satisfaction. High level project phases, referred to as "Beneficial Uses" are as listed below:

Beneficial Use	High Level Description	Months from NTP
BU #1	Launch Contactless Acceptance at stations and bus lines	18
BU #2	Complete Subway and Bus Contactless Acceptance	TBD
BU #3	MTA Card & Retail Network, Mobile Ticketing, and OSVD Software	TBD
BU #4	Vending Machines and TOMs	TBD
BU #5	Completion of Revenue Service Acceptance Testing (RSAT)	60

The SI has identified in its Proposal subway stations and bus lines in which it intends to launch Contactless acceptance for BU #1 (the "**Proposed BU #1 Stations and Lines**"). Notwithstanding the Proposed BU #1 Stations and Lines identified in the Proposal, and the MTA's acceptance of the Proposal, the MTA shall have the right in its sole discretion to direct the SI to revise the Proposed BU #1 Stations and Lines by substituting identified subway stations and bus lines with other MTA-identified subway stations and bus lines; provided, however, that notification of such substitution is provided within 30

days of NTP, and that such substitution shall not result in a material increase in the total number of FCAs, Subway Validators, and Bus Validators that were included in the original Proposed BU #1 Stations and Lines. By way of clarifying example, if the Proposed BU #1 Stations and Lines included in the Proposal identified the 96th Street Station, the MTA shall have the right to direct the SI to launch Contactless acceptance at the 72nd Street Station instead of at the 96th Street Station as part of BU #1.

Beneficial Use #s 2, 3, and 4 are to be determined initially by the SI in its proposal and will be subject to review and approval by MTA. Since time is of the essence, the SI shall provide best system implementation timeframe, adhering to the customer use phasing sequence above.

Each Beneficial Use may have its own Design Review Cycle. Additional details can be found in Technical Specifications Section 26 (Design Reviews).

Division 1G— Payment specifies milestone payments associated with the Beneficial Uses, and the Delivery Schedule provides additional details concerning the timing of such milestones, the required Deliverables and certain assumptions and NFPS Agency facility access and other commitments.

4.9.1 NFPS Implementation

The MTA is seeking to implement the NFPS on schedule, and with a maximum degree of flexibility in how the NFPS is put into effect. The SI shall plan and implement the NFPS to satisfy the following objectives:

- The SI shall develop the NFPS so that the NFPS Agencies may activate features and fare policies independently and on a schedule defined by the MTA on an NFPS Agency-specific basis. For example, the MTA may wish to initially accept Contactless Bank Cards for fare payments, and progressively introduce new Vending Machines and Contactless NFPS Agency-Issued Media at a later date.
- Regardless of the number of features and capabilities active at any time, the NFPS shall satisfy all functional requirements contained herein. The activation of features and capabilities shall be fully regression tested and not adversely affect other system functions.
- As part of the NFPS implementation and testing, the SI will be required to demonstrate use of Interfaces between NFPS Hardware and NFPS Software modules, in addition to use of Interfaces between Legacy Systems as required. The SI shall provide Documentation for all Interfaces and update such Documentation for Interfaces that are changed during implementation of the NFPS. All Interfaces will be licensed to the MTA Group in accordance with the Contract Documents.

4.9.2 Phased Approach

The MTA has adopted a phased, progressive go-live (PGL) approach and will rely on a well-established current state while introducing functionality to customers over time. It also requires parallel operation of the current NFPS Agency fare payment systems during PGL.

It should be noted that the phased Beneficial Uses described have been designed as *one possible approach* to achieve the MTA's project goals and minimize cost and risk; ultimate Project phasing, timing and rollout may differ as further set out in the Contract Documents.

A description of each phase is provided below.

4.9.3 Launch Contactless Acceptance at Stations and Bus Lines Beneficial Use (Beneficial Use #1 or BU #1)

Under Beneficial Use #1, customers shall be able to use Open-Loop Media at stations and onboard

regular and express buses. Open Payment Media includes Contactless Bank Cards as well as mobile phones using an app or virtual wallet. Customers shall also be able to set up and administer their accounts and utilize in-person customer service, the web, and phone to support questions and transactions. The following deliverables are required for this Beneficial Use:

- 4.9.3.1.1 Bus Validators (BVs)
- 4.9.3.1.2 Subway Validators (SVs)
- 4.9.3.1.3 Fare Control Area Local Area Network (FCALAN)
- 4.9.3.1.4 Backend and Back office including Full Access Protocols
- 4.9.3.1.5 Customer website
- 4.9.3.1.6 NFPS Mobile Application, including at a minimum, basic account management for open payments and customer service features
- 4.9.3.1.7 Interactive Voice Response (IVR)
- 4.9.3.1.8 Test Facility at NYCT to support BU #1
- 4.9.3.1.9 System Software, supporting systems, training and equipment (e.g., training, manuals, test equipment, special tools, spare parts)

4.9.4 Complete Subway and Buses Contactless Acceptance Beneficial Use (Beneficial Use #2 or BU #2)

Under Beneficial Use #2, in addition to the deliverables provided under Beneficial Use #1 above, customers shall be able to use Open-Loop Media on Select Bus Service (SBS) buses. The following deliverables are required for this Beneficial Use:

- 4.9.4.1.1 478 Wayside Validator Machines (WVMs) replacing 478 Coin Fare Collectors (CFCs)
- 4.9.4.1.2 Customer Service Point of Sale (CS POS) terminals
- 4.9.4.1.3 Revenue Facility (RF) Workstations (First Batch Quantity)
- 4.9.4.1.4 Mobile application, including at a minimum, integrated travel tools
- 4.9.4.1.5 MNR and LIRR existing mobile ticketing solution acceptance (assumes execution of Validator Optical Barcode Readers Option)
- 4.9.4.1.6 Test Facility at NYCT to support BU #2
- 4.9.4.1.7 Test Facility at each of MNR and LIRR to support BU #2 (existing mobile ticketing solution barcode validation only)
- 4.9.4.1.8 System Software, supporting systems, training and equipment (e.g., training, manuals, test equipment, special tools, spare parts)

4.9.5 NFPS Agency Card Beneficial Use (Beneficial Use #3 or BU #3)

Under Beneficial Use #3, Closed-Loop Media shall be made available to regular fare and special program customers for use on the entire system. Administration of special programs shall be enabled via the web. The following deliverables are required for this Beneficial Use:

- 4.9.5.1.1 Business to Business (B2B) Portal
- 4.9.5.1.2 Extended-Use Media, Limited-Use Media
- 4.9.5.1.3 NFPS Mobile Application, including Closed-Loop mobile payment, and transition of MNR and LIRR existing mobile ticketing solution customers
- 4.9.5.1.4 OSVD Software
- 4.9.5.1.5 Smart Card Certification Workstations (SCCW)

- 4.9.5.1.6 Test Facility at NYCT to support BU #3
- 4.9.5.1.7 Test Facility at each of MNR and LIRR to support BU #3
- 4.9.5.1.8 System Software, supporting systems, training and equipment required to support the system operation under this Beneficial Use (e.g., training, manuals, test equipment, spare parts)

4.9.6 Vending Machines Beneficial Use (Beneficial Use #4 or BU #4)

Under Beneficial Use #4, all transactions that will be enabled on the Configurable Vending Machines shall be available for customer use throughout the system. The following deliverables are required for this Beneficial Use:

- 4.9.6.1.1 Configurable Vending Machine (CVMs)
- 4.9.6.1.2 Revenue Facility (RF) Workstations (Second Batch Quantity)
- 4.9.6.1.3 Ticket Office Machines
- 4.9.6.1.4 Test Facility at NYCT to support BU #4
- 4.9.6.1.5 Test Facilities at each of MNR and LIRR to support BU #4
- 4.9.6.1.6 System Software, supporting systems, training and equipment required to support the system operation under this Beneficial Use (e.g., training, manuals, test equipment, special tools, spare parts)

4.9.7 Revenue Service Acceptance Testing Beneficial Use (Beneficial Use #5 or BU #5)

Under Beneficial Use #5, all NFPS Hardware, NFPS Software, components and Third Party networks shall be fully deployed and operational, on-line and in service as described in Technical Specifications Section 30.4 (Revenue Service Acceptance Testing), and reviewed and approved by the MTA. Deliverables include:

- 4.9.7.1.1 System Software, supporting systems, training and equipment required to support the system operation under this Beneficial Use (e.g., training, manuals, test equipment, special tools, spare parts)

Each NFPS Agency may deploy, on an NFPS Agency-specific basis, in its sole discretion, different fare structures during each BU phase, which will be determined within a timeframe that is agreed upon by the MTA and the SI prior to the applicable BU milestone. The SI is responsible for testing and implementing the agreed upon fare structure in each BU. The NFPS shall permit each NFPS Agency, on an NFPS Agency-specific basis, to efficiently adjust fare structure and policy as needed during implementation of the phased approach.

4.10 Equipment Quantities and Locations

4.10.1 NYCT NFPS Equipment

Including a spare ratio of seven and one half percent (7.5%) and other support peripherals, for the base NFPS Contract, the SI shall supply and install the NFPS Equipment as shown in Table 4.1 (Base NFPS Equipment Quantities).

Table 4.1: Base NFPS Equipment Quantities

Equipment	Technical Specifications Section	Base Quantity	Location
Bus Validators (RFID Reader + Processor)	13 (Bus Validators)	6,000	Onboard NYCT and MTA Bus Company fleet
Subway Validators (SV)	14 (Subway Validators)	4,654	In NYCT subway stations attached to: <ul style="list-style-type: none"> • 3,315 Turnstiles (TS) • 414 AutoGate – Entry devices, and • 575 High Entry Exit Turnstiles (HEET) • 350 additional Turnstiles intended to be procured in 2015
Faregate Control Electronics	14 (Subway Validators)	4,654	
Configurable Vending Machines	16 (Configurable Vending Machines)	1,600	In NYCT subway stations, fare control areas
Customer Service Point of Sale Terminal	17.1 (Customer Service Point of Sale Terminals)	23	<ul style="list-style-type: none"> • 9 reduced fare office terminals • 7 Customer Service Center terminals • 4 Mobile Sales Fleet terminals • 3 Pass office terminals • 2 spares (1 Front Office configuration and 1 Portable configuration)
Wayside Validator Machines	15 (Wayside Validator Machines)	957	Sidewalks and bus stops adjacent to SBS routes
Revenue Facility Workstations	28.3 (Revenue Facility (RF) Workstation)	60	CRF
Smart Card Certification Workstations	28.2 (Smart Card Certification Workstations)	4 (no spares)	Fare Payment Programs; Electronic Maintenance Division; NYCT Test Facility

In addition to the 7.5% spare ratio described above, the MTA requires the following spare parts to be provided as part of the NFPS:

- 15% spares for NFPS Equipment moving parts
- 7.5% spares for NFPS Equipment solid-state parts
- 1,135 (159%) spares for coin vaults for WVMs
- 6,248 (363%) spares for bill vaults for CVMs
- 2,172 (126%) spares for coin vaults for CVMs
- 25% spares for other revenue components for CVMs (Coin Hoppers (2 per CVM), Extended -Use Media Cassettes)

4.10.2 MNR and LIRR Hardware

Hardware for MNR and LIRR will be procured as an Option; however, the design of the Hardware and Software for MNR and LIRR will occur at the same time as the design of Hardware and Software for the rest of the system, and such MNR- and LIRR-specific CVM design is included within the scope of the Base Contract Price. Additional details can be found in Technical Specifications Section 35.12 (MNR and LIRR Equipment).

4.10.3 Optional Equipment

If the MTA (on behalf of itself, other NFPS Agencies, Ancillary MTA Group Entities, or Linked NFPS Entities) exercises one or more Options for additional equipment detailed in Technical Specifications Section 35.4 (Additional NFPS Equipment, Integration Services, and Media), then the SI shall supply additional NFPS Equipment and Media, configured appropriately to meet the needs of the MTA (or other NFPS Agencies, Ancillary MTA Group Entities, or Linked NFPS Entities, as applicable).

5 General Design Requirements

NYCT's Capital Program Management maintains a variety of specifications for work on electrical, mechanical, IT and other systems. These specifications, called Divisions, are included in Appendix H for reference, and govern all relevant work described herein, and as required to design, fabricate, test, deliver, and support the New Fare Payment System. In the case that there is a discrepancy between the Divisions and the standards or reference values cited in these Specifications, the more stringent requirement shall apply.

The Metro-North Railroad Station Standards and Guidelines and the Long Island Rail Road Service Guidelines guide work performed on MNR or LIRR property, and have been attached as Appendix P and Appendix Q to these Technical Specifications. In the case that there is a discrepancy between the Metro-North Railroad Station Standards and Guidelines and other requirements related to Work performed on MNR property, the Metro-North Railroad Station Standards and Guidelines shall take precedence. Similarly, in the event of a discrepancy between the Long Island Railroad Service Guidelines and other requirements related to Work performed on LIRR property, the Long Island Railroad Service Guidelines shall take precedence.

5.1 Design Life

Req. #	Requirement	Assigned CDRL(s)
5.1-1	NFPS Software and NFPS Hardware shall be designed to provide a minimum usable life of no less than 12 years from Substantial Completion as described in Technical Specifications Section 30 (Post-Installation Testing and System Acceptance).	CDRL 5-1
5.1-2	The NFPS shall be scalable so that incorporating technology upgrades may be done with no or minimal redesign of components or modules, extensive Software revisions or other extensive work.	CDRL 5-1

5.2 Prior Service Performance

Req. #	Requirement	Assigned CDRL(s)
5.2-1	The NFPS design will be service proven, or will be derived from a service proven design. A service-proven system, or a system derived from a service proven design, will meet all of the following criteria: <ul style="list-style-type: none">• Has been accepted by a minimum of one transit agency with a gated rail system with vending machines• Has met contract system acceptance at a minimum of one transit agency with a bus fare environment and a bus vehicle fleet• Has achieved, or is capable of achieving, a level of Reliability consistent with the requirements in these Technical Specifications.	CDRL 5-1
5.2-2	Proposed Validators will be similar in design and components to a model deployed and in revenue service, e.g., in use and passed system acceptance at a public or private agency.	CDRL 5-1

Req. #	Requirement	Assigned CDRL(s)
5.2-3	Proposed CVMs will be similar in design and components to a model deployed and in revenue service, e.g., in use and passed system acceptance at a public or private agency.	CDRL 5-1
5.2-4	To establish a design's service proven history, the SI shall submit specific details of the application history, including integration of other OEM's technology(ies), certified by current users of the equipment.	CDRL 5-1
5.2-5	The SI may offer, for approval, a design which is largely unchanged from a service proven design, but which varies slightly in design or manufacture to meet MTA requirements, including newer generations of service proven equipment. The SI shall show, in detail, what has been changed and why such changes will not adversely affect operation in the MTA Group environment.	CDRL 5-1

5.3 Supply and Availability

Req. #	Requirement	Assigned CDRL(s)
5.3-1	At the time of delivery, NFPS Equipment, and all associated NFPS Equipment Software shall contain no non-standard (i.e., irregular, out of the ordinary or abnormal), prototype, obsolete or discontinued products.	CDRL 5-1
5.3-2	Whenever possible, the NFPS shall consist of COTS Components that are available from multiple suppliers.	CDRL 5-1

5.4 Open Technology

Req. #	Requirement	Assigned CDRL(s)
5.4-1	The NFPS shall be designed using Open Standards for all components of the NFPS, including Media, Interfaces, Software design, communications protocols, project management, and other relevant design components.	CDRL 5-1
5.4-2	Compatible Smart Card Media shall be available for competitive purchase by the MTA from multiple U.S. sources. The SI shall provide specifications and associated Documentation necessary to support future MTA Group procurement of new Smart Card Media.	CDRL 5-1
5.4-3	All Interfaces shall be defined and documented and shall be licensed to the MTA Group pursuant to the Contract Documents.	CDRL 5-1
5.4-4	All Documentation shall be licensed to the MTA Group pursuant to the Contract Documents.	CDRL 5-1

Req. #	Requirement	Assigned CDRL(s)
5.4-5	The NFPS shall use only COTS Components where possible, and the NFPS shall not use non-COTS Components unless expressly approved by the MTA. The SI shall provide Documentation identifying and differentiating between all COTS and non-COTS Components within the NFPS.	CDRL 5-1

5.5 Materials and Workmanship

Req. #	Requirement	Assigned CDRL(s)
5.5-1	All components within the NFPS shall be constructed of the highest quality materials suitable for production level use in the intended environment and to last for the NFPS Design Life. The SI shall use only new materials conforming to the requirements of the Contract Documents and approved by the MTA (this does not preclude use of recycling in the manufacture of new materials).	CDRL 5-1
5.5-2	The SI shall be responsible for all materials and workmanship. It is the SI's responsibility to design, select and apply all materials and workmanship to meet the requirements stated herein. Where alternate materials are offered, it is the responsibility of the SI to demonstrate the alternate materials are equivalent to the specified materials and to obtain the MTA's approval for the substitution, prior to any implementation.	CDRL 5-1
Source of Supply		
5.5-3	The SI shall furnish equipment and materials from the manufacturers identified in the SI's submittals, unless otherwise approved by the MTA.	CDRL 5-1
5.5-4	If, at any time prior to acceptance, it is found that sources of supply that have been approved do not furnish a uniform product, or if the product from such source proves unacceptable per the terms set out in the Contract Documents, the SI shall, at no additional expense to the MTA Group, take any and all steps necessary to furnish acceptable materials.	CDRL 5-1
5.5-5	The SI shall select and supply parts, components, subassemblies, modules, and complete assemblies, as well as Software and other essential elements of the NFPS, based on projected availability and anticipated provision of long-term OEM support commensurate with the Design Life.	CDRL 5-1
5.5-6	The SI shall alert the MTA in writing whenever a part, component, subassembly, module, complete assembly or support for OEM material is being discontinued or whenever any such module is nearing obsolescence. The SI shall supply such alerts at least 90 days in advance to enable the MTA to make necessary provisions to maintain NFPS functionality beginning at Substantial Completion and throughout the Term.	CDRL 5-1

5.6 Environmental Conditions

The ranges of conditions provided below are meant to provide guidance for NFPS Equipment design. However, more stringent guidelines may apply based on NY or CT State Code, the Divisions provided in Appendix H, the MNR Station Standards Guidelines provided in Appendix P, or the LIRR Service Guidelines provided in Appendix Q. In all cases, the SI shall adhere to the most stringent guidelines based on the standards and codes listed here and in Technical Specifications Section 5.15 (Codes, Regulations & Reference Standards) for meeting environmental condition tolerance.

5.6.1 Climate Tolerance

Req. #	Requirement	Assigned CDRL(s)
5.6.1-1	Means shall be provided to detect failure of any cooling device and provide for a controlled shutdown of NFPS Equipment components and notification of a maintenance event through the Device Monitoring System (Technical Specifications Section 21.2 (Device Monitoring System)).	CDRL 5-2

5.6.2 Shock & Vibration

Req. #	Requirement	Assigned CDRL(s)
5.6.2-1	NFPS Equipment components will be designed to withstand structure-borne stresses and vibrations caused by the motion of buses and trains, daily customer usage, passing of trains or other vehicles, as well as emergency braking of fully-loaded trains.	CDRL 5-2
5.6.2-2	Fare collection equipment components, including all interior-mounted components and assemblies, will resist horizontal shocks of up to 6 G (where "G" is the earth's gravitational constant or 9.81 meters per second squared) and in the vertical axis of up to 1.2 G for a duration of up to 12 ms without permanent deformation or failure of the such fare collection equipment.	CDRL 5-2
5.6.2-3	There will be no failure of mounts or decrease of operational characteristics of any subsystems under conditions simulated by a sinusoidal sweep vibration test at a sweep rate of one-half octave per minute, from 5 Hz to 25 Hz to 5 Hz, at a peak vibratory acceleration of 0.25g for a minimum of 50 cycles when applied to each of the three axes and repeated continuously for five (5) complete cycles. These tests will be performed during the environmental test. If any assembly or component is a source of vibration, measures will be taken to dampen the vibration. Efforts will be taken to critically dampen any resonant frequencies that may exist in the mounted structures.	CDRL 5-2
5.6.2-4	NFPS Equipment and mounts will be sufficiently constructed to comply with NY and CT State Codes where applicable regarding stability of structures and contents in earthquakes, high velocity wind and other natural phenomena.	CDRL 5-2

5.6.3 Operating Environments

Req. #	Requirement	Assigned CDRL(s)
Onboard Equipment Operating Environment (Bus)		
5.6.3-1	<p>Onboard NFPS Equipment, including Bus Validators and associated components, will be:</p> <ul style="list-style-type: none"> • Designed, built and installed for the harsh, high shock and vibration operating environment in which such component will operate with high volume customer use • Protected to prevent degradation from exposure to moisture or dust raised by inclement weather or interior cleaning • Operation of the fare collection equipment in a revenue service environment will not in any way impair such equipment performance or operational life, during the contracted/specified operational life of such equipment. • Refer to EN60529 (1992) IP54 standards for enclosures. • Fully protected from power washing (to be tested in FIT) 	CDRL 5-2
5.6.3-2	<p>Onboard NFPS Equipment provided by the SI shall operate and not suffer any degradation in performance under the following environmental conditions:</p> <ul style="list-style-type: none"> • Operating temperature: -15°F to 120°F ambient • Drop in temperature: 1° per minute drop in temperature over a 15° range between 110° and 60°F • Relative humidity: 10-97 percent, non-condensing • Airborne dust: up to 180 micrograms per cubic meter, with iron and salt particles • Inclination: 0° to 10° off vertical • Water/solvents: water spray on such components from cleaning floors and walls, industrial cleaning solvents, rain, mud, snow and slush 	CDRL 5-2
5.6.3-3	Notwithstanding the above, onboard NFPS Equipment will be able to operate and not suffer any degradation after being in storage with a range of temperatures from -22° to +150°F.	CDRL 5-2
5.6.3-4	Onboard NFPS Equipment provided by the SI shall be tested and certified to operate under the environmental condition specified herein, to meet the most stringent of guidelines contained in the Contract Documents and SAE J1455.	CDRL 5-2
Wayside Equipment		

Req. #	Requirement	Assigned CDRL(s)
5.6.3-5	<p>Wayside Validator Machines will be:</p> <ul style="list-style-type: none"> Designed to be installed in the open environment of the NYC region with no shelter provided over such equipment Designed to function under environmental conditions including direct sunlight, dust/grit/sand exposure, snowfall, rainfall, electrical storms, earthquakes, ice, freezing rain, laterally wind-driven rain and the range of elevations and altitudes in the operation region Able to function during exposure to all weather conditions known to be present in the operational region <p>Normal operation of the Wayside Validator Machines in this environment will not in any way impair equipment performance or operational life, during the contracted/specified operational life of such equipment.</p>	CDRL 5-2
5.6.3-6	<p>The Wayside Validator Machines provided by the SI shall operate and not suffer any degradation in performance under the following environmental conditions:</p> <ul style="list-style-type: none"> Operating temperature: -15°F to 120°F ambient Drop in temperature: 1° per minute drop in temperature over a 15° range between 110° and 60°F Relative humidity: 10-100 percent, including condensation Airborne dust: up to 180 micrograms per cubic meter, with iron and salt particles Inclination: 0° to 10° off vertical Water/ solvents: water spray on such components from cleaning streets, floors and walls, industrial cleaning solvents, rain, mud, snow and slush Rainfall: up to 6 inches per hour Freezing precipitation: up to 3 inches per hour Wind speed: up to 125 mph in any direction Sunlight: none to full direct Atmospheric pollutants characteristic of the NYC area, including dust and corrosive or base chemicals 	CDRL 5-2
5.6.3-7	Notwithstanding the above, the Wayside Validator Machines will be able to operate and not suffer any degradation after being in storage with a range of temperatures from -22° to +150°F.	CDRL 5-2
Subway Station Equipment		
5.6.3-8	<p>Subway Validators will be designed to be installed in the MTA station environment with steel dust and heat conditions as described in Technical Specifications Section 3 (Existing System Description). Normal operation of such equipment in this environment will not in any way impair equipment performance or operational life.</p>	CDRL 5-2

Req. #	Requirement	Assigned CDRL(s)
5.6.3-9	<p>NFPS Equipment within subway stations shall tolerate the environment in which it is installed and stored. Such equipment shall not suffer any degradation in performance under the following environmental conditions:</p> <ul style="list-style-type: none"> • Operating temperature: -15°F to 120°F ambient • Drop in temperature: Up to 30°F in 1 hour (non-condensing) • Relative humidity: 10-97 percent, non-condensing • Airborne dust: up to 180 micrograms per cubic meter, with iron and salt particles • Platform Inclination: 0° to 4° off vertical • Water/solvents: water spray on equipment from cleaning floors and walls, industrial cleaning solvents and standard cleaning chemicals used by the MTA Group, and incidental rain, mud, snow and slush will come in contact with NFPS Equipment. 	CDRL 5-2
5.6.3-10	Notwithstanding the above, Subway Validators will be able to operate and not suffer any degradation after being in storage with a range of temperatures from -20° to +150°F.	CDRL 5-2
5.6.3-11	Airborne particulates shall not affect the operation of NFPS Equipment within subway stations.	CDRL 5-2
5.6.3-12	Coin, bill, ticket and other openings and enclosure joints for NFPS Equipment within subway stations will be subject to incidental moisture from power washing, patrons and cleaning solutions, and shall be designed to assure proper operation of such equipment under such conditions. All exposed surfaces including the push buttons, display screen, and coin and bill components shall be unaffected by detergents and cleaning solvents used by the MTA Group. Means shall be provided to expel moisture within the station devices to assure continued, reliable operation. Refer to EN60529 (1992) IP54 standards for enclosures.	CDRL 5-2
Commuter Rail Station Equipment¹²		
5.6.3-13	<p>Configurable Vending Machines will be:</p> <ul style="list-style-type: none"> • Designed to be installed in the open environment of the New York City and suburban region with no shelter provided over such Configurable Vending Machines; • Designed to function under environmental conditions including direct sunlight, exposure to dust, grit and sand, snowfall, rainfall, electrical storms, earthquakes, ice, freezing rain, laterally wind-driven rain and the range of elevations and altitudes in the operation region; and • Able to function during exposure to all weather conditions known to be present in the operational region, including those listed in the immediately preceding bullet. 	CDRL 5-2

¹² Req. # 5.6.3-13 through 5.6.3-16 are specific to CMVs utilized by LIIR and MNR.

Req. #	Requirement	Assigned CDRL(s)
	Normal operation of the Configurable Vending Machines in this environment will not in any way impair equipment performance or operational life, during the contracted or specified operational life of such equipment.	
5.6.3-14	<p>NFPS Equipment within commuter rail stations shall tolerate the environment in which it is installed and stored. Such NFPS Equipment shall not suffer any degradation in performance under the following environmental conditions:</p> <ul style="list-style-type: none"> • Operating temperature: -15°F to 120°F ambient; • Drop in temperature: Up to 30°F in 1 hour (non-condensing); • Relative humidity: 10-97 percent, non-condensing; • Airborne dust: up to 180 micrograms per cubic meter, with iron and salt particles; • Platform Inclination: 0° to 4° off vertical; • Water/solvents: water spray on such NFPS Equipment from cleaning floors and walls, industrial cleaning solvents and standard cleaning chemicals used by the MTA Group, and incidental rain, mud, snow and slush will come in contact with such NFPS Equipment; • Rainfall: up to 6 inches per hour; • Freezing precipitation: up to 3 inches per hour; • Wind speed: up to 125 mph in any direction; • Sunlight: none to full direct; and • Atmospheric pollutants characteristic of the New York City and suburban region, including dust and corrosive or base chemicals. 	CDRL 5-2
5.6.3-15	Notwithstanding req. #5.6.3-13 above, the Configurable Vending Machines will be able to operate and not suffer any degradation after being in storage with a range of temperatures from -22° to +150°F.	CDRL 5-2
5.6.3-16	Coin, bill, ticket and other openings and enclosure joints for NFPS Equipment within commuter rail stations will be subject to incidental moisture from patrons and cleaning solutions, and shall be designed to assure proper operation of such equipment under exposure to such conditions. All exposed surfaces including the push buttons, display screen, and coin and bill components shall be unaffected by detergents and cleaning solvents used by the MTA Group. Means shall be provided to expel moisture within the station devices to assure continued, reliable operation. Refer to EN60529 (1992) IP54 standards for enclosures.	CDRL 5-2
Office and Retail Equipment		
5.6.3-17	Customer Service POS Terminals will be designed to be installed in NFPS Agency facilities, including 3 Stone Street, throughout New York City. Normal operation of such equipment in this environment will not in any way impair equipment performance or operational life.	CDRL 5-2

Req. #	Requirement	Assigned CDRL(s)
5.6.3-18	Ticket Office Machines will be designed to be installed in MNR and LIRR stations/facilities. Normal operation of such Ticket Office Machines in this environment will not in any way impair such Ticket Office Machines' performance or operational life.	CDRL 5-2
5.6.3-19	Customer Service POS Terminals configured for use in the Mobile Sales Units will be ruggedized to withstand use onboard vehicles and meet the shock and vibration requirements for onboard fare equipment (see req. #5.6.3-1).	CDRL 5-2

5.7 System Security

With regards to system security, the NFPS shall use a Tokenization process that meets or exceeds PCI Tokenization guidelines, and a certified Point-to-Point Encryption solution for all Payment Data. The Tokenization and encryption solutions will alleviate the need to store, and will allow secure processing of, Payment Data within the NFPS. The NFPS shall also ensure data security to the greatest extent possible and as set out in the Contract Documents.

Req. #	Requirement	Assigned CDRL(s)
5.7-1	Hardware firewalls will be established around all system-specific servers, in addition to Software firewalls and other traffic filtering security measures as required.	CDRL 5-3
5.7-2	Security Sensitive Information will be handled separately according to a procedure to be jointly developed between the SI and the MTA, and subject to MTA approval. Security Sensitive Information will include: <ul style="list-style-type: none"> Information that would allow an individual to duplicate, skim or counterfeit Media or NFPS Accounts Information that would allow an individual to overcome locking features or interlocks intended to prevent access to revenue Other information that would allow an individual to divert revenue, whether electronic or cash, from the NFPS, without such diversion becoming evident to the MTA through normal reporting by the NFPS Any other information designated by the MTA. 	CDRL 5-3
5.7-3	Any NFPS Equipment that will capture, store, transmit or process Payment Card Data will be certified compliant with all applicable PCI standards, either by the SI or by the OEM (as applicable). The SI shall be responsible for demonstrating that all applicable NFPS components are PCI compliant.	CDRL 5-3

Req. #	Requirement	Assigned CDRL(s)
5.7-4	The SI shall be responsible for providing a PCI compliance plan as part of design review and supporting certification for the NFPS. The SI and their QSA shall work with the MTA's Merchant Acquirer and QSA to finalize such plan, subject to the approval of the Merchant Acquirer, the QSA and the MTA. The SI shall be responsible for conducting all testing required to achieve certification, and achieving consensus between their QSA and the MTA's QSA, prior to Final Acceptance.	CDRL 5-3
5.7-5	As delivered, all relevant NFPS Equipment with bank card readers (i.e., NFPS Validators, CVMs, CS POS Terminals) shall be certified as compliant with PCI and EMV Level 1 standards in effect at the time of installation for the acceptance of magnetic stripe, Contact Media and Contactless Bank Cards and (if applicable) MSD bank cards.	CDRL 5-3
5.7-6	The SI shall be responsible for ensuring compliance with all requirements associated with EMV payment acceptance in the U.S., as they are defined by the card associations and issuers.	CDRL 5-3
5.7-7	Applicable portions of NFPS Software shall be certified to newer versions of the EMV standard as they are published at no cost to the MTA Group.	CDRL 5-3
5.7-8	The approach to NFPS security will include not storing Personally Identifiable Information and Payment Card Data whenever possible, and only storing or transmitting PII or Payment Card Data in tokenized or encrypted form, when necessary and otherwise in compliance with all applicable law and PCI requirements.	CDRL 5-3
5.7-9	NFPS components that will capture, store, transmit or process PII will comply with the NY State Technology Law Article 2, and otherwise comply with all applicable law and PCI requirements.	CDRL 5-3
5.7-10	Interfaces between Frontend NFPS Equipment and the NFPS Backend will be over an Internet Protocol (IP) network. Where required by the MTA, the Interfaces will be secured using TLS, or equivalent strong encryption protocol. While the MTA network is not the under the responsibility or control of the SI, the SI shall ensure that the NFPS is designed so that all data traveling over the MTA network is secured in a manner that makes it non-sensitive from a PCI perspective, thus effectively removing the network from PCI scope.	CDRL 5-3

Req. #	Requirement	Assigned CDRL(s)
5.7-11	All Payment Data will be secured from the point when it is provided by the user to when it is received by the Merchant Acquirer. All points of interaction, including any card readers, will be SRED certified, unless otherwise approved by MTA, to support Point-to-Point Encryption and/or token generation of Payment Card Data, as deemed necessary during design review. When communications are over public networks, Virtual Private Networks will be used to increase security. VPN will be used for all communication where practicable.	CDRL 5-3
5.7-12	Any portion of the NFPS vulnerable to cyber attack, will comply with the NIST Cybersecurity Framework, standards consistent with NIST security standards and guidelines and all applicable state and federal law.	CDRL 5-3
5.7-13	The SI shall actively monitor the NFPS to detect potential intrusions. The SI shall submit, among other plans, a data breach prevention and response plan for the MTA's review and approval, and the SI shall comply with the accepted plan throughout the Term.	CDRL 5-3
5.7-14	The NFPS will include robust anti-virus protection. The choice of anti-virus Software will comply with MTA/IT Security Standards, and will be subject to the MTA's review and approval during design review. The SI shall be responsible for keeping all anti-virus Software up to date.	CDRL 5-3
5.7-15	User interface access to all elements of the NFPS Backend and NFPS Back Office, including those elements described in Technical Specifications Sections 20 (NFPS Backend) through 21 (NFPS Back Office), as well as Interfaces for the NFPS Websites (Technical Specifications Section 6.4.4 (Transit Account Management API)), IVR (Technical Specifications Section 6.4.5 (Customer Account Management API)), and backup and disaster recovery systems (Technical Specifications Section 24.4 (Disaster Recovery)), will support two-factor authentication and be managed using MTA's existing Identity Access Management System, I-Vault. I-Vault will provide audit trails and monitoring capability to manage risks based on industry best practices. In addition, the SI shall develop and submit for MTA review and approval the Full Access Protocols, including protocols and procedures relating to the MTA's use of the NFPS pursuant to its Full Access Rights (see Agreement Section 23.9 (MTA Access Rights)).	CDRL 5-3
5.7-16	The NFPS shall have the ability to quickly recover from power Failures. The NFPS shall automatically return to its operating state, without loss of NFPS Data.	CDRL 5-3

Req. #	Requirement	Assigned CDRL(s)
5.7-17	NFPS security features will be maintained and all security issues will be addressed by the SI as they arise. The SI shall provide Software Updates, including Software patches, bug notifications and refinements to address identified security issues, all as further set out in the Contract Documents.	CDRL 5-3
5.7-18	As determined by the MTA and agreed upon during design review, the NFPS shall support Opt-In requirements as further set out in Agreement Section 22.5 (Opt-In Requirement for Collection and Use of Personally Identifiable Information).	CDRL 5-3
Physical Security		
5.7-19	Physical access to NFPS Hardware containing PII and/or Payment Data will be restricted through the use of physical keys, employee IDs and passwords.	CDRL 5-3
5.7-20	Physical security for the NFPS will comply with the latest PCI standards, applicable law and best practices.	CDRL 5-3

5.8 Modular Design and Interchangeability

Req. #	Requirement	Assigned CDRL(s)
5.8-1	The NFPS shall have a modular design for all relevant Software and hardware components. These modules will permit ready field replacement to return the device to service in minimal time in the event of a Failure. It shall also permit upgrades and configuration changes without requiring significant system replacement or redesign.	CDRL 5-1
5.8-2	All parts, components, modules, assemblies and removable devices included in the NFPS shall be fully interchangeable among devices of the same function without the need to make adjustment for proper compatibility.	CDRL 5-1
5.8-3	During Design Review, the SI shall prepare and submit for the MTA's review and approval Substitution Product Specifications for NFPS Hardware and Software (as further set out in Agreement Section 3.2.2.1 (Substitution Product Specifications)), including hardware or Software requirements, such as form and fit dimensions, processor and memory capacity, operating system, device driver interfaces, and certifications for devices or systems of all supplied components should the MTA Group wish to replace them with Substitution Products in the future. These Substitution Product Specifications will ensure that the NFPS will continue to meet all KPIs, Service Levels, and applicable Warranties upon the integration of such Substitution Products into the NFPS, as further set out in Agreement Section 3.2 (MTA Substitution Rights and Rights to Add).	CDRL 5-9

5.8-4	During Design Review, the SI shall prepare and submit for the MTA's review and approval a Verification Process, including tests, test protocols, scripts, and required test results for the purpose of qualifying the use of Verified Additional Products within the NFPS. (See Agreement Section 3.2.2.2 (Verification Process)).	CDRL 5-10
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5.9 Safety

Req. #	Requirement	Assigned CDRL(s)
5.9-1	All of the SI and Subcontractor employees working within operating rail stations, platforms, rights-of-way, and bus divisions will comply with applicable rail, bus or tram operations rules and procedures, including safety rules and regulations. The applicable NFPS Agency will provide required information and briefing to these individuals before that Person is allowed to work on-site.	CDRL 5-1
5.9-2	All NFPS Hardware will be free from safety hazards and will be designed to comply with relevant UL (Underwriter's Laboratory) Standards.	CDRL 5-1
5.9-3	All electrical components of NFPS Hardware will be electrically grounded and will prevent electrical leakage or static charge. Electrical components will have suitable warning graphics indicating the voltage present and other hazards.	CDRL 5-1
5.9-4	All interior and exterior surfaces of the NFPS shall be free from sharp edges, protrusions, exposed wires, or other hazards.	CDRL 5-1

5.10 Aesthetic Requirements and User Interfaces

The SI shall maintain design excellence shall be maintained by applying these best practices throughout the Project: 1) selection of a high quality industrial design firm, with demonstrated design excellence as evidenced by award(s), honors and a portfolio of innovative and highly regarded Media projects (the MTA's standard is that its industrial design on past projects have been recognized by leading design museums such as the Museum of Modern Art and the Smithsonian Cooper Hewitt Museum of Design); 2) employment of a design development and review process that involves internal and external stakeholders, in order to provide the designer with direct input from these user groups; 3) market research in design, testing and early roll-out phases that shall include the creation of models, mock-ups, prototypes and simulations as needed to ensure a dynamic, highly efficient system. The SI shall conduct internal and external research with stakeholders and a representative cross-section of customers, including ADA customers, to ensure input from the customer perspective. As needed, the research will involve the MTA and the SI-provided resources to collect feedback.

Req. #	Requirement	Assigned CDRL(s)
5.10-1	All Field Device components—including interface display, lettering, lights, colors, tactile feedback, brightness, graphics, animation, screen savers, surface texture, component size and height—will be designed and submitted for approval by the MTA, consistent cross-platform branding. The SI shall submit designs for MTA review and approval at defined time intervals. Final Field Device design will be subject to the MTA's approval.	CDRL 5-1
5.10-2	All Field Device components shall provide a coherent customer experience, with similar look and feel across WVMs, CVMs, NFPS Websites and NFPS Mobile Applications and consistent interface structure and logic. The MTA and designated representatives will participate in an industrial design review with the SI to define the customer experience for Field Device components. An appropriate industrial design firm shall be provided by the SI, and will be subject to the MTA's approval.	CDRL 5-1
5.10-3	The NFPS shall be in compliance with the latest applicable ADA standards to maximize ease of use. The NFPS will comply with the most recent version of the ADA Accessibility Guidelines (ADAAG).	CDRL 5-1
5.10-4	The SI shall submit for the MTA's review and approval at the Preliminary Design Review, descriptions and drawings of how each NFPS component will achieve ADA compliance.	CDRL 5-7
5.10-5	NFPS Equipment displays (including the entire surface of the display for the CVM), graphics, signage and all other instructions, labels and information contained on such equipment will be visually readable within all positions of the visual patron interface described in Technical Specifications Sections 12 (Common Validator Requirements), 15 (Wayside Validator Machines) and 16 (Configurable Vending Machines).	CDRL 5-1
5.10-6	NFPS Equipment will provide patrons with displays, graphics and signage, controls and mechanisms that are simple to use, easy to understand and conveniently located. By following instructions given on and by such equipment, an inexperienced user shall be able to understand all transaction processes and results. All such user interfaces will be user-friendly; that is, safe, predictable, simple to use and in accordance with other applicable human engineering principles.	CDRL 5-1
5.10-7	NFPS Equipment will accommodate the broad range of patrons that use public transportation. The range of patrons paying fares will include commuters, infrequent riders, children, the elderly, patrons with impaired vision, patrons in wheelchairs, patrons with limited communications skills including the illiterate, and customers who are hearing impaired.	CDRL 5-1

Req. #	Requirement	Assigned CDRL(s)
5.10-8	NFPS Equipment, including the NFPS Websites and the NFPS Mobile Applications, will be compliant with Title VI, including support of multiple languages, with provision of both audio and text translations for up to 15 languages (14 languages plus English). The SI shall hire a Third Party to provide audio and text translations. The audio and text translations will be submitted to the MTA for approval.	CDRL 5-1

5.11 Electrical Requirements

5.11.1 Power & Voltage Requirements

Req. #	Requirement	Assigned CDRL(s)
5.11.1-1	The SI shall design, supply, install, test and commission all system elements necessary to regulate and condition the NFPS Agency-supplied electrical power for use in the NFPS.	CDRL 5-4
5.11.1-2	Electrical power will be obtained from existing power sources and will be filtered, transformed, converted, battery-stored and distributed by the SI, including all necessary connections and terminations.	CDRL 5-4
5.11.1-3	Primary power will be provided by the NFPS Agencies at primary NFPS Hardware locations and may not be clean and isolated at the voltage level required by the NFPS. Any necessary conditioning of the primary power or addition of line interface filters or power supplies will be the responsibility of the SI, and to the greatest extent possible, will be located within the NFPS Hardware enclosures.	CDRL 5-4
5.11.1-4	NFPS Hardware operating off of line voltage will be designed to operate with a plus or minus 10 percent fluctuation in voltage without any damage or service interruption.	CDRL 5-4
5.11.1-5	NFPS Hardware will retain any and all information stored in Non-Volatile Memory under any conditions of the power supply.	CDRL 5-4
5.11.1-6	No condition occurring in the power source will cause any degradation to Media being processed when the power condition occurs.	CDRL 5-4
5.11.1-7	NFPS Validators will include a maintenance free battery for protection against power fluctuations and outages. NFPS Validators shall have a low voltage indicator or alert that will specify if the battery is not functioning or charged.	CDRL 5-4
5.11.1-8	NFPS Validators will meet the following flammability requirements: <ul style="list-style-type: none"> • UL 94 V-O • UL HB 	CDRL 5-4

Req. #	Requirement	Assigned CDRL(s)
5.11.1-9	Onboard NFPS Equipment components shall be designed by the SI to operate reliably from a transit bus's direct current power source without malfunction.	CDRL 5-4
5.11.1-10	NFPS Equipment and its components will be protected against damage, loss or modification of data caused by: <ul style="list-style-type: none"> • Voltage fluctuations • Reverse polarity of the input voltage • Temporary voltage variations • Over-current draw • Stray currents 	CDRL 5-4
5.11.1-11	Onboard NFPS Equipment components' power supplies will include adequate filters and components to regulate the bus-supplied voltage and render it devoid of power spikes and noise (i.e., zero power spikes and noise). Provisions will include shielding of electronic interference caused by such items as fluorescent light power units, coach alternators, air conditioning units, radio communication units and other accessories characteristic of bus coaches.	CDRL 5-4
5.11.1-12	Adequate protection against transient surges on the bus power supply will be incorporated to the extent necessary to prevent damage to electronic components of the onboard NFPS Equipment components.	CDRL 5-4
5.11.1-13	Power sensing will be incorporated into onboard NFPS Equipment components' power supplies to cause the devices to switch off automatically if the supply voltage increases or decreases to levels beyond the voltage tolerance.	CDRL 5-4

5.11.2 Electrical Noise Requirements

Req. #	Requirement	Assigned CDRL(s)
5.11.2-1	The SI shall incorporate an approach to electromagnetic compatibility that will ensure that all NFPS Hardware will operate without being affected by or causing electromagnetic interference (EMI).	CDRL 5-4
5.11.2-2	All NFPS Hardware will be protected against radio frequency interference (RFI) emission sources, as well as internal conductive or inductive emissions.	CDRL 5-4
5.11.2-3	Operation of the NFPS will not be affected by the electromagnetic fields generated by traction power (overhead catenary or third rail) at distances as close as 20 feet, or by local high voltage power distribution lines at distances as close as 50 feet.	CDRL 5-4
5.11.2-4	Operation of the NFPS will not be adversely affected by station equipment such as lighting and communications equipment within close proximity to the NFPS.	CDRL 5-4

Req. #	Requirement	Assigned CDRL(s)
5.11.2-5	Onboard NFPS Equipment components will be unaffected by interference such as radiation from vehicle equipment, including radio, lights, electronic destination signs, air conditioners and generators.	CDRL 5-4
5.11.2-6	NFPS Equipment components will not emit measurable EMI or RFI that produces harmful interference with any other onboard electronic device or system.	CDRL 5-4
5.11.2-7	The SI shall certify the electromagnetic compatibility of the NFPS components. The SI shall provide results of interaction analysis and testing of each NFPS component with regard to frequency distribution, amplitude and harmonic content.	CDRL 5-4
5.11.2-8	Existing certifications, interaction analysis and testing will be submitted to the MTA for review and acceptance during design review.	CDRL 5-4

5.11.3 Grounding

Req. #	Requirement	Assigned CDRL(s)
5.11.3-1	All NFPS Hardware enclosures, chassis, assemblies, panels, switch boxes, terminal boxes and similar enclosures will be grounded. Protective grounding will be provided to ensure that all exposed metal on any such supplied components are connected to a common ground point.	CDRL 5-4
5.11.3-2	The SI shall meet safety requirements for the grounding system that conform with the National Electric Code (NEC), Underwriter Laboratories (UL), Society of Automotive Engineers (SAE) and local codes where applicable.	CDRL 5-4
5.11.3-3	The SI shall provide certification that all NFPS Hardware has been tested to meet UL applicable criteria. Documentation citing UL certification or acceptable test results will be provided to the MTA. Prior certification of identical equipment and "UL Field Evaluated Marked" will also be acceptable.	CDRL 5-4
5.11.3-4	All NFPS Hardware will contain internal power conditioning equipment capability to handle any stray currents or grounding loops in stations without impact to operations. The design approach to address stray currents or grounding loops for above and below-ground stations may differ. It should be noted that conditions may differ between above or below ground stations and a single solution shall address both deployments.	CDRL 5-4

5.12 NFPS Software Requirements

Open Source Software shall be used to the greatest extent possible in the design and deployment of the NFPS. To the extent that the use of Open Source Software is not feasible, the SI shall use COTS Software to the greatest extent possible in the design and deployment of the NFPS. To the extent possible, all parameters, values, and so forth will be configurable and downloadable by each NFPS Agency from the

NFPS Backend (on an NFPS Agency-specific basis).

Req. #	Requirement	Assigned CDRL(s)
5.12-1	The SI shall supply, design and configure all NFPS Software for optimal system performance, as defined by KPIs in Technical Specifications Section 5.15 (Codes, Regulations & Reference Standards). The SI shall install all Software necessary for system operation that successfully provides adherence to the specifications and performance requirements herein.	CDRL 5-5
5.12-2	The MTA will own all NFPS Data. The MTA will be able to freely access and distribute all NFPS Data throughout the MTA Group within the NFPS at any time and without restriction or cost to the MTA Group, and each NFPS Agency shall have the right to access its corresponding NFPS Agency-specific Data at any time and without restriction or cost to the MTA Group.	CDRL 5-5
5.12-3	As delivered to the NFPS Agencies, the NFPS shall have the capacity to support at least the equipment quantities as described in Technical Specifications Section 4.10 (Equipment Quantities and Locations) and Technical Specifications Section 35.12 (MNR and LIRR NFPS Equipment) and transaction volumes described in Technical Specifications Section 3 (Existing System Description). The NFPS shall be designed to accommodate an expansion of at least two times the current number of transactions.	CDRL 5-5
5.12-4	All features and functions of NFPS Software shall be testable on a systems level. Specific approval by the MTA is required for any feature that is not testable on a systems level.	CDRL 5-5
5.12-5	NFPS Software shall: <ul style="list-style-type: none"> • Be developed employing a programming language that is fully functional within its implementation for the selected microprocessor system, and shall be commercially available in English. • Include provisions for setting and verifying date and time, with automatic adjustments for leap year and daylight savings time changeovers. • Be fully integrated with the Operating System Software to support all required functions of the applications programs in both a networked and a stand-alone environment. • Be coded in a single non-proprietary language and compiled with commercially available compiler. • Except as expressly permitted, not utilize or employ hard coding of configuration parameter values. 	CDRL 5-5
5.12-6	NFPS Software shall: <ul style="list-style-type: none"> • Be fully debugged, provided with Documentation and include all approved revisions introduced up to the time of Final 	CDRL 5-5

Req. #	Requirement	Assigned CDRL(s)
	<p>Completion.</p> <ul style="list-style-type: none"> • Allow for the distribution of Software Updates to all NFPS Equipment from the NFPS Backend. • Be fully source controlled, with the ability to revert to a previous Software Updates. • Support audit trails of activity to show when NFPS Software changes are made and to show MTA authorization for such changes, all in accordance with good change management practices. • Securely support Software Updates at the device level without mechanical intervention or component replacement. • Be designed using best practices that allow for an Operating System or database patches and upgrades with minimal testing. • As part of the SI's Software version control and change management practices, the SI shall utilize central tables and other Documentation detailing codes with versioning and values for each function, and provide a facility update such tables and other Documentation prior to implementation of changes, with an effective date designating the actual implementation of each change. • Any Software Updates that require a shutdown and reboot will be done at pre-defined times, and staggered within a station to ensure that no more than one device is affected at a time. 	
5.12-7	<p>NFPS Software shall:</p> <ul style="list-style-type: none"> • Sample all input conditions at rates sufficient to detect and remedy all unsafe or damaging conditions in the shortest possible time. • Perform self-diagnostic routines and respond promptly, safely and predictably to detected Failures. • Respond safely and predictably when powering up or recovering from power interruptions. • Permit thorough interrogation of all input, output and internal conditions by external diagnostic equipment. • Provide Software error codes that contain easily understood explanatory text and include the manner in which the Error can be corrected. • Provide configuration/deployment management of Software using tools such as CHEF. • Include Software license management process to track compliance with Third Party licensing requirements. 	CDRL 5-5
5.12-8	The NFPS will be built using COTS Software where possible, and non-COTS Software only upon the MTA's approval.	CDRL 5-5

Req. #	Requirement	Assigned CDRL(s)
5.12-9	The SI shall ensure that the MTA Group has all necessary Intellectual Property Rights in the NFPS to allow the MTA Group to engage Third Parties to perform the SI's obligations under the Contract Documents, including to provide the same integration, support and other services provided by the SI. All NFPS Software (including data exchange formats and Software Interfaces) will be testable on provided test benches with simulation provided during NFPS integration testing.	CDRL 5-5
5.12-10	Software Updates will be centrally managed and fully regression tested prior to installation. The NFPS shall be able to roll-back to previous Software Versions without adversely impacting operations.	CDRL 5-5
5.12-11	All Third Party COTS Software will be the latest commercial release at the time of CDR. If a release candidate is pending, the MTA will review and approve the version that will be deployed in the NFPS.	CDRL 5-5

In addition to all other Deliverables, the following are required for this Project. The associated CDRL refers to this Technical Specifications Section where the Deliverable is contained, referenced and explained; Deliverables listed in the table are components of larger CDRLs except where noted.

Software Item Description	CDRL
Software Project Management Plan	CDRL 25-1
Software Development Plan	CDRL 25-1
System Configuration Management Plan	CDRL 25-12 ¹
Software Quality Assurance Plan	CDRL 25-9
Software Verification and Validation Plan	CDRL 26-7 ¹
Software Configuration Items List	CDRL 25-11
Prototyping Plan	CDRL 25-17 ¹
Requirements Traceability Matrix	CDRL 25-18 ¹
Software Requirements Specification	CDRL 26-2, 26-3 26-4
Software Design Description	CDRL 26-2, 26-3, 26-4
Database Design Description	CDRL 26-2, 26-3, 26-4
Software Test Plan	CDRL 27-1, 30-1, 30-4
Standard Software Document	CDRL 5-1
Software System Architect Document	CDRL 20-1, 21-1
Database Administration	CDRL 26-4
Interface Control Requirement Specification	CDRL 32-4 ¹
User Manual	CDRL 32-2

Notes:

1. Standalone CDRL.

5.13 Maintainability and Serviceability

NFPS Hardware shall provide reliable operation over the NFPS' Design Life, and shall be designed to require simple, minimal scheduled and unscheduled maintenance tasks. All NFPS Hardware will include a barcode for asset management purposes, as described in Technical Specifications Section 25.5.1 (Component Identification & Serial Numbers).

Req. #	Requirement	Assigned CDRL(s)
5.13-1	The interior of the NFPS Hardware shall be designed to allow easy and safe access to service equipment and subassemblies. Where applicable, adequate space shall be available to insert keys, to grasp, lift and turn internal components, and to remove and replace units, components, connections, cash storage vaults and ticket stock. As appropriate, guides, rails, tracks, handles and captive fasteners shall be provided to facilitate installation and removal. There shall be no sharp edges that may injure service personnel.	CDRL 5-6
5.13-2	Any NFPS Hardware component that must be lifted (except cash containers when full) shall not weigh more than 20 pounds. Any exceptions to this weight limitation shall be subject to the MTA's approval.	CDRL 5-6
5.13-3	For ease of service, all electrical connections between NFPS Hardware components and subassemblies shall be established by means of connectors to allow rapid removal of a component and/or subassembly. Plug-in connectors shall be equipped with strain relief to prevent damage to cables and connectors.	CDRL 5-6
5.13-4	NFPS Hardware components requiring frequent adjustment shall be conveniently located for access by maintenance staff to facilitate access and adjustment utilizing First-Call Maintenance techniques, as defined within the Contract Documents.	CDRL 5-6
5.13-5	Automatic diagnostic test routines and test equipment shall be provided to aid in troubleshooting malfunctions as specified in Technical Specifications Section 28.1 (Test Facilities). These test routines shall provide the ability to isolate defects to LLRU. Location of test points shall be easily identified. All relevant NFPS Hardware shall have clear labels and symbols that at a minimum indicate safety, warning, servicing steps and wiring connections.	CDRL 5-6
5.13-6	The means to access for service, remove and replace all NFPS Agency-serviceable NFPS modules shall be subject to the MTA's review and approval at the Preliminary Design Review.	CDRL 5-6
5.13-7	All Field Devices shall incorporate a test mode. In this mode, such hardware shall have full functionality and only process test Media. Test transactions shall be segregated in reporting from revenue transactions.	CDRL 5-6
Preventative Maintenance		

Req. #	Requirement	Assigned CDRL(s)
5.13-8	The SI shall provide Documentation during Preliminary Design Review that defines: <ul style="list-style-type: none"> Preventive Maintenance frequency for all NFPS Hardware based upon time and transactions A list of all PM tasks to be performed, including a brief description of the work, and any parts, materials or components required Time required to complete each defined PM task Which PM tasks require tools to complete, and therefore do not satisfy the First-Call Maintenance objective 	CDRL 5-6
Corrective Maintenance		
5.13-9	During the Preliminary Design Review, the SI shall provide Documentation that clearly defines Corrective Maintenance tasks that can and cannot be easily completed on-site within the defined time parameters below.	CDRL 5-6
5.13-10	No more than one person shall be required to perform on-site Corrective Maintenance on an individual unit of NFPS Hardware.	CDRL 5-6
5.13-11	The time for entry into a machine, removal and replacement of a component of NFPS Hardware, and restoration of the same to an operating condition (including testing) shall take no longer onboard and onsite than: <ul style="list-style-type: none"> NFPS Validators – Not more than 7 minutes CVMs, TOMs and WVMs – Not more than 20 minutes 	CDRL 5-6

5.14 Performance Requirements

The NFPS system will meet the following operational performance requirements. All performance requirements must be met on a monthly basis, unless stated otherwise.

Req. #	Requirement	Assigned CDRL(s)
5.14-1	Except as otherwise set out herein, Technical Specifications Section 5.14 (Performance Requirements) shall be applicable upon the timeframes described in Agreement Section 26 (Service Levels and Service Credits).	CDRL 5-8

5.14.1 Applicable KPI and Service Level Definitions

Capitalized terms have the following meanings with respect to KPIs:

Defined Term	Definition
Account Processing Compliance	A measure of all aspects of account processing according to the applicable NFPS Agency's Business Rules.

Defined Term	Definition
Accurate transactions	Transactions in the NFPS Backend that match those posted to the general ledger.
Availability	Measured as ratio of Uptime to Total Time, expressed as a percentage (Uptime/Total Time x 100).
Average Transaction Time	The sum of all Transaction Times divided by total number of Transactions within a month.
Call Hold Time	The time required from the instant that an inbound caller is put on hold by the call router to the instant that the call is answered by an SI agent.
Device response	Must include the use of robust Risk Mitigation techniques for authorization of the fare payment and delivery of a go/no-go message.
IVR Response Time	The time required from the instant that an inbound caller selects the NFPS IVR option from the MTA IVR menu to the instant that the call is answered by the NFPS IVR.
Patron Cycles	A complete transaction from start to finish and will be defined during design review based on an agreed usage model.
Scheduled Downtime	Periods of downtime that the MTA schedules with the SI related to NFPS Software maintenance or upgrades. The MTA will notify the SI prior to the commencement of Scheduled Downtime. Details on advance notice, days and hours for Scheduled Downtime, etc. will be as agreed during design reviews. Scheduled Downtime is expected to primarily be during periods of low activity and/or overnight. When downtime is scheduled in this manner and subject to these types of controls, such Scheduled Downtime is permitted and does not count as downtime.
SI Agent Response Time	The time required from the instant that an inbound caller selects the option to speak with an agent to the instant that the call is answered by an SI agent.
Total Time	The period of time equal to 24 hours/day, 7 days per week. Total Time shall not include Scheduled Downtime, or outages or unavailability caused by hardware devices, Software, routers, wiring and other communications or computing resources outside of the SI's responsibility, as determined by the MTA.
Uptime	The total amount of time in a calendar month when the NFPS Software is accessible and performing its intended functions as specified (" Available ").

5.14.2 Key Performance Indicators (KPIs)

The NFPS shall meet those performance requirements set out in the Contract Documents, including those Key Performance Indicators (KPIs) set out in this Technical Specifications Section 5.14.2 (Key Performance Indicators (KPIs)). These KPIs shall be measured and shall also be part of Acceptance Testing. These KPIs cover reliability, availability, accuracy and speed of performance as applicable and are described below. For a description of “Chargeable Failures” see Technical Specifications Section 30.4.1 (Chargeable Failures).

The SI shall be subject to the following at-risk damages throughout the Term. KPI measurement methodology, including data sources, and reporting will be further defined during design review and documented in CDRL 5-8.

Req. #	Requirement	Assigned CDRL(s)												
5.14.2-1	KPI point assessment for non-compliance with performance requirements specified herein shall result in point-based percentage Service Credit deductions against the Credit Base specified for the KPI at issue .	CDRL 5-8												
5.14.2-2	<p>Service Credits shall be calculated on the basis of “points” as set out below, and monthly KPI Service Credit point assessments shall correspond to the following deductions from the applicable Credit Base:</p> <table><tr><td>1 – 50 points</td><td>no deduction</td></tr><tr><td>51 – 100 points</td><td>2.50%</td></tr><tr><td>101 – 150 points</td><td>3.75%</td></tr><tr><td>151 – 200 points</td><td>5.00%</td></tr><tr><td>201 – 250 points</td><td>6.25%</td></tr><tr><td>Each additional 50 points</td><td>Additional 1.25%</td></tr></table>	1 – 50 points	no deduction	51 – 100 points	2.50%	101 – 150 points	3.75%	151 – 200 points	5.00%	201 – 250 points	6.25%	Each additional 50 points	Additional 1.25%	CDRL 5-8
1 – 50 points	no deduction													
51 – 100 points	2.50%													
101 – 150 points	3.75%													
151 – 200 points	5.00%													
201 – 250 points	6.25%													
Each additional 50 points	Additional 1.25%													
5.14.2-3	<p>Subject to Agreement Section 26.5 (Service Credits), if Service Credits for a particular month exceed the Credit Base (each, a “Credit Overage”), the MTA shall have the right to roll-over the Credit Overage to the following month, and to apply it to the Credit Base for that month.</p> <p>Every twelve (12) months there shall be a true-up of Service Credits. If a Credit Overage exists as of the end of such 12 month period, the MTA shall be entitled to apply the Credit Overage against any other available Credit Bases, the Ongoing Services Letter of Credit and any other amounts identified in the Contract Documents (each, a “Service Credit True-Up”).</p>	CDRL 5-8												

Req. #	Requirement	Assigned CDRL(s)
5.14.2-4	A failure to meet the same KPI, and for the same component or subsystem, for two or more months during the preceding 12 months shall be considered a recurring Failure, and the number of Service Credits for that KPI shall be multiplied by the number of months in which the SI has failed to meet that KPI (e.g., if a KPI is not met for 2 months in a 12 month period, then the Service Credits associated with that KPI shall be doubled in the second month; if a KPI is not met for 3 months in a 12 month period, the Service Credits shall be tripled in the third month).	CDRL 5-8
5.14.2-5	The SI shall calculate performance against these KPIs and provide reports monthly to the MTA.	CDRL 5-8
5.14.2-6	The SI shall incorporate and apply KPI Service Credits into monthly invoicing with respect to the applicable Credit Base, as appropriate. The SI shall itemize such Service Credits, and identify their application against the specified Credit Base.	CDRL 5-8
5.14.2-7	The Credit Bases correspond to the fees set out in Price Proposal Form C and Price Proposal Form F. The MTA and the SI acknowledge, however, that (i) the SI is not entitled to fees associated with Credit Bases for certain Services prior to the completion of BU #5, and (ii) the SI has related performance obligations that are subject to KPIs and Service Credits prior to the completion of BU #5. To address this gap, Service Credits for KPI failures occurring prior to the completion of BU #5 shall be calculated using the identified Credit Bases and the MTA shall deduct the related Service Credits from the Retained Percentage or other amounts payable to the SI. By way of clarifying example, and not limitation, if the SI fails to achieve the KPI for NFPS Software Availability set out in Technical Specifications Section 5.14.3 (NFPS Backend, Back Office, Web, and Mobile Performance Requirements) between BU #2 and BU #3, then (1) the MTA shall be entitled to a Service Credit using the Technical and Software Support Services Fees as the Credit Base, and (2) the MTA shall deduct the amount of the Service Credit from the Retained Percentage.	CDRL 5-8

5.14.3 NFPS Backend, Back Office, Web, and Mobile Performance Requirements

The Credit Base for these KPIs shall be: Technical and Software Support Services Fees.

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
Aggregate Requirement	Transaction Processing	<p>Transactions are processed correctly within 24 hours from receipt at the back office for posting to the FCSS.</p> <p>Correctly processed transaction is defined as a transaction that has been assigned a valid settlement code and processed in accordance with established business rules for that code as evidenced by system data and reports.</p>	99.99%	Per month	<p>50 points for failure to meet req.</p> <p>50 points each 1.0% below 99.99%</p>
Aggregate Requirement	NFPS Software Availability	Measured for each NFPS Software service function. Each service function will be reported on and assessed separately.	99.99%	Per month	100 points for each service function that is not Available
Aggregate Requirement	Revenue Audit Accuracy	Number of accurate transactions/Number of total transactions	99.99%	Per month	<p>50 points for failure to meet req.</p> <p>50 points each 1.0% below 99.99%</p>
Aggregate Requirement	End-to-End transaction time	Transactions that are generated and then processed and posted in the NFPS Backend within five (5) minutes (excluding further processing needed to ensure accurate enforcement of fare policy) per month	99.99%	Per month	<p>50 points for failure to meet req.</p> <p>50 points each 1.0% below 99.99%</p>

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
Aggregate Requirement	Account processing compliance	Percentage of Transit Accounts that go below pre-set floor (negative) per month	< 0.01% of all Transit Accounts	Per month	50 points for failure to meet req. 50 points each 1.0% above 0.01%

5.14.4 Software Support Services Required SI Response Times

The Credit Base for these KPIs shall be: Technical and Software Support Services Fees.

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
Aggregate Requirement	Defect Resolution Time	The applicable portion of the NFPS shall be restored to service or a work around provided within three (3) hours of the MTA's approval of the SI's Software Corrective Maintenance Proposal. A final correction of the defect with a Software Update shall occur within 60 work days. By way of clarification, and not limitation, if the defect impacts the entire NFPS, then the Service Credit for this Defect Resolution Time KPI and the Service Credit for the System Outage Resolution Time KPI shall be cumulative (i.e., both KPIs and related Service Credits shall apply).	Incident-free	Per month	50 points for each failure to meet req.
Aggregate Requirement	Technical Support response time	SI Software technical support personnel shall be available by telephone to the MTA Group during the hours of 8 a.m. to 5 p.m., Eastern time, Monday through Friday, excluding holidays for Severity Level 3 and 4 incidents. Response times for such Severity Level 3 and 4 incidents	99.0% of calls returned within the designated response time	Per month	50 points for failure to meet req. 50 points each 1.0% below 99%

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
		shall be as provided in Agreement Section 19.6.5. (Error Response and Resolution Times).			
Aggregate Requirement	System Outage Response Time	The SI shall respond to all reports of Severity Level 1 and 2 incidents 24 hours a day, seven (7) days per week. Response times for such Severity Level 1 and 2 incidents shall be as provided in Agreement Section 19.6.5. (Error Response and Resolution Times).	Incident-free	Per month	200 points for each incident of a failure to meet req.
Aggregate Requirement	System Outage Resolution Time	The NFPS shall be restored to service or a work around provided within three (3) hours of the MTA's approval of the SI's Software Corrective Maintenance Proposal. A final correction of the defect with a Software Update shall occur within sixty (60) work days.	Incident-free	Per month	200 points for each incident of a failure to meet req.
First-Call Maintenance	Average Response Time	Total time for the SI to arrive on-site after notification or discovery of an incident requiring First-Call Maintenance/Total number of incidents	4 hours	Per month	Included in KPI reporting. No Service Credits.

5.14.5 Hardware Key Performance Indicators (KPIs)

The SI shall meet all requirements for performance contained herein. The NFPS shall meet those performance requirements set out in the Contract Documents, including those Key Performance Indicators (KPIs) set out in this Technical Specifications Section 5.14.5 (Hardware Key Performance Indicators (KPIs)). These KPIs shall be periodically measured and shall also be part of Acceptance Testing. These KPIs cover reliability, availability, accuracy and speed of performance as applicable and are described in the below table. For a description of "Chargeable Failures" see Technical Specifications Section 30.4.1 (Chargeable Failures). The Credit Base for these KPIs (except for those identified as "Standard Warranty Remedies") shall be: Technical and Software Support Services Fees.

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
All NFPS Hardware (excluding "Support Devices" as identified in this table)	Device accuracy	Calculation will be: Ratio of transactions (volume and value, separately) processed by the NFPS Backend to that recorded by devices audit registers	99.99%	Per month	50 points for failure to meet req. 50 points each 1.0% below 99.99%
	Device Reporting after out of service conditions	Devices that go out of service will upon returning to service self-report incidents via device logs per system component specifications. Calculation will be: (out of service devices that self-report incidents upon returning to service)/(all out of service devices). Measurement will be determined by comparison of device failure reporting by the MTA, the SI and device logs of those devices that return to service.	99.99%	Per month	Standard Warranty Remedies ¹³
Validators					
NFPS Validators	Tap Read Error Rate	Number of Taps that Report an Error/Total Number of Taps Calculated on a per-NFPS Validator type (i.e., Bus Validator, Subway Validator, and Wayside Validator Machine) and based on the number of taps that the applicable Validator type returns an error across all deployed Validators of the	< 4.5%	Per month	100 points per NFPS Validator type that fails to meet the requirement

¹³ Applies during the Hardware Warranty Period only for MNR and LIRR. Upon conclusion of the applicable Hardware Warranty Period for MNR- and LIRR-specific NFPS Hardware, the KPIs and Service Credit structure set out in Technical Specifications Section 35.15 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services) shall apply (if the MTA exercises the associated Option).

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
		same type			
Bus Validators	Mean Cycles Between Failures (MCBF)	Number of Patron Cycles/Number of Chargeable Failures	75,000	Per month	Standard Warranty Remedies
	Average Throughput	Total time for patrons throughput (tap a validation device, receive feedback, and proceed)/Total number of patrons	2.5 seconds (24 people per minute)	Per month	Standard Warranty Remedies
	Average Transaction time	Time from Media tap to device response	Less than 500 ms	Per month	Standard Warranty Remedies
Wayside Validator Machines	Mean Cycles Between Failures (MCBF) – excluding printer	Number of Patron Cycles/Number of Chargeable Failures	20,000	Per month	Standard Warranty Remedies
	Average Transaction time	Time from Media tap to device response	Less than 500 ms	Per month	Standard Warranty Remedies
	Mean Cycles Between Failures (MCBF) - printer only	Number of Patron Cycles/Number of Chargeable Failures (including jams)	15,000	Per month	Standard Warranty Remedies
Subway Validators	Mean Cycles Between Failures (MCBF)	Number of Patron Cycles/Number of Chargeable Failures	75,000	Per month	Standard Warranty Remedies
	Throughput	Number of patrons that tap, receive feedback, and clear the turnstile (TS) or HEET	At least 30 people per minute for TS	Per month	Standard Warranty Remedies

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
			At least 17 people per minute for HEET		
	Average Transaction time	Time from Media tap to device response (including turnstile release)	Less than 500 ms	Per month	Standard Warranty Remedies
Distribution Devices					
Configurable Vending Machines (fully configured)	Mean Cycles Between Failures (MCBF)	Number of Patron Cycles/Number of Chargeable Failures	7,000 (overall unit, including jams)	Per month	Standard Warranty Remedies ¹³
Configurable Vending Machines (excluding Bill Handling Unit)	Mean Cycles Between Failures (MCBF)	Number of Patron Cycles/Number of Chargeable Failures	10,000	Per month	Standard Warranty Remedies ¹³
Customer Service POS Terminal	Mean Time Between Failures (MTBF) – excluding printer	Number of Days/Number of Chargeable Failures	180 days	Per year	Standard Warranty Remedies
	Mean Cycles Between Failures (MCBF) – printers only	Number of Patron Cycles/Number of Chargeable Failures (including jams)	20,000	Per month	Standard Warranty Remedies
Ticket Office Machines	Mean Time Between Failures (MTBF) – excluding printer	Number of Days/Number of Chargeable Failures	180 days	Per year	Standard Warranty Remedies ¹³
	Mean Cycles	Number of Patron Cycles/Number of Chargeable	20,000	Per month	Standard Warranty

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
	Between Failures (MCBF) – printers only	Failures (including jams)			Remedies ¹³
Support Devices					
Driver Control Unit (if optional)	Mean Cycles Between Failures (MCBF)	Number of touchscreen touches/Number of Chargeable Failures	75,000	Per month	Standard Warranty Remedies
RF Workstation	Revenue Audit Accuracy	Number of accurate transactions/Number of total transactions	99.99%	Per day	Standard Warranty Remedies ¹³
	Availability	Number of functioning Workstations/Number of total Workstations	95%	Per day	Standard Warranty Remedies ¹³

5.14.6 Support Services and Customer Service Key Performance Indicators (KPIs)

The Credit Base for these KPIs shall be, as applicable: (i) Transition Customer Call Center Services and Customer Service Center Services Fees (pro-rated based on the Measurement Period), or (ii) Extended Customer Service Support Fees.

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
Support Services and Customer Service					
Call Center Support	Availability	Number of hours at least one inbound connection to the SI IVR is open and available (no busy signal or drop)/Total number of operational hours	99.9%	Per month	50 points for failure to meet req. 50 points each 1.0% below 99.9%
Call Center Support	Average Wait Time	Total call hold time/Total number of inbound calls that are initially placed on hold prior to reaching an SI agent	2 minutes	Per month	Included in KPI reporting. No Service Credits
Call Center Support	Abandonment Rate	Percentage of inbound calls that hang up before an SI	5%	Per month	Included in KPI

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
		agent could answer (excluding calls that get a busy signal and those abandoned within 10 seconds).			reporting. No Service Credits
Call Center Support	Average Agent Responsiveness (excluding calls placed on hold by router)	Total of all SI Agent Response Times/Total number of inbound calls answered by an SI Agent	20 seconds	Per month	Included in KPI reporting. No Service Credits
IVR System	Average IVR Responsiveness	Total IVR Response Times for pickup, response, and all self-service transactions processed by IVR/Total number of such transactions	3 seconds	Per month	Included in KPI reporting. No Service Credits

5.14.7 MTA Right to Exclude

The parties acknowledge that NFPS performance relies, in part, on the MTA's enterprise network and the existing MNR and LIRR communications system, and that the SI may be entitled to relief from Service Credits to the extent that its failure to meet an identified requirement is attributable to the MTA's enterprise network or MNR and LIRR communications system. In order to ensure that the KPIs and associated measurements accurately reflect NFPS performance, the MTA shall have the right, throughout the Term and in its reasonable discretion, to remove, and subsequently reinstate, specific portions of the NFPS from any KPI measurement.

By way of clarifying example, if the SI is not meeting the End-to-End Transaction Time KPI requirement because a particular MNR station is consistently failing to meet the requirement due to the MNR communications system, and such failure results in SI relief for other End-to-End Transaction Time failures that are not attributable to the MNR communications system, then the MTA shall have the right to exclude the particular MNR stations impacted by the MNR communications system failure from the End-to-End Transaction Time KPI measurement in order to assess the SI's performance and to determine whether the MTA is entitled to associated Service Credits.

5.15 Codes, Regulations & Reference Standards

The NFPS shall comply with relevant standards, laws and regulations to ensure that it:

- Presents no safety hazards for the MTA Group's passengers and employees
- Will withstand the rigors of the environments in which the NFPS Hardware will be installed, and the public use to which it will be subjected
- Provides for the secure storage and transmittal of NFPS Data

- Is designed using state-of-the-art methods to maximize quality, performance and functionality
- Satisfies federal, state and other requirements for ergonomics and usability

The NFPS shall comply with all relevant codes, ordinances, statutes, standards, rules and regulations, and in any event shall at a minimum include the items below. The latest revision in effect for each standard at the time of FDR shall be used in conjunction with the Contract Documents.

- American Society for Testing and Materials (ASTM) Standards
- Americans with Disabilities Act
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- Advanced Encryption Standard
- ANSI X9.24, Financial Services Retail Key Management
- Connecticut DOT Form 817 – Specifications for Roads, Bridges, Facilities and Incidental Construction
- European Norm EN55022, Emissions standards for CE marking
- European Norm EN55024, Immunity standards for CE marking
- Federal Information Security Management Act (FISMA)
- FCC Part 15 Class B – Radio Frequency Devices
- FIPS 140-2
- Institute of Electrical and Electronics Engineers (IEEE) Standards
- IEEE 802.11 b/g/n standard for wireless data communications
- IEEE 802.11i standard for wireless data network security
- International Electrotechnical Commission (IEC) Standards
- International Electrotechnical Commission Standard 529 (IEC529)
- International Telecommunications Union (ITU) Standards
- Internet Engineering Task Force (IETF) Standards
- ISO/IEC 7810, Identification Cards – Physical Characteristics
- ISO 9001
- ISO/IEC-8583 – Financial transaction card originated messages
- ISO/IEC 14443 Parts 1 through 4 – Contactless Smart Card Standard
- ISO/IEC 18092/ECMA-340, Near Field Communication Interface and Protocol-1
- ISO/IEC 21481/ECMA-352, Near Field Communication Interface and Protocol-2
- ISO/IEC 27001 Information Security Management
- National Electrical Code (NFPA 70)
- National Electrical Manufacturers Association (NEMA) Standards
- National Electrical Manufacturers Association Publication 250-2003
- National Electrical Safety Code (ANSI C2)
- National Fire Protection Association (NFPA) 130
- NCITS 322-2002, American National Standard for Information Technology – Card Durability Test Methods
- New York State Building Code
- NIST Guidelines to Protecting the Confidentiality of PII
- NIST Guidelines for Cyber Security
- Occupational Safety and Health Administration (OSHA)
- Payment Card Industry Data Security Standards (PCI-DSS)
- Payment Card Industry Payment Application Data Security Standards (PA DSS)
- Payment Card Industry PIN Transaction Security (PCI PTS)

- EMV Integrated Circuit Card Specifications for Payment Systems in effect at the time of device installation
- EMV Contactless Specifications for Payment Systems in effect at the time of device installation
- All Federal Information Processing Standards (1-4)
- Society of Automotive Engineers SAE J1113-13 Electrostatic Discharge
- Society of Automotive Engineers SAE J1455 Vibration and Shock
- UL Standard 60950, "Information Technology Equipment – Safety"
- World Wide Web Consortium, Mobile Web Application Best Practices
- Web Content Accessibility Guidelines WCAG 2.0

The Divisions included in Appendix H also apply to the NFPS. In the case of conflict between provisions of codes, laws and ordinances, the more stringent requirement shall apply.

5.16 General Design Requirements Required Submittals

The required submittals specified in this Technical Specifications Section 5 (General Design Requirements) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 5-1	General Design Requirements	Sections 5.1 to 5.5, and 5.8 to 5.10	✓	✓	✓	
CDRL 5-2	Environmental Condition Requirements	Section 5.6	✓	✓	✓	
CDRL 5-3	Data Security Plan and Full Access Protocols	Section 5.7	✓	✓	✓	
CDRL 5-4	Electrical Requirements	Section 5.11	✓	✓	✓	
CDRL 5-5	Software Development Requirements	Section 5.12	✓	✓	✓	
CDRL 5-6	Maintenance Plans	Section 5.13	✓	✓	✓	
CDRL 5-7	ADA Compliance	Section 5.10	✓	✓	✓	
CDRL 5-8	Performance Requirements	Section 5.14	✓	✓	✓	
CDRL 5-9	Substitution Product Specifications	Section 5.8			✓	
CDRL 5-10	Verified Additional Product Verification Process	Section 5.8			✓	

6 System Architecture

The NFPS will be built using an Account-Based Open Architecture, and will otherwise support limited Card-Based Media designs as contemplated under the Contract Documents. The NFPS will accept and process both Closed-Loop and Open Payment Contactless Media.

6.1 General Architecture

The NFPS will be designed using an Account-Based architecture for the sale and distribution of Fare Products (i.e., stored value, rides and passes), as well as for the processing and validation of fare payments. Transit Accounts will be able to be linked to all Media accepted by the NFPS, including Contactless Media, Paper Media with a printed barcode, and mobile apps that generate an electronic barcode. The NFPS will also support limited Card-Based Media, such as a Single Ride Ticket and possibly other stored-trip Fare Products, with fare information written to the Media. The use of Card-Based Media is described in Technical Specifications Section 6.1.2 (Single Ride Tickets (SRTs) and Other Card-Based Products).

6.1.1 Account-Based System

Req. #	Requirement	Assigned CDRL(s)
6.1.1-1	The SI shall design and implement an Account-Based System.	CDRL 6-1
6.1.1-2	The NFPS will manage Transit Accounts, calculate Open- and Closed-Loop fares and Fare Products (based on established Business Rules and NFPS Agency fare policies) and perform fare processing and validation at the time of payment, validation and inspection.	CDRL 6-1
6.1.1-3	The loading of Fare Products and execution of fare payments will be performed using Transit Accounts maintained within the NFPS.	CDRL 6-1
6.1.1-4	Transit Accounts will be accessed using Media accepted by the NFPS, including NFPS Agency-Issued Media, Third Party-Issued Media, Limited-Use Smart Cards, Contactless Bank Cards, and NFC-equipped devices (see Technical Specifications Section 8.3 (Near Field Communications and Other Mobile Payment Devices)), and barcode Media in paper and electronic forms.	CDRL 6-1
6.1.1-5	The Media will serve as a token for accessing an NFPS Account, and no Data will be written to the Media when loading Fare Products or paying a fare, with the exception of Limited-Use SRT (Technical Specifications Section 6.1.2 (Single Ride Tickets (SRTs) and other Card-Based Products)) or Risk Mitigation approaches described in Technical Specifications Section 6.1.4 (Risk Mitigation Techniques).	CDRL 6-1
6.1.1-6	With the exception of SRTs and other limited Card-Based Media, both Closed-Loop and Open Payments will result in the creation or modification of a Transit Account within the NFPS.	CDRL 6-1
6.1.1-7	For Closed-Loop Payments, all Fare Products loaded by the customer will be stored in a Transit Account and reduced or validated as it is used for payment.	CDRL 6-1

Req. #	Requirement	Assigned CDRL(s)
6.1.1-8	For Open Payment transactions, a Transit Account will maintain a record of payments processed against the financial account being used, and allow for the conferring of fare discounts and transfers, as defined by established Business Rules and each NFPS Agency's fare policies.	CDRL 6-1
6.1.1-9	The NFPS will manage, batch and submit Open Payment transactions to the Payment Application (see Technical Specifications Section 21.7 (Payment Application)) as necessary.	CDRL 6-1
6.1.1-10	The NFPS will be scalable such that the NFPS will, at a minimum, support 200 percent of the current NFPS Agencies' ridership figures presented in Technical Specifications Section 4.4 (NFPS Agencies and Linked NFPS Entities).	CDRL 6-1

6.1.2 Single Ride Tickets (SRTs) and Other Card-Based Products

Req. #	Requirement	Assigned CDRL(s)
6.1.2-1	The NFPS will support use of Card-Based SRTs which provide a single entry onto NFPS Agency services within a 2 hour window of purchase (or within such other time frame as configured by each NFPS Agency for such NFPS Agency's services), with no transfers or reloading of SRT Media allowed.	CDRL 6-1
6.1.2-2	SRTs will be encoded onto Limited-Use Media. NFPS Validators will write to this Card-Based Product to deduct the trip at the point of entry. SRTs will not be associated with Transit Accounts but will be tracked as a transaction with all relevant message details at the NFPS Backend.	CDRL 6-1
6.1.2-3	Other limited stored-trip Fare Products, as defined by the MTA, may be supported in the future on the same Card-Based Limited-Use Media as the SRT. Possible Fare Products will be defined during design reviews, and shall not impact the cost, operation or performance of Account-Based Fare Products.	CDRL 6-1
6.1.2-4	SRT and other limited stored-trip Fare Products can be initialized with: <ul style="list-style-type: none"> - Pre-set validity period - Activated upon first use - Activate upon sale Details of Card-Based Fare Products will be defined during design reviews.	CDRL 6-1
6.1.2-5	SRT and other limited stored-trip Media will expire when the loaded Fare Product expires.	CDRL 6-1

6.1.3 Online Communications

Req. #	Requirement	Assigned CDRL(s)
6.1.3-1	All Field Devices will be equipped with online communications to the NFPS Backend (see Technical Specifications Section 20 (NFPS Backend)) and the Device Monitoring System (see Technical Specifications Section 21.2 (Device Monitoring System)).	CDRL 6-1
6.1.3-2	The NFPS Interfaces will support the immediate loading of Fare Products through all distribution channels, and processing of Open- and Closed-Loop fare payments at NFPS Validators and using Onboard Sales and Validation Devices (OSVDs).	CDRL 6-1
6.1.3-3	The lowest-latency connections possible will be employed, using hardwired, cellular and Wi-Fi connections, as appropriate for each device. Any devices using cellular communications will operate on a 4G LTE data network (or faster).	CDRL 6-1
6.1.3-4	The NFPS will support offline operation to perform essential validation and payment functions. In offline operation, devices shall operate according to defined Business Rules, and stored/forward Transaction Data as soon as communications are re-established.	CDRL 6-1
6.1.3-5	Any offline authorization will be recorded as part of the Transaction Data so that offline transactions can be easily identified and tracked.	CDRL 6-1

6.1.4 Risk Mitigation Techniques

The Account-Based Transaction Processor shall support Risk Mitigation techniques to limit fraud, provide accurate Transit Account information and control risk as necessary. The NFPS Backend includes the ATP, its production database and account configuration tools. Risk mitigation techniques, which will consider that certain types of Media may carry higher risks (such as bank GPR cards), may include but are not limited to:

Req. #	Requirement	Assigned CDRL(s)
6.1.4-1	The MTA acknowledges the limitation of today's technology to quickly provide fare validation from payment validators and OSVDs to the backend without affecting processing time and throughput. The SI shall be given latitude on determining how best to address this issue subject to review and approval by MTA.	CDRL 6-1
6.1.4-2	The ATP may support limited writing of Data to Closed-Loop Media for the purposes of fraud mitigation, accurate Transit Account information and risk management, all as necessary. Details will be determined during system design review upon approval by the MTA.	CDRL 6-1

Req. #	Requirement	Assigned CDRL(s)
6.1.4-3	Any Data written to Closed-Loop Media will be used to supplement or mirror ATP Transit Account Data, and will be limited in nature, i.e., the last X transactions, basic account balance or status bits to indicate various account states. All Transit Account Data shall be encrypted and secured per Technical Specifications Section 6.2.1 (Media Formats).	CDRL 6-1
6.1.4-4	If there are conflicts between the Risk Mitigation Data written to Closed-Loop Media and the NFPS Backend, the Transit Account stored in the NFPS Backend shall remain the authoritative record. Timestamps and synchronization logic will be built into the ATP.	CDRL 6-1
6.1.4-5	If used, Positive and Negative Lists will be regularly pushed to Field Devices, and may also be mirrored at ancillary locations (for example, local station controllers) to ensure up-to-date and prompt retrieval by Field Devices. Any mirroring will accurately reflect the master Positive and Negative Lists stored in the NFPS Backend, with instant updating and version control in place to ensure accurate synchronization.	CDRL 6-1
6.1.4-6	The SI shall ensure that the MTA Group has all necessary Intellectual Property Rights in Risk Mitigation techniques to allow the MTA Group to engage Third Parties to provide the same functionality. Any materials embodying such Intellectual Property Rights will also be testable by the standard testing tools provided by the SI as further specified in Technical Specifications Section 27.1 (Inspection and Testing Plan).	CDRL 6-1
6.1.4-7	Any Risk Mitigation practices will comply with PCI-DSS and EMV best practices, banking standard practices, standards and requirements (see Technical Specifications Section 5.7 (System Security)). No sharing or comingling of Open-Loop and Closed-Loop value will occur.	CDRL 6-1

6.2 Open Architecture

The NFPS will be designed and implemented using an Open Architecture approach to provide flexibility as technology and the NFPS Agencies' needs change. The Open Architecture shall apply to the entire NFPS, including all Media, devices, Interfaces and transaction formats for the management, distribution, payment and inspection of fares.

6.2.1 Media Formats

Req. #	Requirement	Assigned CDRL(s)
6.2.1-1	SI shall design, develop, test and provide ISO/IEC-14443 compliant Closed-Loop Contactless Media that will be accepted by the NFPS.	CDRL 6-3

Req. #	Requirement	Assigned CDRL(s)
6.2.1-2	Fully functional Extended-Use Closed-Loop Media and Limited-Use Closed-Loop Media will be provided by the SI for issuance by each NFPS Agency, on an NFPS Agency-specific basis (see Technical Specifications Section 8.2 (NFPS Agency-Issued Media)).	CDRL 6-3
6.2.1-3	Additional MTA-defined formats may be defined during system design that conform to the design principles in this Technical Specifications Section 6 (System Architecture).	CDRL 6-3
6.2.1-4	All SI-supplied Media – with the exception of Paper Media without a barcode and the Card-Based Media described in Technical Specifications Section 6.1.2 (Single Ride Tickets (SRTs) and Other Card-Based Products) – will be Account-Based, and support the secure storage of a unique token used to access a Transit Account in the NFPS, without the necessity to write additional Data to the Media. Exceptions include Risk Mitigation techniques specified in Technical Specifications Section 6.1.4 (Risk Mitigation Techniques).	CDRL 6-3
6.2.1-5	The secure Transit Account token stored on the Media will not be the Media serial number (i.e., UID) or Transit Account number used within the NFPS, and will not be printed on the Media or otherwise accessible using a non-NFPS device.	CDRL 6-3
6.2.1-6	The format of the Transit Account token and Transit Account number used within the NFPS will be subject to the MTA's review and approval as part of design review.	CDRL 6-3
6.2.1-7	The SI shall provide Documentation detailing all card formats supported within the NFPS, including all information necessary to generate required security keys, and the MTA Group's rights in such Documentation shall be as set out in the Contract Documents, including the right to distribute such specifications to Third Parties for Media production and to support multi-application Smart Card implementations.	CDRL 6-3

6.2.2 Transaction Formats

Req. #	Requirement	Assigned CDRL(s)
6.2.2-1	The SI shall provide Documentation detailing the format of all transactions generated and used within the NFPS. This will include any Data formats, message elements and transport protocols which are not already covered by the required APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)), and the MTA Group's rights in such Documentation shall be as set out in the Contract Documents, including the right to distribute the same to Third Parties.	CDRL 6-3

Req. #	Requirement	Assigned CDRL(s)
6.2.2-2	Transaction formats shall be based on published industry standards wherever possible, including those used in the processing of Open Payments and those used to interface with commercial Software packages, such as the Financial Clearing and Settlement System (see Technical Specifications Section 21.6 (Financial Clearing & Settlement System)).	CDRL 6-3
6.2.2-3	The transaction formats shall be designed to meet the system performance requirements (see Technical Specifications Section 5.14 (Performance Requirements)) of the Account-Based Open Architecture, real-time communications architecture (see Technical Specifications Section 6.1.3 (Online Communications)).	CDRL 6-3

6.3 Open Payment Architecture

6.3.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
6.3.1-1	The NFPS will be designed to accept Open Payment Media (i.e., Contactless Bank Cards and their mobile wallet equivalents) for the payment of transit fares wherever fares are paid. This includes all NFPS Validators and OSVDs.	CDRL 6-4
6.3.1-2	<p>The requirements of the NFPS and transaction flow necessary to support Open Payments include:</p> <ul style="list-style-type: none"> • The authorization of payments for transit fares using Contactless Bank Cards at all points where fares are paid, including onboard and off-board vehicles • Real-time, or near real-time, communication with a Merchant Acquirer for the purpose of authorizing Open Payment transactions • Offline authentication of Contactless Smart Cards (including those that transmit magnetic stripe data, if supported and applicable to the MTA), where allowed and enabled based on the MTA configuration, to ensure a genuine card is presented at all points where fares are paid • Security protocols required for the latest PCI and EMV compliance associated with the capture, storage, transmittal and processing of Payment Card Data 	CDRL 6-4
6.3.1-3	All Open Payment fare transactions flowing through the NFPS will be processed by the MTA's Merchant Acquirer(s) via the SI-supplied Payment Application (see Technical Specifications Section 21.7 (Payment Application)). Data flows for transaction processing through the Payment Application will be submitted to the MTA for review and approval.	CDRL 6-4

6.3.2 Supported Formats

Req. #	Requirement	Assigned CDRL(s)
6.3.2-1	The NFPS will support all Open Payments. The NFPS will accept ISO 14443 compliant credit and debit cards, including the following association-branded formats: <ul style="list-style-type: none"> • Visa payWave • Master Card PayPass • American Express ExpressPay • Discover Zip • Third Party-Issued pre-paid debit cards 	CDRL 6-4
6.3.2-2	The NFPS will support any payment formats that comply with existing Open Payment and Contactless communication standards, such as NFC (ISO 18092)-enabled phones or tablets with a mobile wallet application. Validators will also support any mobile wallet provider-specific terminal protocols that enable a streamlined experience for customers using the provider's wallet for payment.	CDRL 6-4
6.3.2-3	The NFPS will support payment using any Contactless EMV Card. The SI shall be responsible for ensuring compliance with all requirements and best practices associated with EMV payment acceptance in the United States, as they are defined by the card associations and issuers, including support for Dynamic Data Authentication (DDA) and Combined Data Authentication (CDA) offline card authentication, merchant routing for debit transactions (i.e., related to the "Durbin Amendment"), etc.	CDRL 6-4

6.3.3 Open Payment Authorizations

Req. #	Requirement	Assigned CDRL(s)
6.3.3-1	NFPS Validators and OSVDs will communicate with the NFPS Backend, which will determine whether to submit the transaction to the Merchant Acquirer for authorization.	CDRL 6-4
6.3.3-2	Prior to permitting entry and/or seeking payment authorization from the Merchant Acquirer, the NFPS will perform basic validation checks on the payment card being used for payment and enforce basic fraud controls. These validation checks will include at a minimum: <ul style="list-style-type: none"> • MOD 10 check of card PAN • Check of card expiry status • MTA-configurable velocity check (i.e., limit on frequency of use within the system) • Offline data authentication (subject to NFPS Agency configuration (on a per-NFPS Agency basis) and settable by card brand) • Permitted IIN and other payment card identifier checks (i.e., to 	CDRL 6-4

Req. #	Requirement	Assigned CDRL(s)
	permit or block acceptance of specific card brands, issuers, card types, etc.) <ul style="list-style-type: none"> The card validation checks shall be performed at the device-level whenever possible, and shall be remotely configurable via downloads. No payment authorization request will be sent for cards that fail any of the validation checks, unless configured by the MTA. 	
6.3.3-3	The NFPS will support real-time fare calculation and online authorization of Open Payments.	CDRL 6-4
6.3.3-4	The NFPS will support real-time, or near real-time, fare calculation and authorization of Open Payments. If the card being used for payment passes all supported validation checks (to be defined during design review), the NFPS will issue a limited authorization (e.g. by NFPS device or server), within the performance requirements specified in Technical Specifications Section 5.14 (Performance Requirements) and request payment authorization through the merchant acquirer.	CDRL 6-4
6.3.3-5	Declined Open Payments shall be tracked as a negative balance in a Closed-Loop Transit Account associated with the payment instrument. The instrument will be removed from the Negative List if the customer resolves the issue and pays the outstanding balance. Customers will be able to resolve outstanding balances associated with Open Payment Media via all self-service sales channels (e.g., NFPS Websites and Vending Machines).	CDRL 6-4
6.3.3-6	The NFPS will be configurable to be able to accept Open Payments when the NFPS Validators or OSVDs cannot communicate with the NFPS due to a temporary loss of connectivity. A valid fare payment signal will be given, and enough card information to complete the transaction will be securely stored on the NFPS Validator or OSVD (and secured to comply with PCI), and transmitted for authorization as soon as the connection is restored.	CDRL 6-4
6.3.3-7	In all cases where an online authorization (if attempted) is not possible, the NFPS will not provide any feedback to the customer or operator to indicate that an authorization was not received.	CDRL 6-4

6.3.4 Payment Aggregation

Req. #	Requirement	Assigned CDRL(s)
6.3.4-1	The NFPS will be able to aggregate Open Payment fare transactions generated using the same payment instrument to reduce payment processing fees. Each NFPS Agency shall be able to configure such aggregation for its own operations.	CDRL 6-4

Req. #	Requirement	Assigned CDRL(s)
6.3.4-2	On first use of a payment instrument, the NFPS will process a pre-authorization for a pre-determined, configurable amount or perform applicable transaction in accordance with card brand rules and begin transaction aggregation.	CDRL 6-4
6.3.4-3	Transactions will be aggregated over a specified time period and up to a specified value, with the initial settings defined during design review. Each NFPS Agency will subsequently be able to configure such parameters for its own operations.	CDRL 6-4
6.3.4-4	The SI shall be responsible for ensuring compliance with all payment card association rules and other applicable banking rules and regulations, including those regarding the aggregation of payments. The NFPS will accommodate scenarios where the aggregation rules vary by card product, association and issuer by determining the card brand using the Issuer Identification Number (IIN) or similar identifier.	CDRL 6-4

6.4 Application Programming Interfaces

6.4.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
6.4.1-1	The SI shall provide APIs that support core NFPS functions and enable access to these functions for any device or system associated with the NFPS (including Legacy Systems), that requires use of them, and such devices or systems may make use of more than one API to support desired functionality.	CDRL 6-5
6.4.1-2	The SI shall provide full API Documentation that specifies the process for sending messages over the APIs between NFPS components, and all messages that the APIs support, including message description, format and timing requirements.	CDRL 6-5
6.4.1-3	The SI shall provide the following APIs, including: <ul style="list-style-type: none"> Fare distribution (device/system to the NFPS) Fare payment (device/system to the NFPS) Transit Account management (device/system to the NFPS) Customer Account management (device/system to CRM System) Device management (device-specific) MTA Bus Time integration (onboard communications) Payment (device/system to payment gateway) Revenue Accounting Remittance Reconciliation 	CDRL 6-5
6.4.1-4	The SI shall implement strong security features to prevent fraudulent use and authenticate users of all APIs based on industry-accepted best practices.	CDRL 6-5

Req. #	Requirement	Assigned CDRL(s)
6.4.1-5	The SI shall demonstrate use of APIs as part of NFPS implementation and testing, and the SI shall provide all associated API Documentation and the SI shall provide updated API Documentation should any APIs change during implementation and testing.	CDRL 6-5
6.4.1-6	The MTA Group's rights in APIs shall be set out in the Contract Documents, including rights to distribute the APIs to Third Parties.	CDRL 6-5
6.4.1-7	MTA/IT will work with the SI to develop an Interface Engine that will allow the APIs to integrate Legacy Systems with the NFPS as needed.	CDRL 6-5

6.4.2 Fare Distribution API

The fare distribution API will support the sale of all Media and Fare Products offered through all fare distribution channels within the NFPS.

Req. #	Requirement	Assigned CDRL(s)
6.4.2-1	The fare distribution API will support the passing of Data between the NFPS and distribution devices and systems, such as: CVMs, TOMs, OSVDs, retail devices and any retail load network, Customer Relationship Management System, NFPS Websites and the NFPS Mobile Applications.	CDRL 6-5
6.4.2-2	The fare distribution API will support the following functionality at a minimum: <ul style="list-style-type: none"> • Sale of Limited-Use Media • Sale of Extended-Use Media and creation of an associated Transit Account • Sale/reload of Closed-Loop transit value/products and update of the associated Transit Account • Sale of Special Program Fare Products and update of the associated Transit Account 	CDRL 6-5
6.4.2-3	Unique Transit Accounts will be generated by the NFPS, and the associated account identifiers passed to the devices/systems via the fare distribution API, to support the issuance of new Media.	CDRL 6-5
6.4.2-4	Fare Products available for sale and the associated pricing will be maintained in the NFPS and sent to distribution devices/systems via the fare distribution API.	CDRL 6-5
6.4.2-5	The fare distribution API will allow any distribution device/system to initiate a sale of any available Media or Fare Product.	CDRL 6-5
6.4.2-6	The fare distribution API will support the generation of transactions containing all required information regarding the sale, including: agency, device/system ID, location, date/time, account number, product sold, payment due, and payment type. Transactions will be processed by the NFPS to allow for the full tracking of all sales.	CDRL 6-5

Req. #	Requirement	Assigned CDRL(s)
6.4.2-7	The fare distribution API will support the return of a confirmation of the actions taken by the NFPS to complete the sale if the sale was successful, or a denial (with reason code) if the sale was unsuccessful.	CDRL 6-5

6.4.3 Fare Payment API

The fare payment API will enable various NFPS Frontend Devices to access the NFPS for purposes of processing fare payments.

Req. #	Requirement	Assigned CDRL(s)
6.4.3-1	The fare payment API will support the payment of fares across the NFPS Agencies and Linked NFPS Entities, using all supported Media and Fare Products, and will be utilized by devices such as the NFPS Validators, CVMs, TOMs, and OSVDs (see Technical Specifications Section 23.2 (Onboard Sales and Validation Devices)) to accept Open- and Closed-Loop fare payments. CVMs and TOMs may also use the fare payment API if Fare Products are used (validated) upon issuance (see Technical Specifications Sections 11 (Common Machine Requirements) through 16 (Configurable Vending Machines), and Technical Specifications Section 17.2 (Ticket Office Machines)).	CDRL 6-5
6.4.3-2	The fare payment API will support the following functionality at a minimum: <ul style="list-style-type: none"> Acceptance of Closed-Loop fare payments using all accepted Media and Fare Products Acceptance of Open Payments using all supported Open Payment network-branded cards and NFC-enabled devices 	CDRL 6-5
6.4.3-3	The fare payment API will support the passing of Data between the NFPS Validators, CVMs, TOMs, OSVDs, and the NFPS to initiate a payment transaction, which will result in a fare calculation being performed and the processing of a payment against a Closed-Loop or Open Payment Transit Account.	CDRL 6-5
6.4.3-4	All fare payment processing will be performed by the NFPS, although the NFPS may distribute Negative Lists and Positive Lists to the payment devices (via the device management APIs), and other Risk Mitigation techniques (see Technical Specifications Section 6.1.4 (Risk Mitigation Techniques)) as deemed appropriate for fraud prevention. Incremental Negative List and Positive List updates, including only changes from prior distributions, are acceptable and are to occur in near real-time.	CDRL 6-5
6.4.3-5	The fare payment API will support the generation of transactions containing all required information regarding the payment, including: agency, device, location, date/time, route type and Transit Account number. Transactions will be processed by the NFPS to allow for the full tracking of all fare payments.	CDRL 6-5

Req. #	Requirement	Assigned CDRL(s)
6.4.3-6	The fare payment API will support confirmation of the action taken by the NFPS and the return of information on the payment status and account, including customer fare category, payment status (i.e., success or denial, including the reason for denial), Fare Product used, amount paid and Transit Account or Fare Product balance.	CDRL 6-5

6.4.4 Transit Account Management API

The transit account management API will support the management of Transit Accounts associated with both Closed-Loop and Open Payment of fares.

Req. #	Requirement	Assigned CDRL(s)
6.4.4-1	The transit account management API will be utilized by devices and systems such as the NFPS CVMs, retail devices and the retail load network, CRM System, NFPS Websites, and the NFPS Mobile Applications to query and modify Data maintained in Transit Accounts.	CDRL 6-5
6.4.4-2	The transit account management API will support the passing of Data between devices/systems and the NFPS to enable the following functionality at a minimum: <ul style="list-style-type: none"> • Query of sales transaction history • Generation of sales adjustments and refunds • Query of fare payment transaction history • Generation of payment adjustments and refunds • Associating Media with value or Fare Products in a Transit Account 	CDRL 6-5
6.4.4-3	The transit account management API will allow devices/systems to query a Transit Account associated with Closed-Loop or Open Payments, and return the sales and fare payment transactions that were conducted against that Transit Account over a specified timeframe.	CDRL 6-5
6.4.4-4	The transit account management API will allow authorized personnel to create adjustment transactions to modify Transit Account balances. Adjustment transactions generated using the API will contain all required information, including: agency, device/system ID, location, date/time, administrator ID, Transit Account number, adjustment type, adjustment value and adjustment reason, and will be processed by the NFPS to allow for the full tracking of all actions.	CDRL 6-5

6.4.5 Customer Account Management API

The customer account management API will support the management of Customer Accounts maintained in the CRM System.

Req. #	Requirement	Assigned CDRL(s)
6.4.5-1	The customer account management API will be utilized by devices and systems such as the CRM System, NFPS Websites, and the NFPS Mobile Applications to create, query and modify Customer Account data.	CDRL 6-5
6.4.5-2	The customer account management API will support the passing of Data between devices/systems and the CRM System to enable the following functionality at a minimum: <ul style="list-style-type: none"> • Registration of a Transit Account (creation of a new customer record) • Query of a Customer Account • Modification of a Customer Account • Setup of Autoload (addition of a funding source or sources to a Customer Account) • Closing of a Customer Account 	CDRL 6-5
6.4.5-3	The customer account management API will support the individual and bulk import of Data on customers applying for a reduced fare classification, including scans of the application and supporting Documentation, eligibility parameters and card personalization information, such as a customer photograph, to be stored in the CRM System.	CDRL 6-5
6.4.5-4	All actions performed through use of the customer account management API will result in the generation of a transaction that contains all required information, including: agency, device/system ID, location, date/time, administrator ID, customer ID, adjustment type and adjustment reason, and will be processed by the CRM System to allow for the full tracking of all actions.	CDRL 6-5
6.4.5-5	If setting up Autoload requires modification to the Transit Account as well as the Customer Account, this change will be handled within the NFPS via an automated process triggered by the update to the Customer Account.	CDRL 6-5

6.4.6 Device Management APIs

The device management APIs will support hardware and Software management of devices deployed within the NFPS.

Req. #	Requirement	Assigned CDRL(s)
6.4.6-1	A device management API will be used by each type of device deployed in the NFPS to report device Errors and events at the module level, and to receive new Software and configuration parameters as required.	CDRL 6-5
6.4.6-2	Device management APIs will be created to support the following devices at a minimum: <ul style="list-style-type: none"> • CVMs (see Technical Specifications Section 16 (Configurable Vending Machines)) • WVMs (see Technical Specifications Section 15 (Wayside 	CDRL 6-5

Req. #	Requirement	Assigned CDRL(s)
	<p>Validator Machines))</p> <ul style="list-style-type: none"> • Customer Service POS Terminals (see Technical Specifications Section 17.1 (Customer Point of Sale Terminals)) • Fare payment validators (see Technical Specifications Sections 12 (Common Validator Requirements) through 14 (Subway Validators)) • TOMs (see Technical Specifications Section 17.2 (Ticket Office Machine)) • OSVDs (see Technical Specifications Section 23.2 (Onboard Sales and Validation Devices)) • Revenue Accounting Remittance Reconciliation (see Technical Specifications Section 6.4.9 (Revenue Accounting Remittance Reconciliation API)) 	
6.4.6-3	The device management APIs will support the passing of Data between the devices and the Device Monitoring System to monitor and track system performance in real-time. The device events and alarm reported via the API will provide enough detail to enable proactive device maintenance at the module or component level, and support accurate reporting on all device performance requirements.	CDRL 6-5
6.4.6-4	The device management APIs will support the real-time distribution of device Software Updates and configuration parameters, as necessary. Device configuration will include real-time updates to any Negative Lists and Positive Lists maintained locally at the devices for the purpose of offline fare processing. It will also include the ability to remotely update EMV processing configuration parameters from the NFPS Backend.	CDRL 6-5
6.4.6-5	Universal APIs to capture device events and distribute Software will be created wherever possible; however, the SI shall work collaboratively with device manufactures to develop device-specific APIs as necessary.	CDRL 6-5

6.4.7 MTA Bus Time Integration API

The SI is responsible for integration of the onboard NFPS Validators with the MTA Bus Time application.

Req. #	Requirement	Assigned CDRL(s)
6.4.7-1	The MTA Bus Time integration API will be utilized by the onboard NFPS Validators to capture geolocation information from the Bus Time application.	CDRL 6-5

6.4.7-2	Other Data from the Bus Time application may be captured by the onboard NFPS Validator including sign-on Data, run/route/direction information and other Bus Time diagnostic data. Details will be determined during NFPS system design.	CDRL 6-5
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6.4.8 Payment API

The payment API will support the processing of bank card payments through the Payment Application (see Technical Specifications Section 21.7(Payment Application)).

Req. #	Requirement	Assigned CDRL(s)
6.4.8-1	The payment API will be utilized to process Open Payment transactions generated by the NFPS Validators, OSVDs or other portions of the NFPS, and bank card sales and adjustments generated by the NFPS Websites, NFPS Mobile Applications, CRM System and IVR.	CDRL 6-5
6.4.8-2	The payment API will support the return of a unique token when a bank card PAN and expiration date is passed to the Payment Application. This unique token will remain associated with the individual bank card so that it can be used for the future tracking and processing of payments.	CDRL 6-5
6.4.8-3	The payment API will use bank card standard transaction formats wherever possible.	CDRL 6-5
6.4.8-4	The payment API will support the processing of payments through the Merchant Acquirer by external systems.	CDRL 6-5
6.4.8-5	The SI shall define the mechanisms for the secure transmission of Payment Data as part of the delivery of the payment API.	CDRL 6-5
6.4.8-6	The payment API will make use all security protocols necessary for compliance with the latest PCI and EMV requirements associated with the secure capture, storage, transmittal and processing of Payment Card Data.	CDRL 6-5

6.4.9 Revenue Accounting Remittance Reconciliation API

As part of the NFPS, the Revenue Accounting Remittance Reconciliation API will support the processing of deposit and withdrawal transactions through Remittance Machines that an NFPS Agency may choose to purchase, outside the scope of this Project. These Remittance Machines will allow MNR and LIRR train crews to turn in their sales and collections, thereby eliminating the current need to perform the remittance process at ticket windows.

Req. #	Requirement	Assigned CDRL(s)
6.4.9-1	The Revenue Accounting Remittance Reconciliation API will be used to exchange revenue and employee information between the Remittance Machines and the NFPS.	CDRL 6-5

6.4.9-2	Data from the Remittance Machines will be captured by the NFPS including sign-on Data, cash deposit amounts, stock serial numbers, employee information, date, time, and other operational data. Details will be determined by the MTA during Design Review.	CDRL 6-5
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6.5 System Architecture Required Submittals

The required submittals specified in this Technical Specifications Section 6 (System Architecture) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 6-1	Primary Account-Based Architecture	Section 6.1	✓	✓	✓	
CDRL 6-2	Component Architecture	Section 6.1			✓	
CDRL 6-3	Open Architecture	Section 6.2	✓	✓	✓	
CDRL 6-4	Open Payment Architecture	Section 6.3	✓	✓	✓	
CDRL 6-5	APIs	Section 6.4	✓	✓	✓	

7 Fare Policies

7.1 General Fare Policy Requirements

This Technical Specifications Section 7 (Fare Policies) describes the NFPS Agencies' fare policies that will be supported by the NFPS. Each NFPS Agency will require configuration and control of its individual fare policies and will be able to administer its individual Business Rules as required.

Req. #	Requirement	Assigned CDRL(s)
7.1-1	The SI shall develop, document and implement all Business Rules necessary to support enforcement of current NFPS Agency fare policies and tariffs.	CDRL 7-1
7.1-2	The SI shall develop, document and implement all fare tables, fare instruments and transaction processing necessary to support each NFPS Agency's Business Rules.	CDRL 7-1
7.1-3	All Media (when used as a time-based Fare Product) will be designed to be usable by one person at a time; that is, only one passenger per Contactless Media, except in the instance of stored value or stored ride transactions that are not subject to fare capping or other NFPS Agency-defined restrictions or group Fare Products provided through Special Programs.	CDRL 7-1
7.1-4	For time-based Fare Products (e.g., pass products), the NFPS will support NFPS Agency-configurable velocity checks and other fraud prevention measures (including Technical Specifications Section 6.1.4 (Risk Mitigation Techniques)), all on an NFPS Agency-specific basis, to prevent passback and unauthorized sharing of Media. The NFPS will also support NFPS Agency-configurable limits on the number and type of fare products that can be purchased, with such configuration on an NFPS Agency-specific basis.	CDRL 7-1
7.1-5	For stored value Fare Products, the NFPS will support separate NFPS Agency-configurable measures to prevent passback and sharing of Media if fare capping applies or other NFPS Agency-defined restrictions, or to prevent accidental multiple payments, with all such configurations on an NFPS Agency-specific basis.	CDRL 7-1
7.1-6	Multiple Fare Products will be able to be associated with one NFPS Account simultaneously (e.g., stored value and a pass products). One NFPS Account will be able to support up to 10 different Fare Products, depending on Business Rules determined during design reviews.	CDRL 7-1
7.1-7	Pass Fare Products will be used first for fare transactions if associated with a Transit Account that also has stored value (see Technical Specifications Section 10.1.3 (Usage Transactions)). Other fare precedence rules will be established in Business Rules determined during design reviews.	CDRL 7-1

7.2 Fare Payment Options

Customers will be able to pay for Media in advance by pre-funding and using a Transit Account (pay-in-advance) or perform Open Payments at the point of entry into the transit system (Pay-As-You-Go or PAYGO). Closed-Loop, pay-in-advance payments will use the NFPS Agency- or Third Party-Issued Media, linked to a Closed-Loop Transit Account, to enable the payment of fares at each NFPS Agency. The following table summarizes the fare payment options that will be available to customers.

Req. #	Requirement	Assigned CDRL(s)
7.2-1	The NFPS shall support pay-in-advance through pre-funding a Transit Account, linked to any supported closed-loop Media, with stored value (pay-per-ride), time-based Fare Products, and other Fare Products to be determined during design review.	CDRL 7-1
7.2-2	The NFPS shall support payments at the point of entry using a Contactless Open Payment Media, including Contactless credit cards and NFC mobile wallets (PAYGO).	CDRL 7-1
7.2-3	A passenger will be able to use pay-in-advance with an Open-Loop Media registered to a Transit Account. Rules for the order in which these methods will be applied will be defined during design review, and will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.2-4	Stored value will also be supported as a payment method for the purchase of Fare Products through all sales channels, by presenting the associated Media, or logging into an associated Customer Account.	CDRL 7-1

7.3 Fare Structure and Pricing

All NYCT fares are currently based on a flat fare structure. All MNR and LIRR fares are currently zone-based and vary by peak and off-peak times and directions (see Technical Specifications Section 3.2.3.1 (Fare Structure Overview)). The NFPS will support all current fare structures, however, other fare structures may be used in the future and are described below as required latent capabilities.

7.3.1 Fare Categories

Req. #	Requirement	Assigned CDRL(s)
7.3.1-1	The SI shall support at a minimum all current NFPS Agency Fare Products (see Appendix A and Appendix K) and reduced Fare Products, with pricing and Fare Products configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.1-2	Additional Fare Products and categories may be defined during design review, including passes (calendar-based, trip-based, mode specific), bonus fares, fare differentials, location-based fares, service-based fares, peak/off-peak pricing and distance-based fares.	CDRL 7-1

7.3.2 Fare Pricing

Req. #	Requirement	Assigned CDRL(s)
7.3.2-1	Each boarding will be priced at a single fare based on the service being paid for, and the fare category associated with the Transit Account, with exception of Fare Products with unlimited rides for a period of time where individual fares do not need to be paid.	CDRL 7-1
7.3.2-2	For NYCT service, fare payment using the NFPS will require a single tap of Contactless Media at the point of entry with no tap-off. Customers shall be required to tap on at all boardings, even if a fare does not need to be paid.	CDRL 7-1
7.3.2-3	The NFPS will support distance-based fares, including zone-based and point-to-point fares, and tap-on/tap-off functionality. For MNR and LIRR, distance-based fares will be supported using all of the Fare Product types described in this Technical Specifications Section 7.3 (Fare Structure and Pricing).	CDRL 7-1
7.3.2-4	The NFPS will be capable of supporting a one-time charge for issuance of a new Extended-Use Media or Limited-Use Media.	CDRL 7-1
7.3.2-5	The NFPS will be capable of supporting a premium pricing structure for certain types of fares, such as SRTs.	CDRL 7-1
7.3.2-6	Fare pricing for each service type, zone, time of day and fare category will be defined during design review, and will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.2-7	The NFPS will support fare pricing based on the service type, including “premium service” (e.g., express bus service) that is priced higher than the base fare and other services which may be priced lower than the base fare.	CDRL 7-1
7.3.2-8	The NFPS will support differential fare pricing based on the type of Media or Fare Products used for payment (e.g., a fare paid using Extended-Use Closed-Loop Media may be discounted over the Open Payment, Paper, or Limited-Use Media).	CDRL 7-1
7.3.2-9	The NFPS will support configurable time-based fare pricing for Closed-Loop and Open Payment fares. The NFPS will support peak/off-peak pricing, weekday/weekend pricing, and free-ride days and hours (e.g., free after 7 p.m. (ET) on Dec. 31 only) by service type.	CDRL 7-1
7.3.2-10	The NFPS will support configurable fare incentives, such as providing a free ride after a certain number of rides have been purchased, or a value-based bonus which will be automatically added to a Customer Account when value is added.	CDRL 7-1
7.3.2-11	The NFPS will support “step-up” fares, using stored value to pay the difference between the value of one ride on a time-based pass, a transfer or a flat fare and a higher-priced service.	CDRL 7-1
7.3.2-12	The NFPS will support time-limited Fare Products that are activated on first use and expire after a certain time interval.	CDRL 7-1

7.3.3 Stored Value/Trips

Req. #	Requirement	Assigned CDRL(s)
Stored Value		
7.3.3-1	The NFPS will support the loading of stored value to Closed-Loop Transit Accounts linked to all supported types of Closed-Loop Media.	CDRL 7-1
7.3.3-2	The NFPS will support the loading of stored value to Closed-Loop Transit Accounts linked to Open Payment Media.	CDRL 7-1
7.3.3-3	The NFPS will support stored value payment for full fare, reduced fare and all special fare customers.	CDRL 7-1
7.3.3-4	Stored value payments will deduct the correct fare on each entry into the NFPS. Transit Account balances will update in real-time, or near real-time, after each entry.	CDRL 7-1
7.3.3-5	For Transit Accounts with stored value, the NFPS will support a “floor” or value below which the Transit Account cannot fall. This “floor” will be defined during system design and will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.3-6	The NFPS will support the capability to assess escheatment which will be determined during design review and comply with laws of the State of New York and the State of Connecticut regarding escheatment.	CDRL 7-1
Stored Trips		
7.3.3-7	The NFPS will support the loading of trip-based Fare Products to Closed-Loop Transit Accounts linked to all supported types of Closed-Loop Media.	CDRL 7-1
7.3.3-8	The NFPS will support the loading of trip-based Fare Products to Closed-Loop Transit Accounts linked to Open Payment Media.	CDRL 7-1
7.3.3-9	Stored trip payments will deduct the correct number of trips at each entry into the NFPS.	CDRL 7-1
7.3.3-10	The capability for bonus trips or value (similar to existing fare policy) will be possible.	

7.3.4 Time-Based Passes

Req. #	Requirement	Assigned CDRL(s)
7.3.4-1	The NFPS will support a variety of time-based Fare Products that may be configured by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.4-2	The NFPS will support the loading of time-based Fare Products to Closed-Loop Transit Accounts linked to all supported types of Closed-Loop Media.	CDRL 7-1
7.3.4-3	The NFPS will support the loading of time-based Fare Products to Closed-Loop Transit Accounts linked to Open Payment Media.	CDRL 7-1

Req. #	Requirement	Assigned CDRL(s)
7.3.4-4	The NFPS will support the removal of un-used passes from NFPS Accounts (configurable and per approval by the MTA), which will be followed by typical accounting practices to correctly balance the general ledger.	CDRL 7-1
Rolling Period		
7.3.4-5	The NFPS will allow Fare Products that are valid for a rolling period of time that begins on activation in the NFPS. For example, 30-day passes that are valid for any 30-day period.	CDRL 7-1
7.3.4-6	Rolling passes shall have the capability to be set to expire at the end of a day, or after a specific time period. For example, a day pass can expire at a pre-defined time (2 AM), or 24 hours after first use. This will be configurable by each NFPS Agency (on an NFPS Agency-specific basis) when setting up the Fare Product.	CDRL 7-1
Calendar Period		
7.3.4-7	The NFPS will allow Fare Products that are valid for the calendar period in which they are activated in the system. For example, weekly passes valid Sunday through Saturday.	CDRL 7-1

7.3.5 Capping

The NFPS shall allow for fare and/or ride capping for certain payment options (e.g., PAYGO) which may be offered in addition to or instead of current Fare Products.

Req. #	Requirement	Assigned CDRL(s)
7.3.5-1	Fare capping will be supported for customers that pay fares using stored value in a Closed-Loop Transit Account, accessed using Closed-Loop or Open Payment Media, although this feature may not be enabled at launch.	CDRL 7-1
7.3.5-2	Fare capping will be supported for customers that use PAYGO via Open Payment Media, although this feature may not be enabled at launch.	CDRL 7-1
7.3.5-3	Fare capping will establish a maximum fare value that a customer will be charged within a defined period (e.g., day, week, month, or year) either on a rolling basis or calendar basis.	CDRL 7-1
7.3.5-4	The NFPS will be configurable to support a range of capping periods, such as per week, month or year. Unique full fare and reduced fare threshold values will be supported for all capping periods.	CDRL 7-1
7.3.5-5	The fare capping algorithm will support configurable accumulators and threshold values based on the payment type, customer fare category and the NFPS Agency and/or service type (e.g., local service, express service) being accessed. The algorithm will apply to the Transit Account, and will allow for lost/stolen/expired Media to be replaced without interruption of fare capping.	CDRL 7-1

Req. #	Requirement	Assigned CDRL(s)
7.3.5-6	Regional fare accumulators with a common threshold value which includes the NFPS Agencies and service types will be supported.	CDRL 7-1
7.3.5-7	The fare capping algorithm and threshold values will be defined during design review, and will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1

7.3.5.1 Ride Capping

Ride capping may be applied in addition to or independently of fare capping.

Req. #	Requirement	Assigned CDRL(s)
7.3.5.1-1	The NFPS will allow the configuration of a maximum number of allowed rides within a capping period. When the maximum number of rides is reached the Fare Product will be blocked from further use during the capping period. The capping period may be rolling or calendar-based, and will be configurable individually by the applicable NFPS Agency, on an NFPS Agency-specific basis. Ride-capping shall have the capability of being applied independently of fare capping.	CDRL 7-1

7.3.6 Transfers

Transfers will be managed electronically by the NFPS.

Req. #	Requirement	Assigned CDRL(s)
7.3.6-1	The NFPS will support all current NFPS Agency transfer rules, including transfers to and from each NFPS Agency and the Linked NFPS Entities.	CDRL 7-1
7.3.6-2	Transfers will be supported for customers who pay fares using stored value in a Closed-Loop Transit Account, using Closed-Loop or Open Payment Media.	CDRL 7-1
7.3.6-3	Transfers will be supported for customers using Fare Products funded through a Closed-Loop Transit Account, using Closed-Loop or Open Payment Media.	CDRL 7-1
7.3.6-4	Transfers will be supported for customers using PAYGO with an Open Payment Media.	CDRL 7-1
7.3.6-5	The NFPS will support configurable transfer rules by number of taps, travel time, stop or station, route, time of day or some combination.	CDRL 7-1
7.3.6-6	The NFPS will support transfers for multiple users using one Media linked to a value-based Fare Products, or using Open-Loop PAYGO.	CDRL 7-1
7.3.6-7	The NFPS will support transfer credits for boardings that occur within a configurable timeframe of tapping at an NFPS Validator.	CDRL 7-1

Req. #	Requirement	Assigned CDRL(s)
7.3.6-8	Transfers may be free for customers transferring between routes or services with the same fares depending on the NFPS Agency-configurable Business Rules. For customers transferring to routes or services with higher fares, the NFPS will support charging an upgrade fare equal to the difference between the applicable fares. Other up charge amounts and rules shall be configured by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.6-9	Rules regarding allowable transfers will be defined during design review, and will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.6-10	The NFPS will be able to accommodate “out of system” transfers where customers must exit the paid area of one subway station to transfer to another line free of charge. This solution may require Software and/or Hardware to implement. This requirement will only apply to specific stations and lines, as defined by each NFPS Agency based on permanent or temporary needs. The time period and locations for “out of system” transfers will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1

7.3.7 Fare Reciprocity

Allocation and settlement of fare revenue between the NFPS Agencies and the Linked NFPS Entities will be based on agreements between the applicable NFPS Agency and the Linked NFPS Entity.

Req. #	Requirement	Assigned CDRL(s)
7.3.7-1	The NFPS will be able to perform fare reciprocity calculations that determine allocation of fare revenue among each NFPS Agency and the Linked NFPS Entities.	CDRL 7-1
7.3.7-2	Revenue allocation will occur on a pre-defined basis with a monthly reconciliation, and will be defined during design review. These rules will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-1
7.3.7-3	Allocated fare revenue will automatically be settled to the NFPS Agencies and the Linked NFPS Entities by the Financial Clearing and Settlement System (see Technical Specifications Section 21.6 (Financial Clearing & Settlement System)).	CDRL 7-1

7.4 Special Fare Programs

The NFPS will support the transition of existing Special Programs to the NFPS, including transition of the existing PIC System for supporting photo ID Media under the NFPS. Each NFPS Agency will continue to offer configurable time- and ride-based Fare Products to participants of Special Programs, as well as non-revenue access for employees and temporary transportation pass holders (i.e., contractors).

Req. #	Requirement	Assigned CDRL(s)
7.4-1	The NFPS will support at least the current range of Special Programs offered by the NFPS Agencies today.	CDRL 7-2
7.4-2	Special Fare Products offered by institutions (for example, employers, schools and social service agencies) will be managed and distributed using the B2B Portal and will not be available to the general public (Technical Specifications Section 22.3 (Business-to-Business (B2B) Portal)).	CDRL 7-2
7.4-3	The full set of special Fare Products to be offered will be defined during design review.	CDRL 7-2
7.4-4	The NFPS will support the group sale of Media and value to employers, the Office of Pupil Transportation, social service organizations and others that may be designated by each NFPS Agency.	CDRL 7-2
7.4-5	The NFPS will support special fare payments using Extended-Use Closed-Loop Account-Based Media, Limited-Use Closed-Loop Media (which may be Card-Based or Account-Based, as defined by each NFPS Agency for that specific NFPS Agency), or via Contactless interfaces using a dedicated NFPS Mobile Applications.	CDRL 7-2
7.4-6	Participating organizations will manage Closed-Loop Transit Accounts assigned to their participants using the B2B Portal including adding value to Transit Accounts and updating NFPS Account information as participants enter and leave the Special Program.	CDRL 7-2
7.4-7	Fare Products available to Special Program customers will include stored value that is available to the general public, as well as special Fare Products (such as time- and ride-limited student passes, and non-revenue access passes).	CDRL 7-2
7.4-8	When paying fares using stored value loaded through Special Programs, full fare pricing will apply, unless a Special Programs account is specifically designated as reduced fare or non-revenue.	CDRL 7-2
7.4-9	The NFPS will support transit benefit sales under the Special Programs, including order management, invoicing, payment processing and the bulk distribution of value.	CDRL 7-2
7.4-10	Stored value and Fare Products loaded through the transit benefit programs will be segregated within a participant's Closed-Loop Transit Account to ensure compliance with all applicable tax regulations.	CDRL 7-2
7.4-11	The NFPS will allow printing of photos on Extended-Use Media in a card-based form factor and production of this Media at designated customer service sites to support at minimum the following photo ID programs: <ul style="list-style-type: none"> • Employee passes • Temporary transportation passes (including Contractor Passes) • Reduced fare cards • Paratransit cards 	CDRL 7-2

Req. #	Requirement	Assigned CDRL(s)
7.4-12	Data related to photo ID Media under the NFPS, including: employee information, reduced fare applications, photographs and access rights, will be stored in and managed by the Photo ID Module of the NFPS Back Office (accessible via the CRMSystem). Administration rights for use of this Photo ID Module will be defined by each NFPS Agency, for that specific NFPS Agency.	CDRL 7-2
7.4-13	The SI will manage the transition of the existing database for administration of student passes, including qualified schools, into the appropriate NFPS database for administering the student program through the B2B Portal.	CDRL 7-2

7.4.1 Reduced Fare Program

The reduced fare category will be assigned to Closed-Loop Transit Accounts linked to registered customers who qualify to pay reduced fares by virtue of age or disability. Customers who qualify for reduced fares will go through the MTA's validation process before being issued personalized Extended-Use Media linked to a Closed-Loop Transit Account designated as reduced fare. The Media for reduced fare customers will contain a printed photo ID. Reduced fare customers shall also be capable of using the NFPS Mobile Applications with an embedded photo ID in lieu of the NFPS Agency-Issued Media.

Req. #	Requirement	Assigned CDRL(s)
7.4.1-1	The NFPS will support a reduced fare program for seniors and persons with qualifying disabilities to apply for reduced fare status. Reduced fare passengers currently pay half regular fares, but this amount will be configurable by each NFPS Agency, for that specific NFPS Agency.	CDRL 7-2
7.4.1-2	The NFPS will support storage of reduced fare applications and supporting Documentation including photos for identification to be printed on Extended-Use Media. Reduced fare customer information will be stored in the Photo ID Module of the NFPS Back Office (accessible via the CRMSystem).	CDRL 7-2
7.4.1-3	The NFPS will support a potential additional fee for Media replacement rate above a certain threshold (e.g., two per year).	CDRL 7-2
7.4.1-4	The SI shall manage transition of all current reduced fare participant Data from the existing PIC System (see Technical Specifications Section 3.1.5.2 (Non-MetroCard System Interfaces)) to the appropriate NFPS database.	CDRL 7-2
7.4.1-5	The SI shall provide a process, subject to the MTA's approval, that enables reduced-fare customers to purchase reduced-fares at NFPS devices without NFPS Agency-Issued photo ID. This would apply, for example, to customers that do not possess a valid NFPS Agency-Issued photo ID but do have a valid Medicare card.	CDRL 7-2

7.4.2 EasyPay (Autoload) Program

Existing EasyPay accounts will migrate to the Autoload feature available for every Closed-Loop Transit

Account within the NFPS.

Req. #	Requirement	Assigned CDRL(s)
7.4.2-1	The NFPS will support an Autoload that full fare and reduced fare passengers can opt into through their Transit Accounts, all in compliance with applicable law.	CDRL 7-2
7.4.2-2	The NFPS will support Autoload of incremental value when a value-based Transit Account falls below a defined threshold, the threshold can be defined by the customer within limits configured by each NFPS Agency, for that specific NFPS Agency. These parameters will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-2
7.4.2-3	The NFPS will support Autoload of a Fare Product (i.e., time-based) on defined date or time remaining on a Fare Product (for example, load a monthly pass on the 20 th which will be valid for the following month), the date or time remaining can be defined by the customer within limits configured by each NFPS Agency, for that specific NFPS Agency. These parameters will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-2
7.4.2-4	The SI shall manage the migration of all current EasyPay and EasyPayXpress accounts (and associated Data) from the current outsourced system to the NFPS.	CDRL 7-2

7.4.3 Employee and Other Non-Revenue Programs

The SI will provide an NFPS that supports configurable non-revenue Fare Products to provide access to NFPS Agency services and facilities. The SI shall be responsible for managing transition of these programs from the MetroCard System into the NFPS CRM System, and associated Photo ID Module as necessary. Following transition, the MTA will manage eligibility for these programs and provide customer service.

Req. #	Requirement	Assigned CDRL(s)
7.4.3-1	The NFPS will support non-revenue access to the NFPS by current employees, pensioners, interns and contractors.	CDRL 7-2
7.4.3-2	The NFPS will support non-revenue access to the NFPS by qualified paratransit customers. No value will be associated these Media.	CDRL 7-2
7.4.3-3	The Photo ID Module of the NFPS Back Office will interface with the I-Vault System to provide a Data feed of unique identifiers for employee pass holders (including: ID card serial number, card status, expiration date, picture and employee ID number). The Photo ID Module will also provide a data feed of relevant serial numbers to Lenel for regulating security access to the NFPS Agency facilities.	CDRL 7-2

Req. #	Requirement	Assigned CDRL(s)
7.4.3-4	The NFPS will support non-revenue access to the NFPS by police, fire department, authorized PATH AirTrain personnel, youth organizations and district attorney designees. No value will be associated with these Media. These NFPS Accounts will be managed via the B2B Portal (Technical Specifications Section 22.3 (Business-to-Business (B2B) Portal)).	CDRL 7-2
7.4.3-5	The SI shall manage transition of all current existing MetroCard System accounts (and migration of associated Data), including: employee, pensioner, interns and contractor data from the existing PIC System (see Technical Specifications Section 3.1.5.2 (Non-MetroCard System Interfaces) to the appropriate NFPS database.	CDRL 7-2

7.4.4 Mail&Ride

Req. #	Requirement	Assigned CDRL(s)
7.4.4-1	The SI shall support the Mail&Ride program for the NFPS. Customers will be able to setup and manage their accounts and products directly, with fulfillment handled by a Third Party vendor. Additionally, management of the Mail&Ride program will be supported through the B2B Portal (see Technical Specifications Section 22.3 (Business-to-Business (B2B) Portal)), if it is administered by MNR and LIRR or a Third Party.	CDRL 7-2

7.4.5 Billing & Payment Terms

Req. #	Requirement	Assigned CDRL(s)
7.4.5-1	The NFPS will support both pre-bill and post-bill payment for Special Programs: <ul style="list-style-type: none"> Pre-bill – the NFPS will generate sale transactions and require payment in advance of the Media or value distribution Post-bill – the NFPS will track system access using non-valued Fare Products and provide the Data necessary to post-bill institutions based on each participant’s actual use. 	CDRL 7-2
7.4.5-2	The NFPS will support multiple payment types for institutional sales, including single payments, periodic payments (e.g., monthly or quarterly), and payments split between payment sources.	CDRL 7-2
7.4.5-3	The designation of billing and payment terms for institutional programs will be configurable individually by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 7-2
7.4.5-4	Credit, debit and ACH payments will be accepted for Special Programs.	CDRL 7-2

7.5 Fare Policies Required Submittals

The required submittals specified in this Technical Specifications Section 7 (Fare Policies) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 7-1	NFPS Business Rules	Sections 7.1, 7.2, 7.3	✓	✓	✓	
CDRL 7-2	NFPS Special Programs	Section 7.4	✓	✓	✓	

8 Media Types

The NFPS will accept multiple Media types for fare payment, including Contactless Open Payment Media, mobile wallets, a variety of Closed-Loop NFPS Agency-issued Smart Cards, barcoded Media in paper and electronic form, and visually validated Paper Media.

The current validation practices and procedures of the NFPS Agencies, which include visual as well as electronic validation, will be supported by the NFPS along with the flexibility to modify as appropriate, based on the NFPS Agency-specific Business Rules and policy decisions. Tickets sold through any sales channel will be able to be inspected, validated, and collected (if applicable) during use of any NFPS Agency service.

8.1 Open Payment Media

The NFPS will accept Open Payment Media in the form of Contactless Bank Cards, and their mobile wallet equivalents, for the payment of fares (see Technical Specifications Section 10.1.1 (Open Payment Media)).

Req. #	Requirement	Assigned CDRL(s)
8.1-1	Open Payment Media will be able to be used as a token, and be registered to a Closed-Loop Transit Account containing the stored value or Fare Products to be used for fare payment.	CDRL 8-1
8.1-2	Open Payment Media will be able to pay for a fare at an NFPS Validator at the time of entry into the transit system using PAYGO. Transfers will be enabled based on each of the NFPS Agency-specific Business Rules, configurable by each NFPS Agency on an NFPS Agency-specific basis.	CDRL 8-1
8.1-3	The SI shall provide a mechanism to uniquely identify, and detect usage of, all Open Payment Media, including those with the same PAN. Companion Media will be identified separately based on each of the NFPS Agency-specific Business Rules to restrict or allow use, which will be configurable by each NFPS Agency on an NFPS Agency-specific basis.	CDRL 8-1
8.1-4	If alias PANs or other tokens (short-term or long-term) are used by card issuers for Open Payment Media, including mobile wallets, the SI shall provide a mechanism to link payments to actual PAN and/or individual customer for the purposes of aggregation, fare- or ride-capping, or the ongoing use of Fare Products stored in a Closed-Loop Transit Account, all in compliance with PCI-DSS and MTA/IT Security Standards. This shall also apply to instances where a customer obtains a replacement instrument or device that contains a new token (such as when a customer receives a new mobile phone).	CDRL 8-1

8.2 NFPS Agency-Issued Media

The NFPS Agencies will issue Extended-Use Media in the form of a transit card (see Technical Specifications Section 18.2 (Extended Use Contactless Media)) and NFPS Mobile Applications (see Technical Specifications Section 23 (NFPS Mobile Software)). Limited-Use Media will also be available to

support SRTs and other limited-trip Fare Products, including Joint Media, as needed. The NFPS Agencies will also issue Paper Media for visual and electronic (barcode) validation, as needed.

8.2.1 General Requirements

The SI shall develop either an industry standard transit payment application for Closed-Loop Media, or a licensed Open Payment Software application to support Closed-Loop fare payments. Either approach will require approval from the MTA during design review, and will meet industry standards at time of FDR.

8.2.1.1 Transit Payment Applications

Req. #	Requirement	Assigned CDRL(s)
8.2.1.1-1	As an alternative to the application described in req. #8.2.1.1-5, the SI shall develop an industry standard transit payment Software application, to support Closed-Loop fare payments for multi-application Smart Cards. The Software application may be the same Software application that is developed for use on the LU Media.	CDRL 8-1
8.2.1.1-2	The transit payment Software application will be compatible with all chips in the product line of the associated multi-application Smart Card platform.	CDRL 8-1
8.2.1.1-3	The transit payment Software application will allow use of Media issued by Third Parties that supports a multi-application Smart Card environment. Compatible Media issued by Third Parties may include, but are not limited to: <ul style="list-style-type: none"> • Transit employee and Contractor ID badges • Corporate employee ID badges • School ID cards • Social service program cards • Police ID cards 	CDRL 8-1
8.2.1.1-4	The NFPS will include the necessary key management tools (see Technical Specifications Section 18.1.3 (Encryption Keys)) to support the sharing, loading and management of the transit payment Software application in a multi-application Smart Card environment.	CDRL 8-1
8.2.1.1-5	EU Closed-Loop Media may make use of a licensed Open Payment Software application, in lieu of the SI-developed Software application described in req. #8.2.1.1-1. Use of the Software Application licensed pursuant to this CDRL will be subject to the MTA's approval during design review. Use of an Open Payment Software application for Closed-Loop Media will support all Risk Mitigation techniques described in Technical Specifications Section 6.1.4 (Risk Mitigation Techniques) and will not increase the burden of PCI compliance for the MTA Group.	CDRL 8-1

8.2.1.2 Alternative Form Factors

Req. #	Requirement	Assigned CDRL(s)
8.2.1.2-1	The provided Media formats will support alternative Contactless form factors that can be read by NFPS Validators.	CDRL 8-1
8.2.1.2-2	Alternative form factors may include, but are not limited to, smart bracelets, smart watches, smart tags or stickers and other compact formats such as key fobs.	CDRL 8-1

8.2.1.3 Media Certifications

Req. #	Requirement	Assigned CDRL(s)
8.2.1.3-1	All SI-provided Media will be certified by all parties involved in the design, manufacture, testing, licensing and issuance of Media.	CDRL 8-1
8.2.1.3-2	Certifications may include, but are not limited to, ISO, NEC, MIL, UL, MIFARE, ADA, PCI-DSS, EMV and any applicable agency certifications related to Media.	CDRL 8-1
8.2.1.3-3	Media recertification will be provided on an ongoing basis as required as part of the Contract Documents.	CDRL 8-1
8.2.1.3-4	Media will undergo a comprehensive Quality Assurance process (as described in Technical Specifications Section 18 (Media)) prior to delivery to ensure adherence to the required performance and certifications. Media that fails to meet performance and/or certifications requirements will be replaced at no cost to the MTA Group.	CDRL 8-1

8.2.2 Extended Use Contactless Smart Cards

Req. #	Requirement	Assigned CDRL(s)
8.2.2-1	The EU Media will be linked to a Closed-Loop Transit Account that holds Fare Products loaded by the customer and is used for payment.	CDRL 8-1
8.2.2-2	The NFPS will be capable of accepting Third Party-Issued EU Media designated by the MTA, such as other Contactless Smart Cards in conformance with applicable standards, linked to Closed-Loop Transit Accounts (see Technical Specifications Section 8.4 (Third Party Media)).	CDRL 8-1
8.2.2-3	In addition to being Contactless, the EU card will have an appropriate interface (barcode, magstripe) to allow the sale and loading of Fare Products at Retail Merchants using the Retail Merchants' existing POS Systems. The format and Data content of the magnetic stripe and barcode will be defined by the selected Retail Network Provider (see Technical Specifications Section 35.3 (Retail Point of Sale Network)) during design review.	CDRL 8-1
8.2.2-4	EU Media will be able to support all passenger types, including full-fare as well as reduced-fare or other Special Program customers who will receive personalized cards with printed photographs.	CDRL 8-1

8.2.3 Limited-Use Contactless Smart Cards

Req. #	Requirement	Assigned CDRL(s)
8.2.3-1	LU Media will be provided for the distribution of SRTs, other trip-limited Fare Products, and/or other Fare Products for Special Programs.	CDRL 8-1
8.2.3-2	The LU Media for NFPS Agency-designated Special Programs and/or Fare Products will be linked to a Closed-Loop Transit Account that holds Fare Products (with applicable Business Rules) and is used for payment.	CDRL 8-1
8.2.3-3	Transit Accounts associated with LU Media will only be reloadable using the B2B Portal (see Technical Specifications Section 22.3 (Business-to-Business (B2B) Portal)) if they are deployed for certain Special Programs, and not by individual passengers.	CDRL 8-1
8.2.3-4	LU Media containing Fare Products that are not managed via the B2B Portal, such as SRTs or other limited trip tickets, will be Card-Based Media not linked to a Transit Account, and not reloadable. See Technical Specifications Section 6.1.2 (Single Ride Tickets (SRTs) and Other Card-Based Products).	CDRL 8-1
8.2.3-5	The NFPS will support the issuance of pre-encoded LU Media and the encoding of the LU Media upon issuance by the applicable NFPS component, using the SI-supplied APIs (see Technical Specifications Section 6.4.2 (Fare Distribution API)).	CDRL 8-1

8.2.4 MTA Employee ID Smart Cards

Req. #	Requirement	Assigned CDRL(s)
8.2.4-1	The NFPS will support an HID iCLASS (secure identity access control) employee card that includes a photograph of the employee. The NFPS Account-linked to this Media will not be allowed to load any value or Fare Products available to the general public, but will provide non-revenue access to the transit system via an employee pass as configurable by the appropriate access provider within the NFPS Agencies.	CDRL 8-1
8.2.4-2	Employee ID cards will contain the appropriate interface (magstripe, barcode) to allow access through the existing building and facility security systems described in Technical Specifications Section 3.1.3.3.4 (Security/Access Programs).	CDRL 8-1
8.2.4-3	Employee ID cards will contain the appropriate interface (magstripe, barcode) to allow swiping in and out of the existing employee timekeeping system described in Technical Specifications Section 3.1.3.3.4 (Security/Access Programs).	CDRL 8-1
8.2.4-4	Integration with all applicable systems to be accessed using the employee ID cards will be the responsibility of the SI.	CDRL 8-1

8.2.5 Joint Media

Joint Media is compatible with systems of more than one (1) entity within the MTA Group, as configurable by the MTA. By means of limited example and not limitation, Joint Media will provide

travel on MNR or LIRR services as well as entry onto NYCT services.

Req. #	Requirement	Assigned CDRL(s)
8.2.5-1	The NFPS will support issuance and acceptance of Joint Media consisting of EU, LU, or Paper Media that also serves as a printed ticket, containing special graphics on the same Media. The Media will have the ability to have a printed 2D barcode as determined during Design Review. The format of the ticket will be defined during NFPS design.	CDRL 8-1
8.2.5-2	Limited Use and Paper Joint Media will include custom printing that identifies a designated areas for MNR and LIRR ticket inspectors to perform a single hole-punch upon inspection or cancellation, so as not to cause damage to the antennae and electronic structure of the LU Media.	CDRL 8-1

8.2.6 Paper Media

If needed, the NFPS Agencies will issue Paper Media. The NFPS shall fully support and accept Paper Media that can be both visually and electronically validated. Electronically validated Paper Media will include security printing, as well as barcodes that can be read by NFPS Equipment that includes a barcode reader (e.g., OSVDs).

Req. #	Requirement	Assigned CDRL(s)
8.2.6-1	The NFPS will support acceptance of Paper Media, which may include MTA-defined security measures such as encrypted 2D barcodes defined for fare payment acceptance. The barcoded Media will be linked to a Transit Account, and all transactions and usage (approved or denied) will be recorded by the NFPS.	CDRL 8-1
8.2.6-2	Paper Media shall include built-in visual security features such as serial and batch numbers, security foil and/or holograms, etc. so as to avoid fraud and duplication. The MTA will review the SI's Paper Media solutions during design review.	CDRL 8-1
8.2.6-3	Paper Media will include custom printing, as well as designated areas for MNR and LIRR ticket inspectors to hole-punch upon cancellation and ride counts.	CDRL 8-1
8.2.6-4	Paper Media can support Fare Products with the following characteristics: <ul style="list-style-type: none"> - Pre-set validity period - Activated upon first use - Activate upon sale Details of Paper Media will be defined during Design Reviews.	CDRL 8-1
8.2.6-5	After a Fare Product is activated, all applicable defined transfer rules and privileges will apply to that Fare Product. Unused Fare Products will expire after a configurable period of time. Activation parameters will be determined during Design Review.	CDRL 8-1
8.2.6-6	Paper Media will expire when the applicable Fare Product (designated by barcode and/or print and graphic) expires.	CDRL 8-1

8.3 Near Field Communications and other Mobile Payment Devices

At launch the NFPS will support use of certain Near Field Communication devices as Media, including mobile phones and tablets. Other Contactless means of mobile device validation, including support of barcode scanning and Bluetooth Low Energy, may also be investigated and deployed by the MTA.

Req. #	Requirement	Assigned CDRL(s)
8.3-1	All NFPS Validators and payment devices included in the NFPS shall support use of NFC devices following the ISO/IEC 18092 standard as Media.	CDRL 8-1
8.3-2	Accepted NFC devices include mobile phones and tablets, in addition to NFC stickers, tags and other alternative ID Media.	CDRL 8-1

8.4 Third Party Media

Req. #	Requirement	Assigned CDRL(s)
8.4-1	The NFPS will support acceptance of MTA-defined Third Party Media, with MTA-defined security measures defined for fare payment acceptance. All transactions and usage, approved or denied, will be recorded by the NFPS.	CDRL 8-1
8.4-2	Acceptable Third Party Media and rules associated with their usage for transit or access services will be defined during design review and configurable by the MTA.	CDRL 8-1

8.5 Media Types Required Submittals

The required submittals specified in this Technical Specifications Section 8 (Media Types) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 8-1	Media Design	Section 8	✓	✓	✓	

9 Media Distribution

The NFPS Agencies will distribute NFPS Agency-Issued Extended-Use and Limited-Use Media through multiple channels. Reloading and account management features will also be supported at various locations. Given the high cost of operating and maintaining in-station equipment, reliance on Configurable Vending Machines (CVMs) will be minimized.

The NFPS distribution strategy will include deployment of a robust Retail POS Network, support for the automatic reloading of value (i.e., Autoload), and multiple self-service options including high-quality NFPS Websites, as well as a mobile account management and Payment Application. The applicable NFPS Agency will also continue to operate MNR and LIRR station ticket windows, the Mobile Sales Fleet and Customer Service Centers that will support sales, customer service transactions and the qualification of reduced fare customers.

Existing fareboxes will continue to be used to accept coin fare payments on buses, but will not be an integrated component of the NFPS.

The features and functions of each distribution channel are described below. The timing of implementation of each sales channel will ultimately depend on the phasing strategy described in Technical Specifications Section 4.9.2 (Phased Approach).

Req. #	Requirement	Assigned CDRL(s)
9-1	The SI shall develop an NFPS that supports all fare distribution options detailed in Technical Specifications Section 9 (Media Distribution).	CDRL 9-1
9-2	The NFPS Backend will serve as the system of record and reporting for all Media and value sales for the NFPS Agencies.	CDRL 9-1
Card Issuance		
9-3	NFPS Agency-Issued Media will contain all necessary information to enable the cards to function as required upon issuance.	CDRL 9-1
9-4	The NFPS will support the NFPS Agency-Issued EU Media issuance and account activation through Retail Merchant Locations, selected configurations of the CS POS Terminal, Special Programs, Mobile Sales Fleet, CVMs, CRM, IVR, TOMs, the NFPS Websites and NFPS Mobile Applications (using mail delivery).	CDRL 9-1
9-5	LU Smart Cards will be available for purchase at CVMs, as well as at NFPS Agency-operated ticket windows and customer service facilities, including the Mobile Sales Fleet, using CS POS Terminals and TOMs. LU Smart Cards may also be distributed through Special Programs.	CDRL 9-1
Account Deposits		
9-6	The NFPS will support the collection and maintenance of deposits for each established Transit Account. The value of the deposit and any deposit refund policies will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 9-1

Req. #	Requirement	Assigned CDRL(s)
9-7	The NFPS shall support the charging of a one-time fee for the issuance of NFPS Agency-Issued Media, and the NFPS shall allow for this fee to be transferred to a Transit Account as usable value upon registration or other activity determined by each NFPS Agency, for that specific NFPS Agency. Fees, including the one-time issuance fee, and account value “refunds” will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 9-1
Account Replenishments		
9-8	The NFPS will support account replenishment (reload) through Retail Merchant Locations, the CS POS Terminal, CVMs, TOMs, IVR, NFPS Websites, NFPS Mobile Applications and Autoload.	CDRL 9-1
9-9	Replenished value may be distributed to various Fare Products associated with one NFPS Account, subject to value “floors” and other restrictions to be defined the MTA during design review, and will subsequently be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 9-1
9-10	The NFPS will support a default account setting, configurable by each NFPS Agency, on an NFPS Agency-specific basis, that supports reload of Fare Products by automatic conversion of stored value to a designated Fare Product; for example, a deposit equivalent to the value of a monthly pass may be set up to always fund a monthly pass rather than stored value of that same amount.	CDRL 9-1

9.1 Distribution Channels

NFPS Agency-Issued EU Media will be distributed via Retail Merchant Locations, customer service locations, through the mail, the Customer Call Center, Customer Service Centers, online (including on the NFPS Websites), and potentially at Vending Machines. The NFPS will support continued distribution of Media by third parties (including Mail&Ride) who will manage the ordering and fulfillment of NFPS Agency-Issued Media via the B2B Portal (see Technical Specifications Section 22.3 (Business-to-Business (B2B) Portal)).

During the initial transition period, NFPS Agency-Issued Media may also be distributed by other temporary mechanisms.

9.1.1 Retail

Retail Merchant Locations will serve as a primary distribution channel for NFPS Agency-Issued Media and the loading of value to Closed-Loop Transit Accounts. As part of the NFPS implementation, the Retail POS Network will have, at minimum, the same or better coverage than the network currently used to distribute MetroCards. Deployment of a Retail POS Network and associated distribution services relating to Media are an option for this procurement (see Technical Specifications Section 35.3 (Retail Point of Sale Network)) and may be procured separately or managed in-house if the NFPS Agencies’ coverage needs are not met. The Retail POS Network will leverage, as much as possible, the infrastructure used to sell, activate, and load Closed-Loop gift cards or pre-paid debit cards through Retail Merchants’ existing POS systems.

Req. #	Requirement	Assigned CDRL(s)
9.1.1-1	The SI shall work with the providers or managers of retail distribution networks to enable integration with the NFPS Backend as needed.	CDRL 9-1
9.1.1-2	The SI shall furnish a fare distribution API (see Technical Specifications Section 6.4.2 (Fare Distribution API)) that enables the retail network providers to format Data generated through the Retail POS Network to be received and processed by the NFPS Backend for the sale of NFPS Media and loading of Fare Products to Closed-Loop Transit Accounts.	CDRL 9-1

9.1.2 Web

The web is a key component of the NFPS distribution strategy. The MTA places a high level of importance on website design that follows industry best practices and standards, is simple to navigate, and results in a positive customer experience. To help ensure delivery of a successful web solution, the MTA will be actively involved in the website design.

Req. #	Requirement	Assigned CDRL(s)
Customer		
9.1.2-1	The SI shall team with or employ professionals in website design and e-commerce to design, develop and deploy NFPS Websites that are PCI and EMV compliant, and serve as convenient and comprehensive online portals for the purchase of NFPS Media, Fare Products and management of Closed-Loop Transit Accounts, Fare Products and Media. See Technical Specifications Section 22 (NFPS Websites) for detailed NFPS Websites requirements.	CDRL 9-1
9.1.2-2	The NFPS Websites will include a mobile optimized site for mobile devices with the same features and functions as req. # 9.1.2-1. See Technical Specifications Section 23 (NFPS Mobile Software) for detailed NFPS Mobile Applications requirements.	CDRL 9-1
Business-to-Business		
9.1.2-3	The SI shall team with or employ professionals in website design and e-commerce to design, develop and deploy NFPS Websites that are PCI and EMV compliant, and serve as convenient and comprehensive online portals for employers, transit benefit administrators, schools, social service agencies and other institutions to administer Transit Accounts on behalf of participants in Special Programs.	CDRL 9-1

9.1.3 Autoload

The NFPS will include the ability to automatically reload value or passes to Closed-Loop Transit Accounts (i.e., Autoload) when the Transit Account balance falls below a certain threshold or at a defined period.

Req. #	Requirement	Assigned CDRL(s)
9.1.3-1	The SI-furnished NFPS will include an Autoload feature that enables the automated reloading of a Transit Account when the associated Customer Account is registered and linked to an accepted form of payment, including a credit or debit card, bank account (ACH transfer) or transit benefit allocation.	CDRL 9-1
9.1.3-2	The Autoload feature will support both threshold-based Autoloads (reloading of value when a Customer Account balance falls below an established minimum) and calendar-based Autoloads (reloading of value on a customer- or system-designated date every month). Both types of Autoload shall allow customers to set their own thresholds, within limits configured by each NFPS Agency, for that specific NFPS Agency, or defaulted to the settings configured by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 9-1
9.1.3-3	Autoload shall be configurable by the customer using the NFPS Websites, the NFPS Mobile Applications, through the Customer Call Center (including the IVR), at the in-person Customer Service Centers and at the Mobile Sales Fleet vehicles. Autoload will also support the Mail&Ride program.	CDRL 9-1
9.1.3-4	Autoload funding source information will be stored within the CRM System in a Tokenized form.	CDRL 9-1
9.1.3-5	A customer may have two funding sources associated with their Customer Account, a primary funding source and a secondary funding source. The NFPS will support splitting of an Autoload payment between the two funding sources.	CDRL 9-1
9.1.3-6	Once a funding source has been established, customers will be able to enable Autoload using the NFPS Websites, the NFPS Mobile Applications, through the Customer Call Center (including the IVR), at the Customer Service Centers and at the Mobile Sales Fleet vehicles.	CDRL 9-1
9.1.3-7	The parameters governing threshold- and calendar-based Autoloads will be fully configurable and established during design review.	CDRL 9-1
9.1.3-8	The Account-Based nature of the NFPS will allow for Autoload payment authorization prior to the loading of any value, and immediate use of the value once the load occurs.	CDRL 9-1
9.1.3-9	All Autoloads (threshold and calendar) shall allow for setup and cancellation by the customer through various channels specified in this Technical Specifications Section 9 (Media Distribution). The acceptable timeframe for cancelling an Autoload prior to its activation will be determined by the MTA during design review on an NFPS Agency-specific basis.	CDRL 9-1

9.1.4 Customer Call Center and Customer Service Centers

The services that the SI shall provide for the Customer Call Center and Customer Service Centers will be

similar, as described in this Technical Specifications Section 9.1.4 (Customer Call Center and Customer Service Centers).

9.1.4.1 NYCT Customer Call Center

The NFPS will support a Customer Call Center to be operated by NYCT with additional support provided by the SI during transition, which is defined to be from the first certification of Beneficial Use (launch Contactless acceptance at stations and bus lines) through Substantial Completion. NYCT's Customer Call Center of 40 FTEs currently handles the following call volumes – as customers transition from the MetroCard System to the NFPS, the SI shall be responsible for handling all additional calls not handled by NYCT.

	Travel Information	MetroCard	Reduced Fare	Customer Service	Switchboard
2014 Calls Received	688,373	362,590	111,333	133,943	39,317

Technical Specifications Section 35.7 (Extended Customer Service Support) describes the Option for expanding the SI's role to provide Customer Call Center support in the long-term.

Req. #	Requirement	Assigned CDRL(s)
9.1.4.1-1	The SI shall furnish an NFPS that enables Media sales and value loads, as well as NFPS Account management and general customer support via a Customer Call Center. Except as otherwise set out in the Contract Documents, the Customer Call Center will be staffed and administered by NYCT. See Technical Specifications Section 9.1.4.2 (NYCT Customer Call Center Support for Transition) for details on the Customer Call Center transition support requirements during transition.	CDRL 9-1
9.1.4.1-2	The SI will furnish a Customer Relationship Management System that allows Customer Call Center staff to perform all necessary customer service functions (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 9-1
9.1.4.1-3	The SI shall provide support for integrating the CRM System Data with internal NYCT systems that require customer service information.	CDRL 9-1
9.1.4.1-4	The SI shall provide a robust IVR system that is connected to (handoff from) the MTA's existing 511 IVR and, such SI-provided IVR serves to manage NFPS call volume, provides customers with a mechanism for obtaining answers to questions and allows NFPS Account management transactions without having to speak to a Customer Call Center representative (see Technical Specifications Section 21.5 (Interactive Voice Response)). These NFPS Account management functions include, but are not limited to account registration, establishing and modifying funding sources, reloading Fare Products, setting up Autoload, checking Transit Account balance and ordering Media.	CDRL 9-1

9.1.4.2 NYCT Customer Call Center Support for Transition

During the transition period as defined in Technical Specifications Section 9.1.4.1 (NYCT Customer Call Center), the SI will provide supplemental Customer Call Center support services for NYCT. The SI-provided Customer Call Center staff will support the same functions as the NYCT-staffed Customer Call Center, with the exception of Tier 2 customer claims which will be investigated and managed by NYCT staff members.¹⁴ All refunds and NFPS Account adjustments are subject to applicable Business Rules and agreements between the SI and the MTA.

Req. #	Requirement	Assigned CDRL(s)
9.1.4.2-1	The SI shall provide for local Customer Call Center support during the initial transition to the NFPS as defined in Technical Specifications Section 9.1.4 (Customer Call Center and Customer Service Centers). The Customer Call Center will provide Media sales and value loads, NFPS Account enrollment, as well as NFPS Account management and general customer support as per Technical Specifications Section 9.1.4 (Customer Call Center and Customer Service Centers). The SI shall provide adequate staffing 24/7 to meet actual call volume above what can be handled by NYCT.	CDRL 9-2
9.1.4.2-2	The SI shall propose a mechanism for routing excess inbound calls to the SI-staffed phone lines during transition. The technical solution for “spill over” calls will be agreed upon during design review.	CDRL 9-2
9.1.4.2-3	The SI shall propose service level pricing to provide an optimal balance of risk and cost to the NFPS Agencies, based on the KPIs for Customer Call Center support detailed in Technical Specifications Section 5.14 (Performance Requirements).	CDRL 9-2
9.1.4.2-4	The SI shall provide access for NYCT customer service managers to see a live dashboard of wait times and call volumes being handled by the SI staffed phone lines.	CDRL 9-2
9.1.4.2-5	The SI shall provide a Call Center Contingency Plan to provide specific action plans to ensure appropriate staff availability during periods of extreme variation in call volume as well as the proven ability to ramp up to significant additional call volume demand such that it is seamless to the customer.	CDRL 9-3
9.1.4.2-6	Customer Call Center contacts received and responded to will be recorded in detail to support monthly reporting and invoicing by the SI, as well as audit by the MTA as deemed necessary, all in compliance with the requirements set out in the Contract Documents, including Agreement Section 11 (Call Center Services)).	CDRL 9-2

¹⁴ Tier 1 issues can generally be addressed directly on the phone or require minimal research/investigation. Tier 2 issues involve more in-depth investigation and/or require NYCT participation.

Req. #	Requirement	Assigned CDRL(s)
9.1.4.2-7	The Customer Call Center shall follow quality assurance/quality control industry best practices and record and monitor customer calls in compliance with all Applicable Laws. The MTA shall be provided access to the recordings upon request, and the SI shall ensure that it has secured sufficient rights to provide the same.	CDRL 9-2

9.1.5 MNR and LIRR Customer Service Centers

The NFPS will support the MNR Customer Information Center and the LIRR Public Information Office which currently handle all their customer service calls.

Req. #	Requirement	Assigned CDRL(s)
9.1.5-1	The SI shall furnish an NFPS that enables Media sales and value loads, as well as NFPS Account management and general customer support via Customer Service Centers. Except as otherwise set out in the Contract Documents, the MNR CIC and the LIRR PIO will be staffed and administered by MNR and LIRR, respectively.	CDRL 9-1
9.1.5-2	The SI will furnish a Customer Relationship Management System that allows Customer Service Center staff to perform all necessary customer service functions (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 9-1
9.1.5-3	The SI shall provide support for integrating the CRM System Data with internal MNR and LIRR systems that require customer service information.	CDRL 9-1
9.1.5-4	The SI-provided IVR system will support transfer to and from the MNR and LIRR Customer Service Centers, in addition to all requirements included in req. #9.1.4.1-4.	CDRL 9-1

9.1.6 NYCT In-Person Customer Service

NYCT will continue to operate the existing in-person Customer Service Center at 3 Stone Street in NYC and the Mobile Sales Fleet, which will serve as locations for customers to make transit inquiries, add value or purchase Media, set up Autoload, register Transit Accounts and register for reduced fare classifications. Access to the NFPS to perform these functions will be available via the configurable CS POS Terminal (see Technical Specifications Section 17.1 (Customer Service Point of Sale Terminals)). The NFPS Agencies will also continue to manage fulfillment of Media orders made via the NFPS Websites, Customer Call Center/IVR and NFPS Mobile Applications described herein, including verification of reduced fare eligibility.

Req. #	Requirement	Assigned CDRL(s)
Customer Service Center		
9.1.6-1	The SI-provided Customer Service POS Terminal (see Technical Specifications Section 17.1 (Customer Service Point of Sale	CDRL 9-1

	Terminals)) will support functions specific to operation of the Customer Service Centers, including taking customer payments.	
9.1.6-2	The SI shall provide technical support for the NFPS Agencies' transition of the existing reduced fare photo system as part of the NFPS implementation.	CDRL 9-1
Mobile Sales Fleet		
9.1.6-3	The SI-provided CS POS Terminal (see Technical Specifications Section 17.1 (Customer Service Point of Sale Terminals)) will support functions specific to operation of the Mobile Sales Fleet.	CDRL 9-1
9.1.6-4	The Mobile Sales Fleet will accept payments in cash and credit and debit cards for initial purchase of Media and reloading of Closed-Loop Transit Accounts. The CS POS Terminal will support real-time processing of NFPS Media sales and reloads.	CDRL 9-1

9.1.7 Ticket Windows

MNR and LIRR will continue to operate existing ticket windows, which will serve as locations for customers to make inquiries and purchase Media. Access to the NFPS to perform these functions will be available through the TOMs (see Technical Specifications Section 17.2 (Ticket Office Machines)).

Req. #	Requirement	Assigned CDRL(s)
9.1.7-1	The SI-provided TOMs (see Technical Specifications Section 17.2 (Ticket Office Machines)) will support functions specific to operation of the ticket window, including taking customer payments.	CDRL 9-1

9.1.8 Configurable Vending Machines (CVMs)

A CVM network will issue Limited-Use Media (see Technical Specifications Section 8.2.3 (Limited-Use Contactless Smart Cards)) and Paper Media if necessary (see Technical Specifications Section 8.2.6 (Paper Media)) in stations, and will be configurable to issue Extended-Use Media if deemed necessary by each NFPS Agency, on an NFPS Agency-specific basis. These CVMs will connect to the NFPS Backend, which will enable device monitoring for maintenance and revenue servicing, as well as the tracking of cash received by the devices and processed at MNR's and LIRR's Revenue Facilities and NYCT's Consolidated Revenue Facility, and processing of payments. Transaction Data resulting from Media sales at the CVMs will be captured by the NFPS Backend for the creation of a Transit Account within the NFPS. CVMs will allow for reload of Closed-Loop Transit Accounts and checking of Transit Account balances.

Req. #	Requirement	Assigned CDRL(s)
9.1.8-1	The Interface of the NFPS Backend to the CVM network will support real-time processing of NFPS Media sales and reloads.	CDRL 9-1
9.1.8-2	The NFPS Backend will serve as the system of record and reporting for all Media sales, and will maintain the Closed-Loop Transit Accounts for all Media.	CDRL 9-1
9.1.8-3	The SI shall provide CVMs which are configurable to vend Limited-Use, Paper and/or Extended-Use Media (see Technical Specifications Section 16 (Configurable Vending Machines)).	CDRL 9-1

Req. #	Requirement	Assigned CDRL(s)
9.1.8-4	The SI shall provide CVMs which enable initial purchase/issuing of Media, reloading of Closed-Loop Transit Accounts, and Transit Account balance inquiries (see Technical Specifications Section 16 (Configurable Vending Machines)).	CDRL 9-1
9.1.8-5	The CVM will require online communication for full operation. Without online communications, the CVM may operate in degraded mode subject to applicable design reviews, including issuance of Card-Based Limited-Use Media, reloads of EU Media and other limited functionality.	CDRL 9-1

9.1.9 Linked NFPS Entities

Linked NFPS Entities (see Technical Specifications Section 4.4.2 (Linked NFPS Entities)) will continue to distribute NFPS Agency-Issued Media via their existing distribution channels. The NFPS will support this continued distribution of Media by Third Parties, and will manage NFPS Agency-Issued Media via the B2B Portal.

Req. #	Requirement	Assigned CDRL(s)
9.1.9-1	The NFPS Backend will serve as the system of record and reporting for all NFPS Media sales, and will maintain the Closed-Loop Transit Accounts for all NFPS Media sold by the NFPS Agencies and the Linked NFPS Entities.	CDRL 9-1
9.1.9-2	The SI shall provide CVMs for at least the affiliates PATH and AirTrain as part of the CVM network noted in Technical Specifications Section 3 (Existing System Description) and to other Linked NFPS Entities that may choose to deploy CVMs as appropriate.	CDRL 9-1

9.1.10 NFPS Mobile Applications

Req. #	Requirement	Assigned CDRL(s)
9.1.10-1	The SI shall design, test and deploy NFPS Mobile Applications for the NFPS (see Technical Specifications Section 23 (NFPS Mobile Software)) which supports the same features and functions as the NFPS Websites, with additional fare payment features.	CDRL 9-1
9.1.10-2	The SI shall incorporate a Contactless ticketing feature into the NFPS Mobile Applications to support use of mobile devices as Media at point of entry to the NFPS (see Technical Specifications Section 23 (NFPS Mobile Software)). Smartphones with these NFPS Mobile Applications will use the same numbering, identification and transaction history structure and passengers will be able to use them in an identical fashion to NFPS Agency-Issued EU Smart Cards.	CDRL 9-1

Req. #	Requirement	Assigned CDRL(s)
9.1.10-3	The NFPS Mobile Application shall allow purchase of barcode mobile tickets, including barcoded Joint Media, which will support visual as well as electronic validation by onboard train crews (see Technical Specifications Section 23 (NFPS Mobile Software)).	CDRL 9-1

9.2 Media Distribution Required Submittals

The required submittals specified in this Technical Specifications Section 9 (Media Distribution) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 9-1	Fare and Media Distribution Design	Sections 9, 9.1	✓	✓	✓	
CDRL 9-2	Customer Service Support Plan	Section 9.1	✓	✓	✓	
CDRL 9-3	Call Center Contingency Plan	Section 9.1	✓	✓	✓	

10 Fare Accounts and Processing

The NFPS will create Transit Accounts for any NFPS Agency-Issued Account-Based Media to hold Fare Products and track payments and usage. These Transit Accounts will also exist to track the use of Open Payment Media. If a customer chooses to register a Transit Account, then the Transit Account associated with her or his Media will be linked to a Customer Account which will allow them to use features such as Autoload or Mail&Ride. If a customer does not register, the Transit Account associated with her or his Media will remain anonymous. Figure 22.1 (NFPS Accounts) in Technical Specifications Section 22 (NFPS Websites) illustrates the relationships between Transit Accounts and Customer Accounts.

10.1 Transit and Customer Accounts

Req. #	Requirement	Assigned CDRL(s)
10.1-1	The NFPS will support establishment and tracking of all Transit Accounts, current and historical status and categorization of all Fare Products required by the NFPS Agencies.	CDRL 10-1
10.1-2	The following Media types will be able to be linked to a Transit Account: <ul style="list-style-type: none">• NFPS Agency-Issued EU Media• NFPS Agency-Issued LU Media• Barcoded Paper Media and Joint Media• NFPS Agency-Issued LU Media for Special Programs• NFC or other mobile payment Media• Open Payment Media• Other Media as determined by the MTA	CDRL 10-1
10.1-3	Upon issuance of NFPS Agency-Issued Media to a customer, the associated Transit Account shall be activated. If the customer registers the Media, the Customer Account “profile” shall contain the user’s name and other information as detailed below; otherwise, the Transit Account shall remain in the default “anonymous” state. Some Special Program accounts may be activated prior to issuance of Media, depending on the Business Rules of the Special Program.	CDRL 10-1
10.1-4	Each entry in the registered Customer Account database shall include the following Data fields at minimum: <ul style="list-style-type: none">• Account Number (unique for each account)• Customer Name• Address• Primary Phone• Secondary Phone• Mobile Phone (for SMS text messages)• Email Address• User Login ID (unique for each account)• User Password (with minimum security characteristics)• Secret question & answer (no less than three (3) per account)	CDRL 10-1

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> • Preferred communication method (primary/secondary phone, SMS, email) • Special fare permissions (none, reduced fare, student) • Special fare authorization information (e.g., case number, Medicare) • Account Category/Class Code • Issuing NFPS Agency <p>For each data field in the Customer Account, each NFPS Agency shall be able to designate, on an NFPS Agency-specific basis, whether the field is required or optional and whether the field is restricted to that specific NFPS Agency's use only.</p>	
10.1-5	The NFPS will allow account holders and authorized NFPS Agency users to create, modify and delete Customer Accounts. All changes to Customer Account Data, including the user making the change, shall be recorded in the account database.	CDRL 10-1
10.1-6	Access to Customer Account Data shall be strictly password controlled and limited to authorized NFPS Agency users.	CDRL 10-1
10.1-7	Authorized Special Program administrators will be granted limited and appropriate access to Customer Account Data for the purposes of account management via the B2B Portal.	CDRL 10-1
10.1-8	The NFPS will secure all Customer Account Data stored in and transmitted to the NFPS Backend database.	CDRL 10-1
10.1-9	The NFPS Backend will store no payment method Data (such as credit/debit card numbers) covered by PCI and EMV requirements in the Customer Account database.	CDRL 10-1
10.1-10	Payment Media (credit, debit, EBT, ACH) may be registered to a valid Customer Account.	CDRL 10-1
10.1-11	Transit Accounts will include information that will indicate operational status conditions, to be defined during design review.	CDRL 10-1

10.1.1 Open Payment Media

Req. #	Requirement	Assigned CDRL(s)
PAYGO		
10.1.1-1	The NFPS will accept for payment Contactless Media presented to an NFPS Validator or OSVD. The NFPS will process the transaction as agreed to in design reviews. Based on each NFPS Agency's Business Rules and card brand operating regulations (where applicable), the NFPS will request bank authorization one or more times. If authorization requests are declined by the bank, the card may be added to a Negative List.	CDRL 10-1

Req. #	Requirement	Assigned CDRL(s)
10.1.1-2	A Transit Account will be established on initial presentation of a card to an NFPS device (see Technical Specifications Section 10.1 (Transit and Customer Accounts)); this Transit Account will track transaction history and will be available for registration using the card's PAN or other mechanism to uniquely identify Open Payment Media.	CDRL 10-1
Pay-in-Advance		
10.1.1-3	The NFPS will support the loading of Fare Products to Transit Accounts associated with Open Payment Media. Customers may present their Open Payment Media to an NFPS Validator or OSVD, and the Fare Product in their Transit Account will be updated according to defined rules.	CDRL 10-1

10.1.2 Fare Products

Req. #	Requirement	Assigned CDRL(s)
10.1.2-1	The NFPS will allow multiple distinct Fare Products specified in Technical Specifications Section 7.3 (Fare Structure and Pricing) to be associated with Transit Accounts. These Fare Products may be created, terminated or modified by each NFPS Agency, on an NFPS Agency-specific basis. These modifications will also be available to customers via self- or customer-service options, and their availability will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 10-1
10.1.2-2	Special Fare Products will be associated with a Transit Account only after eligibility has been established according to the NFPS Agencies' Business Rules. Eligibility may require creation of an associated Customer Account.	CDRL 10-1
10.1.2-3	The NFPS will support a base limit, configurable by each NFPS Agency, on an NFPS Agency-specific basis, to the value associated with a value-based Fare Product (a "floor"), so that any subsequent transactions will be denied as long as such value in the Transit Account remains below the base limit.	CDRL 10-1
10.1.2-4	Rolling-period Fare Products associated with a Transit Account will be "pending" until first use at the point of entry.	CDRL 10-1
10.1.2-5	The NFPS shall support addition of bonus rides or value for a Transit Account based on thresholds or Fare Product usage that are configurable by each NFPS Agency, on an NFPS Agency-specific basis. The details of bonus rides and other supported Fare Products are in Technical Specifications Section 7.3 (Fare Structure and Pricing).	CDRL 10-1

Req. #	Requirement	Assigned CDRL(s)
10.1.2-6	The NFPS will force customers to remedy Transit Accounts that have dropped below the allowable “floor” whenever a customer performs a replenishment transaction at any distribution channel (see Technical Specifications Section 9 (Media Distribution)) to restore the Transit Account deposit to the minimum value before making additional funds available for transit use. For example, if an account is \$5 negative and a customer adds \$20, they will have \$15 in stored value available for use. The messaging regarding negative Transit Account balances and replenishment transactions will be defined by the MTA during design review.	CDRL 10-1

10.1.3 Usage Transactions

Req. #	Requirement	Assigned CDRL(s)
10.1.3-1	NFPS Validators, CVMs, TOMs, and OSVDs shall communicate with the NFPS Backend or Payment Application in real-time (or near real-time) for the processing of Media taps. Some Fare Products sold through MNR and LIRR CVMs and TOMs will be used (i.e., validated) upon sale and therefore require generation of a usage transaction. As determined during Design Review, devices may reference an Account Master Status List (as defined in req. # 10.2.1-1) for authorization or denial.	CDRL 10-1
10.1.3-2	The NFPS Validators, CVMs, TOMs, and OSVDs shall record the results of all transactions and transmit Data to the NFPS Backend. All Transaction Data will be available for viewing by the MTA and the customer via the NFPS Websites and NFPS Mobile Applications.	CDRL 10-1
10.1.3-3	Media associated with an active Fare Product will utilize that Fare Product first; if the Fare Product is unavailable or expired, the NFPS will use stored value in the Transit Account. If stored value is not available and the Media is Open Payment, the Media will be used for a PAYGO transaction. Other fare precedence rules will be established in Business Rules determined during design reviews.	CDRL 10-1

10.1.4 Issuance, Usage and Replenishment Transaction Flows

Req. #	Requirement	Assigned CDRL(s)
10.1.4-1	The SI shall submit a series of flow charts depicting all Media issuance, usage and replenishment transactions. The flow charts shall show all steps in the processing of an Open Payment and Closed-Loop transaction, as well as Autoload and Mail&Ride processes. Transaction flow charts shall cover all major transaction types and all fare policies.	CDRL 10-1

10.2 Account Lists

As noted in Technical Specifications Section 6 (System Architecture), the NFPS may use, at minimum, Positive Lists and Negative Lists to allow for Risk Mitigation. The SI may provide design solutions for structuring and use of these Lists and any others, so long as the NFPS emulates the following functionality.

10.2.1 NYCT Account Lists

Req. #	Requirement	Assigned CDRL(s)
10.2.1-1	Every NFPS device that processes fare payments will reference account lists (such as Positive and Negative Lists) in conducting transactions as determined during Design Review. This will include an Account Master Status List, details of which will be determined during Design Review.	CDRL 10-2
10.2.1-2	The NFPS Backend shall update the contents of the account lists as necessary to reflect the most recent transaction results as reported by all NFPS devices, sales and replenishment transactions from all sources, and deactivation, suspension and reactivation instructions conducted by Authorized Users.	CDRL 10-2
10.2.1-3	The NFPS shall broadcast account list updates to all relevant NFPS devices at a frequency that can be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 10-2
10.2.1-4	Each entry in the account lists shall contain sufficient information to enable an NFPS device to conduct transactions in support of the NFPS Agencies' fare policies and to provide accurate and complete transaction results to the passenger, and as applicable, to the vehicle operator, sales clerk and/or fare inspector as determined during Design Review.	CDRL 10-2
10.2.1-5	The NFPS Backend will process transaction records received from devices and determine when an NFPS Account changes status, such as when the stored value balance falls below the floor threshold. In such cases, the NFPS Backend shall update the NFPS Account's status on the account lists and with all other NFPS Account changes during the current calculating period and broadcast the updated account lists to all relevant devices.	CDRL 10-2
10.2.1-6	If an NFPS Agency-Issued Media is reported lost or stolen, its invalid status will also be included in the account lists.	CDRL 10-2
10.2.1-7	The account lists will be regularly pushed to Field Devices, with timeframes defined during design review, and may also be mirrored at ancillary locations (i.e., local station controllers) to ensure up-to-date and prompt retrieval by Field Devices. Any mirroring will accurately update the master Positive and Negative Lists stored in the NFPS Backend, with instant updating and version control in place to ensure accurate synchronization. For example, a replenishment transaction that removes a customer from the Negative List will result in the immediate ability to access the transportation system. See Technical Specifications Section 6.1.4 (Risk Mitigation Techniques).	CDRL 10-2

10.2.2 Third Party-Issued Valid Card List

Req. #	Requirement	Assigned CDRL(s)
10.2.2-1	The NFPS will also track the status and history of any Third Party-Issued cards that are allowed to be used as Media. The NFPS will track the appropriate secure identifier for these cards on an internal Positive List, i.e., a list of known valid cards. These cards will be differentiated from NFPS Agency-Issued cards in the NFPS.	CDRL 10-2
10.2.2-2	The approved Third Party (or parties) shall be responsible for transmitting to the NFPS Agencies (via a web portal) updated lists of known valid cards. The NFPS Backend shall transmit the updated lists to all devices no less than daily.	CDRL 10-2
10.2.2-3	All Third Party-Issued Media shall function as read-only credentials; the NFPS shall make no alterations to the Data encoded on these cards.	CDRL 10-2

10.3 Fare Accounts and Processing Required Submittals

The required submittals specified in these Technical Specifications Section 10 (Fare Accounts and Processing) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 10-1	NFPS Customer Accounts and Processing	Section 10.1	✓	✓	✓	
CDRL 10-2	NFPS Account Lists	Section 10.2	✓	✓	✓	

CHAPTER 2: NFPS EQUIPMENT

11 Common Machine Requirements

Both the Configurable Vending Machine and the Wayside Validator Machine will be able to process coin transactions and bank card transactions, necessitating similar requirements for physical security and internal modules. The requirements in this Technical Specifications Section 11 (Common Machine Requirements) are common to these two types of machines and will be referenced where appropriate in the Technical Specifications Sections that follow.

Req. #	Requirement	Assigned CDRL(s)
11-1	Machines will satisfy all general design, security and performance requirements in Technical Specifications Section 5 (General Design Requirements) and elsewhere herein.	CDRL 11-1
11-2	Machines will satisfy all applicable ADA and Title VI requirements described in Technical Specifications Section 5.10 (Aesthetic Requirements and User Interfaces).	CDRL 11-1
11-3	All machine bank card transactions will be conducted in full compliance with all PCI and EMV requirements (see Technical Specifications Section 5.7 (System Security)).	CDRL 11-1
11-4	Machines shall comply with all applicable safety standards including each NFPS Agency's operating procedures and practices.	CDRL 11-1

11.1 Machine Enclosure Construction

Req. #	Requirement	Assigned CDRL(s)
11.1-1	Machine enclosure, mounting pedestals and any external accoutrements (such as button panels, rain shields and light fixtures) will be robust and vandal-resistant. The machine enclosure and pedestal design will be submitted for the MTA's review and approval.	CDRL 11-1
11.1-2	The cabinet will have a base or mounting pedestal constructed of Grade 316 stainless steel and will accommodate variations in fare control area and wayside sidewalk construction. Bases and pedestals for all machines will be sized according to need and direction to be provided by the MTA at design review.	CDRL 11-1
11.1-3	The cabinet will provide controlled levels of access to the interior of the applicable NFPS Equipment for maintenance personnel, revenue servicing personnel and cash processing personnel at each Revenue Facility, as defined by the MTA during design review. The locks will be secured locks, programmable to more than one key and approved by the MTA.	CDRL 11-1
11.1-4	The cabinet will provide, without undue delay, access to the applicable NFPS Equipment by authorized personnel equipped with proper keys and individual access code(s) as defined by the MTA during design review.	CDRL 11-1

Req. #	Requirement	Assigned CDRL(s)
11.1-5	The cabinet will be constructed to provide the best possible protection against vandalism and burglary. Reinforcement will be provided at the positions where there is the possibility of burglary.	CDRL 11-1
11.1-6	While all outer doors are secured, the machine will remain operational and undamaged after experiencing any impact resulting in a concentrated load of 400 pounds per one square inch to any part of the enclosure.	CDRL 11-1

11.2 Alarm Unit

Req. #	Requirement	Assigned CDRL(s)
11.2-1	Where specified, each machine will be equipped with an alarm unit that will have the ability to monitor machine security conditions and report them to the machine Electronic Control Unit (ECU) to be forwarded to the NFPS Backend in real-time. If the machine is without power or the ECU is disabled for any reason, the alarm unit will continue to operate independently and monitor the machine for security breaches and impacts.	CDRL 11-1
11.2-2	The alarm unit will be able to be disarmed through authorized entry or trigger an alarm caused by unauthorized entry. Each time a security breach or impact is detected, an event record of the activation with date and time will be created and stored in the non-volatile register memory of the ECU.	CDRL 11-1
11.2-3	Adjustable sensors will detect severe frontal blows to the machine, breakage to the glass cover of the Patron Display and attempts at unauthorized or forced entry. The alarm unit will activate the siren as soon as the impact sensor is triggered. In such cases, the siren will shut off and re-arm after a separate time period that is adjustable by each NFPS Agency on an NFPS Agency-specific basis, unless continued impacts or attempts at intrusion are detected. The siren shall be designed so that it can be disabled by each NFPS Agency's personnel if desired; however, even if the siren is disabled, event and alarm messages will continue to be transmitted.	CDRL 11-1
11.2-4	The alarm unit and the ECU will exchange "heartbeat" messages at least once every two (2) seconds. If the ECU detects a failure of the alarm unit, it will record the event in its Non-Volatile Memory and transmit an alarm unit Failure message to the NFPS Backend. If the alarm unit detects Failure of the ECU, the alarm unit will operate in its stand-alone mode until communication with the ECU is restored.	CDRL 11-1

11.3 Power Supply and Switches

Req. #	Requirement	Assigned CDRL(s)
11.3-1	<p>The machine will have at least two power switches that are easily accessible from within the enclosure:</p> <ul style="list-style-type: none"> • A main switch that removes all power from all components within the cabinet; and • A machine power switch that removes power from the machine's power supply only. <p>The machine may include additional secondary power switches, but all other secondary switches will be connected through the main switch.</p>	CDRL 11-1
11.3-2	The machine will be equipped with a modular, filtered power supply which will be connected to the incoming grounded electrical service and will deliver all of the necessary operating voltages for the machine.	CDRL 11-1
11.3-3	The power supply will be mounted as high as practical within the enclosure, and no less than thirty-six (36) inches from the platform surface.	CDRL 11-1
11.3-4	Voltages internal to the machine will be limited to no more than incoming power, nominally 125 VAC (excluding abnormal power surges or spikes).	CDRL 11-1
11.3-5	The machine power switch will turn the machine's power supply on or off; this switch will be separate from the external main circuit breaker that removes all power from the machine. There will be no electrical safety risks to maintenance personnel with the machine power turned off.	CDRL 11-1
11.3-6	A Ground Fault Circuit Interrupter (GFCI) duplex convenience outlet, plus a secondary duplex outlet wired as a load to the GFCI outlet, rated at 125 VAC, 15 amps will be easily accessible within the interior of each cabinet. These outlets will be installed as high as practical within the enclosure, and no less than thirty-six (36) inches above the finished platform, will be protected by a separate circuit breaker internal to the machine enclosure, and will be grounded.	CDRL 11-1
11.3-7	Appropriate warning labels will be provided on or near any components or cables that may have hazardous voltages present while the machine power supply switch is off.	CDRL 11-1
11.3-8	Indicator lamps will indicate when all aspects of the power supply are functional.	CDRL 11-1
11.3-9	Whenever the machine shuts down due to loss of incoming AC power, upon restoration of power, the machine will automatically resume operations within four (4) minutes.	CDRL 11-1

11.4 Supplemental Battery Power

Req. #	Requirement	Assigned CDRL(s)
11.4-1	The machine will be equipped with a battery operated supplemental power supply integral to the machine and connected to the machine's power supply. This battery power supply will automatically provide power for the machine in the event the incoming voltage falls below the reliable machine operating voltage and in the event of loss of AC power to the machine.	CDRL 11-1
11.4-2	The supplemental power supply will contain a battery, a trickle-charge circuit, one or more switches to turn on/off the charging circuit and to enable/disable power output, and appropriate indicators.	CDRL 11-1
11.4-3	The machine ECU will monitor the power supply's source of power and will transmit a power alarm to the NFPS Backend as soon as it is informed that supplemental battery power is being utilized.	CDRL 11-1
11.4-4	<p>The supplemental power supply will be of sufficient capacity to permit the machine to perform the following functions in the event of an AC power failure or fault, or other fault that would cause the machine to shut down without AC power:</p> <ul style="list-style-type: none"> • If the entire transaction value has been collected prior to loss of AC power, the machine will complete the transaction. This includes transfer of inserted money to associated vault(s). • If loss of AC power occurs before the entire transaction amount has been collected, the machine will cancel the transaction and return all inserted money to the patron. • Transmit a power loss alarm message to the NFPS Backend. • Record an event in the machine's Non-Volatile Memory indicating date and time of power loss. • Provide for an orderly shutdown of the machine such that no Data loss occurs. • In case of a 'momentary' power loss, the machine will continue full operation during a defined time period after which time the battery back-up will perform an orderly shut-down. • Provide power for functioning of the alarm unit. 	CDRL 11-1
11.4-5	At no time will a transaction be permitted to commence while the machine is operating on supplemental battery power.	CDRL 11-1
11.4-6	Batteries in the supplemental power supply will have an expected life of no less than five (5) years of normal use.	CDRL 11-1
11.4-7	The supplemental battery power module will indicate the need to replace the batteries prior to the end of battery life; if such indication is not available, the machine maintenance manual will clearly identify the batteries' recommended replacement interval.	CDRL 11-1

11.5 Coin Handling Unit

Req. #	Requirement	Assigned CDRL(s)
11.5-1	Machines configured to accept coins will be equipped with a Coin Handling Unit (as further defined herein) consisting of the following coin handling modules: a coin acceptor/verifier, coin recirculating system (as needed), a coin vault, and a chassis and its associated wiring and electronic devices.	CDRL 11-2
11.5-2	The Coin Handling Unit will accept, dispense for change and store the following US coins: nickels, dimes, quarters, and post-1978 dollar coins.	CDRL 11-2
11.5-3	Each coin storage module will be key-locked into the machine and will be removable from the machine without tools.	CDRL 11-2
11.5-4	Any module containing coins will remain secure when removed from the machine; access to money stored in such modules will be granted only with keys available in the associated Revenue Facility.	CDRL 11-2
11.5-5	The Coin Handling Unit will automatically switch to an out-of-service condition if any one coin processing module is not installed or not operating properly.	CDRL 11-2
11.5-6	The Coin Handling Unit will be electrically and mechanically constructed to fulfill the requirements of this specification. Complete performance and status information will be available locally and remotely at the NFPS Backend.	CDRL 11-2
11.5-7	The Coin Handling Unit will minimize coins jams under all operating conditions.	CDRL 11-2
11.5-8	The coin insertion slot shutter described in Technical Specifications Section 11.5.1 (Coin Insertion Slot) will remain closed until a transaction is selected for which cash payments are available. The shutter will automatically open once a cash-eligible transaction has been selected and the payment due has been displayed.	CDRL 11-2

11.5.1 Coin Insertion Slot

Req. #	Requirement	Assigned CDRL(s)
11.5.1-1	The machine will contain a coin insertion slot. The coin insertion slot will be sized to limit the dimensions of inserted material to the largest coin accepted. To minimize jams, the coin slot will also be sized to prevent the simultaneous insertion of two coins.	CDRL 11-2
11.5.1-2	The coin insertion slot will be robust and scratch resistant and be designed to withstand wear and abrasion for the life of the machine.	CDRL 11-2
11.5.1-3	The coin insertion slot will be equipped with a protective shutter to ensure that foreign matter cannot enter the unit while the machine is not accepting coins.	CDRL 11-2
11.5.1-4	The coin insertion slot will be designed so that liquids entering through the slot flow out of the machine to avoid damage to the machine and its components.	CDRL 11-2

11.5.2 Coin Acceptor

Req. #	Requirement	Assigned CDRL(s)
11.5.2-1	The coin acceptor will include a coin insertion mechanism and a verifier to accept only the specified U.S. coins.	CDRL 11-2
11.5.2-2	The coin acceptor will reject and return to the coin return bin unverified, counterfeit, excessively bent, and foreign coins, as well as slugs and other foreign objects.	CDRL 11-2
11.5.2-3	The coin acceptor will be capable of accepting and discriminating at least six (6) types and denominations of coins.	CDRL 11-2
11.5.2-4	The coin acceptance and verification process will take less than two (2) seconds per deposited coin, measured from the instant the coin is inserted into the coin slot until the coin acceptor is ready to process another coin.	CDRL 11-2
11.5.2-5	Deposited coins will be verified for denomination and validity, based upon their metallic content. Coin verification will be consistent and repeatable.	CDRL 11-2
11.5.2-6	The criteria for verifying coins will be adjustable by each NFPS Agency, on an NFPS Agency-specific basis, for each coin denomination and type.	CDRL 11-2
11.5.2-7	The geometry of the coin path and other provisions of the coin acceptor will prevent the retrieval of coins by fishing such as with wire or attached thread.	CDRL 11-2
11.5.2-8	<p>The coin acceptor will meet all coin acceptance rates in the OEM's published specification, including:</p> <ul style="list-style-type: none"> • Percentage of valid coins accepted upon initial insertion; • Percentage of valid coins accepted in no more than two insertion attempts; and • All known counterfeit coins, common slugs, foreign coins and coins of denominations not accepted by the machine are rejected upon every insertion. <p>The published specifications will be provided to the MTA during Design Review.</p>	CDRL 11-2
11.5.2-9	The coin acceptor will identify valid acceptable coins with at least 99.99% accuracy.	CDRL 11-2
11.5.2-10	The coin acceptor will not accept coins once the vault has reached 90% capacity.	CDRL 11-2

11.5.3 Coin Vault

Req. #	Requirement	Assigned CDRL(s)
11.5.3-1	Each machine will be equipped with a removable coin vault having a capacity of at least 300 cubic inches. The coin vault will function as an end collection container for coins.	CDRL 11-2
11.5.3-2	The coin vault will be installable in one unique position, and concealed, tamperproof sensors will detect when a coin vault has been properly installed.	CDRL 11-2
11.5.3-3	The coin vault will be self-locking and self-sealing, so that when it is removed from the machine, it cannot be opened locally or re-inserted in a machine without emptying the contents of the vault through authorized means.	CDRL 11-2
11.5.3-4	The coin vault will be designed and constructed as a safe box of 12 gauge stainless steel and shall provide a secure interface between the coin chute and the cashbox. The coin vault door shall be constructed with 7 gauge stainless steel and shall be equipped with an MTA-approved three point locking mechanism. It will withstand regular removal, replacement and normal handling without deformation or in any way interfering with the insertion and removal process. Alternative coin vault materials may be considered for review and approval during Design Review.	CDRL 11-2
11.5.3-5	When a full coin vault (containing no less than 250 cubic inches of mixed U.S. coins) is dropped from a height of three (3) feet onto a concrete floor on any corner or side, the vault will remain fully operational, will suffer no more than cosmetic damage, will not open, nor will its locking mechanism be impaired.	CDRL 11-2
11.5.3-6	The coin vault will have a handle or handles placed to avoid injury, which provides adequate gloved-hand clearance for easy insertion, removal and carrying.	CDRL 11-2
11.5.3-7	When full (containing no less than 250 cubic inches of mixed U.S. coins), the coin vault will not weigh more than 40 pounds.	CDRL 11-2
11.5.3-8	It will not be possible to open the coin vault while it is installed in the machine, nor will it be possible to install an open or unlocked coin vault into the machine.	CDRL 11-2
11.5.3-9	When properly installed in the machine, it will be impossible to access coins in the coin vault without damaging the vault in an obvious manner.	CDRL 11-2
11.5.3-10	Using sensors or other means, the machine will confirm the passage of all coins to the coin vault; failure to detect a coin being deposited into the coin vault will be considered a jam and the machine will cease accepting coins and display an appropriate message to patrons.	CDRL 11-2

11.5.4 Coin System Security Interlocks

Req. #	Requirement	Assigned CDRL(s)
11.5.4-1	The coin vault will be locked into the machine and will be provided with security interlocks to restrict access to monies.	CDRL 11-2
11.5.4-2	The coin vault and storage units will be locked into the machine in such a manner that they do not interfere with maintenance of the coin acceptor/verifier mechanism.	CDRL 11-2
11.5.4-3	Access to coins will not be possible at any time during maintenance or revenue transfer operations, but will only be accessed with a controlled key(s) issued to the cash processing personnel designated by each NFPS Agency, for that specific NFPS Agency.	CDRL 11-2
11.5.4-4	Each coin vault will have a visually and electronically readable component code and serial number. The machine will automatically read and verify as valid the component code and serial number of each inserted coin storage module. This Data will be made available both locally at the machine and remotely at the NFPS Backend.	CDRL 11-2
11.5.4-5	The machine will read the electronically readable component code at a frequency fast enough to ensure that the component cannot be exchanged without the machine detecting the removal of the unit.	CDRL 11-2
11.5.4-6	The electronically readable component code and serial number will not require the connection or disconnection of cables when replacing the coin storage module.	CDRL 11-2

11.6 Bank Card Processing Interfaces

11.6.1 PIN Pad

Req. #	Requirement	Assigned CDRL(s)
11.6.1-1	All machines will contain a secure bank card PIN keypad. The PIN Pad shall be vandal resistant, weather resistant and not be removable from outside and be easily replaceable. It will also operate with minimal maintenance and have a life expectancy of five million (5,000,000) cycles.	CDRL 11-3
11.6.1-2	The PIN keypad will be capable of operating in both an encrypting and non-encrypting or "clear" mode so that it can be used for Data entry and patron selection by the visually impaired.	CDRL 11-3
11.6.1-3	The PIN keypad will employ encryption as required in accordance with banking requirements and be PCI-PTS (Pin Transaction Security) compliant. The SI shall supply all PIN keypads with production encryption keys injected in a secure, PCI compliant manner.	CDRL 11-3
11.6.1-4	The PIN keypad will support PIN entry subject to the NFPS Agencies' Business Rules, EMVCo requirements, and card brand operating regulations. The PIN keypad will also be used to enter ZIP codes to satisfy address verification requirements.	CDRL 11-3

Req. #	Requirement	Assigned CDRL(s)
11.6.1-5	The PIN keypad will be mounted in a location that is ADA-compliant and adheres to security best practices (for machines that are configured to accept bank cards).	CDRL 11-3
11.6.1-6	The layout of the keys on the PIN keypad will be similar to those of touchtone telephones, and the central “5” key will have a raised dot or other identifying tactile feature to aid the visually impaired, in compliance with the ADA.	CDRL 11-3

11.6.2 Magnetic Stripe/Contact Bank Card Reader

Req. #	Requirement	Assigned CDRL(s)
11.6.2-1	Machines configured to accept bank card payments will include a Magnetic Stripe/Contact Bank Card Reader, as defined in this Technical Specifications Section 11.6.2 (Magnetic Stripe/Contact Bank Card Reader).	CDRL 11-3
11.6.2-2	The Magnetic Stripe/Contact Bank Card Reader will consist of a push/pull (insert/remove) card reader such that the bank card is not captured completely by the reader. The SI shall design and equip the reader unit opening with sensors to detect the insertion and removal of cards from the reader unit.	CDRL 11-3
11.6.2-3	The Magnetic Stripe/Contact Bank Card Reader card slot will be sealed so that no liquids introduced into the slot enter the interior of the machine.	CDRL 11-3
11.6.2-4	The Magnetic Stripe/Contact Bank Card Reader will accept and process standard size cards with ISO/IEC 7811 magnetic data stripes.	CDRL 11-3
11.6.2-5	The Magnetic Stripe/Contact Bank Card Reader will be capable of reading Contact Smart Cards that are compliant with ISO/IEC 7816 parts 1 through 4.	CDRL 11-3

11.6.3 Contactless Card Reader

Req. #	Requirement	Assigned CDRL(s)
11.6.3-1	Machines configured to accept card payments will include a Contactless Card Reader, as defined in this Technical Specifications Section 11.6.3 (Contactless Card Reader).	CDRL 11-3
11.6.3-2	The Contactless Card Reader will be clearly marked with a separately replaceable pictogram or other information.	CDRL 11-3
11.6.3-3	The Contactless Card Reader antenna module will be vandal resistant and protrude no more than 0.5 inches from the face of the machine front door.	CDRL 11-3
11.6.3-4	The Contactless Card Reader will read Contactless NFPS Agency-Issued EU and LU Smart Cards, Contactless MSD-compliant bank cards (if applicable at time of award), Contactless Bank Cards, and Contactless MSD (if applicable) and EMV mobile wallet applications, such as Android Pay and Apple Pay.	CDRL 11-3

11.7 Receipt Printer

11.7.1 Function

Req. #	Requirement	Assigned CDRL(s)
11.7-1	The receipt printer will be able to print all alphanumeric characters in both upper and lower case and the standard symbols of the ASCII character set. Printed characters will be produced with a minimum height of 0.12 inches and a maximum height up to 1.0 inch. The approximate height to width ratio of the characters will be 5:3.	CDRL 11-4
11.7-2	The receipt printer will utilize a thermal print head that provide no less than 100 dots per inch of resolution.	CDRL 11-4
11.7-3	Thermal print heads will produce no fewer than 250,000 receipts without the loss of a single pixel due to wear or electronic failure.	CDRL 11-4
11.7-4	The receipt printer will be equipped with a self-sharpening cutting mechanism to cut individual receipts from the roll supply. Each cutter will perform at least 1,000,000 cuts without requiring replacement or sharpening. The cutter shall be designed such that no adjustment of the cutting edges shall be required.	CDRL 11-4
11.7-5	Component replacement and clearing of printer jams will be easily completed using First-Call Maintenance procedures.	CDRL 11-4

11.7.2 Transaction Receipt Content

Req. #	Requirement	Assigned CDRL(s)
11.7.2-1	All receipts will clearly indicate that the document is a receipt and not a valid ticket, and will contain at least the following information: <ul style="list-style-type: none">• Machine Number – up to eight alphanumeric characters• Date – month, day and the last two digits of the year, totaling nine characters• Time – four digits separated by a colon and followed by two letters “AM” or “PM,” using a 12-hour clock• Station name or location where purchased – up to 16 characters• Employee Identification (if applicable)• Ticket purchased or transaction type – up to 16 characters• Transaction amount• Machine-unique transaction sequence number• Other information will be determined during design review.	CDRL 11-4
11.7.2-2	Receipts for bank card transactions will also include all information as identified in Federal Regulations E and Z, and other information necessary to comply with banking standards and Federal Reserve regulations.	CDRL 11-4

11.8 LU/Paper Media Dispenser

11.8.1 Function

Req. #	Requirement	Assigned CDRL(s)
11.8.1-1	The LU/Paper Media Dispenser will be able to select, cut, print and dispense LU and/or Paper Media of different types, using at least two different ticket rolls. All ticket rolls will be LU Smart Card Media or Paper Media (see Technical Specifications Section 18 (Media)). The dispenser shall have the capability to be configured to process LU Smart Card Media and/or Paper Media.	CDRL 11-5
11.8.1-2	The LU/Paper Media Dispenser will sense the progress of the ticket through the machine and detect the completion of the dispensing process. A final sensor will detect when the Media has left the machine on its way to the Media/Coin Return Bin. Should the LU/Paper Media Dispenser detect an unrecoverable ticket jam or the failure of the ticket to clear the final sensor, the machine will cancel the transaction and respond accordingly.	CDRL 11-5
11.8.1-3	The LU/Paper Media Dispenser will include a sensor, adjustable by each NFPS Agency, on an NFPS Agency-specific basis, to detect when each ticket roll is at 10 percent to 25 percent of capacity. When this sensor is activated, the ECU will record it as an event and transmit an alert to the NFPS Backend.	CDRL 11-5
11.8.1-4	When any ticket roll is depleted, the ECU will record as an event and transmit to the NFPS Backend a ticket stock empty condition.	CDRL 11-5
11.8.1-5	Replacement of stock will require only rudimentary knowledge of the machine. Clearly illustrated instructions showing proper ticket stock orientation and feeding procedures will be placed inside the machine adjacent to the ticket stock holders.	CDRL 11-5
11.8.1-6	Each printer in the LU/Paper Media Dispenser will be equipped with a self-sharpening cutting mechanism to cut individual tickets from the roll supply. Each cutter will perform at least 1,000,000 cuts without requiring replacement or sharpening.	CDRL 11-5

11.8.2 Media Encoding

Req. #	Requirement	Assigned CDRL(s)
11.8.2-1	The LU/Paper Media Dispenser will be able to encode Data onto each LU Smart Card prior to dispensing, including ticket type, fare category, expiration date, encryption keys and other Data as necessary to support the NFPS Agencies' Business Rules and fare policies (see Technical Specifications Section 7 (Fare Policies)).	CDRL 11-5
11.8.2-2	Prior to dispensing the Smart Card Media, the LU/Paper Media Dispenser will read the Media to verify that all Data has been properly encoded, and to read the ticket's Unique Identifier (UID) code.	CDRL 11-5
11.8.2-3	If the LU/Paper Media Dispenser cannot read the UID and verify that the ticket has been properly encoded, the machine will capture the ticket in a ticket reject bin and attempt to issue another ticket.	CDRL 11-5

Req. #	Requirement	Assigned CDRL(s)
11.8.2-4	The ticket reject bin will have a capacity of no less than 50 tickets. When the bin has reached maximum capacity the LU/Paper Media Dispenser will be taken out of service.	CDRL 11-5
11.8.2-5	If the LU/Paper Media Dispenser fails to issue a ticket after an MTA-configurable number of attempts, the machine will disable the LU/Paper Media Dispenser.	CDRL 11-5
11.8.2-6	Upon successful issuance of a ticket, the LU/Paper Media Dispenser will inform the machine's ECU of the UID of the issued ticket.	CDRL 11-5

11.8.3 LU/Paper Media Printing

Req. #	Requirement	Assigned CDRL(s)
11.8.3-1	<p>The LU/Paper Media Dispenser will be able to print all alphanumeric characters in both upper and lower case and the standard symbols of the ASCII character set. Printed characters will be produced with a minimum height of 0.12 inches and a maximum height up to 1.0 inch. The approximate height to width ratio of the characters will be 5:3. The printer(s) will be of the direct thermal type, with the flexibility of being programmed to print tickets with the following configurations.</p> <ul style="list-style-type: none"> • Various print sizes on the same ticket • Reverse printing (white characters on black background) • Composite type over several lines • Vertical and horizontal character orientation 	CDRL 11-5
11.8.3-2	The LU/Paper Media Dispenser will utilize one or more thermal print heads that provide no less than 100 dots per inch of resolution.	CDRL 11-5
11.8.3-3	Thermal print heads will be easily replaceable, and will produce no fewer than 250,000 NFPS Media without the loss of a single pixel due to wear or electronic failure.	CDRL 11-5
11.8.3-4	The LU/Paper Media Dispenser will be capable of printing a variety of information on each ticket (see Technical Specifications Section 11.8.3 (LU/Paper Media Printing)), including MTA-defined 2D barcodes, which will be determined during design review.	CDRL 11-5
11.8.3-5	LU Media print data will be clearly legible. Printing will not degrade the physical condition of the Media. There will be no extraneous marks placed on the Media as a result of the printing operation.	CDRL 11-5
11.8.3-6	All encoding and printing will be completed within two (2) seconds from start of the print cycle.	CDRL 11-5
11.8.3-7	The NFPS Agencies will require occasional Media print format modifications, or additional Fare Products for sale from the machines, both on an NFPS Agency-specific basis. Such changes will be able to be performed by NFPS Agency employees. Printing format, including information to be printed, print location, orientation, size and font, will be configurable from the NFPS Backend.	CDRL 11-5

Req. #	Requirement	Assigned CDRL(s)
11.8.3-8	The SI shall provide the Software utilities for adding, changing and deleting text on Media, passenger display messages, and accounting/registration printouts where Fare Products and transaction types are listed. The SI shall demonstrate these Software utilities during the machine Functional Tests conducted during the Factory Acceptance Tests.	CDRL 11-5
11.8.3-9	The SI shall submit type of printer, model and manufacturer for the MTA's review and approval.	CDRL 11-5

11.9 Electronic Control Unit

Req. #	Requirement	Assigned CDRL(s)
11.9-1	Each machine will be equipped with an Electronic Control Unit to control, store, coordinate, supervise and respond as appropriate to the status, operation, security and accounting of all machine functions.	CDRL 11-6
11.9-2	The ECU will cause the Patron Display to convey instantaneously, with minimal perceptible delay to the patron, information that is to be displayed in response to patron input. For example, upon selection of a transaction type, the display screen will react instantaneously by displaying the transaction type selected and amount of fare or fees due. "Instantaneously" is defined as no greater than 0.1 seconds between selection and display response.	CDRL 11-6
11.9-3	The ECU will be equipped with a Central Processing Unit, Random Access Memory, Input and Output (I/O), Non-Volatile Memory, removable Solid State Memory Module (SSMM) and Software capable of performing all control and data processing functions of the machine.	CDRL 11-6
11.9-4	The ECU will be suitable for operation in the environment in which the machine will be installed.	CDRL 11-6

11.9.1 ECU Hardware

The ECU Hardware at minimum will include:

Req. #	Requirement	Assigned CDRL(s)
11.9.1-1	A microprocessor with adequate processing speed for the type of service for which it is intended.	CDRL 11-6
11.9.1-2	Adequate RAM for operating program(s) and other temporary needs. The ECU will have sufficient RAM to avoid the use of virtual memory as a means of temporarily supplementing RAM during normal machine activities. Provision will be furnished to permit plug-in upgradeability to double the amount of memory initially supplied.	CDRL 11-6
11.9.1-3	Solid-state Non-Volatile Memory for Operating System and Application Software (hard disk drives will not be used for this purpose). The primary copy of dynamic data registers, status flags, ticket text, fare tables, event records, etc. will be stored on the Non-Volatile Memory. Capacity will exceed current storage needs by at least 200 percent.	CDRL 11-6

Req. #	Requirement	Assigned CDRL(s)
11.9.1-4	An NFPS Interface for removable read/write storage media as required for Software upgrades and Data transfers.	CDRL 11-6
11.9.1-5	An NFPS Interface for the removable SSMM described in Technical Specifications Section 11.9.3 (Removable Solid State Memory Module (SSMM)).	CDRL 11-6
11.9.1-6	Additional (unused) communication ports, minimum of two, or the ability to communicate with at least two additional internal modules without requiring additional ECU Hardware.	CDRL 11-6
11.9.1-7	Ethernet (minimum 100 Mbps) and other communications interfaces as required to support external communications.	CDRL 11-6
11.9.1-8	A “watchdog” timer circuit that automatically initiates an orderly Operating System restart (i.e., a system shutdown and reboot) in the event of a Software-induced Failure such as a total suspension of all activities.	CDRL 11-6
11.9.1-9	If applicable, components as necessary to support the Voice Messaging System described in Technical Specifications Section 11.13 (Voice Messaging System).	CDRL 11-6

11.9.2 Data Memory

Req. #	Requirement	Assigned CDRL(s)
11.9.2-1	The ECU will contain programmable memory to contain all station names or machine locations, service parameters, all types of tickets and transactions, machine operating parameters and fare tables.	CDRL 11-6
11.9.2-2	The ECU will provide Non-Volatile Memory for accounting, registration and event Data; the contents of these registers will be updated with each transaction or event.	CDRL 11-6
11.9.2-3	All sales, status and event Data will be successively and safely registered, even if a power Failure occurs.	CDRL 11-6
11.9.2-4	An alternate means of removing Data from the CVM and WVM will be provided for instances where there is a Failure of the device to transmit Data to the NFPS Backend for any reason.	CDRL 11-6

11.9.3 Removable Solid State Memory Module (SSMM)

Req. #	Requirement	Assigned CDRL(s)
11.9.3-1	All dynamic data that is unique to each device, including configuration, register, status and event Data recorded in the ECU Non-Volatile Memory, will be duplicated in a removable SSMM.	CDRL 11-6
11.9.3-2	In the event that the ECU or the primary Non-Volatile Memory becomes inoperative and will be replaced, Data from the SSMM will be copied to the new primary Non-Volatile Memory before the device returns to service.	CDRL 11-6

Req. #	Requirement	Assigned CDRL(s)
11.9.3-3	The SSMM will use Non-Volatile Memory and store Data required to reactivate a machine to its previous working state without further Data entry. Configuration and other information that is generic to all machines may be stored on the SSMM or may be retrieved by the device from the NFPS Backend upon re-initialization. Alternate methods of retrieving this Data will be provided for times when the NFPS Backend or data network are inoperable.	CDRL 11-6
11.9.3-4	The SSMM will be readily accessible and easily exchanged without the use of tools.	CDRL 11-6
11.9.3-5	When an ECU (or primary Non-Volatile Memory) is replaced, the removable SSMM from the faulty ECU will be installed in the new ECU (see req. # 11.9.3-2).	CDRL 11-6
11.9.3-6	The SSMM will be capable of storing all machine dynamic data, and its capacity will exceed current storage needs by at least 200 percent.	CDRL 11-6
11.9.3-7	The SSMM will use flash memory or other similar non-volatile RAM technology requiring no battery.	CDRL 11-6
11.9.3-8	Data in the SSMM will be updated concurrently with the Non-Volatile Memory internal to the ECU; no queuing of updates to the SSMM is permitted. Data in the SSMM will at all times (to the extent possible due to hardware limitations) be identical to the ECU's primary Non-Volatile Memory.	CDRL 11-6
11.9.3-9	The contents of the ECU's primary Non-Volatile Memory will be compared at least once per day to the contents in the SSMM. In addition, this comparison will be made each time a machine is placed into operation. Any discrepancies in this comparison will result in an SSMM Failure event being recorded by the device and reported to the NFPS Backend.	CDRL 11-6
11.9.3-10	The machine will require a properly installed and functioning SSMM to enter service.	CDRL 11-6
11.9.3-11	The SI shall submit a description of the ECU replacement process for the MTA's review and approval.	CDRL 11-6

11.9.4 ECU Clock

Req. #	Requirement	Assigned CDRL(s)
11.9.4-1	Each ECU will contain its own real-time electronic clock, which will be used to generate time signals and maintain an accurate and current record of year, month, day, date and time (in the Eastern time zone).	CDRL 11-6
11.9.4-2	Without manual input or communications from the NFPS Backend, the device clock will automatically adjust for changeovers between standard and daylight savings time and account for leap years. Daylight savings time start and end dates will be programmed in a format easily altered by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 11-6
11.9.4-3	The ECU clock will maintain accuracy while the device is shut down.	CDRL 11-6

Req. #	Requirement	Assigned CDRL(s)
11.9.4-4	If the ECU clock utilizes an internal battery, the machine will indicate the need to replace the battery prior to the end of battery life, but if such indication is not available, the device maintenance manual will clearly identify the battery's recommended replacement interval.	CDRL 11-6
11.9.4-5	The machine will provide a service command to enable an authorized technician to manually set the ECU clock.	CDRL 11-6
11.9.4-6	The ECU clock will be synchronized by remote communication from the NFPS Backend, no less than once per day. The machine will also request clock synchronization from the NFPS Backend each time the device is powered up and/or initialized.	CDRL 11-6
11.9.4-7	The ECU clock will synchronize with the NFPS Backend clock described in Technical Specifications Section 21.2 (Device Monitoring System) with sufficient frequency to be kept within five (5) seconds of the time reported by the NFPS Backend clock. If the ECU clock indicates a time more than 30 seconds different from the time as reported by the NFPS Backend, the device will generate, record and transmit to the NFPS Backend a clock warning event.	CDRL 11-6

11.10 Machine Software

11.10.1 Machine Operating System Software

Req. #	Requirement	Assigned CDRL(s)
11.10.1-1	The machine will employ a current version of COTS Operating System Software as approved by the MTA. The machine Operating System will be capable of performing all tasks necessary to support the machine and its Application Software, including the ability to perform multiple tasks concurrently and communicate with the NFPS Backend.	CDRL 11-6
11.10.1-2	Upon issuing a command from the internal maintenance keyboard, the ECU Operating System will perform an orderly shutdown (preserving all file and data integrity) and restart. It will not be necessary to cycle power to restart the ECU.	CDRL 11-6

11.10.2 Machine Application Software

Req. #	Requirement	Assigned CDRL(s)
11.10.2-1	Machine Application Software will consist of Software code that operates on the ECU for control and supervision of machine functions. The Software will be compliant with Technical Specifications Section 5.12 (NFPS Software Requirements).	CDRL 11-6
11.10.2-2	In the event the module fails to transmit a "heartbeat" message, the master Software module will reinitialize (i.e., restart) the Software module. Should the Software module fail to reinitialize, the master Software module will cause the machine to perform an orderly shutdown and reboot after any transactions in progress have been completed.	CDRL 11-6

Req. #	Requirement	Assigned CDRL(s)
11.10.2-3	The SI shall submit a description of the machine Application Software, depicting all functions and transaction flows, for the MTA's review and approval.	CDRL 11-6
11.10.2-4	The SI shall submit a complete listing of all variable operational parameters for the machine for the MTA's review and approval.	CDRL 11-6

11.10.3 Fare Tables

Req. #	Requirement	Assigned CDRL(s)
11.10.3-1	The machine Application Software will be designed to accommodate the NFPS Agencies' existing fare structure and other fare policies defined in Technical Specifications Section 7 (Fare Policies).	CDRL 11-6
11.10.3-2	When new fare tables are created on the NFPS Backend, it will be possible to download them from the NFPS Backend to the machines via the data communications link. New fare tables will also be transferable onto an SSMM or other removable storage media.	CDRL 11-6
11.10.3-3	Once fare tables are downloaded into the machine, the new fare table will be activated automatically in the machine at the specified date/time as programmed by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 11-6

11.11 Machine Screen Flow

Req. #	Requirement	Assigned CDRL(s)
11.11-1	The progression of screens presented to the patron during transactions will be logical and straightforward.	CDRL 11-8
11.11-2	The SI shall provide detailed screen flows depicting "snapshots" of each screen layout arranged as a logical flow chart for the MTA's review and approval. The flow charts will depict the screen flows for the machines as they will be configured for revenue service. Machine screen flows, including all content and operation, will be modifiable by each NFPS Agency (on an NFPS Agency-specific basis), and will also be configurable by machine type and individual machine location.	CDRL 11-8

11.12 Multi-Lingual Capabilities

Req. #	Requirement	Assigned CDRL(s)
11.12-1	English will be the default language while a machine is in idle mode and will return to English after a transaction is completed or cancelled (by pressing the CANCEL button).	CDRL 11-7
11.12-2	The machine will include one or more selection buttons or touch regions to toggle the display and the Voice Messaging System between English and up to 14 other available languages (see Technical Specifications Section 5.10 (Aesthetic Requirements and User Interfaces)).	CDRL 11-7

Req. #	Requirement	Assigned CDRL(s)
11.12-3	The alternate language button(s) or region(s) will be active at all times while the machine is in service. Pressing an alternate language button or touch screen region at any time while the device is in the idle condition, and at any time during a transaction, will cause the device to switch displayed and audio messages to the selected language.	CDRL 11-7

11.13 Voice Messaging System

Req. #	Requirement	Assigned CDRL(s)
11.13-1	On demand of the patron, the device will provide audible voice instructions and will function to meet all ADA and Title VI requirements, including multiple languages designated in Technical Specifications Section 5.10 (Aesthetic Requirements and User Interfaces).	CDRL 11-7
11.13-2	The Voice Messaging System, as defined in this Technical Specifications Section 11.13 (Voice Messaging System), will utilize human recorded speech or digitally synthesized speech. If digitally synthesized speech is used, it will approximate human speech.	CDRL 11-7
11.13-3	The Voice Messaging System will provide context-sensitive voice messages, in audio form, conveying information shown on the device Patron Display with adjustable volume.	CDRL 11-7
11.13-4	Each variable message will occur as close as possible to the event or change in transaction status as possible, and be as brief as possible to convey the necessary information.	CDRL 11-7
11.13-5	No additional moving parts will be required to play back the recorded information.	CDRL 11-7
11.13-6	The device will provide a standard jack for headphone use in addition to an internally-mounted vandal-resistant speaker. Whenever headphones are plugged into the jack, the external speaker will be disabled, and all tones and messages will be directed to the headphone jack.	CDRL 11-7
11.13-7	If the machine is in the idle state when the VOICE button is pressed, the Voice Messaging System will produce a brief introductory instruction message in the currently selected language.	CDRL 11-7
11.13-8	If the machine is not in the idle state when the VOICE button is pressed, the Voice Messaging System will produce the message for the current screen in the currently selected language.	CDRL 11-7
11.13-9	As cash is inserted, the Voice Messaging System will produce audio messages to indicate the value remaining to be deposited for the selected transaction.	CDRL 11-7
11.13-10	After the VOICE button is pushed, the device will convey all necessary messages to aid the visually impaired in completion of a transaction. The messages will be reviewed and approved by the MTA during design review.	CDRL 11-7

Req. #	Requirement	Assigned CDRL(s)
11.13-11	Upon cancellation of a transaction in progress (i.e., by pressing the CANCEL button), a "Transaction Canceled" message will be played and the Voice Messaging System will turn off.	CDRL 11-7
11.13-12	When a transaction is completed and the device returns to the idle state, the Voice Messaging System will turn off.	CDRL 11-7
11.13-13	The SI shall submit a conceptual description of Voice Messaging System Hardware and operation for the MTA's review and approval.	CDRL 11-7
11.13-14	The SI shall submit content of all voice messages for the MTA's review and approval.	CDRL 11-7

11.14 Common Machine Requirements Required Submittals

The required submittals specified in this Technical Specifications Section 11 (Common Machine Requirements) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 11-1	General and Security Requirements for Machines	Sections 11.1 to 11.4	✓	✓	✓	
CDRL 11-2	Machine Coin Handling	Section 11.5	✓	✓	✓	
CDRL 11-3	Machine Bank Card Handling	Section 11.6	✓	✓	✓	
CDRL 11-4	Receipt Printers	Section 11.7	✓	✓	✓	
CDRL 11-5	LU/Paper Media Dispensers	Section 11.8	✓	✓	✓	
CDRL 11-6	ECU and Machine Software	Sections 11.9, 11.10	✓	✓	✓	
CDRL 11-7	Common Machine Interfaces	Sections 11.12, 11.13	✓	✓	✓	
CDRL 11-8	Machine Screen Flows	Section 11.11	✓	✓	✓	

12 Common Validator Requirements

NFPS Validators are the customer facing devices used to pay fares onboard buses, at SBS bus stops (wayside) and in subway Faregates. Unless otherwise stated, the following requirements apply to all NFPS Validators. All NFPS Validators will contain an ISO/IEC 14443-compliant Contactless Reader/writer, a display screen, multi-colored lamps and speakers to convey transaction results and other required user interfaces. There is a preference for the use of a COTS payment reader module within the NFPS Validators, including manufacturer- and/or acquirer-developed firmware, and a configurable, brand-certified payment (i.e., PCI-DSS & EMV) kernel.

Each NFPS Validator will be similar in form and function in order to provide a common customer experience across all modes to the greatest extent possible, with identical customer facing units as the preferred approach.

The SI shall leverage Legacy Equipment to the greatest extent possible. Other NFPS Validator components, such as the wireless communications Hardware (Wi-Fi and/or cellular), GPS, microprocessor control, Non-Volatile Memory (for lists and configuration parameters), and power supplies, will be included as necessary and as determined during design review.

12.1 General Validator Requirements

Req. #	Requirement	Assigned CDRL(s)
12.1-1	The SI shall use COTS Equipment that conforms to Open Standards and Open Architecture to the greatest extent possible for NFPS Validators (see Technical Specifications Section 5.4 (Open Technology)).	CDRL 12-1
12.1-2	If NFPS Validators are purchased from a Third Party, the SI shall deliver the latest generation device manufactured by the OEM. If a newer generation NFPS Validator is released after design review, but prior to device procurement, then the MTA will have the option to upgrade to the newer device at no cost to the MTA Group, and the SI shall be solely responsible for any additional costs associated with upgrading to the newer NFPS Validator.	CDRL 12-1
12.1-3	NFPS Validators will receive date/time synchronization from the NFPS Backend at start up. Additionally, NFPS Validators will synchronize date/time throughout the business day as defined during design review.	CDRL 12-1
12.1-4	NFPS Validators will support all common ISO-14443 (Type A and B), ISO 18092 (NFC), EMV, and Closed-Loop (e.g., the entire MIFARE Fare Product line) Media formats and all formats defined in Technical Specifications Section 8 (Media Types). Expansion for the acceptance of user-defined formats may occur during design review.	CDRL 12-1
12.1-5	NFPS Validators will satisfy all general design, security and performance requirements in Technical Specifications Section 5 (General Design Requirements) and elsewhere herein.	CDRL 12-1
12.1-6	NFPS Validators will be able to accept fare payments in an offline mode. Risk Mitigation strategies will be employed to limit exposure for declined payments (see Technical Specifications Section 6.1.4 (Risk Mitigation Techniques)).	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.1-7	NFPS Validators will provide no indication to the customer when they are operating in an offline mode.	CDRL 12-1
12.1-8	Installation of the NFPS Validator will optimize operator and passenger ergonomics and ADA requirements specified in Technical Specifications Section 5 (General Design Requirements). Installation placement will be subject to the MTA's review and approval.	CDRL 12-1
12.1-9	NFPS Validators will be designed with a minimum of two spare USB ports. One port will allow a laptop with appropriate Software, direct connection to obtain NFPS Data that cannot be extracted due to NFPS Validator component Failure. Additional ports will support the future connection of ancillary devices such as a barcode reader or SAM modules.	CDRL 12-1
12.1-10	In addition to having a Contactless Reader, all NFPS Validators will support BLE communications through an integrated Bluetooth radio that may be used to accept payment or for other related functions. The specific uses of BLE communications will be determined during design review.	CDRL 12-1

12.2 Validator Functional Requirements

12.2.1 Configurability

Req. #	Requirement	Assigned CDRL(s)
12.2.1-1	The NFPS Validator will support configurability through adjustable parameters as defined herein, via the NFPS Backend (see Technical Specifications Section 20 (NFPS Backend)).	CDRL 12-1
12.2.1-2	NFPS Validator Software design will allow for accepted Media, including NFPS Agency-defined formats, to be enabled and disabled via the parameters that are configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 12-1
12.2.1-3	NFPS Validators will be remotely configurable and managed through a Device Monitoring System, as described in Technical Specifications Section 21.2 (Device Monitoring System). NFPS Validator Software and configuration, including all applicable Positive Lists and Negative Lists (see Technical Specifications Section 10.1.1 (Open Payment Media)) will be managed through the NFPS.	CDRL 12-1
12.2.1-4	The SI shall submit comprehensive Documentation describing the configurability of the NFPS Validators, including a listing of all configurable parameters.	CDRL 12-1

12.2.2 Fare Tables

Req. #	Requirement	Assigned CDRL(s)
12.2.2-1	The SI shall propose and describe the use of local device fare tables or equivalent fare configuration files if they prove necessary for timely and efficient processing of Media.	CDRL 12-2

Req. #	Requirement	Assigned CDRL(s)
12.2.2-2	If local fare tables are used, the NFPS Validators will store a minimum of three (3) complete fare tables. One fare table will be the current active table; other future tables will include a date and time at which each additional table is to become active.	CDRL 12-2
12.2.2-3	Fare tables will be highly configurable by each NFPS Agency, on an NFPS Agency-specific basis, and will include support for all fare policies and pricing structures defined herein (see Technical Specifications Section 7 (Fare Policies)) and the NFPS Agencies' other policies and operations.	CDRL 12-2
12.2.2-4	The SI shall submit comprehensive Documentation describing the configurability of the fare tables and their function.	CDRL 12-2

12.2.3 Transaction Records and Storage

Req. #	Requirement	Assigned CDRL(s)
12.2.3-1	NFPS Validators will generate and store a discrete data record for each transaction performed.	CDRL 12-1
12.2.3-2	Each transaction record will be unique within the NFPS and will include the following information, at a minimum: <ul style="list-style-type: none"> • Date and time of transaction • Device ID • Vehicle or Location (bus stop or subway fare control area) ID • Operator ID (if applicable) • Route number (if applicable) • Block number (if applicable) • Vehicle location, if applicable (most recent GPS coordinates) • Media Type ID • Transit Account number • Third Party account number (if applicable) • Fare Product type • Action performed • Transaction value • Transaction number (unique per day per NFPS Validator) • Sequence number • Direction ID Transaction records details will be finalized during design reviews.	CDRL 12-1
12.2.3-3	NFPS Validators will include sufficient embedded storage to hold at least thirty (30) days of fare payment transactions, and all Risk Mitigation lists as determined during design review.	CDRL 12-1
12.2.3-4	NFPS Validators will support expandable storage in a common, commercially available format (e.g., compact flash, secure digital, etc.) that can be quickly and easily swapped or expanded without modification to the rest of the device components.	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.2.3-5	An alternate means of removing data from the NFPS Validator shall be provided for instances where there is a Failure of the wired or wireless communication or power supply.	CDRL 12-1

12.2.4 Audit Registers

All NFPS Validators will provide audit register counts for purposes of data tracking and analysis. The audit registers will store counts of specific events and cannot be modified or erased, unless by maintenance intervention, and will be stored in Non-Volatile Memory.

Req. #	Requirement	Assigned CDRL(s)
12.2.4-1	NFPS Validators will maintain local Data records in Non-Volatile Memory in the event that communications to the NFPS Backend is unavailable. The local records will only be removed when verification of database storage of each record is received from the NFPS Backend.	CDRL 12-1
12.2.4-2	<p>The audit registers will maintain counts of each event below as applicable. At minimum, each NFPS Validator will generate, store and forward to the NFPS Backend a record for each of the following events:</p> <ul style="list-style-type: none"> • Power on counts • Power on self-test result • Operator login/logout • Maintenance parameter changed • Route changed • Default fare or service level changed • Communication between the NFPS Backend and NFPS Validator failed or restored • New downloaded list(s) received and/or activated • New fare table version received and/or activated • New Software version received and/or activated • New configuration data received and/or activated • Internal clock reset • Data memory nearing capacity or full • NFPS Validator unscheduled reset • Taps of cards by Media type (EU, LU, Open Payment, NFC, etc.) • Count of device approved and denied transactions • Count of limited approved and denied transactions • Count of NFPS Backend approved and denied transactions • Count of read Failures <p>Final device events will be determined during design reviews.</p>	CDRL 12-1
12.2.4-3	NFPS Validators will have capacity to store a minimum of 1,000 audit records. Configuration control parameters will have the ability to temporarily disable audit registers at the discretion of each NFPS Agency's staff, on an NFPS Agency-specific basis.	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.2.4-4	Audit Register records will be transmitted and stored in the NFPS Backend every hour initially. The transmit period will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 12-1

12.2.5 Event Records

As part of the Device Monitoring System (see Technical Specifications Section 21.2 (Device Monitoring System)), the NFPS Validators will provide real-time status of device Errors and events. The NFPS Validator will also maintain local event and error logs in the event that communications to the NFPS Backend is unavailable.

Req. #	Requirement	Assigned CDRL(s)
12.2.5-1	<p>At a minimum, the NFPS Validator will generate, store and forward to the NFPS Backend an event record for each of the following events with their corresponding date/time:</p> <ul style="list-style-type: none"> • Power on • Power on self-test result • Power off • Operator login and logout, including Operator ID • Maintenance parameter changed, including parameter and new value • Route changed, including new route number • Default fare or service level changed, including new fare set • End of transit business day • Communication between the NFPS Backend and NFPS Validator failed or restored • New downloaded list(s) received, including type and version number • New downloaded list(s) activated, including date/time of activation, list type, and version number • New fare table received, including version number • New fare table version activated, including date/time of activation and version number • New Software version received, including version number • New Software activated, including date/time and version number • New configuration data received, including version number • New configuration data activated, including date/time and version number • Internal clock reset for a time discrepancy greater than 1 minute • Data memory near full (data near full percentage will be configurable) • Data memory full • NFPS Validator unscheduled reset <p>Other event records will be determined during design reviews.</p>	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.2.5-2	Each event record will include, at minimum: <ul style="list-style-type: none"> • Date and time of event • Event record data (as defined above) • Device ID • Fare control area or wayside bus stop ID (if applicable) • Vehicle ID (if applicable) • Operator ID (if applicable) • Route number (if applicable) • Block number (if applicable) • Vehicle location (most recent GPS coordinates) Other event record content will be determined during design reviews.	CDRL 12-1
12.2.5-3	Duration of device stored event records will be configurable. The NFPS Validator will have capacity to store a minimum of 1,000 event records. Configuration control parameters will have the ability to turn off recording of events at the discretion of each NFPS Agency's staff, on an NFPS Agency-specific basis.	CDRL 12-1

12.2.6 Downloadable Lists

Req. #	Requirement	Assigned CDRL(s)
12.2.6-1	The NFPS Validator will be able to receive multiple account lists from the NFPS Backend, including Negative Lists and Positive Lists. These lists will be updated at regular configurable intervals and as defined in Technical Specifications Section 10.2 (Account Lists).	CDRL 12-1
12.2.6-2	If supported by the payment entities, bank cards will be compared to the Negative Lists stored by the payment entities to limit the MTA Group's exposure to fraud; the NFPS Backend will store the results of any denied authorization requests.	CDRL 12-1
12.2.6-3	The SI shall submit a complete description of the downloaded lists (including content and format, capacity, and the procedures employed to update the lists) to the MTA for review and approval.	CDRL 12-1

12.2.7 Data Integrity

Req. #	Requirement	Assigned CDRL(s)
12.2.7-1	All NFPS Validator transactions, audit records, events, fare tables, downloaded lists, configuration and Software Application data memory will be Non-Volatile Memory.	CDRL 12-1
12.2.7-2	NFPS Validators will retain transaction and event records in its Non-Volatile Memory until notified that the NFPS Backend has successfully received and stored the records in the NFPS databases.	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.2.7-3	NFPS Validators will generate an alarm through the device monitoring system (see Technical Specifications Section 21.2 (Device Monitoring System)) and provide a local visual indication if a Failure of either the primary or backup data storage occurs.	CDRL 12-1

12.2.8 Software and Configuration Updates

Req. #	Requirement	Assigned CDRL(s)
12.2.8-1	NFPS Validator Software and configuration Updates will be remotely managed from the NFPS Backend. All Software general requirements in Technical Specifications Section 5.12 (NFPS Software Requirements) will be followed.	CDRL 12-1
12.2.8-2	Each Update will have a unique version number and include an effective date and time if applicable and as decided during design review.	CDRL 12-1
12.2.8-3	NFPS Validators will activate Updates as soon as possible or according to effective dates as configured and controlled by the NFPS Backend.	CDRL 12-1
12.2.8-4	The download process will in no way cause Data or file corruption if communications are lost with the NFPS Backend. The process will recover from such loss and complete the download without memory loss or leaks at the NFPS Validator.	CDRL 12-1
12.2.8-5	Remote configuration procedures will include the ability to remotely update EMV processing configuration parameters from the NFPS Backend.	CDRL 12-1
12.2.8-6	The SI shall submit a detailed description of the process for updating NFPS Validator Software and configurations to the MTA for review.	CDRL 12-1

12.2.9 PCI and EMV Compliance

Req. #	Requirement	Assigned CDRL(s)
12.2.9-1	All NFPS Validators will follow the data security requirements in Technical Specifications Section 5.7 (System Security), in addition to the requirements listed in this Technical Specifications Section 12 (Common Validator Requirements) and will support Tokenization and encryption as outlined in Technical Specifications Section 21.7.3 (Tokenization).	CDRL 12-1
12.2.9-2	NFPS Validators will be PCI certified for the acceptance of bank-issued Contactless Smart Cards using all common formats.	CDRL 12-1
12.2.9-3	All NFPS Validators will support payment using any Contactless EMV Cards.	CDRL 12-1

12.3 Validator Patron Interface

Req. #	Requirement	Assigned CDRL(s)
12.3-1	NFPS Validators will include full color displays that support adjustable brightness, contrast, and refresh rate that can be easily read under any combination of ambient lighting, including direct sunlight and night-time operation.	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.3-2	NFPS Validator color displays may be separate from or integrated with the Contactless Reader. In either case, the tap area will be easily identified and reachable by patrons.	CDRL 12-1
12.3-3	The NFPS Validator display will be capable of displaying partial or full video or animation as required by each NFPS Agency, on an NFPS Agency-specific basis. The animations may be used to indicate fare feedback, relevant patron action or other general information deemed appropriate by each applicable NFPS Agency. Video or animation files shall be capable of being replaced remotely, or installed via removable memory by maintenance staff.	CDRL 12-1
12.3-4	NFPS Validators will include at least three (3) multicolor LED indicator lights that can be configured to provide feedback on payment and device status.	CDRL 12-1
12.3-5	NFPS Validators will include an audio interface and speakers for customizable audio feedback, including varying tones, volume and full speech. Audio files shall be capable of being replaced remotely, or installed via removable memory by maintenance staff.	CDRL 12-1
12.3-6	NFPS Validators will be able to display low account balance information. This will be configurable by each NFPS Agency, on an NFPS Agency-specific basis, for balance floor value and there will be an ON/OFF parameter for enabling/disabling the feature.	CDRL 12-1
12.3-7	The visual and audio interfaces will provide visual and audible feedback on fare payment and device status that meets all ADA and Title VI requirements.	CDRL 12-1
12.3-8	All NFPS Validator visual and audio output will be fully configurable and subject to the MTA's review and approval during design review.	CDRL 12-1

12.4 Validator Operations

Req. #	Requirement	Assigned CDRL(s)
12.4-1	The NFPS Validator will have no external power switch.	CDRL 12-1
12.4-2	After successful power on, the NFPS Validators will automatically and continuously poll for all supported Media formats.	CDRL 12-1
12.4-3	To the extent possible, internal diagnostic programs will check the NFPS Validator for proper performance while the device is operating. The malfunction detection will cover at least Failure of power or control circuitry, and any NFPS Validator Failure that could result in a false, incomplete or corrupted reading or encoding of a Fare Product.	CDRL 12-1
12.4-4	When a Failure is detected that causes the NFPS Validator to cease functioning or cause transactions to fail, the NFPS Validator will go out of service and provide visual indication on the appropriate displays. The detected defect will be recorded as an event record.	CDRL 12-1

Req. #	Requirement	Assigned CDRL(s)
12.4-5	NFPS Validators will display one or more pages for maintenance and configuration purposes when an operator with maintenance privileges logs in to the unit. The method and operator interface design used to perform maintenance functions will be determined during design review.	CDRL 12-1
12.4-6	Prior to powering down, NFPS Validators will generate and store an event record and perform all necessary steps to retain integrity of all stored Data.	CDRL 12-1

12.5 Validator Finish and Mounting

Req. #	Requirement	Assigned CDRL(s)
12.5-1	NFPS Validators will be rugged and function under potentially extended severe environmental conditions including: direct sunlight, dust/grit/sand, humidity, electrical storms, exposure to urban environment, power washing and the range of elevations and altitudes in the operating region (see Technical Specifications Section 5.6 (Environmental Conditions) for operating environment requirements). Enclosures will comply with EN60529 (1992) IP54 standards.	CDRL 12-1
12.5-2	NFPS Validator housing will be resistant to corrosion, abrasion, scratching, impacts and vandalism. NFPS Validator housing color and finish will be such that it minimizes reflection and is highly resistant to fading, cracking and peeling.	CDRL 12-1
12.5-3	All NFPS Validator corners will be rounded, and there will be no exposed bolt heads, nuts, sharp edges or cracks on outside surfaces.	CDRL 12-1
12.5-4	NFPS Validator displays will be flush mounted in the housing.	CDRL 12-1
12.5-5	Covers on the NFPS Validator housing for accessing modules and subassemblies will be secured with mechanical locks and keys that are not readily duplicated, nor readily available to the public and uniquely serialized and stamped "Do Not Duplicate."	CDRL 12-1
12.5-6	All required mounting hardware and brackets will be provided by the SI.	CDRL 12-1
12.5-7	NFPS Validator design and mounting will meet all applicable Title VI and ADA requirements.	CDRL 12-1
12.5-8	A sample of each NFPS Validator configuration and its mounting will be demonstrated for each vehicle and platform type as part of final design review.	CDRL 12-1
12.5-9	NFPS Validator design, appearance and styling, and mounting will be subject to the MTA's review and approval as part of design review.	CDRL 12-1

12.6 Common Validator Requirements Required Submittals

The required submittals specified in this Technical Specifications Section 12 (Common Validator Requirements) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 12-1	NFPS Validator Configuration and Control	Section 12	✓	✓	✓	
CDRL 12-2	Fare table Configuration and Control	Section 12	✓	✓	✓	

13 Bus Validators

13.1 General

The SI shall provide a Bus Validator (BV) that is the same throughout the entire bus fleet. Each Bus Validator will be identical with regard to the reader, color schemes, appearance, and other ergonomic and user interface features. The BV shall contain ISO 14443/18092 compliant read/write antenna circuits, a suitable display screen, simple multi-colored lamps to convey transaction results, audio transducers and other required user interfaces. The BV will not be integrated with the existing integrated farebox unit (IFU) currently on all buses.

The BV will interface to an existing Vehicle Logic Unit/Transit Control Head (VLU/TCH) used under the Bus Radio System (BRS). This interface will use standard open messages and protocols. The VLU/TCH will provide the appropriate logon information described herein. The BV will accept the VLU/TCH messages and go into service. The BV will send the appropriate fare payment information to the VLU/TCH for display. The BV will be part of the onboard single sign-on required for all bus onboard systems. The SI shall be responsible for developing the necessary VLU/TCH Software for communication with the BV.

Other elements of the BV, such as the wireless data communications Hardware (Wi Fi and/or cellular broadband), GPS, microprocessor control, Non-Volatile Memory for Transaction Data, configuration parameters, and dynamic Data (such as Negative Lists), power supplies, etc., shall be included in each BV as necessary and as decided during design review. These elements will be defined as appropriate within this Technical Specifications Section 13 (Bus Validators).

13.1.1 Description

Req. #	Requirement	Assigned CDRL(s)
13.1.1-1	The SI shall provide and install a BV and associated components in support of payment processing of NFPS Media.	CDRL 13-1
13.1.1-2	The BV will include an integrated Electronic Control Unit (ECU) which will control all aspects of the BV components including the ISO reader and will interface with the VLU/TCH. The ECU will be responsible for all file processing, fare tables, transaction processing and memory storage. All downloadable parameters, lists, tables and other operational Data will be stored on the ECU.	CDRL 13-1
13.1.1-3	The ECU will employ current, COTS multi-tasking Operating System Software. The Operating System will be capable of performing all tasks necessary to support the BV and associated components and applications. The ECU will have the ability to perform multiple tasks concurrently and communicate with the NFPS Backend.	CDRL 13-1
13.1.1-4	The SI shall furnish each of the MTA, NYCT, and MTA Bus Company with all Hardware, Software, cabling and other supporting equipment capable of processing all fares (as further set out in Technical Specifications Section 7 (Fare Policies)) based on the respective Business Rules of each of such agencies.	CDRL 13-1

Req. #	Requirement	Assigned CDRL(s)
13.1.1-5	The BV components will include the flexibility to ensure that each of the MTA, NYCT, and MTA Bus Company can configure such BV components, on an agency-specific basis, to accommodate future modifications in fare policies without Software modifications from the SI. All fare policy modifications, if any, will be made by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, through Software parameter configuration changes. All configuration and modifications will be performed at the NFPS Backend, and downloadable from the NFPS Backend.	CDRL 13-1
13.1.1-6	The BV will receive geo-location Data from the existing MTA Bus Time processor units. The SI shall ensure integration with the Bus Time units for this function. The proposed solution cannot degrade nor otherwise impair the performance of either the NFPS, Bus Time or any other systems.	CDRL 13-1
13.1.1-7	The onboard BV design, including operating functionality, dimensions and mounting options for all bus types, is subject to the MTA's review and approval.	CDRL 13-1
13.1.1-8	The BV components will be designed, built and installed for the harsh, extreme shock and vibration operating environment in which the BV will operate.	CDRL 13-1
13.1.1-9	The BV components will be protected to prevent degradation from exposure to moisture or dust raised by interior cleaning.	CDRL 13-1
13.1.1-10	Normal operation of the BV in the bus environment will not in any way impair equipment performance or operational life.	CDRL 13-1

13.1.2 Installation Design

Req. #	Requirement	Assigned CDRL(s)
13.1.2-1	The BV will be installed on each bus such that the reader will be in proximity to the front door and will be positioned so that a customer may easily present the NFPS Media for payment upon boarding the bus.	CDRL 13-1
13.1.2-2	When installed, the BV will not obstruct the operator's view out the vehicle windows, and will not cause glare on the windshield during bright sun conditions or at night with the vehicle interior lights off.	CDRL 13-1
13.1.2-3	The SI shall securely mount the BV and components using stainless steel Hardware in a location and manner that is safe for customers, Bus Operators and other personnel.	CDRL 13-1
13.1.2-4	Mounting will be compliant with ADA requirements and will be approved by the MTA.	CDRL 13-1
13.1.2-5	Mounting will not interfere with maintenance of other onboard bus systems, components, or displays and will be approved, for all bus types, by the MTA.	CDRL 13-1

Req. #	Requirement	Assigned CDRL(s)
13.1.2-6	The BV components will receive power from the 12 or 24 VDC batteries existing on the buses through a circuit breaker assigned to the BV. No external convertors or conditioning circuits will be required to permit the BV to operate on the battery circuits.	CDRL 13-1
13.1.2-7	All BV components, cabling, installation methods and mounting will be prototyped on each bus type operated by the MTA, NYCT, and MTA Bus Company, and subject to written approval by the MTA before installation can proceed.	CDRL 13-1

13.2 Enclosure

Req. #	Requirement	Assigned CDRL(s)
13.2-1	The BV will be fabricated in such a manner as to ensure durability of housings for at least the required Design Life.	CDRL 13-1
13.2-2	All BVs will be manufactured to resist intrusion by foreign objects and moisture of any kind. Moisture seals on all BV components, wiring harnesses, connectors and cables will prevent water intrusion into the BV enclosure.	CDRL 13-1
13.2-3	All exterior finishes will resist abrasion, scratching and corrosion and will be free of sharp edges, welding marks or other projections that could result in injury.	CDRL 13-1

13.3 Onboard Bus Systems Integration

Req. #	Requirement	Assigned CDRL(s)
13.3-1	Single sign-on will enable the logon/logoff and other Data, including operator ID, block, route, trip, service, fare level and direction to be captured by the other onboard bus systems as required and stored for use in NFPS transactions using Open Standard interfaces, including: <ul style="list-style-type: none"> • EIA-232/422 • RS-435 • J1708/1587 • 10/100 Base-T wired Ethernet • Bluetooth • USB 	CDRL 13-4
13.3-2	The BV will be able to accept appropriate logon/logoff data from the VLU/TCH using the Open Standard interfaces stipulated above in req. # 13.3-1.	CDRL 13-4
13.3-3	The BV will send the VLU/TCH messages for display of fare payment information and other relevant Data as appropriate and as defined during design review.	CDRL 13-4
13.3-4	The BV will make use of an existing onboard modem or cellular router, which will serve as the secondary means of communication with the NFPS Backend.	CDRL 13-4

Req. #	Requirement	Assigned CDRL(s)
13.3-5	The SI shall provide detailed Interface Control Documentation detailing message formats and contents, procedures, interfaces and transport protocols used for the onboard systems integration effort.	CDRL 13-4

13.4 Operations

13.4.1 Power Up and Logon

Req. #	Requirement	Assigned CDRL(s)
13.4.1-1	The BV components will be available within three (3) minutes of engine on, and operational until a time after ignition off, configurable by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, subject to normal operating conditions.	CDRL 13-1
13.4.1-2	The BV will require a valid logon to function. The Bus Operator will be able to present an Employee ID card to the reader for purposes of tap logon. If the Bus Operator's card proves inoperative, the Bus Operator will be able to manually logon via the VLU/TCH.	CDRL 13-2
13.4.1-3	If the Employee ID card is accepted for valid logon, the BV will send a message to the VLU/TCH prompting the Bus Operator to enter a 4 digit PIN on the VLU/TCH.	CDRL 13-2
13.4.1-4	The BV will confirm the employee ID and PIN are valid based on a downloadable list configured, by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, and transmitted from the NFPS Backend.	CDRL 13-2

13.4.2 Service Parameters

Req. #	Requirement	Assigned CDRL(s)
13.4.2-1	The Bus Operator will be required to enter various parameters into the VLU/TCH prior to the BV entering service. At a minimum, these parameters may include block, run, route, direction, service and trip. Not all parameters may be used and therefore the parameters used will be configurable from the NFPS Backend by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis. The parameter sizes and restrictions will be determined during design review. The BV will accept these parameter messages from the VLU/TCH and go into service.	CDRL 13-2
13.4.2-2	The parameters will be menu selectable and the menu will be configurable by the personnel of each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, from the NFPS Backend. The menus will be based on downloadable lists from the NFPS Backend.	CDRL 13-2
13.4.2-3	Valid logon parameters will be stored in local lists and Bus Operator input will be validated against these lists for successful logon.	CDRL 13-2
13.4.2-4	The Bus Operator will be able to modify the service parameters without having to logoff.	CDRL 13-2

Req. #	Requirement	Assigned CDRL(s)
13.4.2-5	Each processed NFPS Media transaction record or message will include the service parameters in effect at the time of the transactions for purposes of transaction cataloging, tracking and reporting.	CDRL 13-1

13.4.3 Transaction Results Display

Req. #	Requirement	Assigned CDRL(s)
13.4.3-1	The BV and VLU/TCH will each have visual and audible indicators that provide distinctive messages for approval or denial of a payment transaction with NFPS Media.	CDRL 13-2
13.4.3-2	The displays will be clearly visible in all forms of ambient light on the bus and viewable at a minimum angle of 45 degrees from the display.	CDRL 13-2
13.4.3-3	The transaction result will include an NFPS Transit Account low balance indication. This display will be configurable by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, as an ON/OFF configuration parameter, set by downloadable configuration parameters from the NFPS Backend.	CDRL 13-2

13.4.4 Audio Feedback

Req. #	Requirement	Assigned CDRL(s)
13.4.4-1	The BV will emit audio tones to indicate the results of transaction processing. These tones will be ADA-compliant.	CDRL 13-2
13.4.4-2	A minimum of two (2) tones, each differentiated in pitch, is required to enable distinguishing of unique tones for approval and denial of NFPS Media.	CDRL 13-2
13.4.4-3	The decibel levels of the tones will be programmable locally and the emitted tones will be capable of being heard and distinguished at a minimum of eight (8) feet.	CDRL 13-2
13.4.4-4	At BV power up, the BV will emit both tones in sequence during device initialization as part of a self-diagnostic check.	CDRL 13-2

13.4.5 In-Service Operator Commands and Functions

Req. #	Requirement	Assigned CDRL(s)
13.4.5-1	The BV will accept a fare override function from a VLU/TCH message. The BV will flag the fare transaction so that it is priced at a reduced fare, even if a full fare Transit Account is being used for payment. The fare override function will be ON/OFF and rider class configurable from the NFPS Backend and will support both Open and Closed-Loop payments. The BV will restore to the default fare upon completion of the transaction.	CDRL 13-2
13.4.5-2	Requirement Removed	
13.4.5-3	Requirement Removed	

13.4.6 In-Service Operating Status Messages

Req. #	Requirement	Assigned CDRL(s)
13.4.6-1	The BV and VLU/TCH will provide messages indicating operating status clearly visible to the Bus Operator.	CDRL 13-2
13.4.6-2	The BV will display a “memory near full” message by percentage, where both the message and the percentage will be configurable by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis. When the BV reaches the configured percentage, it will sound a transient set of three (3) audio tones in sequence to signal this condition (see Technical Specifications Section 12.2.3 (Transaction Records and Storage)).	CDRL 13-2
13.4.6-3	Displays will indicate when the BV system is in communication with the NFPS Backend and when it establishes connection to the bus depot remote access point.	CDRL 13-2

13.4.7 Data Exchange

Req. #	Requirement	Assigned CDRL(s)
13.4.7-1	Whenever the BV installed on a bus of the MTA, NYCT, or MTA Bus Company is in range of the applicable bus depot remote wireless access point operated by the same agency that operates the bus, the BV will download, on an agency-specific basis, all downloadable lists that are more recent than those in the BV’s memory.	CDRL 13-1
13.4.7-2	The BV will only upload Transaction Data to the NFPS Backend via cellular data service, but non-transaction Data may be uploaded via wireless while at the bus depot. The BV will not require the Bus Operator or technician to login to initiate communications of any kind.	CDRL 13-1
13.4.7-3	Data exchange shall occur on an applicable agency-specific basis, and such exchange shall include the following at a minimum: <ul style="list-style-type: none"> • Uploading of all stored transactions, event records, and audit registers • Downloading of all configurable device parameter files and fare tables • Downloading of any and all local lists • Downloading of program/Software updates to the BV, ECU and VLU/TCH 	CDRL 13-1
13.4.7-4	When the bus engine is turned off, the BV will remain powered for a time, configurable by the MTA, NYCT, or MTA Bus Company, on an agency-specific basis, to allow completion of transmission of any and all Data files, transaction records and fare tables. If data transfer has not completed in the configured time, the BV will extend the time to allow completion. The audio transducers will emit a sequence of distinct tones to indicate that such extended communication is taking place.	CDRL 13-1

13.4.8 Maintenance Functions

Req. #	Requirement	Assigned CDRL(s)
13.4.8-1	The BV will monitor and record instances of power or voltage drops or losses that are below the minimum required for proper operation of the BV and components. These drops will be signaled by a visible indicator on	CDRL 13-3

Req. #	Requirement	Assigned CDRL(s)
	the BV.	
13.4.8-2	Self-diagnostics will check the proper operation of the BV and associated components after power on.	CDRL 13-3
13.4.8-3	Self-diagnostics will confirm communications integrity with other NFPS bus system components, and to the extent possible, exercise all external components. Any failures identified will be recorded in the BV's internal status registers and will result in event messages that will be transmitted to the Device Monitoring System of the applicable agency immediately.	CDRL 13-3
13.4.8-4	The BV will be capable of detecting that the bus engine is not running, and will begin an orderly shutdown after a period of time that is configurable by the MTA, NYCT, and MTA Bus Company, on an agency-specific basis (maximum of 60 minutes). This configuration parameter will be set and transmitted from the NFPS Backend, with such configuration parameter set by each of the MTA, NYCT, and MTA Bus Company, on an agency-specific basis. The BV will receive the ignition sense input and remain ON for this configurable time after ignition is turned OFF. The necessary components to implement this delay-on break timer will be internal to the BV.	CDRL 13-3
13.4.8-5	The SI shall provide a means for maintenance personnel to logon with permissions to perform maintenance on the BV, ECU and associated components. This logon will be completed through the normal service parameters screen using the Employee ID card of the maintenance person to signal the devices into maintenance mode. If the BV cannot read the employee ID card, a manual logon process will be available.	CDRL 13-3
13.4.8-6	Maintenance personnel logon ID will be part of the downloadable Operator ID table with a distinct code or element to distinguish a maintenance logon.	CDRL 13-3
13.4.8-7	<p>When in maintenance mode the BV will provide the technician the ability to test the modules using a variety of commands through the VLU/TCH. The following will be included, at a minimum:</p> <ul style="list-style-type: none"> • Initiate a Power On Self-Test • Activate the BV for testing using the technician's employee ID card The BV will read the card and display the card UID without any fare processing • Allow adjustment of the audio transducers • Allow adjustment of the visual displays • Display the date and time • Display all versions of fare tables, current and future, including date of activation • Display the memory usage as a percentage and as absolute values • Display the GPS location coordinates as received from the Bus Time processor • Display current communication status with the NFPS Backend • Initiate a ping to confirm communications with the depot Wi-Fi as necessary 	CDRL 13-3

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Initiate a test to exercise all visual displays and LEDs and audio transducers 	

13.5 Communications Interfaces

Req. #	Requirement	Assigned CDRL(s)
13.5-1	The BV will be capable of Data communications to the NFPS Backend through a modem or bus cellular router, as approved by the MTA during design review.	CDRL 13-1
13.5-2	The BV will be designed with an Ethernet port that enables connection to existing mobile data routers and modems installed on all buses. Where available, the mobile data routers and modems will serve as the secondary means of communication with the NFPS Backend.	CDRL 13-1
13.5-3	All BVs will include an embedded cellular communications interface that supports 4G networks on all major U.S. carriers. The mobile data routers and modems will be automatically triggered to be used in instances where BV embedded cellular communications is not available.	CDRL 13-1
13.5-4	All BVs will include Wi-Fi (802.11 n or better) communications to enable integration with other systems, exchange of non-critical data at designated locations and sharing of data connections on vehicles. This Wi-Fi communication component will communicate with existing bus depot wireless access points operated by the MTA, NYCT, and MTA Bus Company, on an agency-specific basis, as needed for download of lists and Software. Wi-Fi communications will conform to data security requirements in Technical Specifications Section 5.7 (System Security).	CDRL 13-1
13.5-5	The SI shall propose an integration communication mechanism to capture geo-location Data from the MTA Bus Time processors.	CDRL 13-1
13.5-6	If additional communications components are required to support NFPS devices the SI shall mount all such components in a secure and sturdy enclosure, with the location to be approved by the MTA. Each such enclosure will include lock and key access to be approved by the MTA.	CDRL 13-1

13.6 Bus Validators Required Submittals

The required submittals specified in this Technical Specifications Section 13 (Bus Validators) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 13-1	BV Hardware, Software and Communications Design	Sections 13.1, 13.2, 13.3, 13.5	✓	✓	✓	

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 13-2	BV and VLU/TCH Patron and User Interface Design	Section 13.4.	✓	✓	✓	
CDRL 13-3	BV Maintenance Procedures	Section 13.4.8	✓	✓	✓	
CDRL 13-4	Single Sign-On and Bus Integration ICD	Section 13.3	✓	✓	✓	

14 Subway Validators

14.1 General

All Faregates will remain in place and be equipped with NFPS Subway Validators (each, an "**SV**") for fare processing. The SVs will support the reading of Open Payment Media as well as all common ISO 14443 Type A and B compliant Closed-Loop card platforms, NFC and provide for possible future expansion to other technologies. The SI shall leverage existing and planned assets of the MTA, NYCT, and SIRTOA to minimize costs associated with implementing the NFPS.

14.1.1 Description

Req. #	Requirement	Assigned CDRL(s)
14.1.1-1	The SV will work in parallel with and independent of the MetroCard System.	CDRL 14-1
14.1.1-2	The SV provided by the SI shall support all Faregate functions. The SVs will allow for the control of the Faregate operation, and visual and audio feedback through supporting Interfaces incorporated into the Faregate.	CDRL 14-1
14.1.1-3	MTA Group customers will tap their Contactless Smart Media on an SV and receive a message indicating acceptance or denial; acceptance will be accompanied by release of the Faregate arm or gate.	CDRL 14-1
14.1.1-4	The SI shall propose appropriate Interfaces, with an Interface to the SV that allow control of the existing displays, transducers and gate controls after processing of NFPS Media.	CDRL 14-1
14.1.1-5	The SI may propose additional interface displays, indicators and annunciators to augment existing devices, for review and approval by the MTA.	CDRL 14-1

14.1.2 Installation Design

Req. #	Requirement	Assigned CDRL(s)
14.1.2-1	The SI shall propose, based on market and design research, the best placement of the SV, both during the transition period while NFPS Media and Legacy Media are in circulation and in use, and after the transition when only NFPS Media are in use.	CDRL 14-1
14.1.2-2	The SI shall propose a cable management solution inside turnstiles as part of the design for the MTA's review and approval.	CDRL 14-1
14.1.2-3	The SI shall also propose the integration of the control electronics. All SV and control electronics installation designs will be subject to the MTA's review and approval.	CDRL 14-1
14.1.2-4	The SI shall propose a supporting schedule, with design workshops, prototypes and other research methods, for the SV integration design review process.	CDRL 14-1
14.1.2-5	The initial installation will to the extent practicable be the permanent location of the Subway Validator and associated components, as determined to be optimal by the MTA, NYCT, and SIRTOA, on an agency-specific basis. However, if an interim solution is required, the SI shall propose a two (2) step installation procedure wherein initially, the SV and	CDRL 14-4

Req. #	Requirement	Assigned CDRL(s)
	associated electronics will work within the existing devices alongside the MetroCard System components and, at a later date, a method to optimize relocation and placement of the NFPS components after the MetroCard System is decommissioned. Decommissioning will be completed by the MTA, NYCT, and SIRTOA, on an agency-specific basis, whereas equipment removal will be completed by the SI (See req. # 14.1.2-9 and Technical Specifications Section 34 (Equipment Removal)).	
14.1.2-6	The two (2) step method described in req. # 14.1.2-5 above will require the SI to provide the MTA, NYCT, and SIRTOA, on an agency-specific basis, with all necessary design drawings, installation procedures, and replacement or upgrade parts, fittings, and supplies necessary to perform both steps at no additional cost to the MTA Group.	CDRL 14-4
14.1.2-7	The SV will be independent of current MetroCard System infrastructure within the Faregate. However, the SI shall be responsible for providing power to all Frontend NFPS Equipment from existing power supplies at the point of entry within the Legacy Systems as agreed during design review.	CDRL 14-4
14.1.2-8	The SI shall be responsible for installation of all power and electrical work from a termination point provided by the MTA, NYCT, and SIRTOA, on an agency-specific basis, to the Frontend NFPS Equipment in the subway fare control areas.	CDRL 14-4
14.1.2-9	After MetroCard decommissioning, the SI shall be responsible for removing Legacy Equipment, including but not limited to boards, electronic components, and serial cabling associated with the MetroCard System from the Faregates (see Technical Specifications Section 34 (Equipment Removal)).	CDRL 14-4

14.2 Faregate Release and Visual Annunciator Control

Req. #	Requirement	Assigned CDRL(s)
14.2-1	The SV will contain an appropriate Patron Display screen, and other required user interfaces.	CDRL 14-2
14.2-2	The SV and/or associated components will be capable of connection to and control of the existing visual and audio displays, though the SI may propose replacement of the current display unit as long as the parallel MetroCard System operations are not adversely affected.	CDRL 14-2
14.2-3	The SV and/or associated components will, based on applicable processing to be determined during Design Reviews, release the Faregate, permitting customer access to the subway system.	CDRL 14-2
14.2-4	The SV and/or associated components will make use of the position sensors which monitor and control the operational sequence of the turnstile tri-pod rotation.	CDRL 14-1
14.2-5	All current Faregate functions will be supported during transition and post-MetroCard System decommissioning.	CDRL 14-2

Req. #	Requirement	Assigned CDRL(s)
14.2-6	The NFPS will support local and remote configuration of Faregate settings and functions in real-time by the MTA, NYCT, and SIRTOA, on an agency-specific basis; specific Faregate functions will be configurable by the MTA, NYCT, and SIRTOA, on an agency-specific basis, based on parameters including location and NFPS Account type.	CDRL 14-1

14.3 Mounting

14.3.1 Transition Configuration (Magstripe & Contactless Media)

Req. #	Requirement	Assigned CDRL(s)
14.3.1-1	The initial SV configuration will contain both MetroCard System and NFPS SV components working in parallel within each piece of subway equipment.	CDRL 14-4
14.3.1-2	The SV control electronics will not interfere with or otherwise degrade the performance of the MetroCard System components. The SI shall not make any Software changes to the legacy MetroCard System controller board.	CDRL 14-4
14.3.1-3	The SI shall securely mount the SV using stainless steel hardware such that the location is safe to customers and staff of the MTA, NYCT, and SIRTOA, as approved by the MTA.	CDRL 14-4
14.3.1-4	Mounting will be compliant with ADA requirements.	CDRL 14-4
14.3.1-5	Mounting will facilitate to the greatest extent possible the easy removal and replacement of defective components.	CDRL 14-4
14.3.1-6	Mounting of SV and associated components will not interfere with revenue or maintenance service of MetroCard System components. The placement of SV components will be reviewed and approved by the MTA during design review.	CDRL 14-4
14.3.1-7	Mounting of SV components will be resistant to damage from customer use and vandalism.	CDRL 14-4

14.3.2 Final Configuration (Contactless Media Only)

Req. #	Requirement	Assigned CDRL(s)
14.3.2-1	The SI shall propose a method, cost, and schedule for the removal of Legacy Systems (including the MetroCard System equipment and cabling) during the final transition stage of the NFPS deployment.	CDRL 14-4
14.3.2-2	The final configuration, after removal of MetroCard System components, will have no exposed internal components and all bezels, openings, and other leavings from the MetroCard System will have flush mounted covers or insets so that the Faregates are free of projections and sharp edges or corners that could result in an unsafe condition.	CDRL 14-4
14.3.2-3	Regarding turnstiles and HEETs, the SI may propose a replacement turnstile and HEET top cabinet. The proposed replacement is subject to the MTA's review and approval.	CDRL 14-4

14.4 Operations

14.4.1 Power Up

Req. #	Requirement	Assigned CDRL(s)
14.4.1-1	The SV and associated components will power up when Faregate power is applied to the existing MetroCard System equipment, i.e., the NFPS Equipment components will power on and off with the Faregate as if they are an integrated unit.	CDRL 14-1

14.4.2 Power-on Self-Test

Req. #	Requirement	Assigned CDRL(s)
14.4.2-1	SV components will use internal diagnostics on power up to check the proper performance of the SV.	CDRL 14-1
14.4.2-2	On power up, the SV and/or associated components will illuminate all LEDs and other displays, including any individual dot matrix or LCD cells, for a period sufficient for operational and maintenance personnel to evaluate they are functional. If dot matrix displays are used, the individual cells will cycle on and off at once to verify they are functional.	CDRL 14-1
14.4.2-3	The SV and/or associated components will emit an audio tone to verify functionality of audio components.	CDRL 14-1
14.4.2-4	The SV display will display the current version of Software during power on self-test.	CDRL 14-1

14.4.3 Maintenance Functions

Req. #	Requirement	Assigned CDRL(s)
14.4.3-1	The SV and/or associated components will support a maintenance logon function for testing and configuration by maintenance personnel of the MTA, NYCT, and SIRTOA, on an agency-specific basis.	CDRL 14-3
14.4.3-2	The SV will monitor and record instances of power or voltage drops or loss that are below the minimum required for proper operation of the SV and associated components. This drop will generate an appropriate status message.	CDRL 14-3
14.4.3-3	The associated SV components will include a keypad and display for use by maintenance personnel of the MTA, NYCT, and SIRTOA. This display/keypad will be internal to the Faregate. The efficacy of this design element will be determined during the design stage as stated in Technical Specifications Section 14.1.2 (Installation Design).	CDRL 14-3
14.4.3-4	The service keypad will be used to enter access codes and maintenance and diagnostic commands; all routine service interaction with the SV and associated components will be made via this keypad.	CDRL 14-3
14.4.3-5	The service display will be used to indicate SV component error codes, and will have the capability of displaying multiple error codes, such that one error code will not need to be cleared to display other error codes.	CDRL 14-3

Req. #	Requirement	Assigned CDRL(s)
14.4.3-6	The SI shall propose a conceptual design of the service keyboard and display, and a preliminary listing of service commands, Error displays, diagnostic messages, etc. that are available with the service interface to be submitted for the MTA's review and approval at the Conceptual Design Review.	CDRL 14-3

14.4.4 Data Exchange

Req. #	Requirement	Assigned CDRL(s)
14.4.4-1	The NFPS components will use the planned Fare Control Area Local Area Network and existing fiber (i.e., network backbone infrastructure) of the MTA, NYCT, and SIRTOA for communications to the NFPS Backend.	CDRL 14-1
14.4.4-2	SVs will be designed with an Ethernet port that enables connection to the NFPS Backend.	CDRL 14-1
14.4.4-3	The SV components will support a current display of Transit Account balance, if applicable, when processing Media for payment. This feature will be on/off configurable by the staff of the MTA, NYCT, or SIRTOA, on an agency-specific basis, and will not be ON initially unless approved by the applicable agency, on an agency-specific basis. This configuration parameter will be downloadable from the NFPS Backend by each of the MTA, NYCT, and SIRTOA, on an agency-specific basis.	CDRL 14-1

14.5 Subway Validators Required Submittals

The required submittals specified in this Technical Specifications Section 14 (Subway Validators) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 14-1	SV Hardware, Software and Communications Design	Sections 14.1, 14.4	✓	✓	✓	
CDRL 14-2	SV Patron and User Interface Design	Section 14.2	✓	✓	✓	
CDRL 14-3	SV Maintenance Procedures	Section 14.4.3	✓	✓	✓	
CDRL 14-4	Faregate Transition Plan	Sections 14.1.2, 14.3	✓	✓	✓	

15 Wayside Validator Machines

15.1 Description

The Wayside Validator Machine (WVM) will support the sale and validation of Select Bus Service boarding receipts at select bus stops as designated by the MTA for NYCT, MTA Bus Company, and SIRT OA (on an agency-specific basis). The WVM will support use of coins, credit, and will contain a Validator for processing of NFPS Media, all towards purchase of the boarding receipts. The WVM will have reduced functionality from the CVM in that modular configuration is not required, change will not be dispensed and the sole function of the WVM is validation of fares and the dispensing of the SBS boarding receipt. The WVM will act as a point of entry device for SBS buses, including use of magnetic bank cards in a PAYGO mode.

Req. #	Requirement	Assigned CDRL(s)
15.1-1	The WVM will be compatible with and be able to use all NFPS Media for payment for SBS service. The WVM will dispense a paper receipt for Proof-of-Payment only; it will not dispense NFPS EU Media or LU Media.	CDRL 15-1
15.1-2	NFPS Media will be used as validation or payment for the SBS POP receipts by a simple tap of the Media, and subsequent immediate dispensing of the SBS POP receipt. NFPS Media payment will be verified at the NFPS Backend.	CDRL 15-1
15.1-3	In general, each WVM will: <ul style="list-style-type: none">• Accept U.S. coins• Accept open payment cards as stipulated in Technical Specifications Section 10.1.1 (Open Payment Media)• Respond to patron's choice of action• Display the current amount due based on patron selections and payments• Print and issue SBS receipts and audit tickets• Display instructions and notices• Return monies deposited if a transaction is canceled or aborted• Register and store accounting Data• Provide audio output of messages and instructions• Contain a security and alarm system• Communicate over a network to send and receive Data and commands with the NFPS Backend	CDRL 15-1
15.1-4	The receipt as printed by the WVM will be the receipts used by patrons for POP onboard SBS buses. The printed receipt will duplicate current printing format and will be reviewed for accuracy and possible updating during design review.	CDRL 15-1
15.1-5	The WVM will not be used to recharge Media nor will it display NFPS Account information.	CDRL 15-1

Req. #	Requirement	Assigned CDRL(s)
15.1-6	The WVM will always act in an “exact fare” only mode, issuing a SBS ticket when the proper fee has been reached, either by insertion of coins, automatic charge or validation against the Transit Account, or an exact fee charge against a bank card used in a PAYGO transaction. Multiple purchases will require multiple transactions. Overpayment with coins is allowed with the overpayment amount reflected on the SBS receipt. Final receipt content will be configurable, and it will be determined and approved by the MTA during Design Review.	CDRL 15-1
15.1-7	The WVM will allow customer selection of reduced fares even in the absence of a reduced fare card (senior or disabled) or employee ID card.	CDRL 15-1
15.1-8	The fares will be configurable and downloadable from the NFPS Backend.	CDRL 15-1
15.1-9	The SI shall submit preliminary design drawings of the interior and exterior of the WVM and all major assemblies identified for the MTA's review and approval.	CDRL 15-1

15.2 WVM Enclosure and Mounting Pedestal

Req. #	Requirement	Assigned CDRL(s)
15.2-1	All WVMs will incorporate common cabinetry, control electronics, Software, user interface, power supplies, cabling and internal module mounting hardware.	CDRL 15-1
15.2-2	Overall dimension of the WVM will not exceed 64” high x 25” wide x 18” deep	CDRL 15-1
15.2-3	The WVM cabinet shall comply with the requirements defined in Technical Specifications Section 11.1 (Machine Enclosure Construction).	CDRL 15-1

15.3 Patron Interface

15.3.1 General Patron Interface Requirements

Req. #	Requirement	Assigned CDRL(s)
15.3.1-1	The WVM will provide patron interface through a variety of devices, each of which will be designed to satisfy its intended purpose in an ergonomic and safe manner. Together, the elements of the WVM patron interface will provide patrons with an easy-to-use WVM that satisfies all functional and performance requirements stated herein.	CDRL 15-2
15.3.1-2	The patron interface with the WVM will be at the front of the WVM.	CDRL 15-2
15.3.1-3	All patron interface openings will be designed to prevent unauthorized access to the WVM interior.	CDRL 15-2
15.3.1-4	The technology used to detect patron selections will be resistant to scratches and other normal wear. No coatings or other materials applied to the outer surface of the display’s protective shield will be required to detect the patron’s selection.	CDRL 15-2

Req. #	Requirement	Assigned CDRL(s)
15.3.1-5	The WVM will automatically detect what form of payment the patron has inserted, patrons will not have to declare whether the transaction will be by coin, NFPS Agency-Issued Media, or a bank card. However, payment types will be mutually exclusive. Attempts at simultaneous payment by more than one payment method will result in the transaction being automatically canceled.	CDRL 15-2
15.3.1-6	When paying by coin, the WVM will permit the patron to deposit coins in any sequence.	CDRL 15-2
15.3.1-7	All WVMs will include an encrypting keypad (i.e., PIN Pad) that will also support use by visually impaired patrons for transaction selections and other inputs.	CDRL 15-2
15.3.1-8	The WVM credit components will include a reader capable of reading a magnetic stripe card, a Contactless Smart Card, Contactless MSD bank cards and a Contact Smart Card to accommodate both magnetic stripe and EMV certified cards (see Technical Specifications Section 11.6 (Bank Card Processing Interfaces)).	CDRL 15-2
15.3.1-9	There will be a headphone jack conforming to current ADA and Title VI requirements.	CDRL 15-2
15.3.1-10	The Patron Display height and mounting will be in conformance with all current ADA requirements.	CDRL 15-2

15.3.2 Patron Selection Control

Req. #	Requirement	Assigned CDRL(s)
15.3.2-1	There will be touch screen buttons for language selection (see Technical Specifications Section 11.12 (Multi-Lingual Capabilities)).	CDRL 15-2
15.3.2-2	There will be a touch screen button to initiate audio instructions per ADA requirements (see Technical Specifications Section 11.13 (Voice Messaging System)).	CDRL 15-2
15.3.2-3	The WVM will emit distinctive tones to provide audio feedback to the patron each time a valid button is pressed per ADA requirements (see Technical Specifications Section 11.13 (Voice Messaging System)).	CDRL 15-2
15.3.2-4	The volume (decibel level) of the tones will be field-adjustable locally for each WVM, and will be audible in all installed locations per ADA requirements (see Technical Specifications Section 11.13 (Voice Messaging System)).	CDRL 15-2

15.3.3 WVM Patron Display

Req. #	Requirement	Assigned CDRL(s)
15.3.3-1	The WVM will include a touch screen Patron Display bearing simple, basic instructions which will sequentially instruct the patron how to perform a transaction.	CDRL 15-2
15.3.3-2	The display screen will have a maximum operating temperature rating of at least 120 °F.	CDRL 15-2

Req. #	Requirement	Assigned CDRL(s)
15.3.3-3	The display screen will provide a level of visibility sufficient to allow all displayed instructions to be read easily by the patron under all ambient light conditions and without the need for any additional peripheral light source or shading device.	CDRL 15-2

15.3.4 Instructional Graphics

Req. #	Requirement	Assigned CDRL(s)
15.3.4-1	The WVM will provide Instructions on the front panel to clearly indicate each step a patron will follow to pay or validate a fare and print an SBS receipt for POP. The sequence of steps will be clearly indicated by the use of graphics and symbols.	CDRL 15-2
15.3.4-2	The design of instructions and graphics will minimize glare and other effects of sunlight and ambient lighting that could otherwise reduce the readability of the instructions on the WVM.	CDRL 15-2
15.3.4-3	Instructional graphics will include pictograms that clearly depict proper insertion orientation of coins and bank cards into their respective slots. To ensure uniformity, the WVM will have similar graphics to those graphics used in other NFPS Equipment in NYCT subways (CVMs and SVs) and buses (BVs).	CDRL 15-2

15.3.5 In Service/Out of Service Indicator

Req. #	Requirement	Assigned CDRL(s)
15.3.5-1	The WVM will have a prominent "IN SERVICE" indicator, clearly visible, on the front of the machine.	CDRL 15-2
15.3.5-2	Each WVM will have a visible exterior indication that it is in need of servicing.	CDRL 15-2
15.3.5-3	As delivered, the service indicator will be activated under any of the following conditions: <ul style="list-style-type: none"> • The WVM is out of service (except during power failure) • The WVM is operating in a degraded mode • One or more receipt printer stock is low or empty • A security breach is in progress • The alarm siren is activated due to impact detection 	CDRL 15-2

15.4 Receipt Printer

15.4.1 Function

Req. #	Requirement	Assigned CDRL(s)
15.4.1-1	The WVM will be equipped to print and issue SBS-specific receipts.	CDRL 15-1
15.4.1-2	The receipt printer will be able to select, cut, print and issue POP receipts and payment receipts on thermally-sensitive paper, as per the requirements in Technical Specifications Section 18.5 (Receipt Stock).	CDRL 15-1

Req. #	Requirement	Assigned CDRL(s)
15.4.1-3	Formats for both SBS POP receipts and payment receipts will be determined during design review.	CDRL 15-1

15.4.2 Receipt Stock Description

Req. #	Requirement	Assigned CDRL(s)
15.4.2-1	The WVM receipt printer will issue SBS tickets/receipts from roll stock that is commercially available in the U.S. All receipt stock will be paper-based and will meet the specifications outlined in Technical Specifications Section 11.7 (Receipt Printer).	CDRL 15-1

15.5 Power Supply and Switches

The MTA has a preference for solar power for wayside infrastructure where there is no impact to performance. If possible, WVMs shall be solar powered.

Req. #	Requirement	Assigned CDRL(s)
15.5-1	The WVM will include a power supply and switches, and supplemental battery power, which satisfy the requirements stated in Technical Specifications Section 11.3 (Power Supply and Switches) and Technical Specifications Section 11.4 (Supplemental Battery Power).	CDRL 15-1
15.5-2	While the WVM power supply switch is off and the main power switch is on, the following devices will remain powered: <ul style="list-style-type: none"> • An internal service light • The auxiliary GFCI power outlets • All internal fans, heaters, and cooling devices 	CDRL 15-1
15.5-3	The SI shall be responsible for connecting installed WVMs to the existing power supply termination box at all wayside sites. This may require trenching or other underground installation work. All electrical work performed will be subject to the requirements set forth in Division 16 (Appendix H). In the case that there is a discrepancy between Division 16 and the requirements in these Technical Specifications, the more stringent requirement shall apply.	CDRL 15-1

15.6 Operations

15.6.1 Normal Operations

Req. #	Requirement	Assigned CDRL(s)
15.6.1-1	Each WVM will normally be ready to respond to a patron selection when it is in the idle condition. If the WVM is not ready, all operating functions will be disabled.	CDRL 15-3

Req. #	Requirement	Assigned CDRL(s)
15.6.1-2	When a failure occurs during a transaction, the WVM will make every attempt to complete the transaction or return all deposited funds. If necessary, the WVM will err in favor of the patron, even if it means a possible loss of accounting accuracy.	CDRL 15-3
15.6.1-3	The WVM will not commence in-service activation until the outer door is closed and the outer door lock is returned to its fully secured position.	CDRL 15-3
15.6.1-4	Whenever the Alarm System siren is sounding, the WVM will go out of service (see Technical Specifications Section 11.2 (Alarm Unit)). When the siren is silenced, the WVM will perform self-diagnostics, and if possible, return to the idle state.	CDRL 15-3

15.6.2 Transaction Speed

Req. #	Requirement	Assigned CDRL(s)
15.6.2-1	The total time for server authorization of the NFPS Agency-Issued Media by the NFPS Backend will not exceed 500 milliseconds.	CDRL 15-3
15.6.2-2	The time for authorization of Open Loop PAYGO transactions by the NFPS Backend (e.g., hot and cold list checks) will not exceed 500 msec. This may require use of Risk Mitigation techniques as described in Technical Specifications Section 6.1.4 (Risk Mitigation Techniques).	CDRL 15-3
15.6.2-3	For coin ticket purchase transactions, the time from acceptance of the last coin to issuance of the receipt from the printer will not exceed three (3) seconds.	CDRL 15-3
15.6.2-4	If a coin transaction is canceled before coin payment is complete, all inserted money will be returned and the WVM will resume its idle condition within seven (7) seconds. This interval will apply under normal operating conditions, when no more than 10 coins have been inserted.	CDRL 15-3

15.6.3 Cancel Operations

Req. #	Requirement	Assigned CDRL(s)
15.6.3-1	When a cancellation event occurs prior to issuance of a SBS receipt, the ECU will initiate a cancel signal, causing all deposited monies to be returned and the transaction canceled. Whenever a transaction in progress is canceled, an explanatory message will be shown on the Patron Display for a period of time configurable at the NFPS Backend.	CDRL 15-3
15.6.3-2	If the patron manually cancels a transaction before any payment has been made, the WVM will immediately return to the idle screen without displaying a cancel message.	CDRL 15-3
15.6.3-3	Unless otherwise specified elsewhere herein, any shutdown condition, including AC power failure, will result in cancellation of the transaction, the return of all deposited funds, and orderly shutdown of the WVM.	CDRL 15-3

15.6.4 Time-Out Operations

Req. #	Requirement	Assigned CDRL(s)
15.6.4-1	The WVM will have MTA-, NYCT-, MTA Bus Company-, and SIRTOA-adjustable (on an agency-specific basis) time-out periods to return the WVM 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, will also be adjustable by the MTA, NYCT, MTA Bus Company, and SIRTOA (on an agency-specific basis).	CDRL 15-3
15.6.4-2	All time-outs will be identified in the review of the transaction process that will occur at the Preliminary Design Review, and will be subject to the MTA's approval at the Final Design Review.	CDRL 15-3

15.6.5 Service Parameters

Req. #	Requirement	Assigned CDRL(s)
15.6.5-1	The WVM requires the stop location as a service parameter for the printed SBS receipt. The range of stop identification information, other service parameters, and restrictions will be determined during design review.	CDRL 15-3
15.6.5-2	The WVM service parameters will be menu selectable from the service interface and the menu will be configurable by authorized MTA, NYCT, MTA Bus Company, and SIRTOA (on an agency-specific basis) personnel from the NFPS Backend. The menus will be based on downloadable lists from the NFPS Backend.	CDRL 15-3

15.6.6 Data Exchange

Req. #	Requirement	Assigned CDRL(s)
15.6.6-1	The WVM will use a 4G LTE or greater cellular modem for connection to the NFPS Backend. The SI shall propose an appropriate modem for review and approval by the MTA.	CDRL 15-3
15.6.6-2	The WVM will communicate with the NFPS Backend in real-time to the greatest extent possible.	CDRL 15-3
15.6.6-3	WVMs will be designed with an Ethernet port that enables direct connection to the NFPS Backend if such a connection is available.	CDRL 15-3
15.6.6-4	WVMs will be designed with a spare USB port to support connection of an ancillary device, such as a laptop, for direct connection to obtain NFPS Data that cannot be extracted due to WVM component Failure.	CDRL 15-3

15.6.7 Maintenance Functions

Req. #	Requirement	Assigned CDRL(s)
15.6.7-1	Inside the WVM, located within easy reach and viewing while the outer door is open, will be a keypad and display for use by maintenance and revenue service personnel. The Patron Display may be used for maintenance purposes if the Patron Display is viewable while using the service keypad.	CDRL 15-3

Req. #	Requirement	Assigned CDRL(s)
15.6.7-2	The service keypad will be used to enter access codes and maintenance and diagnostic commands; all routine service interaction with the WVM will be via this keypad.	CDRL 15-3
15.6.7-3	The service display will be used to indicate WVM error codes, and will have the capability of displaying multiple error codes, such that one error code will not need to be cleared to display other error codes.	CDRL 15-3
15.6.7-4	The SI shall propose a conceptual design of the service keyboard and display, and a preliminary listing of service commands, error displays, diagnostic messages, etc. that are available with the service interface to be submitted for the MTA's review and approval at the Conceptual Design Review.	CDRL 15-3

15.7 Coin Handling Unit

Req. #	Requirement	Assigned CDRL(s)
15.7-1	The WVM will include a Coin Handling Unit, with all components described in Technical Specifications Section 11.5 (Coin Handling Unit) with the exception of any coin recirculation.	CDRL 15-1
15.7-2	The coin insertion slot shutter will remain closed until the WVM start button is pushed upon which time it will open to accept coins.	CDRL 15-1

15.8 Bank Card Processing Unit

The WVM will include the necessary module(s) to process bank cards for the purchase/validation of SBS fares including a PIN keypad, dip reader, EMV Contact card reader and EMV Contactless card reader.

Req. #	Requirement	Assigned CDRL(s)
15.8-1	The WVM will include Bank Card Processing Interface modules as described in Technical Specifications Section 11.6 (Bank Card Processing Interfaces), with the following additional requirements.	CDRL 15-1
15.8-2	The bank card transaction will be for the exact single fare required to issue an SBS receipt.	CDRL 15-1
15.8-3	The PIN keypad and other bank card components will be mounted within proximity of each other so as to indicate their collective functionality.	CDRL 15-1
15.8-4	When the Voice Messaging System is active during transactions, the WVM Voice Messaging System will direct patrons to press screen and buttons as required.	CDRL 15-1

15.9 WVM Transaction Procedures

Req. #	Requirement	Assigned CDRL(s)
15.9-1	The WVM will generate, store and forward to the NFPS Backend a discrete data record for each transaction performed. The WVM will immediately transmit each transaction record to the NFPS Backend upon completion of the transaction. When communications with the NFPS Backend are disabled, the WVM will transmit Transaction Data as soon as communications are restored.	CDRL 15-4
15.9-2	The WVM will not perform NFPS Agency-Issued Media or bank card transactions when out of communications with the NFPS Backend. It may perform coin transactions but as above, will store and immediately transmit completed coin transactions when communication is restored.	CDRL 15-4
15.9-3	The WVM will display when it is in this "COINS ONLY" mode so that the patron clearly understands the WVM is operating in reduced mode.	CDRL 15-4
15.9-4	Each transaction record will be unique within the NFPS and will include the following information, at a minimum: <ul style="list-style-type: none"> • Date and time of transaction • Machine ID • Bus Stop ID • Direction • Route number • Media Type ID • Transit Account number • Third Party account number (if applicable) • Action performed • Transaction value • Transaction number (which will be unique per day per validator) • Machine Sequence number 	CDRL 15-4
15.9-5	WVMs will include sufficient embedded storage to hold thirty (30) days of fare payment transactions, and all Risk Mitigation lists as determined during design review.	CDRL 15-4
15.9-6	The WVM will store sales and Transaction Data in Non-Volatile Memory. The WVM will continuously retain sales and Transaction Data records for the current and at least seven (7) previous days in the primary and secondary Non-Volatile Memory.	CDRL 15-4
15.9-7	An alternate means of removing Data from the WVM will be provided for instances where there is a Failure of the wired or wireless communication or power supply.	CDRL 15-4
15.9-8	The ECU will maintain accurate counts of all coins accepted, record this information in the data memory unit and transmit this information periodically to the NFPS Backend in the form of coin audit records.	CDRL 15-4

15.10 Events Data and Device Monitoring

As part of the Device Monitoring System, the WVM will provide real-time status of device Errors and events. The WVM will also maintain local event and error logs in the event that communications to the NFPS Backend is unavailable.

Req. #	Requirement	Assigned CDRL(s)
15.10-1	<p>At a minimum, the WVM will generate, store and forward to the NFPS Backend an event record for each of the following events:</p> <ul style="list-style-type: none"> • Power On • Power On Self-Test complete • Power On Self-Test failure • Power Off • Maintenance parameter changed, including parameter and new value • Default fare (service level) changed, including new fare set • End of transit business day • Communication between the NFPS Backend and WVM failed • Communication between the NFPS Backend and WVM restored • New downloaded list(s) received, including list type and version number • New downloaded list(s) activated, including date/time of activation, list type, and version number • New fare table received, including version number • New fare table version activated, including date/time of activation and version number • New Software Version received, including Version number • New Software activated, including date/time and Version number • New configuration Data received, including Version number • New configuration Data activated, including date/time and version number • Internal clock reset for a time discrepancy greater than 1 minute • Data memory nearing capacity (data near full percentage will be configurable) • Data memory full • WVM unscheduled reset • Other Errors and Failures as will be applicable and determined during design reviews. • Anti-virus definitions updated • Authorized entry • Coin vault removed • Bank card reader Failure • Printer Failure 	CDRL 15-1
15.10-2	<p>Each event record will include, at minimum:</p> <ul style="list-style-type: none"> • Date and time of event • Machine ID • Route number • Stop ID or location (latitude/longitude) • Block number (if applicable) 	CDRL 15-1

Req. #	Requirement	Assigned CDRL(s)
15.10-3	Duration of device stored event records will be configurable. The WVM will have capacity to store a minimum of 3,000 event records. Configuration control parameters will have the ability to turn off recording of events at the discretion of MTA, NYCT, MTA Bus Company, and SIRTOA staff (on an agency-specific basis).	CDRL 15-1

15.11 Wayside Validator Machines Required Submittals

The required submittals specified in this Technical Specifications Section 15 (Wayside Validator Machines) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 15-1	WVM Hardware, Enclosure and Security Design and Configuration	Sections 15.1, 15.2, 15.4, 15.5, 15.7, 15.8, 15.10	✓	✓	✓	
CDRL 15-2	WVM Patron Interface Design	Section 15.3	✓	✓	✓	
CDRL 15-3	WVM Operations	Section 15.6	✓	✓	✓	
CDRL 15-4	WVM Transaction Procedures	Section 15.9	✓	✓	✓	

16 Configurable Vending Machines

16.1 General

The Configurable Vending Machines (CVMs) will support a variety of sales, replenishment and customer service functions as stated below, and shall be both Hardware and Software configurable, on an NFPS Agency-specific basis, to enable each NFPS Agency to select operable functions and features for each CVM. A fully-configured CVM will sell new Extended-Use Media, Limited-Use Media, and Paper Media, replenish transit accounts, and provide other customer services such as Transit Account status/balance information and transaction history. The CVM will be able to process cash, coin and bank card transactions, necessitating requirements for physical security and internal modules. Fully-configured CVMs will accept payments with cash (any combination of coins and bills) and bank cards.

Req. #	Requirement	Assigned CDRL(s)
16.1-1	The CVMs will be compatible with the Media specified in Technical Specifications Section 18 (Media).	CDRL 16-1
16.1-2	The CVMs will support all current and future NFPS Agency fare policies and Fare Products and established Business Rules (see Technical Specifications Section 7 (Fare Policies)).	CDRL 16-1
16.1-3	<p>In general, each fully-configured CVM will:</p> <ul style="list-style-type: none">• Accept U.S. coins and bills• Accept authorized magnetic strip, Contact, and Contactless Bank Cards• Accept EBT cards• Respond to patron's choice of action• Display the current amount due based on patron selections and payments• Print and issue short-duration Fare Products on LU Contactless Smart Card Media• Print and issue receipts and audit tickets• Dispense new NFPS Agency-Issued EU Smart Cards• Dispense new NFPS Agency-Issued LU-R Smart Cards and LU-S Smart Cards, including Joint Media• Dispense new NFPS Agency-Issued Paper Media, including barcoded tickets• Read barcoded Media, including Paper Media with a printed barcode, and mobile apps that generate an electronic barcode• Add stored value to Transit Accounts associated with NFPS Agency-Issued Smart Cards and Transit Accounts associated with authorized Contactless Bank Cards• Add time-based passes to Transit Accounts associated with NFPS Agency-Issued EU Smart Cards and NFPS Accounts associated with authorized Contactless Bank Cards• Display instructions and notices• Issue change if excess payment is made and change is available• Return monies deposited if a transaction is canceled or aborted• Register and store accounting Data	CDRL 16-1

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Provide audio output of messages and instructions Contain a security and alarm system Communicate over a network to send and receive data and commands with the NFPS Backend 	
16.1-4	The CVM will automatically limit available transaction types based on the modules that are equipped and activated, which includes the ability to reduce the CVM to a degraded mode.	CDRL 16-1
16.1-5	The CVM will be monitored by and will respond to commands from the NFPS Device Monitoring System as stipulated in Technical Specifications Section 21.2 (Device Monitoring System).	CDRL 16-1
16.1-6	The SI shall submit preliminary design drawings of the interior and exterior of the CVM and all major assemblies identified for the MTA's review and approval.	CDRL 16-1

16.2 CVM Transaction Procedures

16.2.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
16.2.1-1	<p>Fully-configured CVMS will support at a minimum the transactions listed below:</p> <ul style="list-style-type: none"> Purchase new EU Smart Card Purchase LU Fare Products, including reduced fare LU Media Purchase new Joint Media Purchase Paper Media, including barcoded tickets Load value or Fare Product(s) to a Transit Account Review Transit Account balance and history Perform cash, credit and debit transactions <p>If a CVM is configured as cashless, cashless CVMs will perform identical functions to full service CVMs with the exception of accepting cash and providing change. A full list of transactions and detailed process flows will be submitted by the SI for the MTA's review and approval.</p>	CDRL 16-19
16.2.1-2	All transactions to be performed by the CVMs will support all NFPS Agency fare policies described in Technical Specifications Section 7 (Fare Policies).	CDRL 16-19
16.2.1-3	For all customer transactions, the user interface design will endeavor to minimize the number of keystrokes and steps required to complete the transaction.	CDRL 16-19

16.2.2 Reduced Fare Product Sales

Req. #	Requirement	Assigned CDRL(s)
16.2.2-1	The CVM will be capable of enabling or disabling the availability and sale of NFPS Agency reduced fare LU Fare Products by default. Products disabled by default shall be capable of being enabled if an NFPS Agency-Issued reduced fare eligibility Smart Card credential is tapped at the CVM. Details and rules per Fare Product will be determined during design reviews.	CDRL 16-19
16.2.2-2	Upon presentation of a valid NFPS Agency-Issued Contactless reduced fare eligibility Smart Card credential to the Contactless Smart Card Reader, the CVM will enable the display of applicable NFPS Agency reduced fare ticket selections described in Technical Specifications Section 7 (Fare Policies).	CDRL 16-19
16.2.2-3	The reduced fare ticket selections will be available for the duration of the transaction.	CDRL 16-19
16.2.2-4	Upon completion or cancellation of the transaction, the CVM will revert to making available for sale or reload only full-fare Fare Products.	CDRL 16-19
16.2.2-5	The CVM will determine validity of reduced fare eligibility credentials either by communication with the NFPS Backend, or by referencing an internal list of valid reduced fare eligibility credentials. Any such internal list will be updated remotely no less than once per day.	CDRL 16-19
16.2.2-6	The CVM will be capable of a reduced Fare Product sales configuration based on location (i.e., NYCT, MNR, or LIRR facility) and NFPS Agency.	CDRL 16-19

16.3 Modular Configurability

Req. #	Requirement	Assigned CDRL(s)
16.3-1	All CVMs will incorporate common cabinetry, control electronics, Software, user interface, power supplies, cabling and internal module mounting hardware.	CDRL 16-1
16.3-2	All CVMs will support the independent removal and installation of any payment acceptance and Media dispensing module. The CVM will automatically adjust its operation according to the installed modules.	CDRL 16-1
16.3-3	Via local and remote Software configuration, each CVM will support the independent deactivation and reactivation of any installed payment acceptance and Media dispensing module. The CVM will automatically adjust its operation according to the active modules.	CDRL 16-1
16.3-4	As necessary, for each CVM, the SI shall supply blanking plates for installation over any outer door openings resulting from the lack or deactivation of a module. All such blanking plates will be easily secured from within the CVM. When installed, blanking plates will be flush with the outer surface of the CVM door and will provide security against intrusion and vandalism when the corresponding module is not present.	CDRL 16-1
16.3-5	Each CVM will provide each NFPS Agency the ability to disable and enable modules and features (on an NFPS Agency-specific basis) to support functional and operational configurability. CVMs will be configurable locally at the CVM and remotely via the NFPS Backend.	CDRL 16-7

Req. #	Requirement	Assigned CDRL(s)
16.3-6	At minimum, each NFPS Agency will be able to disable and enable the following modules and functions (on an NFPS Agency-specific basis), individually or in any combination: <ul style="list-style-type: none"> • Coin Handling Unit • Supplemental Change Supply Module • BHU • Bank card Reader • Contactless bank card reader • Smart Card processor (if separate) • EU Smart Card dispenser • LU Media dispenser • Change dispensing module (while retaining cash payments) • Cash payment modules • Bank Card processing module 	CDRL 16-7
16.3-7	When a module or function is disabled, each NFPS Agency will be able to configure the messages shown on the Patron Display, for that NFPS Agency's Patron Displays, including the ability to suppress all system-reported maintenance type error messages associated with the disabled module or function.	CDRL 16-7
16.3-8	When a module is disabled, the CVM will allow removal of the module without affecting the performance of the CVM.	CDRL 16-7
16.3-9	When a module or function is disabled, each NFPS Agency will be able to configure (on an NFPS Agency-specific basis) all event messages associated with that module or function to be suppressed (i.e., not sent to the NFPS Backend).	CDRL 16-7
16.3-10	The Service Indicator described in Technical Specifications Section 16.19 (Service Indicator) will ignore the operational status of disabled CVM modules.	CDRL 16-7

16.4 CVM Cabinet Construction

16.4.1 Equipment Enclosure

All CVM modules will be enclosed in a sturdy cabinet that will conform to the following specifications:

Req. #	Requirement	Assigned CDRL(s)
16.4.1-1	The overall dimensions of an installed CVM will not exceed 80 inches high, 36 inches wide and 25 inches deep (depth limitations exclude exterior light fixture housing). The MTA prefers to reduce the size of the CVM footprint; the depth and width of the CVM cabinet will be optimized to reduce the CVM cabinet footprint.	CDRL 16-4
16.4.1-2	The design of the CVMs will permit installation as stand-alone units, side-by-side units (including units abutted to each other), back-to-back units (with units abutted to each other) and in recessed areas.	CDRL 16-4

Req. #	Requirement	Assigned CDRL(s)
16.4.1-3	The door hinges and/or pivoting mechanism will be tamperproof and adjustable to allow for proper alignment of the door and locking devices, to prevent any wear or binding between the enclosure and the door when opening or closing the door. All hinge and latch hardware and metal surfaces subject to sliding contact will be stainless steel.	CDRL 16-4
16.4.1-4	The CVM access door will be locked with at least a three-point latching device with a bascule bolt and hook bar, or equivalent construction.	CDRL 16-4
16.4.1-5	The CVM interior will be illuminated by a service lamp that will operate by a manual switch and only while the outer door is open. The interior fixture will use one or more standard, commercially-available compact fluorescent or LED light bulbs and provide sufficient illumination for service activities.	CDRL 16-4
16.4.1-6	With the outer door latched, it will not be possible to view any internal components or insert any foreign objects into the cabinet through the gaps between door and cabinet.	CDRL 16-4
16.4.1-7	The CVM will be equipped with internal power conditioning equipment capability to handle any stray currents or grounding loops in stations without impact to operations. The design approach to address stray currents or grounding loops for above and below-ground stations may differ. It should be noted that conditions may differ between above or below ground stations and a single solution shall address both deployments.	CDRL 16-4
16.4.1-8	If an internal heater is required to maintain sufficient internal cabinet temperatures for reliable CVM operation, the heater will be thermostatically controlled. The heater shall incorporate a fan to distribute evenly heat throughout the cabinet, and the thermostat shall be adjustable and clearly marked to indicate proper operating position. It will be possible to operate the fan independently of the heating elements to facilitate cooling during warm weather.	CDRL 16-4
16.4.1-9	If a cooling system is required to maintain internal cabinet temperatures for reliable CVM operation, the cooling system will be thermostatically controlled. Any air filters necessary to maintain proper operation of the cooling equipment will be easily replaceable disposable type filter sized for replacement no more frequently than annually. Any condensate resulting from cooling will drain to the exterior of the CVM.	CDRL 16-4
16.4.1-10	For CVMs at NYCT facilities, the top of the CVM will slope at least fifteen degrees downward and to the front of the CVM to prevent any accumulation of debris.	CDRL 16-4
16.4.1-11	For CVMs at MNR and LIRR facilities, the top of the CVM will slope at least fifteen degrees downward and to the back of the CVM to protect customers on exposed platforms from precipitation.	CDRL 16-4

Req. #	Requirement	Assigned CDRL(s)
16.4.1-12	The SI shall submit a sample of the finished stainless steel of the CVM cabinet for the MTA's review and approval. This sample will clearly indicate the gauge or thickness of the material, and specify the grade of stainless steel.	CDRL 16-4
16.4.1-13	The SI shall submit a conceptual plan and elevation drawings of CVM showing outer door open and closed, and drawings of CVM interior showing all module locations, including those mounted to inside of exterior door, will be submitted for the MTA's review and approval.	CDRL 16-1
16.4.1-14	The SI shall present drawings showing CVM modules in service positions, indicating servicing and maintenance clearances, for the MTA's review and approval.	CDRL 16-1

16.4.2 Mounting Pedestal

Req. #	Requirement	Assigned CDRL(s)
16.4.2-1	If required, pedestals for all CVMs will be sized to position the highest operable patron control at 48 inches above the finished platform where the CVM will be installed.	CDRL 16-4
16.4.2-2	The SI shall submit the design of the standard and optional pedestals for the MTA's review and approval.	CDRL 16-4

16.4.3 Exterior Light Fixture

The CVM will be equipped with an exterior light fixture that will:

Req. #	Requirement	Assigned CDRL(s)
16.4.3-1	Illuminate the front face of the CVM.	CDRL 16-4
16.4.3-2	Consume less than 15 watts and use nominally white LED lighting.	CDRL 16-4
16.4.3-3	Be fully operable in the complete range of temperatures specified in Technical Specifications Section 5.6 (Environmental Conditions).	CDRL 16-4
16.4.3-4	Under all ambient lighting conditions, provide a level of lighting sufficient to allow patrons to read easily all instructions and other items on the front of the CVM without the need for additional peripheral light source. Lighting intensity will be suitable for vision-impaired patrons under the most adverse lighting conditions.	CDRL 16-4
16.4.3-5	Meet the vandal-resistant strength requirements stated in Technical Specifications Section 11.1 (Machine Enclosure Construction). The material, thickness, and finish of the fixture enclosure will be the same as those for the CVM housing.	CDRL 16-4
16.4.3-6	Keep out dirt, moisture and insects.	CDRL 16-4
16.4.3-7	Contain a commercially available lamp or lamps and circuits, and be constructed to allow easy replacement of the lamp with access obtained by use of a key.	CDRL 16-4

Req. #	Requirement	Assigned CDRL(s)
16.4.3-8	Be operable by a bypass switch inside the CVM enclosure to permit the light fixture to be switched on and off manually.	CDRL 16-4

16.5 CVM Locks and Access Control

16.5.1 CVM Keys and Locks

Req. #	Requirement	Assigned CDRL(s)
16.5.1-1	All CVMs will have controlled key locks, to be defined by the MTA during design review. The door on all CVMs will be equipped with tubular lock(s) containing high security programmable lock cylinders.	CDRL 16-5
16.5.1-2	The keyways for all high security keys will be registered to the MTA, and replacements shall be available only to MTA-authorized personnel directly from the lock manufacturer, or their authorized representative.	CDRL 16-5
16.5.1-3	The SI shall provide keys, each easily identifiable and uniquely numbered. These keys shall be securely shipped under separate cover directly to the MTA's Director of Revenue Control. The number of keys will be determined and approved by the MTA during design review.	CDRL 16-5
16.5.1-4	Sensors will detect the status of the outer door lock, and the CVM door shall be considered open or unsecured whenever the outer door lock is not in the fully locked position. For the CVM door to be considered closed and secure, the door will be fully closed and the outer door lock fully engaged in its locked position.	CDRL 16-5
16.5.1-5	To avoid excessive strain on the lock and key, a device other than the key will actuate the front door latching mechanism.	CDRL 16-5
16.5.1-6	Locks and keepers will be drill-resistant stainless steel, and be mounted flush with the outside surface of the access door.	CDRL 16-5
16.5.1-7	To further secure the CVM, a "hockey puck" type padlock with high security key locks will be able to be added to the CVM in order to provide protection for the locking mechanisms that are described in req. # 16.5.1-1.	CDRL 16-5

16.5.2 Access to CVM Interior

Req. #	Requirement	Assigned CDRL(s)
16.5.2-1	Access to the interior of the CVM for maintenance and servicing will be by opening the front door with a key and strain-relief device described in Technical Specifications Section 11 (Common Machine Requirements).	CDRL 16-5
16.5.2-2	Under normal operating circumstances, the CVM will require the following steps for an individual to gain access to the interior of a CVM for either servicing or maintenance. <ul style="list-style-type: none"> • Proper opening of the front door of the CVM. • Entering a valid individual ID code and valid PIN on the service keypad inside the CVM or tapping a valid ID card in addition to entering a valid PIN. 	CDRL 16-5

Req. #	Requirement	Assigned CDRL(s)
16.5.2-3	If the proper access method is not followed, the intrusion alarm will be activated and the CVM will notify the NFPS Backend of a security breach (see Technical Specifications Section 11.2 (Alarm Unit)).	CDRL 16-5
16.5.2-4	Audit and maintenance receipts printed by the CVM will never include sufficient printed information to allow unauthorized access or another employee's identity to be used to gain entry.	CDRL 16-5
16.5.2-5	If the CVM includes other external access panels, opening the panel will require that the CVM front door is opened first and all proper entry procedures are followed before the access panel may be opened.	CDRL 16-5
16.5.2-6	If the external access panel is opened without proper front door access authorization, the intrusion alarm will be activated (see Technical Specifications Section 11.2 (Alarm Unit)), and the CVM will notify the NFPS Backend of a security breach.	CDRL 16-5
16.5.2-7	The SI shall submit a proposed plan for access methods for the MTA's review and approval.	CDRL 16-5

16.5.3 Internal Access Restrictions

Req. #	Requirement	Assigned CDRL(s)
16.5.3-1	The CVM will be programmed with individual codes and corresponding security codes, which will restrict the actions available to the individual based on his or her authorized activities.	CDRL 16-5
16.5.3-2	A database of security codes, personnel codes, maintenance and servicing functions will be provided at the NFPS Backend and downloaded into each CVM. The MTA shall have full access to modify this database for each NFPS Agency.	CDRL 16-5
16.5.3-3	Security codes and personnel codes will contain a minimum of four and a maximum of twelve alphanumeric or numeric characters.	CDRL 16-5
16.5.3-4	Personnel codes will be assigned to distinct categories for access permissions that will be administered by MTA personnel. These codes will be defined by the MTA during design review.	CDRL 16-5
16.5.3-5	The arrangement of modular mechanical and electrical components and money containers will be such that normal maintenance, including replacement of defective modules, will neither require removal of nor provide access into the coin and bill storage containers.	CDRL 16-5
16.5.3-6	Security categories and access rights will be developed and approved by the MTA during design review.	CDRL 16-5
16.5.3-7	Vaults and other money storage devices (coin hoppers, bill vaults, recirculating coin tubes) will only be accessed with a controlled key(s) issued to MTA-designated Revenue Facility cash processing personnel.	CDRL 16-5
16.5.3-8	Removal of a cash storage device by any person not so authorized will activate the CVM local siren and result in a revenue security alarm being recorded by the CVM and transmitted to the NFPS Backend.	CDRL 16-5

Req. #	Requirement	Assigned CDRL(s)
16.5.3-9	The SI shall submit a detailed description of the CVM access method, security codes, restrictions per security code, and security code database content and modification procedures for the MTA's review and approval.	CDRL 16-5

16.6 Patron Interface

16.6.1 General Patron Interface Requirements

Req. #	Requirement	Assigned CDRL(s)
16.6.1-1	The CVM will provide patron interface through a variety of devices, each of which will be designed to satisfy its intended purpose in an ergonomic and safe manner. Together, the elements of the CVM patron interface will provide patrons with an easy-to-use CVM that satisfies all functional and performance requirements stated herein.	CDRL 16-6
16.6.1-2	The patron interface with the CVM will be at the front of the machine.	CDRL 16-6
16.6.1-3	All patron interface openings will be designed to prevent unauthorized access to the CVM interior.	CDRL 16-6
16.6.1-4	The CVM will enable the patron to change any transaction selection up to the moment when the first coin or bill is deposited, or when a bank card has been inserted or tapped. Once payment Media has been inserted, it will no longer be possible for new patron selections to be made until the current transaction has been completed or canceled.	CDRL 16-6
16.6.1-5	The CVM will automatically detect what form of payment the patron has inserted. Depending on configuration, patrons will not have to declare whether the transaction will be by cash (coin or bill), or a bank card. Payment types will be mutually exclusive.	CDRL 16-6
16.6.1-6	For CVMs equipped with cash acceptance modules, when paying by cash, the CVM will permit the patron to deposit coins and bills in any sequence.	CDRL 16-6
16.6.1-7	All CVMs will include an encrypting keypad (i.e., PIN Pad) that will also support use by visually impaired patrons for transaction selections and other inputs.	CDRL 16-6
16.6.1-8	When equipped to accept bank cards for payments, the PIN Pad will support patron entry of Personal Identification Numbers and ZIP codes.	CDRL 16-6
16.6.1-9	When configured to accept bank cards for payments, the CVM will include a module or modules to accept bank cards (credit and debit). These modules will include a magnetic stripe card Reader, a Contactless Bank Card reader, and a Contact Smart Card interface (see Technical Specifications Section 11.6 (Bank Card Processing Interfaces)).	CDRL 16-6
16.6.1-10	All CVMs will include a Contactless Smart Card Interface to read NFPS Agency-Issued Media.	CDRL 16-6
16.6.1-11	The SI shall submit a conceptual description of the function, configuration, and arrangement of all devices on the front panel will be submitted to the MTA for review and approval.	CDRL 16-6

16.6.2 CVM Patron Display

The CVM will include a Patron Display bearing simple, basic instructions which will sequentially instruct the patron how to perform any transaction available from the CVM.

Req. #	Requirement	Assigned CDRL(s)
16.6.2-1	The display screen will consist of a color, trans-reflective back-lighted Liquid Crystal Display (LCD).	CDRL 16-6
16.6.2-2	The display screen will provide resolution of no less than 1024 by 768 pixels, and will generally use dark characters on a light background.	CDRL 16-6
16.6.2-3	The display screen will utilize LEDs for backlighting.	CDRL 16-6
16.6.2-4	The display screen will be capable of displaying at least 256 distinct colors.	CDRL 16-6
16.6.2-5	The display screen will measure at least 15 inches diagonally.	CDRL 16-6
16.6.2-6	The display screen will display characters and symbols compliant with ADA requirements. All displayed text will be as described in Technical Specifications Section 5.10 (Aesthetic Requirements and User Interfaces).	CDRL 16-6
16.6.2-7	The display screen will have a maximum operating temperature rating of at least 50 °C.	CDRL 16-6
16.6.2-8	The Patron Display shall be operable by a patron with gloves during cold weather.	CDRL 16-6
16.6.2-9	The display screen will produce a minimum of 1,000 nits brightness with at least a 750:1 contrast ratio, and provide a level of visibility sufficient to allow all displayed instructions to be read easily by the patron under all ambient light conditions and without the need for any additional peripheral light source or shading device.	CDRL 16-6
16.6.2-10	The display screen will be angled at least 15 degrees from vertical to permit ease of use by standing patrons as well as those seated in wheelchairs.	CDRL 16-6
16.6.2-11	The Patron Display will be easily replaceable from within the CVM interior and shall require minimal maintenance effort.	CDRL 16-6
16.6.2-12	Within the entire viewing area, all portions of the Patron Display will be visible and not obstructed by any portion of the CVM outer door, mounting bezels or other elements of the CVM.	CDRL 16-6
16.6.2-13	The CVM will include an ambient light sensor to adjust automatically the intensity of the Patron Display backlight. Each NFPS Agency will be able to adjust the extent to which the backlight intensity is reduced during low ambient light conditions for that NFPS Agency's CVMs.	CDRL 16-6
16.6.2-14	All text messages and information displayed on the Patron Display will be capable of being easily modified by each NFPS Agency, for its respective Patron Displays. All such messages will be configured on the NFPS Backend and will be downloaded to the CVMs via the network or will be transferable to the CVMs via an SSMM or other removable storage media.	CDRL 16-6
16.6.2-15	The SI shall submit to the MTA for approval information on type of display and patron messages to be displayed. Conceptual designs of the Patron Display unit, messages and shield will be submitted for the MTA's review and approval.	CDRL 16-6

Req. #	Requirement	Assigned CDRL(s)
16.6.2-16	The SI shall submit procedures to modify Patron Display message content and format for the MTA's review and approval.	CDRL 16-6

16.6.3 Required Pre-Defined Buttons

All CVMs will provide pre-defined pushbuttons that are always functional while the CVM is operating:

Req. #	Requirement	Assigned CDRL(s)
16.6.3-1	One VOICE message pushbutton which, when depressed, will cause message(s) to be annunciated to the patron in the currently selected language. See Technical Specifications Section 11.13 (Voice Messaging System).	CDRL 16-6
16.6.3-2	One CANCEL pushbutton which, if activated before fare payment has been completed or before commencing Media dispensing activity, will cancel the transaction according to the procedures described in Technical Specifications Section 16.22.5 (Cancellation).	CDRL 16-6

16.6.4 Push Button Requirements

If applicable, all push buttons will:

Req. #	Requirement	Assigned CDRL(s)
16.6.4-1	Be made of stainless steel or hardened aluminum or other MTA-approved material.	CDRL 16-6
16.6.4-2	Have a flat front surface of approximately 1 square inch to provide proper finger contact.	CDRL 16-6
16.6.4-3	Not rotate.	CDRL 16-6
16.6.4-4	Be accompanied by an audible tone upon being depressed.	CDRL 16-6
16.6.4-5	Provide less than 8 ounces of resistance to depressing.	CDRL 16-6
16.6.4-6	Protrude no more than 0.25 inches from the face of the front panel.	CDRL 16-6
16.6.4-7	Be protected against vandalism, including impact resistance from pounding, such as by a person's foot or fist.	CDRL 16-6
16.6.4-8	Be liquid-proof to provide sealed contacts for all switches.	CDRL 16-6
16.6.4-9	Not be removable from the outside.	CDRL 16-6
16.6.4-10	Be easily replaceable from the inside.	CDRL 16-6
16.6.4-11	Comply with all applicable ADA and Title VI regulations.	CDRL 16-6
16.6.4-12	Function properly with the same amount of applied force irrespective of where the force is applied on the front surface of the button.	CDRL 16-6

16.6.5 Patron Selection Touch Screen

Req. #	Requirement	Assigned CDRL(s)
16.6.5-1	The Patron Display will incorporate a touch sensitive surface to allow clearly delimited regions of the display to perform variably-defined functions as transactions progress. This interface is hereafter referred to as "touch screen."	CDRL 16-6

Req. #	Requirement	Assigned CDRL(s)
16.6.5-2	Using the CVM's touch screen, patrons will be able to select any available transaction type; the CVM will present patrons only those selections that are currently available according to operating status, module configuration, ticket stock availability, and so on.	CDRL 16-6
16.6.5-3	The touch screen will provide for no less than 12 clearly delimited regions from which selections can be made. Each region will be no less than two (2) square inches. Suitable spacing between regions will be provided to limit accidentally erroneous selections.	CDRL 16-6
16.6.5-4	The dynamically defined menus that can be constructed using these touch regions will be capable of supporting the functions required, including a minimum of 256 entries in each fare table (current and future).	CDRL 16-6
16.6.5-5	One or more touch regions will be dedicated to selecting the language of displayed messages (and voice messages, if activated) between English and other languages. These regions will be active throughout the transaction process.	CDRL 16-6
16.6.5-6	One region will be dedicated to the CANCEL function, duplicating the function of the pre-defined CANCEL push button. This region will be active whenever cancellation of the transaction is possible.	CDRL 16-6
16.6.5-7	When the same function appears in several screens, selection regions will be consistently placed on the screen.	CDRL 16-6
16.6.5-8	The technology used to detect patron selections will be resistant to scratches and other normal wear. No coatings or other materials applied to the outer surface of the display's protective shield will be required to detect the patron's selection.	CDRL 16-6
16.6.5-9	The sensitivity of the touch screen will be unaffected by precipitation, temperature, sunlight, and other environmental conditions typical of the MTA Group operating regions.	CDRL 16-6
16.6.5-10	The touch screen will accommodate patrons wearing gloves and using prosthetic devices.	CDRL 16-6
16.6.5-11	The patron selection touch screen will be easily replaceable from within the CVM interior, and require minimal maintenance effort.	CDRL 16-6
16.6.5-12	The SI shall submit details of touch screen interface technology, size, and orientation on the CVM front panel for the MTA's review and approval.	CDRL 16-6

16.6.6 Audible Tones

Req. #	Requirement	Assigned CDRL(s)
16.6.6-1	The CVM will emit distinctive tones to provide audio feedback to the patron each time a valid button or touch screen region is pressed.	CDRL 16-6
16.6.6-2	The CVM will emit distinctive tones to provide audio feedback during circumstances where additional patron action is required (including at minimum while prompting the patron to retrieve coins, bills, or tickets from their respective return locations).	CDRL 16-6
16.6.6-3	The volume of the tones will be field-adjustable locally for each CVM, and will be audible in all station environments.	CDRL 16-6

Req. #	Requirement	Assigned CDRL(s)
16.6.6-4	The SI shall identify all audible tones and provide digitally recorded samples of each for the MTA's review and approval.	CDRL 16-6

16.6.7 Instructional Graphics

Req. #	Requirement	Assigned CDRL(s)
16.6.7-1	The CVM will provide Instructions on the front panel to clearly indicate each step a patron will follow to choose and purchase a new EU Smart Card, purchase one or more LU Smart Cards and perform Transit Account replenishment transactions. The sequence of steps will be clearly indicated by the use of graphics and symbols.	CDRL 16-6
16.6.7-2	CVM instruction graphics will be modular so that the graphics can easily be configured to match the configuration of the CVM. For example, only CVMs that accept cash will include instructional graphics depicting coins and bills.	CDRL 16-6
16.6.7-3	The design of instructions and graphics will minimize glare and other effects of sunlight and ambient lighting that could otherwise reduce the readability of the instructions on the CVM.	CDRL 16-6
16.6.7-4	CVM instruction graphics will include raised lettering and Braille instructions in conformance with ADA requirements.	CDRL 16-6
16.6.7-5	Instructional graphics will include pictograms that clearly depict proper insertion orientation of bills and bank cards into their respective slots.	CDRL 16-6
16.6.7-6	All instructions, Braille, and graphics directly applied to the front face of the CVM will be presented in American English.	CDRL 16-6
16.6.7-7	The SI shall submit conceptual designs of the CVM instructions and related graphics for the MTA's review and approval.	CDRL 16-6

16.6.8 Coin Insertion Slot

Req. #	Requirement	Assigned CDRL(s)
16.6.8-1	When configured to accept coins, the CVM will contain a coin insertion slot as described in Technical Specifications Section 11.5 (Coin Handling Unit).	CDRL 16-9
16.6.8-2	For CVMs not configured to accept coins, the SI shall supply and install a blanking plate in lieu of the coin insertion slot assembly.	CDRL 16-9

16.6.9 Bill Slots

Req. #	Requirement	Assigned CDRL(s)
16.6.9-1	When configured to accept bills, the CVM will include one or more slots for insertion and return of bills.	CDRL 16-10
16.6.9-2	The bill insertion slot will be designed to guide the bills fed into the CVM without jamming.	CDRL 16-10
16.6.9-3	The CVM will return bills to a separate bill return slot, or to the bill insertion slot.	CDRL 16-10

Req. #	Requirement	Assigned CDRL(s)
16.6.9-4	The bill insertion and return slots will be robust and scratch resistant and be designed to withstand wear and abrasion for the life of the CVM.	CDRL 16-10
16.6.9-5	A shutter or a similar feature to ensure that foreign matter cannot enter the CVM will protect the bill entry slot while the CVM is not accepting bills.	CDRL 16-10
16.6.9-6	For CVMs not configured to accept bills, the SI shall supply and install one or more blanking plates to cover the openings in the CVM door dedicated to the bill insertion and return slots.	CDRL 16-10

16.6.10 Media/Coin Return Bin

Req. #	Requirement	Assigned CDRL(s)
16.6.10-1	The CVM will include a Media/Coin Return Bin that will safely hold dispensed Media, returned coins and receipts.	CDRL 16-13
16.6.10-2	The opening for the Media/Coin Return Bin will 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 patrons. The door will be at least 0.25 inches thick and completely cover the opening when closed.	CDRL 16-13
16.6.10-3	The bin and its door will be robust, scratch-resistant and visually prominent.	CDRL 16-13
16.6.10-4	The geometry of the bin and its door will minimize intrusion into the CVM while the Media/Coin Return Bin door is open.	CDRL 16-13
16.6.10-5	The Media/Coin Return Bin will be designed to drain any liquids placed in the bin to the outside of the CVM.	CDRL 16-13
16.6.10-6	The preferred minimum height of the centerline of the Media/Coin Return Bin is at least 24 inches from the finished floor.	CDRL 16-13
16.6.10-7	The Media/Coin Return Bin will contain lights or other visual signal to alert the customer to its location.	CDRL 16-13

16.7 Service Interface

Req. #	Requirement	Assigned CDRL(s)
16.7-1	Inside the CVM, located within easy reach and viewing while the outer door is open, will be a keypad and display for use by maintenance and revenue service personnel. The Patron Display may be used for maintenance purposes if the Patron Display is viewable while using the service keypad.	CDRL 16-14
16.7-2	The service keypad will be used to enter access codes and maintenance and diagnostic commands; all routine service interaction with the CVM will be via this keypad.	CDRL 16-14
16.7-3	The service display will be used to indicate CVM error codes, and will have the capability of displaying multiple error codes, such that one error code will not need to be cleared to display other error codes.	CDRL 16-14

Req. #	Requirement	Assigned CDRL(s)
16.7-4	The conceptual design of the service keyboard and display, and a preliminary listing of service commands, error displays, diagnostic messages, etc. that are available with the service interface will be submitted for the MTA's review and approval.	CDRL 16-14

16.8 Coin Handling Unit

Req. #	Requirement	Assigned CDRL(s)
16.8-1	CVMs configured to accept coins will be equipped with a Coin Handling Unit as described in Technical Specifications Section 11.5 (Coin Handling Unit), in addition to the coin recirculating system described below.	CDRL 16-9

16.8.1 Coin Recirculating System

Req. #	Requirement	Assigned CDRL(s)
16.8.1-1	The coin recirculating system will receive and store coins that have been verified by the coin acceptor/verifier.	CDRL 16-9
16.8.1-2	The coin recirculating system will include a minimum of five self-filling coin recirculating modules.	CDRL 16-9
16.8.1-3	Each coin recirculating module will have a capacity of at least fifty (50) coins.	CDRL 16-9
16.8.1-4	A recirculating module will be assigned to each of the accepted U.S. coin types (nickel, dime, quarter and dollar).	CDRL 16-9
16.8.1-5	The fifth recirculating module for each NFPS Agency will be configurable by that NFPS Agency to supply additional recirculating capacity for any accepted coin type.	CDRL 16-9
16.8.1-6	The coin recirculating system for each NFPS Agency will be configurable by that NFPS Agency to assign any future accepted coin types to a recirculating module or be directed to the coin vault.	CDRL 16-9
16.8.1-7	If the cancel button is activated before completion of the transaction, or the transaction is otherwise aborted, the coin recirculating system will return coins equal to the value of inserted coins to the Media/Coin Return Bin.	CDRL 16-9
16.8.1-8	The coin recirculating system will deposit coins into the coin vault when the recirculating module for that particular coin is full and when a coin type has no recirculating coin module assigned.	CDRL 16-9
16.8.1-9	The Coin Handling Unit will automatically detect the location of each recirculating coin module, continuously monitor the contents of each and adjust its operation accordingly.	CDRL 16-9
16.8.1-10	Coin recirculating modules will provide for the safe deposit and secure storage of coins. At no time will a removed recirculating module provide unauthorized access to coins.	CDRL 16-9
16.8.1-11	The CVM will provide authorized personnel distinct diagnostics and commands. All necessary CVM data registers will reflect performed diagnostics.	CDRL 16-9

16.8.2 Coin Jams

Req. #	Requirement	Assigned CDRL(s)
16.8.2-1	In the event a foreign object, coin, slug, bent coin or a coin having a sticky substance on it becomes jammed inside the coin acceptor/verifier, activation of a coin release mechanism will cause the jammed coin(s) to be released into the Media/Coin Return Bin.	CDRL 16-9
16.8.2-2	While the CVM is in service, activation of the CANCEL push button will cause the coin release mechanism to activate (either directly via mechanical means or indirectly via electronic means).	CDRL 16-9
16.8.2-3	When the Coin Handling Unit detects a jam in the coin acceptor/verifier, the CVM will automatically activate the coin release mechanism.	CDRL 16-9
16.8.2-4	At no time will the coin insertion slot open to accept an additional coin if a coin is already jammed in the coin system.	CDRL 16-9
16.8.2-5	It will be possible for maintenance and revenue service personnel to gain quick access to the jam to remove any jammed object if activation of the coin release mechanism does not clear the jam.	CDRL 16-9

16.9 Supplemental Change Dispensing System

Req. #	Requirement	Assigned CDRL(s)
16.9-1	When configured to dispense change, CVMs will include a supplemental change dispensing system to provide an additional supply of change that is replenished in bulk by NFPS Agency revenue service personnel.	CDRL 16-9
16.9-2	The CVM's supplemental change dispensing system will be capable of dispensing supplemental change from at least three separate change-dispensing modules (also referred herein as "coin hoppers").	CDRL 16-9
16.9-3	When configured to dispense supplemental change, the CVM will contain two separate supplemental change-dispensing modules, one each for nickels and quarters; the third position will remain functional but empty.	CDRL 16-9
16.9-4	Each supplemental coin hopper will have a capacity of at least one thousand (1,000) coins of any denomination chosen by the MTA.	CDRL 16-9
16.9-5	Each NFPS Agency will be able to configure its own coin hoppers to dispense nickels, quarters or dollar coins. Configuring a coin hopper for another denomination will require no Hardware modifications and no Software upgrade to the hopper.	CDRL 16-9
16.9-6	Coin hoppers will be used as a supplemental stock of coins for automatic change making purposes and will operate independently of the recirculating coin system.	CDRL 16-9
16.9-7	The CVM will automatically detect the presence or absence of each coin hopper and the type of coins contained in each unit; the CVM will automatically adjust its operation accordingly.	CDRL 16-9
16.9-8	The CVM will continue to function without a full complement of coin hoppers, and it will not be necessary for all CVMs to be equipped with identical coin hopper configurations.	CDRL 16-9

Req. #	Requirement	Assigned CDRL(s)
16.9-9	Coins dispensed from the change-dispensing modules will be deposited into the Media/Coin Return Bin.	CDRL 16-9
16.9-10	Each change dispensing module will be able to sense that the correct change has been given to the patron and that no jam has occurred, and will signal each action made to the Electronic Control Unit. The ECU will retain a record of the value of monies dispensed.	CDRL 16-9
16.9-11	If an incorrect amount is dispensed or a jam occurs, the CVM Electronic Control Unit will generate and store an appropriate event record, and the CVM will automatically disable the affected dispensing. If such a failure results in a patron being short-changed, the CVM will make all necessary attempts to dispense correct change from other sources.	CDRL 16-9
16.9-12	The CVM will detect a repetitive cycle failure, which would dispense excess change, and invoke a positive electrical shutdown of the change dispensing module to prevent a "jackpot."	CDRL 16-9
16.9-13	Because the supplemental change modules will be replenished in bulk when serviced, the modules will secure their contents in sturdy containers equipped with high security locks.	CDRL 16-9
16.9-14	When removed from the CVM, the change storage containers will remain secure not allowing insertion or removal of coin and will only be accessed with a controlled key(s) issued to Revenue Facility cash processing personnel.	CDRL 16-9
16.9-15	The supplemental change storage containers will be of sturdy construction, manufactured from stainless steel or other material approved by the MTA and will withstand normal handling and regular removal and replacement without deformation that would in any way interfere with the insertion and removal process.	CDRL 16-9
16.9-16	Rails, shelving or tracks that guide the containers in and out of position will also be constructed of stainless steel or other material approved by the MTA.	CDRL 16-9
16.9-17	When dropped from a height of three feet on a concrete floor on any corner or side, a full supplemental change storage container will retain its contents, will not open, nor will its locking mechanism be impaired or compromised.	CDRL 16-9
16.9-18	The supplemental change storage containers will have a handle or handles placed to avoid injury, which provides adequate gloved-hand clearance for easy insertion, removal and carrying.	CDRL 16-9
16.9-19	The CVM will detect when each supplemental change storage container is near-empty and empty, which will cause the ECU to record the event and transmit an event record to the NFPS Backend. The determination of a nearly empty condition will be Software controllable and adjustable by each NFPS Agency, for that NFPS Agency's CVMs.	CDRL 16-9
16.9-20	When full, a supplemental coin hopper will not exceed 50 pounds.	CDRL 16-9

Req. #	Requirement	Assigned CDRL(s)
16.9-21	Each supplemental coin hopper will not exceed the following outside dimensions: Height: 12 inches Width: 7 inches Depth: 10 inches	CDRL 16-9

16.10 Bill Handling Unit

Req. #	Requirement	Assigned CDRL(s)
16.10-1	When configured to accept bills, the CVM will be equipped with a Bill Handling Unit (BHU).	CDRL 16-10
16.10-2	The BHU will include a bill validator, a bill escrow module, bill recirculator modules, bill vault and a chassis and its associated wiring and electronic devices.	CDRL 16-10
16.10-3	The BHU will be an integral component of the CVM's change-making capability, and will use patron-inserted bills as sources of change for cash transactions.	CDRL 16-10
16.10-4	Except during efforts to clear jams in the bill path, access to bills will not be possible at any time during maintenance or revenue transfer operations, but will only be accessible by controlled-key lock.	CDRL 16-10

16.10.1 Bill Validator

Req. #	Requirement	Assigned CDRL(s)
16.10.1-1	The bill validator will accept one bill at a time and will determine the denomination and validity of the bill.	CDRL 16-10
16.10.1-2	The bill validator will determine the denomination and validity of both sides of a bill by dimension checks and pattern and color recognition.	CDRL 16-10
16.10.1-3	The bill validator will accept at least 32 different types of bills.	CDRL 16-10
16.10.1-4	The bill validator will be capable of accepting multiple varieties of \$1, \$2, \$5, \$10, \$20, \$50 and \$100 bills.	CDRL 16-10
16.10.1-5	The bill validator will be able to accept bills inserted in any of the four possible length-wise orientations.	CDRL 16-10
16.10.1-6	The bill validator will accept valid bills in general circulation. The bill acceptor may reject bills with excessive physical defects. Bills with these defects are not considered as valid for purposes of determining acceptance rate.	CDRL 16-10
16.10.1-7	If the bill is acceptable, the bill validator will transfer it to the escrow module.	CDRL 16-10
16.10.1-8	The bill validator will be able to detect counterfeit bills, including copies made in either single or double-sided printing on an electronic copier and those made with color printers.	CDRL 16-10

Req. #	Requirement	Assigned CDRL(s)
16.10.1-9	If the bill validator deems the inserted bill to be invalid, the bill will be returned and gripped so that the TVM retains a hold on the item.	CDRL 16-10
16.10.1-10	The BHU will present and hold rejected and returned bills in the bill return slot for NFPS Agency-programmable times (programmable on an NFPS Agency-specific basis). During such time, the BHU will accept no additional bills. If the patron fails to retrieve the returned bills, upon expiration of the programmable timer and cancellation of the transaction, the BHU will take whatever actions are necessary to return to full functionality (Patron inaction will not cause the BHU to go out of service).	CDRL 16-10
16.10.1-11	The bill validator will be designed to reject or expel pieces of paper or other foreign material that can be introduced into the bill insertion slot.	CDRL 16-10
16.10.1-12	The bill validator will include a mechanical blocking function to prevent withdrawal of a bill after acceptance.	CDRL 16-10
16.10.1-13	Each NFPS Agency will be able to configure, on an NFPS Agency-specific basis, the BHU to inhibit the acceptance of any denomination and insertion orientation.	CDRL 16-10
16.10.1-14	As the U.S. Treasury releases new designs of bills, the BHU will be capable of being programmed to accept the new designs while continuing to accept the current designs.	CDRL 16-10
16.10.1-15	Each NFPS Agency will be able to configure, on an NFPS Agency-specific basis, the BHU to inhibit the acceptance of any bill by transaction type. For example, high-denomination bills may be denied for single-ride ticket purchases. In such cases, whenever a valid bill is rejected due to transaction-specific criteria, the CVM will not cancel the transaction, but present an explanatory message on the Patron Display, such as "Please use a smaller denomination." Note that this response is distinct from that described in Technical Specifications Section 16.11.1 (Change Payout Limits) when the maximum change payout is exceeded.	CDRL 16-10
16.10.1-16	<p>The bill slot shutter will open or be activated once a transaction type has been selected and the CVM has displayed the fare. The shutter will automatically close or be deactivated when one of the following situations occur:</p> <ul style="list-style-type: none"> • Fare amount due has been inserted into the CVM. • Bank card is processed for payment before any cash is accepted. • Cancel button has been pressed or the transaction is automatically canceled. • Bill vault is full. • Bill is jammed. • Bill escrow is full. • CVM or BHU switches to an out-of-service condition. • The patron changes transaction selection to a type not available due to stock depletion or other malfunction. 	CDRL 16-10

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> The patron changes transaction selection to a type that cannot be purchased with cash. 	
16.10.1-17	<p>The bill validator will meet the following acceptance rates:</p> <ul style="list-style-type: none"> At least 95 percent of valid bills are accepted upon initial insertion. At least 98 percent of valid bills are accepted in no more than two insertion attempts. All known counterfeit bills, color photocopies of valid bills, duplicates made by other known means, foreign bills, and bills of denominations not accepted by the CVM are rejected upon every insertion. 	CDRL 16-10
16.10.1-18	The bill validator will identify valid acceptable bills with measured accuracy of at least the manufacturer's published specification. The published specification will be provided to the MTA during Design Review.	CDRL 16-10
16.10.1-19	The bill validator will be secured to the BHU via a high-security lock and will be separately removable from the BHU for servicing.	CDRL 16-10
16.10.1-20	The methods and procedures for adjusting the acceptance characteristics of the BHU will be submitted for the MTA's review and approval.	CDRL 16-10

16.10.2 Bill Escrow Module

Req. #	Requirement	Assigned CDRL(s)
16.10.2-1	Upon acceptance of each inserted bill, the bill validator will forward the bill to an escrow to be stored temporarily until completion or cancellation of the transaction.	CDRL 16-10
16.10.2-2	Bills will be escrowed in a module dedicated to escrowing bills and in the bill recirculating modules.	CDRL 16-10
16.10.2-3	Each NFPS Agency will be able to configure the location for escrowing each denomination of bills for its bill escrow module. In general, higher denomination bills that will not be issued as change will be escrowed in the bill escrow module; only denominations to be issued as change will be escrowed in the bill recirculating modules.	CDRL 16-10
16.10.2-4	The bill escrow module will have the capacity to store a minimum of 15 bills.	CDRL 16-10
16.10.2-5	The bill acceptor will cease accepting bills upon the earlier of (i) the bill escrow becoming full, and (ii) an NFPS Agency-adjustable limit of inserted bills per transaction being reached (adjustable on an NFPS Agency-specific basis).	CDRL 16-10
16.10.2-6	When the patron cancels the transaction, the CVM aborts the transaction, or the CVM switches to an out-of-service condition, the BHU will return from escrow the exact same bills inserted for the transaction. The BHU will return the escrowed bills in a single stack to the bill return slot.	CDRL 16-10
16.10.2-7	When a transaction is completed, all bills in the bill escrow module will be transported to the bill vault for retention.	CDRL 16-10

16.10.3 Bill Recirculating System

Req. #	Requirement	Assigned CDRL(s)
16.10.3-1	The BHU will include a bill recirculating system that is capable of recirculating at least four denominations of bills. Each denomination to be recirculated will be assigned to a bill recirculating module.	CDRL 16-10
16.10.3-2	Each bill recirculating module will have a minimum capacity of 30 bills.	CDRL 16-10
16.10.3-3	When a bill recirculating module is full, the BHU will escrow in the bill escrow module, inserted bills normally assigned to the full bill recirculating module.	CDRL 16-10
16.10.3-4	Upon completion of a transaction, bills escrowed in the bill recirculating modules will remain in their respective modules.	CDRL 16-10
16.10.3-5	When dispensing bills as change, the BHU will assemble the bills to be issued into a single stack prior to dispensing the bills through the bill return slot.	CDRL 16-10
16.10.3-6	Each NFPS Agency will be able to configure the operating parameters for the change dispensing process for its own BHUs.	CDRL 16-10

16.10.4 Supplemental Bill Dispensing Module

Req. #	Requirement	Assigned CDRL(s)
16.10.4-1	Requirement Removed	
16.10.4-2	Requirement Removed	
16.10.4-3	Requirement Removed	
16.10.4-4	Requirement Removed	
16.10.4-5	Requirement Removed	
16.10.4-6	Requirement Removed	
16.10.4-7	Requirement Removed	
16.10.4-8	Requirement Removed	
16.10.4-9	Requirement Removed	
16.10.4-10	Requirement Removed	

16.10.5 Bill Vault

Req. #	Requirement	Assigned CDRL(s)
16.10.5-1	The BHU will be equipped with a removable bill vault. The bill vault will have a capacity of no less than 1,400 stacked bills in street condition.	CDRL 16-10
16.10.5-2	Bills will be stored in a neat stack in the bill vault.	CDRL 16-10
16.10.5-3	It will not be possible to open the bill vault while it is installed in the BHU, nor will it be possible to install an open or unlocked bill vault into the BHU.	CDRL 16-10
16.10.5-4	When properly installed in the BHU, it will be impossible to access bills in the bill vault without damaging the vault in an obvious manner.	CDRL 16-10

Req. #	Requirement	Assigned CDRL(s)
16.10.5-5	The bill vault will be constructed of sturdy material, and will withstand normal handling and regular removal and replacement without deformation that would in any way interfere with the insertion and removal process.	CDRL 16-10
16.10.5-6	When dropped from a height of three feet on a concrete floor on any corner or side, the full bill vault will remain fully operational, will suffer no more than cosmetic damage, will not open, nor will its locking mechanism be impaired.	CDRL 16-10
16.10.5-7	The bill vault will have a handle or handles placed to avoid injury and provide adequate gloved-hand clearance for easy insertion, removal and carrying.	CDRL 16-10
16.10.5-8	When full, the bill vault weight will not exceed 20 pounds.	CDRL 16-10
16.10.5-9	The CVM will detect when the bill vault is near-full and full, which will cause the ECU to record the event and transmit an event record to the NFPS Backend. The determination of a nearly full condition will be Software controllable and adjustable, and each NFPS Agency will be able to make such adjustments for each of its CVMs.	CDRL 16-10
16.10.5-10	The CVM will cease to accept bills (i.e., enter “No Bills Accepted” mode) when the bill vault becomes full.	CDRL 16-10
16.10.5-11	The CVM will automatically reset all appropriate money counters when the bill vault is removed.	CDRL 16-10
16.10.5-12	If, during design review, the MTA determines that the recirculating capabilities are unnecessary, then the CVM BHU bill vault will have a capacity of no less than 2,000 stacked bills in street condition, and the recycling requirements herein will not be obligatory.	CDRL 16-10

16.10.6 Bill System Security Interlocks

Req. #	Requirement	Assigned CDRL(s)
16.10.6-1	The bill vault and SBDM will be locked into the BHU and will include security interlocks to restrict access to monies on a “need to gain access” basis defined by the MTA during design review.	CDRL 16-10
16.10.6-2	A security interlock in the BHU will ensure that bills leave the escrow module for transfer into the bill vault only when a bona fide bill vault and escrow module are inserted fully in their proper operating positions.	CDRL 16-10
16.10.6-3	Each bill storage module will have a visually and electronically readable component code and serial number. The CVM will automatically read and verify as valid the component code and serial number of each inserted bill storage module. This information will be made available both locally at the CVM and remotely at the NFPS Backend.	CDRL 16-10
16.10.6-4	The CVM will read the electronically readable component code at a frequency fast enough to ensure that the component cannot be exchanged without the CVM detecting the removal of the unit.	CDRL 16-10

Req. #	Requirement	Assigned CDRL(s)
16.10.6-5	The electronically readable component code and serial number will not require the connection or disconnection of cables when replacing the bill storage module.	CDRL 16-10
16.10.6-6	Once a bill storage module has been removed, it will not be able to be re-inserted into the CVM until it has been reset at each Revenue Facility, as applicable.	CDRL 16-10
16.10.6-7	Each component code and serial number will also be provided on a securely attached but replaceable tag. This tag shall be made of etched or stamped metal or other MTA-approved material, and will be oriented upright and visually readable when the bill storage module is installed in the CVM.	CDRL 16-10
16.10.6-8	If a bill storage module is removed or replaced while the CVM is out of service, when the CVM is restored to service, the CVM will automatically adjust all appropriate money counters to reflect that a module has been exchanged or removed.	CDRL 16-10

16.10.7 Bill Jams

Req. #	Requirement	Assigned CDRL(s)
16.10.7-1	Except for those instances where removal of the bill vault or the SBDM is required to clear a jam, it will be possible for maintenance and revenue service personnel to gain quick, tool-free access to remove a jammed bill.	CDRL 16-10
16.10.7-2	In the event a bill becomes jammed inside the BHU, the BHU will immediately cease accepting bills and make several attempts to automatically clear the jam. Upon failure to clear the jam, the CVM will cancel the transaction, return all monies possible, and leave the BHU out of service.	CDRL 16-10
16.10.7-3	At no time will the bill entry slot open to accept an additional bill if another bill is already jammed in the BHU.	CDRL 16-10
16.10.7-4	Upon retrieval of a jammed bill, the CVM will provide the technician means to deposit the jammed bill into the bill vault. All such deposits will be recorded as non-revenue deposits.	CDRL 16-10

16.11 Change Dispensing

Req. #	Requirement	Assigned CDRL(s)
16.11-1	When configured to dispense change, the CVM will utilize the coin recirculating system, coin hoppers, bill recirculating system, and the SBDM, as sources for change. Change rules, order and precedence will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 16-15

Req. #	Requirement	Assigned CDRL(s)
16.11-2	The CVM will not issue change for cash transactions that add value to a Transit Account. For those transactions, all inserted cash will be added to the customer's Transit Account (within maximum value limits, and including any bonus values as described in Technical Specifications Section 7 (Fare Policies)). The ability to issue change for cash transactions that add value to a Transit Account shall be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 16-15

16.11.1 Change Payout Limits

Req. #	Requirement	Assigned CDRL(s)
16.11.1-1	For each denomination of coin and bill issued as change, the CVM will provide a separately programmable maximum quantity to be dispensed for any single transaction. These parameters will be adjustable on an NFPS Agency-specific basis, by each NFPS Agency, at the NFPS Backend.	CDRL 16-15
16.11.1-2	A separate adjustable parameter will determine the maximum value of change that can be dispensed for any given transaction. The maximum change parameter will be individually adjustable locally at each CVM and at the NFPS Backend.	CDRL 16-15
16.11.1-3	If a pending surplus payment would result in change that exceeds the maximum change value, the transaction will be automatically canceled, an explanatory message will be shown on the Patron Display, and all deposited monies returned. For example, if the maximum change parameter is set to \$8.00, and the transaction is for a \$2 fare, by inference, \$10 bills are permitted for this transaction. If the patron then inserts a \$1 bill followed by a \$10 bill, the CVM will cancel the transaction and display a message such as "Maximum change value exceeded."	CDRL 16-15

16.11.2 Exact Fare Only Mode

Req. #	Requirement	Assigned CDRL(s)
16.11.2-1	The CVM will support "Exact Fare Only" mode if it has insufficient change or meets other specified criteria, with such criteria specified on an NFPS Agency-specific basis.	CDRL 16-15
16.11.2-2	The CVM will have a maximum overpayment limit as a parameter adjustable by each NFPS Agency, on an NFPS Agency-specific basis. This parameter will limit the amount a patron could forfeit if a surplus payment is made while the CVM is in Exact Fare Only Mode and cannot supply as change. This parameter will be individually adjustable for each CVM remotely via the NFPS Backend.	CDRL 16-15

Req. #	Requirement	Assigned CDRL(s)
16.11.2-3	If a pending overpayment (a surplus payment for which the CVM cannot make change) exceeds the maximum overpayment limit value, the CVM will automatically cancel the transaction, display an explanatory message on the Patron Display, and return all deposited monies. Note that if this parameter is set to zero, all overpayments that would result in forfeiture of change will result in canceled transactions.	CDRL 16-15
16.11.2-4	While in “Exact Fare Only” mode, the Coin Handling Unit will continue to accept inserted coins. If sufficient coins are inserted to restore change-making capabilities, the CVM will resume normal operations.	CDRL 16-15
16.11.2-5	While in “Exact Fare Only” mode, the BHU will continue to accept inserted bills. If sufficient bills are inserted to restore change-making capabilities, the CVM will resume normal operations.	CDRL 16-15
16.11.2-6	While in “Exact Fare Only” mode, the CVM will always determine if correct change can be dispensed for a given surplus payment within the quantity limits defined in Technical Specifications Section 16.11 (Change Dispensing). Whenever possible, correct change will be dispensed, even if the CVM is in “Exact Fare Only” mode.	CDRL 16-15

16.12 Smart Card Processing System

Req. #	Requirement	Assigned CDRL(s)
16.12-1	When configured to process NFPS Agency-Issued EU Smart Cards, the CVM will incorporate an ISO/IEC 14443 standard Contactless Smart Card Processing System (as this term is defined in this subsection).	CDRL 16-11
16.12-2	When configured to process NFPS Agency-Issued EU Smart Cards and to accept bank card payments, the CVM will have only one Contactless Smart Card Interface for NFPS Agency-Issued EU Smart Cards and Contactless Bank Cards.	CDRL 16-11
16.12-3	The CVM Smart Card Processing System will be compatible with the Smart Card Media specified in Technical Specifications Section 8 (Media Types).	CDRL 16-11
16.12-4	The Smart Card Processing System unit will be compliant with both the A and B variants of the ISO/IEC 14443 standard.	CDRL 16-11
16.12-5	The Smart Card Processing System will be activated (i.e., the antenna energized) while the CVM is in the idle state (including while the screen saver is active) and during those portions of transactions where reading a Smart Card is necessary or relevant.	CDRL 16-11
16.12-6	All Smart Card transactions will be individually recorded by the CVM.	CDRL 16-11
16.12-7	All transactions that replenish Transit Accounts associated with existing EU Smart Cards will require the CVM to communicate with the NFPS Backend to modify the Transit Accounts associated with the cards. If communication with the NFPS Backend is unavailable, the CVM will not process EU Smart Card transactions.	CDRL 16-11

Req. #	Requirement	Assigned CDRL(s)
16.12-8	All transactions that replenish Transit Accounts linked to existing EU Smart Cards will proceed only if the associated Transit Account is valid (i.e., not on the Negative List, suspended, dormant, etc.).	CDRL 16-11
16.12-9	The Smart Card Processing System will process NFPS Agency-Issued Smart Cards and will be capable of reading ISO IEC 14443-compliant cards from other sources.	CDRL 16-11
16.12-10	The SI shall submit a detailed description of the Smart Card Processing Module for the MTA's review and approval.	CDRL 16-11

16.13 Bank Card Processing System

Req. #	Requirement	Assigned CDRL(s)
16.13-1	When configured to accept bank cards for payment, the CVM will include the necessary module(s) to process bank cards for the purchase of tickets and Smart Card transactions. These modules are described in Technical Specifications Section 11.6 (Bank Card Processing Interfaces).	CDRL 16-12
16.13-2	Each fare table entry (account replenishment and ticket type selection) will have an associated NFPS Agency-adjustable parameter (adjustable on an NFPS Agency-specific basis) that determines whether the selection can be purchased with a bank card. Such transactions will be "Cash Only," and the CVM will display an appropriate message whenever the patron selects such transactions.	CDRL 16-12
16.13-3	The CVM will support cardholder verification methods, including address verification and all methods defined by EMV, to allow each NFPS Agency to manage risk. For any given transaction, a customer may be prompted to enter a PIN, billing ZIP code, or none, depending on NFPS Agency-configurable parameters (each configurable on an NFPS Agency-specific basis), including: <ul style="list-style-type: none"> • Country of card issuance (e.g., U.S., Canada, etc.) • Card brand (e.g., Visa, MasterCard) • Card type (e.g., EMV, prepaid, Contactless, transit benefit, specific IIN, etc.) 	CDRL 16-12
16.13-4	Distinct bank card transaction time-outs, modifiable on an NFPS Agency-specific basis by each NFPS Agency where possible, will be provided for each required input.	CDRL 16-12
16.13-5	The patron will have the ability to cancel the bank card transaction up until the time authorization is received by the CVM.	CDRL 16-12
16.13-6	Bank card transactions will be authorized by the NFPS Backend (for local Negative List and configurable velocity controls, both on an NFPS Agency-specific basis) and the NFPS payment application prior to dispensing a new EU Smart Card, issuing ticket(s) or confirming the replenishment of a Transit Account. If a bank card is declined for certain reasons the CVM will display related information to the customer, subject to the MTA's approval.	CDRL 16-12

Req. #	Requirement	Assigned CDRL(s)
16.13-7	Offline bank card acceptance at CVMs will be available pursuant to MTA policy. The CVM will have the ability to process offline authorizations according to configurable limits determined during design review. The configuration for offline processing will be downloaded from the NFPS Backend and can be enabled/disabled by NFPS Agency personnel. If offline transactions are disabled, and communications to the NFPS Backend are unavailable, bank card transactions will be disabled and all CVMs will enter "Cash Only" mode.	CDRL 16-12
16.13-8	The SI shall submit a detailed description of the Bank Card Processing System for the MTA's review and approval.	CDRL 16-12

16.14 LU/Paper Media Dispenser

16.14.1 Function

Req. #	Requirement	Assigned CDRL(s)
16.14.1-1	When configured to vend LU Media, each CVM will be equipped with an LU/Paper Media Dispenser as described in Technical Specifications Section 11.8 (LU/Paper Media Dispenser).	CDRL 16-2
16.14.1-2	The CVM's LU/Paper Media Dispenser will have the capability for multiple feeds from both rolled and stacked dispensers.	CDRL 16-2
16.14.1-3	<p>The following ticket stock capacities are required:</p> <ul style="list-style-type: none"> 2 rolls of at least 2,000 and up to 3,000 roll feed Limited Use/Paper Media 2 stackers of at least 2,000 and up to 3,000 stacked Limited Use/Paper Media <p>This will be configurable by each NFPS Agency, on an NFPS Agency-specific basis (e.g., it would be possible to have one LU Smart Card and one Paper Media dispenser).</p>	CDRL 16-2
16.14.1-4	When any ticket roll is depleted, the ECU will record as an event and transmit to the NFPS Backend a ticket stock empty condition.	CDRL 16-2
16.14.1-5	Upon depletion of a ticket stock roll, the CVM will commence using the second (or additional) roll, until all rolls are depleted.	CDRL 16-2
16.14.1-6	If a patron selects a product requiring stock that the CVM cannot dispense (due to stock depletion or other malfunction), the CVM will display "Currently Unavailable." Alternatively, ticket selections that are unavailable shall be omitted from the menu of selections available shown on the Patron Display.	CDRL 16-2

16.14.2 Products to be Vended

Req. #	Requirement	Assigned CDRL(s)
16.14.2-1	LU and Paper Media types to be vended by CVMs will be determined during design review.	CDRL 16-2

Req. #	Requirement	Assigned CDRL(s)
16.14.2-2	At minimum, ticket types, prices, printed text, printed barcodes, and assigned ticket stock will be NFPS Agency-configurable from the NFPS Backend, with such configuration on an NFPS Agency-specific basis.	CDRL 16-2
16.14.2-3	LU Media and barcoded Paper Media, including Joint Media, will be associated with a Transit Account upon issuance.	CDRL 16-2

16.15 Receipt Printer

Req. #	Requirement	Assigned CDRL(s)
16.15-1	The CVM will be equipped to print and issue patron receipts and audit tickets for accounting and registration. Receipts and audit tickets will print on separate receipt stock using a receipt printer described in Technical Specifications Section 11.7 (Receipt Printer).	CDRL 16-16
16.15-2	Separately for each payment type (cash and bank cards), the CVM will be configurable to provide receipts: <ul style="list-style-type: none"> • Upon patron request • Automatically for transactions that equal or exceed an NFPS Agency-configurable value (configurable on an NFPS Agency-specific basis), upon patron request if below the configurable value • For every transaction • Never (applicable to cash transactions only) 	CDRL 16-16
16.15-3	On demand of an authorized technician and automatically as required, the CVM will produce audit tickets, including: <ul style="list-style-type: none"> • Recirculating Coin Replenishment • Coin Vault Removal/Insertion • Coin Hopper Removal/Insertion • Supplemental Bill Dispenser Module Removal/Insertion • Bill Vault Removal/Insertion • Recovered Jammed Bill Deposit • Software Versions and CVM Configuration • CVM Revenue Status • CVM Current Status Samples of all audit tickets will be submitted for the MTA's review and approval.	CDRL 16-7
16.15-4	Each audit ticket will indicate the date, time, CVM number, technician name or number (not security code) and other specific information as required.	CDRL 16-7
16.15-5	Where audit tickets provide information that is subject to modification, including coin and bill denominations and ticket types, means will be provided that permit each NFPS Agency to easily modify printed text on an NFPS Agency-specific basis. For example, should LIRR decide to accept \$2 bills, add a new ticket type, or change the name of a ticket type, all affected audit tickets applicable to LIRR will be easily reconfigurable to accommodate the change.	CDRL 16-7

16.16 EU Smart Card Dispensers

Req. #	Requirement	Assigned CDRL(s)
16.16-1	When configured to dispense new EU Smart Cards, the CVM will be equipped with one or more EU Smart Card Dispenser modules.	CDRL 16-3
16.16-2	The EU Smart Card Dispenser module(s) will dispense NFPS Agency-Issued EU Smart Card Media from an internal stock that combined will have a total capacity of no less than 600 cards.	CDRL 16-3
16.16-3	The EU Smart Card Dispenser module(s) will monitor the contents of the card stock and transmit an event to the CVM ECU whenever available stock in a dispenser module is below an NFPS Agency-configurable low threshold and whenever a stack is empty, both on an NFPS Agency-specific basis.	CDRL 16-3
16.16-4	Prior to dispensing a card, the Smart Card Dispenser module will read the Unique Identifier (UID) of the card and any pre-encoded data on the card to confirm that the card is functioning.	CDRL 16-3
16.16-5	If the Smart Card Dispenser cannot read the UID and verify the pre-encoded data, the module will capture the card in a card reject bin and attempt to dispense another card.	CDRL 16-3
16.16-6	The card reject bin will have a capacity of no less than 25 cards.	CDRL 16-3
16.16-7	If a Smart Card Dispenser module fails to issue a card after an NFPS Agency-configurable number of attempts (initially set to three, but definable on an NFPS Agency-specific basis), the CVM will disable the Smart Card Dispenser module.	CDRL 16-3
16.16-8	Upon successful issuance of a card, the Smart Card Dispenser will inform the CVM's Electronic Control Unit of card's identity, in full compliance with PCI-DSS requirements.	CDRL 16-3
16.16-9	The Smart Card Dispenser module(s) will utilize two or more removable cassettes to store the EU Smart Card stock. The cassettes will securely hold cards and enable each NFPS Agency to replenish the EU Smart Card Dispenser by exchanging cassettes.	CDRL 16-3
16.16-10	When a cassette is empty or unable to dispense a card, the Smart Card Dispenser will automatically switch to another available cassette to dispense cards. When all cassettes are empty or unavailable, the CVM will enter "No New Cards Available" mode and transmit a corresponding event message to the NFPS Back Office.	CDRL 16-3
16.16-11	The Smart Card Dispenser module(s) will deposit dispensed cards into the Ticket/Coin Return cup no more than two seconds after commencing the vending process.	CDRL 16-3
16.16-12	All transactions that dispense new EU Smart Cards will require the CVM to communicate with the NFPS Backend to create the Transit Account associated with the card. If communication with the NFPS Backend is unavailable, the CVM will not dispense new EU Smart Cards.	CDRL 16-3

16.17 Electronic Control Unit

Req. #	Requirement	Assigned CDRL(s)
16.17-1	Each CVM will be equipped with an ECU as described in Technical Specifications Section 11.9 (Electronic Control Unit) and its subsections.	CDRL 16-17
16.17-2	The SI shall submit design of the CVMECU for the MTA's review and approval.	CDRL 16-17

16.18 CVM Software

Req. #	Requirement	Assigned CDRL(s)
16.18-1	The CVM will employ Software that satisfies the requirements in Technical Specifications Sections 5.12 (NFPS Software Requirements) and 11.10 (Machine Software).	CDRL 16-18
16.18-2	The CVM and NFPS Backend will be capable of supporting at least three fare tables (one current and two future), each with a capacity of at least 256 entries, where an entry in the fare table provides all configuration data corresponding to a transaction type selectable by passengers. Future tables will include a date and time at which each additional table is to become active.	CDRL 16-18
16.18-3	The CVM Application Software will be designed to accommodate each NFPS Agency's existing fare structure and fare policy described in Technical Specifications Section 7 (Fare Policies). The CVM will be capable of handling at least 12 other ticket types and 12 other EU Smart Card transactions.	CDRL 16-18
16.18-4	Each entry in the fare table (i.e., each ticket type selection) will be individually and dynamically configurable for availability for sale at each individual CVM. For example, an authorized NFPS Backend user will be able to configure CVMs in a specific station to vend special event round trip tickets, and then to subsequently disable such sales, without affecting other CVMs in the NFPS. Such configurability will not require the creation and download of new fare tables.	CDRL 16-18
16.18-5	Each entry in the fare table will at a minimum contain: <ul style="list-style-type: none"> • The price of the selection • Programmable text of the messages on the passenger display • Information to be printed on the ticket (as applicable) • As applicable, a variable parameter to specify the validity period of the Fare Product (expressed in minutes from the current time and days from the current date) for all Fare Products that have variable expiry date and time • Necessary information to identify the proper voice message to play when the transaction type is selected • Associated variable text for those audit receipts that include a listing of ticket types 	CDRL 16-18
16.18-6	The structure and layout of the fare table entries and the CVM's ability to accommodate existing and future fare policies will be subject to the MTA's review and approval.	CDRL 16-18

16.19 Service Indicator

Req. #	Requirement	Assigned CDRL(s)
16.19-1	Each CVM will have a visible exterior indication that the equipment is in need of servicing.	CDRL 16-7
16.19-2	Events that trigger activation of the Service Indicator (as described in this Technical Specifications Section 16.19 (Service Indicator)) will be NFPS Agency-selectable, on an NFPS Agency-specific basis.	CDRL 16-7
16.19-3	Subject to MTA review and confirmation, the Service Indicator will be activated under any of the following conditions: <ul style="list-style-type: none"> • CVM is out of service (except during power failure) • CVM is in Exact Fare Only mode • One or more enabled CVM modules has failed • The CVM is operating in a degraded mode • Coin vault is near full or full • Bill vault is near full or full • One or more supplemental change storage modules is low or empty • One or more ticket stocks is low or empty • A security breach is in progress • The alarm siren is activated due to impact detection • Communication with the NFPS Backend has failed 	CDRL 16-7
16.19-4	The Service Indicator will automatically extinguish whenever all conditions that caused the Service Indicator to activate are corrected.	CDRL 16-7

16.20 Security Camera Accommodations

Req. #	Requirement	Assigned CDRL(s)
16.20-1	The cabinet front panel will include a convex “fish eye” “two-way” mirror, which will permit use of a security camera (internal to the CVM) to view out the front of the CVM.	CDRL 16-5
16.20-2	The inside of the CVM door will include mounting studs to enable each NFPS Agency to supply and install digital security cameras. The security cameras will be powered by Ethernet and have no interaction with the CVM ECU.	CDRL 16-5

16.21 Scrolling Marquee Sign

Req. #	Requirement	Assigned CDRL(s)
16.21-1	Each CVM will have a scrolling marquee sign located on the front of the machine and easily visible to customers. Design, placement and content of the messages will be subject to the MTA's review and approval during design review. Marquee content shall be configurable both locally and remotely.	CDRL 16-6

16.22 CVM Operation

Req. #	Requirement	Assigned CDRL(s)
16.22-1	The SI shall submit detailed CVM transaction flows and performance metrics for the MTA's review and approval for each CVM configuration to be used by each individual NFPS Agency.	CDRL 16-19

16.22.1 Normal Operations

Req. #	Requirement	Assigned CDRL(s)
16.22.1-1	Each CVM will normally be ready to respond to a patron selection when it is in the idle condition. If the CVM is not ready, all operating functions will be disabled.	CDRL 16-19
16.22.1-2	The operating status, modular configuration and fare table configuration of each CVM will determine the availability of ticket and transaction types. Only ticket and transaction types that are available will be shown on the Patron Display.	CDRL 16-19
16.22.1-3	When a failure occurs during a transaction, the CVM will make every attempt to complete the transaction or return all deposited funds. If necessary, the CVM will err in favor of the patron, even if it means a possible loss of accounting accuracy.	CDRL 16-19
16.22.1-4	The CVM will not commence in-service activation until the outer door is closed and the outer door lock is returned to its fully secured position.	CDRL 16-19
16.22.1-5	Whenever the CVM alarm system siren is activated, the CVM will go out of service. When the siren is silenced, the CVM will perform self-diagnostics, and if possible, resume normal operations.	CDRL 16-19

16.22.2 Limited Operation of CVM

Req. #	Requirement	Assigned CDRL(s)
16.22.2-1	The CVM will provide continued but limited operation in the event of a failure of one or more components; provided that the failure poses no risk of further damage to the CVM or its components, the CVM will remain in service as long as it is capable of vending tickets or processing Smart Cards.	CDRL 16-19
16.22.2-2	At a minimum, the fully configured CVM will provide the reduced level of operations. CVMs configured with some modules or functions disabled will provide limited operations and corresponding messages as described herein.	CDRL 16-19
16.22.2-3	Whenever possible, the CVM will remain in service even if multiple Failures occur; for example, it will be possible for the CVM to simultaneously be in both "No Coins Accepted" mode and "Exact Fare Only" mode.	CDRL 16-19

Req. #	Requirement	Assigned CDRL(s)
16.22.2-4	<p>The CVM will go out of service only when one or more of the following occur:</p> <ul style="list-style-type: none"> • A component necessary to support all CVM operations fails, such as the Electronic Control Unit, power supply, Patron Display, etc. • All payment accepting modules fail (Coin Processing System, BHU, Bank Card Subsystem) • Both the LU Ticket Dispenser and the Smart Card Processor fail • Other operational conditions as defined herein occur • Other conditions as approved by the MTA during design review. 	CDRL 16-19
16.22.2-5	The CVM's ECU will indicate the limited operating condition to the NFPS Backend.	CDRL 16-19

16.22.3 Transaction Speed

The assumed speed of CVM transactions is a critical parameter in the calculations used to determine the number of CVMs required at each vending location.

Req. #	Requirement	Assigned CDRL(s)
16.22.3-1	<p>For ticket transactions purchased with cash, transaction time is defined as the time from completion of ticket selection to when all tickets are deposited in the Media/Coin Return Bin and all change is returned. Assuming:</p> <ul style="list-style-type: none"> • All inserted coins and bills are inserted at maximum possible speed, • All inserted coins and bills are accepted on the first insertion, and • All transactions are for the purchase of a single ticket 	CDRL 16-19
16.22.3-2	For all ticket and EU Smart Card purchase and replenishment transactions, the time from acceptance of the last coin or bill to deposit of the first EU Smart Card in the Media/Coin Return Bin or display of transaction results on the Patron Display will not exceed 3 seconds.	CDRL 16-19
16.22.3-3	Where transactions produce multiple tickets, the time between successive Media being deposited in the Media/Coin Return Bin will not exceed two (2) seconds each.	CDRL 16-19
16.22.3-4	For CVM cash transactions where no more than one piece of Media is dispensed, the time to complete the transaction after payment is complete (including dispensing the item, all change and a receipt) will not exceed 7 seconds.	CDRL 16-19
16.22.3-5	Transaction times for LU ticket or EU card purchases paid by bank card, measured from the time a bank card is read by the bank card subsystem and all required patron input is complete, to the time the CVM dispenses an LU ticket or EU Smart Card to the Media/Coin Return Bin will not exceed 7 seconds.	CDRL 16-19
16.22.3-6	Excluding the time for merchant acquirer processing, transaction times for transit account replenishments paid by bank card, measured from the time a bank card is authorized to when the results are conveyed on the Patron Display and any purchased Fare Media is issued, will not exceed three (3) seconds.	CDRL 16-19

Req. #	Requirement	Assigned CDRL(s)
16.22.3-7	For all CVM transactions, the time between the completion of the transaction (i.e., when all tickets or EU Smart Card, all change, and receipt are deposited in the Media/Coin Return Bin) and the CVM's readiness to begin another transaction will not exceed five (5) seconds, or the inter-transaction time-out defined in Technical Specifications Section 16.22.4 (Time-Out Operations), whichever is longer.	CDRL 16-19
16.22.3-8	If a transaction is canceled before cash payment is complete, all inserted money will be returned and the CVM will resume its idle condition within seven (7) seconds, or the inter-transaction time-out defined in Technical Specifications Section 16.22.4 (Time-Out Operations), whichever is longer. This interval will apply under normal operating conditions, when no more than 10 coins and 5 bills have been inserted.	CDRL 16-19
16.22.3-9	If a transaction is canceled before the patron's bank card is read or authorization received, the CVM will resume its idle condition within five (5) seconds, or the duration of the inter-transaction time-out defined in Technical Specifications Section 16.22.4 (Time-Out Operations), whichever is longer.	CDRL 16-19
16.22.3-10	For EU Smart Card replenishment transactions, the time to retrieve and display the associated Transit Account's status information will not exceed three (3) seconds.	CDRL 16-19
16.22.3-11	When applicable, the receipt printer will deposit receipts in the Media/Coin Return Bin within three (3) seconds of the dispensing of the last item, completion of a Smart Card replenishment, or patron's request for a receipt.	CDRL 16-19
16.22.3-12	Where possible, CVM speed will be optimized by the use of concurrent activities. For example: <ul style="list-style-type: none"> • If change requirements call for dispensing change from multiple devices (the recirculating coin system, one or more modules of the supplemental change storage system, the BHU), devices will be activated simultaneously. • If a canceled transaction requires the return of coins and bills, the ECU will direct both the coin and bill systems to do so simultaneously. 	CDRL 16-19

16.22.4 Time-Out Operations

Req. #	Requirement	Assigned CDRL(s)
16.22.4-1	The CVM will provide NFPS Agency-adjustable (on an NFPS Agency-specific basis) time-out periods to return the CVM 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, will also be adjustable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 16-19

Req. #	Requirement	Assigned CDRL(s)
16.22.4-2	The CVM will provide an intra-transaction time-out function which will limit the time between successive steps of any transaction. These steps will include inserting the required money, presenting bank cards or Smart Cards, presenting an NFPS Agency-Issued EU Smart Card, or any other patron input after initiating a transaction.	CDRL 16-19
16.22.4-3	The intra-transaction timer will start after selection is commenced, and will reset and re-start after each patron input, insertion of a coin or a bill, or presentation of a Smart Card or bank card. This will be configurable by each NFPS Agency, on an NFPS Agency-specific basis, and completed during design review.	CDRL 16-19
16.22.4-4	CVM operation will also provide for an inter-transaction time-out. This timer will limit the amount of time the CVM waits after completion or cancellation of a transaction (except as noted below) before resuming the idle state.	CDRL 16-19
16.22.4-5	During the inter-transaction time-out, the CVM Patron Display will indicate either that the transaction is complete (including reminders to retrieve any change and dispensed LU tickets, EU Smart Card or receipt, as applicable), or that the transaction has been canceled (including a reminder to retrieve returned cash when applicable).	CDRL 16-19
16.22.4-6	After an NFPS Agency-adjustable period displaying the idle screen, the NFPS Agency-specific CVM will display a screen saver as described in Technical Specifications Section 16.22.6 (Screen Saver). Each NFPS Agency will be able to configure the screen saver time-out on that NFPS Agency's CVMs.	CDRL 16-19
16.22.4-7	The CVM will include a separate time-out parameter to define the time allowed for a response from the NFPS Backend for bank card transaction authorization. This parameter will be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 16-19
16.22.4-8	If the CVM receives no response from the NFPS Backend for a bank card authorization within the allotted time, the CVM will cancel the transaction.	CDRL 16-19
16.22.4-9	If a customer leaves a Contact bank card in the reader after the transaction is authorized, the CVM will emit a distinct audible alert and display a warning message prompting the patron to retrieve the card. The audible alert and warning message will continue until the card is removed from the reader, or an NFPS Agency-configurable timer has elapsed, with such timer configurable on an NFPS Agency-specific basis. This timer will support the range of 1 to at least 90 seconds, in increments of 1 second, and will be initially configured to 30 seconds.	CDRL 16-19

16.22.5 Cancellation

Req. #	Requirement	Assigned CDRL(s)
16.22.5-1	When a cancellation event occurs prior to commencement of Media issue or encoding a presented Smart Card, the ECU will initiate a cancel signal, causing all deposited monies to be returned and the transaction canceled. Whenever a transaction in progress is canceled, an explanatory message will be shown on the Patron Display for a period equal to the inter-transaction time-out described in Technical Specifications Section 16.22.4 (Time-Out Operations).	CDRL 16-19
16.22.5-2	Actuation of the cancel button will cancel the transaction in progress.	CDRL 16-19
16.22.5-3	If the patron manually cancels a transaction before any payment has been made (by pressing the CANCEL button), the CVM will immediately return to the idle screen without displaying a cancel message.	CDRL 16-19
16.22.5-4	Once LU ticket issuing or EU Smart Card dispensing has begun, the cancel button will have no effect.	CDRL 16-19
16.22.5-5	The CVM will automatically cancel a transaction following deposit of an amount for a selected fare that would result in exceeding an NFPS Agency-configurable (on an NFPS Agency-specific basis) maximum change payout.	CDRL 16-19
16.22.5-6	The CVM will automatically cancel a transaction following deposit of an amount in excess of an NFPS Agency-configurable limit of overpayment while the CVM is in "Exact Fare Only" mode (configurable on an NFPS Agency-specific basis), and which the CVM cannot supply as change.	CDRL 16-19
16.22.5-7	Insertion of quantities of coins or bills greater than programmable limits (adjustable by each NFPS Agency, on an NFPS Agency-specific basis, and initially set to 12 bills and 30 coins) will cause the CVM to cancel the transaction and return all deposited funds.	CDRL 16-19
16.22.5-8	Unless otherwise specified elsewhere herein, any shutdown condition, including AC power failure, will result in cancellation of the transaction, the return of all deposited funds and orderly shutdown of the CVM.	CDRL 16-19

16.22.6 Screen Saver

Req. #	Requirement	Assigned CDRL(s)
16.22.6-1	When the screen saver time-out described in Technical Specifications Section 16.22.4 (Time-Out Operations) elapses, the CVM will automatically display a screen saver on the Patron Display.	CDRL 16-6
16.22.6-2	The screen saver will be downloadable from the NFPS Backend and will be an NFPS Agency-configurable (on an NFPS Agency-specific basis) for each individual CVM.	CDRL 16-6

Req. #	Requirement	Assigned CDRL(s)
16.22.6-3	The screen saver program will support the following: <ul style="list-style-type: none"> • A single static image in any common graphics format, including .JPG, .TIFF, .BMP • A repeating “slide show” of static images in common graphics format • A pre-recorded video in any common format, including .MPEG, .WMV, .MOV, .AVI • Published agency video feeds from other MTA sources to provide information to patrons • Any combination of the above 	CDRL 16-6
16.22.6-4	The screen saver will automatically terminate and the CVM will display the idle screen as soon as any button is pressed or the Patron Display is touched.	CDRL 16-6

16.22.7 Automatic Activation of Time-of-Day or Day-of-Week (Peak and Off-Peak) Fares

Req. #	Requirement	Assigned CDRL(s)
16.22.7-1	Whenever the current fare table includes time-of-day (i.e., rush hour/non-rush hour) or day-of-week (i.e., weekday, weekend) fare pricing, the CVM will automatically alter the price of Fare Products according to the fare table in effect, and according to the date and time indicated by the CVM’s internal clock.	CDRL 16-19
16.22.7-2	A configurable NFPS Agency parameter (with such parameters configurable on an NFPS Agency-specific basis) will determine if patrons are permitted to select whether they wish to purchase a peak or non-peak fare; the CVM will automatically determine the Fare Product pricing.	CDRL 16-19
16.22.7-3	The CVM will also include an NFPS Agency-adjustable “grace period” that extends the time period during which the non-peak fares are in effect, with such grace period adjustable on an NFPS Agency-specific basis. The “grace period” parameter will be adjustable in one-minute increments, which will be equally applied to the beginning and ending times for the non-peak fare.	CDRL 16-19
16.22.7-4	This feature will be configurable by each NFPS Agency (on an NFPS Agency-specific basis) and may not be enabled at launch.	CDRL 16-19

16.22.8 Sales and Transaction Data

Req. #	Requirement	Assigned CDRL(s)
16.22.8-1	The ECU will process and store all Transaction Data in the data memory unit and transmit this information upon demand to the NFPS Backend. Access to Data records at the CVM will be restricted to authorized personnel on a need to know basis (Data access to be granted depending on authorization codes used to gain internal CVM access as described in Technical Specifications Section 11.1 (Machine Enclosure Construction).	CDRL 16-19
16.22.8-2	Each CVM sales transaction will be separately recorded by the CVM.	CDRL 16-19

Req. #	Requirement	Assigned CDRL(s)
16.22.8-3	Transaction records will include at minimum: <ul style="list-style-type: none"> • Unique transaction sequence number • CVM number • Date and time • Ticket type or Smart Card transaction type • Number of LU tickets or EU Smart Cards dispensed in transaction, if applicable • Dollar value by payment method (cash, credit card, debit card) • Serial number of dispensed ticket(s), if applicable • EU Smart Card identification (compliant with PCI-DSS), if applicable • Overpayment amount, if applicable 	CDRL 16-19
16.22.8-4	The CVM will continuously retain sales and transaction Data records for the current and at least seven (7) previous days in its primary and secondary Non-Volatile Memory.	CDRL 16-19
16.22.8-5	The CVM will immediately transmit each transaction record to the NFPS Backend upon completion of the transaction, or when polled by the NFPS Backend.	CDRL 16-19
16.22.8-6	When communications with the NFPS Backend are disabled, the CVM will transmit Transaction Data as soon as communications with the NFPS Backend are restored.	CDRL 16-19

16.22.9 CVM Version and Configuration Status

Req. #	Requirement	Assigned CDRL(s)
16.22.9-1	The CVM will record and update Software Versions and CVM configurations to reflect current status and all changes.	CDRL 16-18
16.22.9-2	Current Software Version and CVM configuration information will be available to all personnel authorized to gain entry to the CVM.	CDRL 16-18
16.22.9-3	The CVM will immediately report to the NFPS Backend any change in CVM configuration.	CDRL 16-18
16.22.9-4	On demand, the CVM will print an audit ticket indicating the Software Versions and CVM configuration, and the date and time each configuration item was most recently changed.	CDRL 16-18
16.22.9-5	At minimum, the CVM will record and report the following: <ul style="list-style-type: none"> • ECU Operating System Release • CVM Application Software Release • Versions of NFPS Equipment Software embedded in secondary controllers • CVM fare table • Anti-virus and anti-malware definitions file • Status (enabled/disabled) of all configurable CVM modules • Other CVM adjustable parameters 	CDRL 16-18

16.22.10 CVM Revenue Status

Req. #	Requirement	Assigned CDRL(s)
16.22.10-1	The ECU will maintain accurate counts of all coins and bills in the cash storage modules, record this information in the data memory unit, and transmit this information upon demand to the NFPS Backend. Access to Data records at the CVM will be restricted to authorized personnel on a need to know basis (Data access to be granted depending on authorization codes used to gain internal CVM access as described in Technical Specifications Section 11.1 (Machine Enclosure Construction)).	CDRL 16-20
16.22.10-2	On demand, the CVM will print an audit ticket with CVM revenue status information.	CDRL 16-20
16.22.10-3	At a minimum, each CVM will record and transmit to the NFPS Backend the following Data about current revenue status. <ul style="list-style-type: none"> • Serial number of each cash storage device • Number and type of coins stored in each coin recirculator • Number and type of coins stored in each of the coin hoppers • Contents of coin vault (total and by denomination) • Number and denomination of bills stored in each bill recirculator • Number and denomination of bills stored in the Supplemental Bill Dispenser Module • Contents of bill vault (total and by denomination) • Total value of all money currently stored in all devices 	CDRL 16-20

16.22.11 Current CVM Status

Req. #	Requirement	Assigned CDRL(s)
16.22.11-1	The ECU will record and update the status of the CVM to reflect changes in the CVM's condition. Current status information will be available to all personnel authorized to gain entry to the CVM.	CDRL 16-7
16.22.11-2	Any change in CVM status will be immediately forwarded to the NFPS Backend.	CDRL 16-7
16.22.11-3	On demand, the CVM will print an audit ticket indicating all status conditions and the date and time each condition occurred.	CDRL 16-7
16.22.11-4	The complete list of CVM status properties to be recorded and reported will be subject to the MTA's review and approval.	CDRL 16-7

16.22.12 Events Data

Req. #	Requirement	Assigned CDRL(s)
16.22.12-1	The ECU will process and store all CVM event Data in the data memory unit and transmit this information upon demand to the NFPS Backend. Access to Data records at the CVM will be restricted to authorized personnel on a need to know basis. (Data access to be granted depending on authorization codes used to gain internal CVM access as described in Technical Specifications Section 11.1 (Machine Enclosure Construction)).	CDRL 16-7

Req. #	Requirement	Assigned CDRL(s)
16.22.12-2	<p>At a minimum, the CVM will record and report to the NFPS Backend the following events:</p> <ul style="list-style-type: none"> • Any Alarm Unit event (see Technical Specifications Section 11.2 (Alarm Unit)) • CVM initialized (i.e., ECU boot) • CVM polled by NFPS Backend • Data downloaded from NFPS Backend • Anti-virus definitions downloaded from NFPS Backend • Entry authorized by security code • Entry authorized by alarm keyswitch (if applicable) • Coin vault removed/installed • Bill vault removed/installed • Recirculating coin supply replenished (manually) • Recirculating coins emptied to vault (manually) • SSMM data retrieved • CVM clock error (i.e., excessive time difference) • Failed/interrupted bank card authorization request • Defective ticket captured in reject bin • Defective Smart Card captured in reject bin • Manual diagnostic test routine initiated • Supplemental change module removed/installed • Supplemental Bill Dispenser Module removed/installed 	CDRL 16-7
16.22.12-3	Each event record will contain, as appropriate, the CVM number, date, time, event code, employee identification number, CVM status, component code of inserted or removed component, and cash contents by denomination.	CDRL 16-7
16.22.12-4	The CVM will record an event each time the CVM outer door is locked or unlocked and each time the CVM door is opened or closed. Upon successful login of a maintenance or service technician, the CVM will record an event that will include at minimum the individual accessing the interior of the CVM, date and time.	CDRL 16-7
16.22.12-5	Each event will be capable of being classified into one of at least three priorities. Event priorities will be adjustable by each NFPS Agency at the NFPS Backend, with such adjustments made on an NFPS Agency-specific basis. Each event priority level will also be NFPS Agency-definable (on an NFPS Agency-specific basis) as either an on-line or off-line event. On-line events will cause the CVM to initiate communications to the NFPS Backend and transmit Data about the event. Off-line events will be recorded locally by the CVM and transmitted to the NFPS Backend upon the next polling.	CDRL 16-7
16.22.12-6	Events will also be classified into categories to simplify later reporting and analysis. Each event will be assigned to one of the following categories: Maintenance, Revenue, Administrative or Other.	CDRL 16-7
16.22.12-7	The complete list of events to be recorded and the priority and category of each will be submitted to the MTA for review and approval.	CDRL 16-7

16.22.13 Alarm Conditions

Req. #	Requirement	Assigned CDRL(s)
16.22.13-1	Events will be considered alarm conditions of varying severity. The assigned priority of all alarms will be configurable by each NFPS Agency, with such configuration available on an NFPS Agency-specific basis. The CVM will transmit alarm conditions to the NFPS Backend as soon as possible.	CDRL 16-7
16.22.13-2	For each alarm event, a corresponding event to clear the alarm will be transmitted by the CVM as soon as the alarm condition is no longer present. Alarm conditions will be cleared either automatically by the CVM or by manual intervention, as is appropriate to the alarm.	CDRL 16-7
16.22.13-3	A description of alarm events and their processing will be submitted for the MTA's review and approval.	CDRL 16-7

16.22.14 CVM Test Routines

Req. #	Requirement	Assigned CDRL(s)
16.22.14-1	Each CVM will automatically perform self-diagnostic tests at regular intervals (at least once per day) and each time the CVM is initialized. Self-diagnostic tests will at a minimum confirm communications integrity with all major modules, and to the extent possible, exercise all electro-mechanical devices. Any failures identified during self-diagnostics will be recorded in the CVM's internal status registers and will result in corresponding events being recorded by the CVM and transmitted to the NFPS Backend.	CDRL 16-7
16.22.14-2	Each CVM will be capable of performing test routines under manual command while the CVM is out of service and the front door is open.	CDRL 16-7
16.22.14-3	Authorized Users of the NFPS Backend will also have the ability to remotely initiate test routines. All remote tests will be conducted only while the CVM is out of service but in communication with the NFPS Backend. If the CVM is in service, remote testing will be preceded by a remote command to remove the CVM from service.	CDRL 16-7
16.22.14-4	A descriptive listing of all manually initiated diagnostic routines and remote diagnostic tests will be submitted by the SI for the MTA's review and approval.	CDRL 16-7

16.23 Barcode Reader

Req. #	Requirement	Assigned CDRL(s)
16.23-1	The SI shall provide an optical barcode reader as a separate module installed in the CVM. The barcode reader shall be a COTS Component.	CDRL 16-21
16.23-2	The optical barcode reader will be capable of reading all barcode types deployed within the NFPS (e.g., 1D, 2D, Aztec, and/or other format), including those on Paper Media with a printed barcode, and mobile apps that generate an electronic barcode.	CDRL 16-21
16.23-3	The SI shall provide all Software required for the barcode reader to perform the functions described herein.	CDRL 16-21

16.24 Configurable Vending Machines Required Submittals

The required submittals specified in this Section 16 (Configurable Vending Machines) are summarized below. They are further described in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 16-1	CVM Hardware Interior, Exterior, Module, and Major Assembly Design	Sections 16.1, 16.3, 16.4	✓	✓	✓	
CDRL 16-2	LU Media Module Design	Section 16.14	✓	✓	✓	
CDRL 16-3	EU Media Module Design	Section 16.16	✓	✓	✓	
CDRL 16-4	CVM Cabinet and Pedestal Design	Section 16.4	✓	✓	✓	
CDRL 16-5	CVM Security and Access Control	Sections 16.5, 16.20	✓	✓	✓	
CDRL 16-6	CVM Patron Interface Design	Sections 16.6, 16.21, 16.22.6	✓	✓	✓	
CDRL 16-7	CVM Configuration, Monitoring, Maintenance and Administrative Procedures	Sections 16.3, 16.15, 16.19, 16.22.11, 16.22.12, 16.22.13, 16.22.14	✓	✓	✓	
CDRL 16-8	INTENTIONALLY OMITTED					
CDRL 16-9	Coin Payment and Processing Module	Sections 16.6.8, 16.8, 16.9	✓	✓	✓	
CDRL 16-10	Bill Payment and Processing Module	Sections 16.6.9, 16.10	✓	✓	✓	
CDRL 16-11	Smart Card Processing Module	Section 16.12	✓	✓	✓	
CDRL 16-12	Bank Card Processing Module	Section 16.13	✓	✓	✓	
CDRL 16-13	Media/Coin Return Bin	Section 16.6.10	✓	✓	✓	
CDRL 16-14	CVM Service and Maintenance Interface	Section 16.7	✓	✓	✓	
CDRL 16-15	Change Dispensing Module	Section 16.11	✓	✓	✓	
CDRL 16-16	Receipt Printer Design	Section 16.15	✓	✓	✓	
CDRL 16-17	ECU Design	Section 16.17	✓	✓	✓	
CDRL 16-18	CVM Software Design	Sections 16.18, 16.22.9	✓	✓	✓	
CDRL 16-19	CVM Transaction Flows and Performance	Sections 16.2, 16.22	✓	✓	✓	

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 16-20	CVM Revenue Reconciliation	Section 16.22.10	✓	✓	✓	
CDRL 16-21	CVM Barcode Reader Design	Section 16.23	✓	✓	✓	

17 Customer Service Devices

17.1 Customer Service Point of Sale Terminals

The Customer Service Point of Sale Terminal will provide the NFPS Agencies with the capability to perform a range of customer service activities upon demand and when a customer is present. These terminals will have several different configurations depending on their intended location, and will be used to sell Media and perform customer service onboard the Mobile Sales Fleet, at in-person customer service locations such as 3 Stone Street and in office facilities such as customer claims. This Technical Specifications Section 17.1 (Customer Service Point of Sale Terminals) includes Customer Service Point of Sale Terminal-specific requirements.

17.1.1 CS POS Terminal General Requirements

Req. #	Requirement	Assigned CDRL(s)
17.1.1-1	The Customer Service Point of Sale Terminal will be a modular device and will support multiple configurations, depending on the peripheral modules included. The CS POS Terminal hardware will be optimized for its intended use and configuration.	CDRL 17-1
17.1.1-2	The CS POS Terminals will be designed to permit rapid exchange of the device and peripheral modules to restore service in minimal time. Repairs and adjustments will be performed in shop facilities and no special tools or instruments will be required for exchange of modules. Minor repairs and adjustments will be capable of being performed in the field.	CDRL 17-1
17.1.1-3	The SI shall supply CS POS Terminals in the listed configurations, all of which will utilize the same NFPS Equipment Software. <ul style="list-style-type: none">• Front Office Customer Service POS Terminal• NFPS Back Office Customer Service POS Terminal• Portable Customer Service POS Terminal	CDRL 17-1
17.1.1-4	The Front Office CS POS Terminal will provide all functions available and will be installed for walk-up customer transactions. The device will include: <ul style="list-style-type: none">• Integrated touch-screen and computer enclosure• Separate keyboard and mouse that are tethered• Contactless Smart Card Reader• Cash drawer• Bank card processing module• Patron Display• Receipt printer• Separate digital camera and tripod• Separate document scanner• Limited-Use Media printer/encoder• Extended-Use Smart Card printer/encoder• Uninterruptible power supply• Communications Interfaces as necessary	CDRL 17-1

Req. #	Requirement	Assigned CDRL(s)
17.1.1-5	<p>The NFPS Back Office CS POS Terminal will be configured to support the NFPS Agencies' internal needs and transactions where the customer is not present, including single and multiple card order fulfillments, NFPS Agency employee card issuance, bulk card personalization, and other transactions. The device will include the following modules, which will be identical to those used in the Front Office CS POS Terminal:</p> <ul style="list-style-type: none"> • Integrated touch-screen and computer enclosure • Separate keyboard and mouse • Contactless Smart Card Reader • Separate digital camera and tripod • Separate document scanner • Limited-Use Media printer/encoder • Extended-Use Smart Card printer/encoder • Uninterruptible power supply • Communications Interfaces as necessary 	CDRL 17-1
17.1.1-6	<p>The Portable CS POS Terminal will be based on a laptop computer or tablet with an integrated touch screen interface, keyboard and pointing device. The portable configuration will support remote sales and card personalization programs. In addition to the laptop computer, the device will include the following modules, which will be identical to those used for the Front Office CS POS Terminal (except where noted herein):</p> <ul style="list-style-type: none"> • Contactless Smart Card Reader • Bank card processing module • Receipt printer • Separate digital camera and tripod • Separate document scanner • Extended-Use Smart Card printer/encoder • Cellular broadband data modem (specific to Portable CS POS Terminal) and other communications Interfaces as necessary 	CDRL 17-1
17.1.1-7	All CS POS Terminal configurations and peripheral modules will be subject to the MTA's review and approval.	CDRL 17-1
17.1.1-8	To accommodate the required variety of installation locations, the CS POS Terminal (excluding peripheral modules) will be compact and easily positioned for user comfort.	CDRL 17-1
17.1.1-9	<p>The CS POS Terminal will conduct a variety of Smart Media transactions required to support the NFPS Agencies' fare policies (on an NFPS Agency-specific basis) and those defined herein. At minimum, these transactions will include:</p> <ul style="list-style-type: none"> • Issue new EU cards (with and without Fare Product, and with and without deposit) • Add stored value and Fare Products to an existing Transit Account • Activate and sell pre-encoded Limited-Use Media • Encode, print, and issue custom LU Media (when configured to do so) 	CDRL 17-1

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Encode, print, and issue personalized EU Media (when configured to do so) Conduct a read-only transaction and display the NFPS Account or card balance and transaction history Initiate and register an anonymous Transit Account Modify the information of an existing Customer Account Accept payments and provide change 	

17.1.2 CS POS Terminal Hardware

17.1.2.1 CS POS Terminal

Req. #	Requirement	Assigned CDRL(s)
17.1.2.1-1	All configurations of the CS POS Terminal will include an integrated flat panel touchscreen display with no less than XGA resolution.	CDRL 17-2
17.1.2.1-2	The touchscreen will provide suitable touch sensitivity and resolution to satisfy operator selection and input requirements.	CDRL 17-2
17.1.2.1-3	The CS POS Terminal will include integrated at minimum 10BaseT Ethernet or cellular broadband modem, or external communications interfaces (such as an external USB hub) to satisfy the requirements of the configuration.	CDRL 17-2

17.1.2.2 CS POS Terminal Keyboard and Pointing Device

Req. #	Requirement	Assigned CDRL(s)
17.1.2.2-1	Fixed (non-portable) configurations of the CS POS Terminal will include a full-sized keyboard and a mouse with scrolling wheel.	CDRL 17-2
17.1.2.2-2	Portable configurations will include a keyboard and pointing device.	CDRL 17-2
17.1.2.2-3	The CS POS Terminal shall be able to accommodate a securely tethered second keyboard for secure entry of a customer's password or other "security" information.	CDRL 17-2

17.1.2.3 CS POS Terminal Contactless Smart Card Reader

Req. #	Requirement	Assigned CDRL(s)
17.1.2.3-1	The Contactless Smart Card Reader will be a separate module cabled to the CS POS Terminal.	CDRL 17-2
17.1.2.3-2	The CS POS Terminal will support the ability to interface with two Contactless Smart Card Readers, one each for the customer and the clerk.	CDRL 17-2

17.1.2.4 CS POS Terminal Cash Drawer Module

Req. #	Requirement	Assigned CDRL(s)
17.1.2.4-1	The cash drawer will open only under command of the Customer Service POS Terminal, which will also monitor the status of the drawer at all times.	CDRL 17-2
17.1.2.4-2	The cash drawer will incorporate an insert with space for five bill denominations and five coin denominations.	CDRL 17-2
17.1.2.4-3	When the cash drawer opens or closes, an alarm or bell tone will sound indicating when the drawer has released and is open, and when the drawer has been closed and is locked. The volume will be controllable.	CDRL 17-2
17.1.2.4-4	The cash drawer will accommodate installation under a counter, be pry-resistant and be made of high quality, heavy gauge steel.	CDRL 17-2

17.1.2.5 CS POS Terminal Bank Card Processing Module

Req. #	Requirement	Assigned CDRL(s)
17.1.2.5-1	The Bank Card Processing Module (as further defined in this Technical Specifications Section 17.1.2.5 (CS POS Terminal Bank Card Processing Module)) will be a single integrated module cabled to the CS POS Terminal.	CDRL 17-2
17.1.2.5-2	The Bank Card Processing Module will include: <ul style="list-style-type: none"> • Magnetic stripe Reader • Contact Bank Card Reader (EMV certified) • Contactless Bank Card Reader (EMV, payWave®, PayPass®, ExpressPay®, and Zip® certified) • Signature capture pad • PCI compliant PIN pad 	CDRL 17-2
17.1.2.5-3	The CS POS Terminal will support the ability to interface with two linked Bank Card Processing Modules, one each for the customer and the clerk.	CDRL 17-2

17.1.2.6 CS POS Terminal Receipt Printer

Req. #	Requirement	Assigned CDRL(s)
17.1.2.6-1	The CS POS Terminal receipt printer will print on a single roll of continuous thermal paper that is subject to the MTA's review and approval.	CDRL 17-2
17.1.2.6-2	The receipt printer will provide for easy loading of a new paper roll.	CDRL 17-2
17.1.2.6-3	The receipt printer will have a cutting edge to enable the operator to manually separate the receipt from the roll.	CDRL 17-2

17.1.2.7 CS POS Terminal Patron Display

Req. #	Requirement	Assigned CDRL(s)
17.1.2.7-1	The Patron Display will convey transaction price, status and other pertinent information subject to the MTA's review and approval.	CDRL 17-2
17.1.2.7-2	The Patron Display will separately mount on a pole or other support for optimum visibility for all customers, including those in wheelchairs.	CDRL 17-2

Req. #	Requirement	Assigned CDRL(s)
17.1.2.7-3	The Patron Display will use backlit LCD, LED, vacuum fluorescent or other highly visible display technology suitable for the office environment.	CDRL 17-2
17.1.2.7-4	The Patron Display will provide no less than 2 lines of text, with minimum 24 characters per line, with each character no less than 0.5 inches high.	CDRL 17-2

17.1.2.8 CS POS Terminal Digital Camera and Tripod

Req. #	Requirement	Assigned CDRL(s)
17.1.2.8-1	When configured to issue personalized Media, the CS POS Terminals will include a digital camera and tripod for capturing customer photos.	CDRL 17-2
17.1.2.8-2	The camera will include a built-in flash and an image sensor of no less than two (2) megapixels. The camera will produce images of suitable resolution, clarity, and contrast to satisfy the requirements of photo ID cards.	CDRL 17-2
17.1.2.8-3	For each camera, the SI shall provide a tripod optimized for the specific CS POS Terminal installation and photo capture location.	CDRL 17-2

17.1.2.9 CS POS Terminal Scanner

Req. #	Requirement	Assigned CDRL(s)
17.1.2.9-1	When configured to issue personalized Media, the CS POS Terminals will include a digital scanner for capturing customer eligibility documents in a format approved by the MTA.	CDRL 17-2
17.1.2.9-2	The digital scanner will support the capture of black & white and color images at a resolution of up to 1200 x 1200 dpi.	CDRL 17-2
17.1.2.9-3	The digital scanner will support the auto-feeding of documents and support double-side scanning at no less than 10 pages per minute.	CDRL 17-2

17.1.2.10 CS POS Terminal LU Media Printer/Encoder

Req. #	Requirement	Assigned CDRL(s)
17.1.2.10-1	The CS POS Terminal LU Media printer/encoder will utilize thermal printing technology, and will encode LU Media with requisite Data in coordination with the printing process.	CDRL 17-2
17.1.2.10-2	The LU Media printer/encoder will be enclosed in a secure container suitable for use in areas with minimal counter space.	CDRL 17-2
17.1.2.10-3	The LU Media printer/encoder will have a Media stock capacity of no less than 1,000 roll stock Smart Cards.	CDRL 17-2
17.1.2.10-4	The printer(s) will be of the direct thermal type, with the flexibility of being programmed to print tickets with the following: <ul style="list-style-type: none"> All alphanumeric characters in both upper and lower case and the standard symbols of the ASCII character set NFPS Agency-specified graphics on an NFPS Agency-specific basis Various print sizes on the same ticket Reverse printing (white characters on black background) 	CDRL 17-2

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Vertical and horizontal character orientation 	
17.1.2.10-5	Ticket printing format, including information to be printed, print location, orientation, size and font, will be configurable by the NFPS Agencies (on an NFPS Agency-specific basis) using NFPS Software.	CDRL 17-2
17.1.2.10-6	The LU Media printer/encoder will utilize one or more thermal print heads that provide no less than 100 dots per inch of resolution.	CDRL 17-2
17.1.2.10-7	Thermal print heads will be easily replaceable, and will produce no fewer than 250,000 NFPS Agency tickets without the loss of a single pixel due to wear or electronic failure.	CDRL 17-2
17.1.2.10-8	Printing will not degrade the physical or operational condition of the Media. There will be no extraneous marks placed on the Media as a result of the printing operation.	CDRL 17-2
17.1.2.10-9	The LU Media printer/encoder will be able to encode Data onto each Smart Card prior to dispensing, including product type, fare category, expiration date, encryption keys, and other data as necessary to support the Media types and fare policies required herein.	CDRL 17-2
17.1.2.10-10	Prior to dispensing the ticket, the LU Media printer/encoder will read the ticket to verify that all Data has been properly encoded.	CDRL 17-2
17.1.2.10-11	If the LU Media printer/encoder cannot verify that the Media has been properly encoded, the device will capture the Media in an LU Media reject bin and attempt to issue another Smart Card. The LU Media reject bin will have a capacity of no less than 50 Smart Cards.	CDRL 17-2
17.1.2.10-12	The LU Media printer/encoder will be equipped with a self-sharpening cutting mechanism to cut individual Smart Cards from the roll supply.	CDRL 17-2
17.1.2.10-13	Each cutter will perform at least 1,000,000 cuts without requiring replacement or sharpening.	CDRL 17-2
17.1.2.10-14	All Media encoding and printing, including any NFPS Agency-specified graphics, will be completed within two (2) seconds from start of the print cycle.	CDRL 17-2
17.1.2.10-15	Media dispensed by the LU Media printer/encoder will be deposited in a cup or bin capable of holding no less than 20 Smart Cards.	CDRL 17-2
17.1.2.10-16	Upon successful printing and encoding, the LU Media printer/encoder will inform the CS POS Terminal of the successful issuance of each Smart Card, and the identification number of each issued card.	CDRL 17-2

17.1.2.11 CS POS Terminal EU Smart Card Printer/Encoder

Req. #	Requirement	Assigned CDRL(s)
17.1.2.11-1	The EU Smart Card printer/encoder module will utilize re-transfer printing technology, and will encode EU Smart Cards with requisite Data (such as an encrypted token) in coordination with the printing process.	CDRL 17-2
17.1.2.11-2	The EU Smart Card printer/encoder will print edge-to-edge (i.e., "full bleed") in at least 4 colors (YMCK) and will apply the printed images to a laminate film and then apply the laminate to one side of the card.	CDRL 17-2

Req. #	Requirement	Assigned CDRL(s)
17.1.2.11-3	The EU Smart Card printer/encoder will employ easily replaceable ribbons for the transfer printing and lamination films.	CDRL 17-2
17.1.2.11-4	The EU Smart Card printer/encoder will provide print resolution no less than 300 dots per inch.	CDRL 17-2
17.1.2.11-5	The EU Smart Card printer/encoder will produce no less than 75 cards per hour.	CDRL 17-2
17.1.2.11-6	The EU Smart Card printer/encoder will include input and output card hoppers with a capacity of no less than 100 cards each. The output card hopper shall be lockable for security.	CDRL 17-2
17.1.2.11-7	If the EU Smart Card printer/encoder cannot verify that the Media has been properly encoded, the device will capture the Media in an EU Media reject bin and attempt to issue another Smart Card. The EU Media reject bin will have a capacity of no less than 50 Smart Cards.	CDRL 17-2
17.1.2.11-8	Upon successful printing and encoding, the EU Smart Card printer/encoder will inform the CS POS Terminal of the successful issuance of each card, and the identification number of each issued card.	CDRL 17-2

17.1.2.12 CS POS Terminal Uninterruptible Power Supply

Req. #	Requirement	Assigned CDRL(s)
17.1.2.12-1	Each CS POS Terminal will receive power from a dedicated Uninterruptible Power Supply with sufficient battery capacity to operate all components of the CS POS Terminal for a minimum of 10 minutes.	CDRL 17-2
17.1.2.12-2	The UPS will cause the CS POS Terminal to shut down without loss of data integrity whenever the UPS determines that its remaining battery capacity is low.	CDRL 17-2
17.1.2.12-3	The UPS will provide no less than 500 joules of overvoltage (surge) protection for all connected devices.	CDRL 17-2

17.1.3 CS POS Terminal Software

All NFPS Equipment Software will be subject to the MTA's review and approval at the Preliminary and Final Design Review.

17.1.3.1 CS POS Terminal Operating System and Application Software

Req. #	Requirement	Assigned CDRL(s)
17.1.3.1-1	The CS POS Terminal will utilize a standard, current Microsoft Windows® Operating System.	CDRL 17-3
17.1.3.1-2	The CS POS Terminal will use Application Software that is developed with a high-level language and that supports all functions described herein.	CDRL 17-3
17.1.3.1-3	If Risk Mitigation lists (i.e., Positive/Negative Lists) are employed in the NFPS, the CS POS Terminal will receive from the NFPS Backend and store updated lists (see Technical Specifications Section 10.2 (Account Lists)). If a card presented for replenishment is on a Risk Mitigation list, the CS POS Terminal will notify the Customer Service Agent.	CDRL 17-3

Req. #	Requirement	Assigned CDRL(s)
17.1.3.1-4	Once installed, the CS POS Terminal will not enter service until it has communicated with the NFPS Backend to receive current fare table, Application Software, administrative and maintenance login IDs, Positive/Negative Lists, and other configurable Data.	CDRL 17-3
17.1.3.1-5	Authorized Users of the NFPS Backend will be able to remotely manage and administer CS POS Terminals. Remote management functions will include: <ul style="list-style-type: none"> • Changing configurable parameters • Enabling and disabling payment methods • Downloading Data • Extracting transaction and event records • Synchronizing date and time 	CDRL 17-3
17.1.3.1-6	On each CS POS Terminal, the SI shall supply, install, and configure client versions of anti-virus and anti-malware Software approved by the MTA.	CDRL 17-3
17.1.3.1-7	The CS POS Terminal shall fully comply with all PCI regulations.	CDRL 17-3
17.1.3.1-8	The SI shall submit descriptions of the CS POS Terminal Software design for the MTA's review and approval. CS POS Terminal Software design submittals will include: <ul style="list-style-type: none"> • CS POS Terminal data registers • CS POS Terminal transaction, event, log-in, etc. records • CS POS Terminal operator interface • CS POS Terminal configurable parameters and their value range • CS POS Terminal Risk Mitigation list storage, update and processing (if applicable) • CS POS Terminal transaction limitation procedures • CS POS Terminal setup and administration procedures • CS POS Terminal login types and permitted functions • CS POS Terminal anti-virus and anti-malware Software and procedures 	CDRL 17-3

17.1.3.2 CS POS Terminal Data Records

Req. #	Requirement	Assigned CDRL(s)
17.1.3.2-1	The CS POS Terminal will generate transactions and events, including operator log-in and logout and diagnostics. Each data record will incorporate a unique identification number for that CS POS Terminal and day, and will be date/time stamped.	CDRL 17-3
17.1.3.2-2	Each CS POS Terminal customer transaction record will, at minimum, consist of the following: <ul style="list-style-type: none"> • Sequential transaction number (unique per CS POS Terminal) • CS POS Terminal number • Location (where available) • User ID • Serial number of card 	CDRL 17-3

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> • Time and date • Transaction result (e.g., success, failure) • Transaction result reason (e.g., approved by NFPS Backend, denied by local risk list) • Fare category (e.g., full fare, reduced fare) • Transaction type (e.g., new card, account value, pass type) • Transaction value • Payment amount per payment method 	
17.1.3.2-3	<p>When a user signs on to the CS POS Terminal, the following Data will be stored in a data record:</p> <ul style="list-style-type: none"> • CS POS Terminal number • Location (where available) • User ID • Time and date • Log-in attempts <p>When the user logs off the CS POS Terminal, the device will store a similar record.</p>	CDRL 17-3
17.1.3.2-4	<p>The CS POS Terminal will be capable of detecting basic internal malfunctions and will annunciate failures directly on the operator display and to the Device Monitoring System (see Technical Specifications Section 21.2 (Device Monitoring System)). The malfunction detection will cover at least Failure of power or control circuitry, and any Failure of the Contactless Smart Card Reader that could result in a false, incomplete, or corrupted encoding of a Smart Card.</p>	CDRL 17-3
17.1.3.2-5	<p>The CS POS Terminal will be capable of recording locally data representing no less than 3,000 events, including changes in status, communication problems, and problems detected during the automatic diagnostic testing. At a minimum, each event record will include:</p> <ul style="list-style-type: none"> • CS POS Terminal number • Time and date • Event code • Any associated event data • Identifier of the failed test • Iteration number of test • Reason for test failure (unique code) • Additional information to define the nature of the Failure 	CDRL 17-3
17.1.3.2-6	<p>Each CS POS Terminal will contain registers that track the following information:</p> <ul style="list-style-type: none"> • The total number and value of all transactions completed by the CS POS Terminal since Data was last uploaded to the NFPS Backend. • The date and time of the last successful Data upload to the NFPS Backend. 	CDRL 17-3

Req. #	Requirement	Assigned CDRL(s)
	These registers will be modified only by the Customer Service POS Terminal itself and will not be manually alterable.	
17.1.3.2-7	The register totals for the cash value of transactions of each CS POS Terminal uploaded to the back end will be available to the CRF Cash Settlement System (as defined in these Technical Specifications) for revenue servicing and processing requirements.	CDRL 17-3

17.1.3.3 CS POS Terminal Offline Processing

Req. #	Requirement	Assigned CDRL(s)
17.1.3.3-1	For those transactions that may be completed while the CS POS Terminal is offline (such as card-based single-ride ticket sales), each CS POS Terminal will have NFPS Agency-configurable limits (configurable on an NFPS Agency-specific basis) that control the number and value of offline transactions that the device may conduct before Transaction Data will be uploaded to the NFPS Backend. As each transaction is completed, the CS POS Terminal will increment internal data registers that track the number and value of completed transactions. Any Customer Data gathered during offline transactions will be encrypted.	CDRL 17-3
17.1.3.3-2	When either data register is within 75 percent of the defined limits for the device, the CS POS Terminal will initiate data communications with the NFPS Backend.	CDRL 17-3
17.1.3.3-3	Upon successful completion of Data uploading, the data registers reflecting number and value of transactions since last Data upload will be zeroed.	CDRL 17-3
17.1.3.3-4	If the CS POS Terminal cannot communicate with the NFPS Backend, then the CS POS Terminal will make repeated attempts at communicating at an NFPS Agency-configurable (on an NFPS Agency-specific basis) interval.	CDRL 17-3
17.1.3.3-5	If a CS POS Terminal reaches the permitted limit of the number or value of offline transactions without Data uploading, the CS POS Terminal will discontinue all sales and replenishment transactions until all Transaction Data is successfully transmitted to the NFPS Backend.	CDRL 17-3

17.1.3.4 CS POS Terminal Fare Table Updates

Req. #	Requirement	Assigned CDRL(s)
17.1.3.4-1	The CS POS Terminal will maintain a table of fares which will include the list of all Fare Products to be sold or replenished, their prices, characteristic parameters (such as the validity periods for unlimited ride passes) and other dynamic information such as the text to display on the operating and Patron Displays and receipts.	CDRL 17-3
17.1.3.4-2	Each time the CS POS Terminal communicates with the NFPS Backend, the NFPS Backend will transmit any updates to the fare table; the CS POS Terminal will store all such updates. With each update of the fare table, the CS POS Terminal will confirm that the list has been properly updated.	CDRL 17-3

Req. #	Requirement	Assigned CDRL(s)
17.1.3.4-3	The CS POS Terminal will retain in Non-Volatile Memory the current and at least two future fare tables. Each future fare table will include all entries to reflect the intended fare structure and the date and time at which the new fare structure is to take effect.	CDRL 17-3
17.1.3.4-4	Any new fare table will be activated automatically in the CS POS Terminal at the specified date and time as programmed by the NFPS Agencies (on an NFPS Agency-specific basis).	CDRL 17-3

17.1.3.5 CS POS Terminal Software Updates

Req. #	Requirement	Assigned CDRL(s)
17.1.3.5-1	When required, modification of the CS POS Terminal's Software will be performed by downloading new Software from the NFPS Backend. The NFPS Backend will record and track the version number of all such Software in each CS POS Terminal, and the date that the Software Versions were downloaded and installed.	CDRL 17-3
17.1.3.5-2	CS POS Terminals will accept and apply Software Updates from the NFPS Backend for the CS POS Terminal's Software.	CDRL 17-3
17.1.3.5-3	Each time the CS POS Terminal communicates with the NFPS Backend, the NFPS Backend will transmit any Software Updates to the CS POS Terminal's Software. The CS POS Terminal will not commence installing Software Updates until it has received and verified the complete Software Update.	CDRL 17-3
17.1.3.5-4	The NFPS Backend will centrally manage the deployment of Software Updates to the CS POS Terminal's Operating System Software.	CDRL 17-3
17.1.3.5-5	Upon receipt and verification of the Software Update, the NFPS Backend will apply the Software Update (rebooting if necessary) at a time configurable by the NFPS Agencies (on an NFPS Agency-specific basis) for each CS POS Terminal.	CDRL 17-3

17.1.3.6 CS POS Terminal Configuration Control

Req. #	Requirement	Assigned CDRL(s)
17.1.3.6-1	Operating parameters, including EMV configuration parameters, will be downloadable to the CS POS Terminal from the NFPS Backend via the wide area network provided by the MTA and cellular data networks, as appropriate for each installation or CS POS Terminal configuration.	CDRL 17-3
17.1.3.6-2	The CS POS Terminal will support configurability through numerous adjustable parameters, with such configuration available to each NFPS Agency on an NFPS Agency-specific basis. The CS POS Terminal's Application Software will at minimum support configurability for: <ul style="list-style-type: none"> • Fare Products available for sale and upgrade • Pricing • Payment method selection • Receipt content 	CDRL 17-3

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> All text and touchscreen region labels Value of deposit to be collected for new or replaced Media Authorized Users and passwords (if stored locally at the CS POS Terminal) All other relevant fare table entries 	

17.1.3.7 CS POS Terminal Smart Media Inventory Control

Req. #	Requirement	Assigned CDRL(s)
17.1.3.7-1	Upon issuance and/or initialization of a Smart Card, the CS POS Terminal will record an issue record, including the date, time, fare category, card identification number and other pertinent information of the Smart Card and any associated NFPS Account. The CS POS Terminal will transmit this record to the NFPS Backend.	CDRL 17-3
17.1.3.7-2	The Inventory Management System (see Technical Specifications Section 21.3 (Inventory Management System)) will track the Smart Cards distributed to each NFPS Agency sales location. Using the list of cards issued to each sales location and the issuance and/or initialization records previously transmitted to the NFPS Backend, it will be possible for authorized CS POS Terminal users to query the NFPS Backend for the identification numbers and total quantity of Smart Media that remain in the sale location's inventory.	CDRL 17-3

17.1.4 CS POS Terminal Communications

Req. #	Requirement	Assigned CDRL(s)
17.1.4-1	The CS POS Terminal will communicate with the NFPS Backend via secure Internet connection to send and receive Transaction Data, send event and status information, and receive clock synchronization information, Positive/Negative Lists, and configuration parameters. This will be possible both automatically at a scheduled time and manually, upon selection by authorized Users.	CDRL 17-4
17.1.4-2	All communications between the NFPS Backend and the CS POS Terminals will be via a direct Ethernet cable connection or cellular broadband data modem.	CDRL 17-4
17.1.4-3	For transactions requiring NFPS Backend access to a Transit Account, or to establish a Customer Account, the CS POS Terminal will communicate with the NFPS Backend in real-time.	CDRL 17-4
17.1.4-4	Transactions requiring NFPS Backend access to a Transit Account will be disabled if the CS POS Terminal is unable to communicate with the NFPS Backend.	CDRL 17-4

Req. #	Requirement	Assigned CDRL(s)
17.1.4-5	For transactions that may occur offline, such as sales of Card-Based Media, communications may be deferred, but will normally be accomplished automatically, at NFPS Agency-specified times or time intervals, which such times or time intervals are specified on an NFPS Agency-specific basis.	CDRL 17-4
17.1.4-6	CS POS Terminal communication with the NFPS Backend will be able to be initiated manually at the device at any time without affecting the automated procedures.	CDRL 17-4
17.1.4-7	If the CS POS Terminal has missed a scheduled communication with the NFPS Backend, upon restoration of communications, the CS POS Terminal will automatically initiate communications.	CDRL 17-4

17.1.5 CS POS Terminal Operations

17.1.5.1 CS POS Terminal Log-in and Logout

Req. #	Requirement	Assigned CDRL(s)
17.1.5.1-1	The CS POS Terminal will remain inactive and unable to perform any functions unless a proper log-in has been completed.	CDRL 17-5
17.1.5.1-2	The CS POS Terminal will enable log-in to be performed by manual entry or by tapping an employee ID on the Contactless Smart Card Reader and entering a PIN number.	CDRL 17-5
17.1.5.1-3	The CS POS Terminal will support at least three levels of log-ins with assigned functionality configurable by the NFPS Agencies (on an NFPS Agency-specific basis).	CDRL 17-5
17.1.5.1-4	The CS POS Terminal will require the operator to identify the initial funds bank (i.e., starting cash drawer balance) at the start of each shift.	CDRL 17-5
17.1.5.1-5	The CS POS Terminal will support relief shifts, with the replacement of the cash drawer. The CS POS Terminal will also maintain statistics for the relief shift separately and will not affect the main shift information.	CDRL 17-5
17.1.5.1-6	If the CS POS Terminal has not been used in a number of minutes configurable by the NFPS Agencies (on an NFPS Agency-specific basis), then the user will be automatically logged out. The CS POS Terminal will close all files and display the login prompt screen.	CDRL 17-5
17.1.5.1-7	Upon logging out or otherwise indicating an end-of-shift condition, the CS POS Terminal will produce a report and receipt depicting the ending balance of the cash drawer.	CDRL 17-5
17.1.5.1-8	The CS POS Terminal will store a data record for each successful log-in, each unsuccessful log-in, and each logout.	CDRL 17-5
17.1.5.1-9	The CS POS Terminal will provide field audit reports and support reconciliation processes as defined by the NFPS Agencies (on an NFPS Agency-specific basis).	CDRL 17-5

17.1.5.2 CS POS Terminal Sales

Req. #	Requirement	Assigned CDRL(s)
17.1.5.2-1	The CS POS Terminal will function as an “intelligent cash register,” allowing patrons and clerks to interact in a manner that is as similar as possible to normal retail sales transactions. Sales transactions will include: <ul style="list-style-type: none"> • Purchase of new Media • Adding of value and passes to existing Media and Transit Accounts 	CDRL 17-5
17.1.5.2-2	When issuing a new EU Smart Card, the CS POS Terminal will permit the clerk to select whether an NFPS Agency-configurable card fee (configurable on an NFPS Agency-specific basis) (i.e., deposit) is to be collected.	CDRL 17-5
17.1.5.2-3	The CS POS Terminal will support two methods of selling LU Media: <ul style="list-style-type: none"> • Activation of pre-printed, pre-encoded individual Media presented to the Contactless Smart Card Reader • Encoding and printing one or more new Smart Cards from a roll, using the LU Media printer/encoder module. 	CDRL 17-5
17.1.5.2-4	At no time will the CS POS Terminal add a Fare Product to an NFPS Account if doing so would result in the NFPS Account having more than one pending Fare Product valid on the same service.	CDRL 17-5
17.1.5.2-5	All unlimited ride rolling Fare Product will be added to the NFPS Account in the pending state (without an expiration date set for the Fare Product).	CDRL 17-5
17.1.5.2-6	The purchase of multiple Fare Products for a single Customer Account will be able to be performed in a single transaction, and with payment collected once.	CDRL 17-5
17.1.5.2-7	When configured to conduct sales, the CS POS Terminal will support a variety of payment methods. These will include: <ul style="list-style-type: none"> • Cash • Bank cards (credit and debit) • Personal and/or Company checks • Any combination of the above 	CDRL 17-5
17.1.5.2-8	The CS POS Terminal will provide means by which patrons may exchange unused Legacy Media as a means of payment for Smart Card-based Fare Products. The CS POS Terminal will track the value of exchanged Legacy Media used as payment.	CDRL 17-5
17.1.5.2-9	The CS POS Terminal will support payments using including multiple bank cards, to be used for payment in a single transaction.	CDRL 17-5
17.1.5.2-10	For each sales transaction, the CS POS Terminal will enable the clerk to select the payment method. If the clerk selects more than one payment method, the CS POS Terminal will prompt the clerk to enter the amount to be paid using each payment method.	CDRL 17-5
17.1.5.2-11	Cash transactions will provide the total amount due, allow the clerk to enter amount tendered, and display the change due.	CDRL 17-5
17.1.5.2-12	The CS POS Terminal will control and monitor the cash drawer, and open the cash drawer upon calculation and display of the amount of change due.	CDRL 17-5

Req. #	Requirement	Assigned CDRL(s)
17.1.5.2-13	All credit and debit card transactions will be authorized via the Customer Service POS Terminal and its connection to the NFPS payment gateway (see Technical Specifications Section 21.7 (Payment Application)).	CDRL 17-5
17.1.5.2-14	The Customer Service POS Terminal will print a patron receipt for every completed sales transaction. Receipts will include the content specified in Technical Specifications Section 11.7.2 (Transaction Receipt Content) and the resulting status and value of the Transit Account, where applicable.	CDRL 17-5
17.1.5.2-15	For each completed transaction, a data record will be stored and transmitted to the NFPS Backend.	CDRL 17-5
17.1.5.2-16	The CS POS Terminal will enable a clerk to display (and print via the receipt printer) totals of all completed transactions by that clerk for the current day.	CDRL 17-5
17.1.5.2-17	The CS POS Terminal will enable an administrative user to display (and print via the receipt printer) totals of all conducted transactions for the current and each of the prior 7 days. These totals will be displayed on the operator's display, and will indicate daily totals by clerk and payment type. As necessary, the CS POS Terminal may retrieve Data from the NFPS Backend. Alternatively, prior days' sales reports may be provided by network access to the NFPS Backend or from the CS POS Terminal's browser interface.	CDRL 17-5

17.1.5.3 CS POS Terminal Issuance of Personalized Media

Req. #	Requirement	Assigned CDRL(s)
17.1.5.3-1	When configured to do so, the CS POS Terminal will include the necessary Software and peripherals to enable the NFPS Agencies to issue personalized cards to customers eligible for reduced fares, to NFPS Agency employees, and in support of other Special Programs.	CDRL 17-5
17.1.5.3-2	Personalized cards will include the cardholder's name and photograph printed on one side of the card, accompanied by other NFPS Agency-defined graphics and information (defined on an NFPS Agency-specific basis).	CDRL 17-5
17.1.5.3-3	The SI shall supply printing templates (also known as "masks") using NFPS Agency-supplied graphic designs (on an NFPS Agency-specific basis) for all personalized card types. The CS POS Terminal will support no less than 70 pre-loaded templates from which the user will select prior to printing. Where possible, template selection will be automatic based on card type.	CDRL 17-5
17.1.5.3-4	When printing a personalized card, the CS POS Terminal will scale the photo image to fit within the area defined by the printing template without distorting the image or changing its native aspect ratio.	CDRL 17-5
17.1.5.3-5	The MTA will supply the graphics for printing templates within 90 days following NTP. The SI shall supply printing masks no later than 30 days before the commencement of CS POS Terminal Factory Acceptance Testing.	CDRL 17-5

Req. #	Requirement	Assigned CDRL(s)
17.1.5.3-6	The CS POS Terminal will support issuance of personalized cards in individual and bulk production modes.	CDRL 17-5
17.1.5.3-7	For individual card personalization, a digital camera controlled by the CS POS Terminal will capture the customer images as necessary.	CDRL 17-5
17.1.5.3-8	Upon successful production of the personalized Smart Card, the CS POS Terminal will store a transaction record, including all personalization Data, the identification number of the issued card, the digital photograph image and all other Transaction Data. The CS POS Terminal will transfer the entire transaction record, and all accompanying Data, to the NFPS Backend.	CDRL 17-5
17.1.5.3-9	The NFPS Back Office CS POS Terminal will exclusively support production runs (using data imported from an external source) for bulk card personalization in quantities of 1 to at least 100 cards per batch.	CDRL 17-5
17.1.5.3-10	For bulk card personalization production runs, the CS POS Terminal will use Data files imported from an external source in an MTA-specified format. The Data files will include the customer name, digital photograph, and other Data as required.	CDRL 17-5
17.1.5.3-11	The NFPS Back Office CS POS Terminal will support selection of custom printing templates for bulk personalization production, which may be used to support corporate partner, university, and other institutional programs.	CDRL 17-5
17.1.5.3-12	Upon successful production of each card, the NFPS Back Office CS POS Terminal will store a transaction record similar to those created for individually personalized cards, and transmit all records to the NFPS Backend.	CDRL 17-5
17.1.5.3-13	The NFPS Agencies will issue customers who have reduced fare privileges Smart Cards with personalized information printed on one side of the card, including a digital photograph and the name of the cardholder. Using the appropriate customized printing template for reduced fare Media, the CS POS Terminal will print and issue personalized cards.	CDRL 17-5
17.1.5.3-14	The CS POS Terminal will support the capture of all Data needed to validate, register and issue personalized Media for reduced fare and paratransit customers.	CDRL 17-5
17.1.5.3-15	The CS POS Terminal will support manual entry of reduced fare and paratransit Customer Account Registration Data using a simple graphical user interface. The interface will be reviewed and approved by the MTA during design review.	CDRL 17-5
17.1.5.3-16	The CS POS Terminal will capture physical reduced fare and paratransit customer applications and submitted supporting documentation using the SI-provided document scanner.	CDRL 17-5
17.1.5.3-17	The CS POS Terminal will capture reduced fare and paratransit customer photographs using the SI-provided camera.	CDRL 17-5
17.1.5.3-18	All Customer Data captured and used by the CS POS Terminal will be securely stored within the SI-provided CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management) using	CDRL 17-5

Req. #	Requirement	Assigned CDRL(s)
	the APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)) and will not be stored locally on the CS POS Terminal.	
17.1.5.3-19	Using a printing template customized for each NFPS Agency (on an NFPS Agency-specific basis) employee ID cards, pensioner ID cards, and Contractor ID cards, the CS POS Terminal will print and issue personalized NFPS Agency (on an NFPS Agency-specific basis) employee cards on relevant Media.	CDRL 17-5
17.1.5.3-20	All Data for the creation of employee and contractor badges will be captured directly by the CRM System through the SI-provided PeopleSoft Interface (see Technical Specifications Section 21 (NFPS Back Office)).	CDRL 17-5
17.1.5.3-21	During the issuance process, the CS POS Terminal will prompt the operator to enter PII as required by NFPS Agency (on an NFPS Agency-specific basis) personnel policies, including access privileges relevant to the NFPS.	CDRL 17-5
17.1.5.3-22	The selections for access privileges will be “check box” items on the operator display, and will be configurable by the NFPS Agency (on an NFPS Agency-specific basis). The CS POS Terminal will support the selection of no less than 25 distinct employee access privileges as part of the employee ID issuance process.	CDRL 17-5
17.1.5.3-23	For employee and contractor cards, a transaction will be sent to the MTA's existing I-Vault System through a direct Interface to support configuration of security access privileges.	CDRL 17-5

17.1.5.4 CS POS Terminal Media Inquiry

Req. #	Requirement	Assigned CDRL(s)
17.1.5.4-1	Whenever an NFPS Smart Card (LU or EU Media) is presented to the CS POS Terminal Contactless Smart Card Reader, the CS POS Terminal will read the card and display the current status and value of the LU ticket or the Transit Account lined to the EU Smart Card on the operator display and customer display.	CDRL 17-5
17.1.5.4-2	If the customer's Smart Card is not functioning, the CS POS Terminal will permit the clerk to manually enter the card identification number.	CDRL 17-5
17.1.5.4-3	Upon request, the CS POS Terminal will query the NFPS Backend for details of the most recent transactions posted to the Media or Transit Account. Upon receipt of the transaction history, the CS POS Terminal will display the results of the Transit Account history query on the operator display, along with the current status and value of the Media or Transit Account.	CDRL 17-5
17.1.5.4-4	The CS POS Terminal will be able to display at minimum 25 recent transactions, with the maximum number displayed configurable by the NFPS Agencies (on an NFPS Agency-specific basis).	CDRL 17-5

Req. #	Requirement	Assigned CDRL(s)
17.1.5.4-5	For each prior transaction displayed, history details will include, at minimum: <ul style="list-style-type: none"> • Date and time of transaction • Transaction type (e.g., pas activation, pass usage, value usage, transfer, replenishment/purchase) • Transaction value • Usage location (e.g., station name, bus route) • Replenishment location (e.g., CVM, retailer location, Autoload) 	CDRL 17-5
17.1.5.4-6	Upon request using the operator touchscreen, the CS POS Terminal will print a receipt of the current status and value of the ticket or associated Transit Account.	CDRL 17-5

17.1.5.5 CS POS Terminal Customer Account Management

Req. #	Requirement	Assigned CDRL(s)
17.1.5.5-1	The CS POS Terminal will enable operators to setup and modify Customer Accounts.	CDRL 17-5
17.1.5.5-2	The CS POS Terminal will enable the operator to create a new Customer Account by registering an anonymous Transit Account.	CDRL 17-5
17.1.5.5-3	The CS POS Terminal will enable the operator to modify any fields in the existing Customer Accounts that are deemed user-alterable.	CDRL 17-5
17.1.5.5-4	The CS POS Terminal will enable operators to establish, modify, and cancel patron subscriptions for Autoload.	CDRL 17-5
17.1.5.5-5	To prevent manual data entry error where possible, the identification number of the customer's Smart Card will be captured by the Contactless Smart Card Reader, and the bank card processor module will read any bank card data required for Autoload subscription.	CDRL 17-5
17.1.5.5-6	Reduced fare privileges are subject to expiration. The CS POS Terminal will include a function to re-authorize reduced fare privileges and update the NFPS Account information with a new reduced fare privilege expiration date.	CDRL 17-5

17.1.5.6 CS POS Terminal Media Replacement

Req. #	Requirement	Assigned CDRL(s)
17.1.5.6-1	The CS POS Terminal will support replacing registered EU Smart Cards by disassociating the lost or stolen Smart Card from the NFPS Account and linking a new Smart Card in its place.	CDRL 17-5
17.1.5.6-2	Prior to replacing a registered EU Smart Card, the CS POS Terminal will require verification of the customer's identity through the entry of the Customer Account identifier, password and/or answers to secret questions, as recorded by the NFPS Backend.	CDRL 17-5
17.1.5.6-3	If the replacement Smart Card requires no personalization, the CS POS Terminal will prompt the operator to present the new Smart Card to the	CDRL 17-5

Req. #	Requirement	Assigned CDRL(s)
	Contactless Smart Card Reader.	
17.1.5.6-4	When replacing a previously issued personalized Smart Card, the CS POS Terminal will support use of the digital photograph, printing template, and other Data from the original issue record to facilitate replacement without requiring the cardholder's presence, or the use of the digital camera to create and store a new digital image.	CDRL 17-5
17.1.5.6-5	Upon reading or issuing the replacement Smart Card, the CS POS Terminal will transmit to the NFPS Backend an issue record containing the card's identification number, and a corresponding record to block use of the replaced Smart Card.	CDRL 17-5
17.1.5.6-6	Replacing a malfunctioning Smart Card will be possible if the patron presents the malfunctioning Smart Card. Procedures to replace a defective Smart Card will be similar to those used to replace a lost Smart Card, however, a defective Smart Card will not need to have been registered to qualify for replacement.	CDRL 17-5
17.1.5.6-7	The replacement process will support entry of the defective Smart Card's identification number as the means to initiate replacement.	CDRL 17-5

17.1.5.7 CS POS Terminal Refunds and Reversals

Req. #	Requirement	Assigned CDRL(s)
17.1.5.7-1	For refund or error correction purposes, the CS POS Terminal will provide operators the ability to reverse the last replenishment transaction performed to a Transit Account if: <ul style="list-style-type: none"> • The same CS POS Terminal conducted the replenishment transaction • The transaction occurred within an NFPS Agency-configurable period (initially set to 5 minutes, and configurable on an NFPS Agency-specific basis) • The Transit Account has no usage transactions since the replenishment 	CDRL 17-5
17.1.5.7-2	Reversal transactions will require the deletion of the relevant Fare Product or deduction of the value added from the Transit Account during the replenishment transaction.	CDRL 17-5
17.1.5.7-3	The CS POS Terminal will fully record and transmit to the NFPS Backend all reversal transactions.	CDRL 17-5

17.2 Ticket Office Machines

If exercised, Ticket Office Machines (TOMs) will be installed by the SI at designated MNR and LIRR station locations and such TOMs will provide MNR and LIRR with the capability to perform a range of customer service activities upon demand and when a customer is present. The TOMs feature hardware that is similar to the CS POS Terminal. This Technical Specifications Section 17.2 (Ticket Office Machines) includes TOM-specific requirements.

17.2.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
17.2.1-1	The TOM will satisfy all general design, security and performance requirements in Technical Specifications Section 5 (General Design Requirements) and elsewhere herein.	CDRL 17-6
17.2.1-2	The TOM will be a modular device. The TOM hardware will be optimized for its intended use and configuration.	CDRL 17-6
17.2.1-3	The TOM will be designed to permit rapid exchange of the device and peripheral modules to restore service in minimal time. Repairs and adjustments will be performed in shop facilities and no special tools or instruments will be required for exchange of modules. Minor repairs and adjustments will be capable of being performed in the field.	CDRL 17-6
17.2.1-4	<p>The TOM will be installed for walk-up customer transactions. Each TOM will include:</p> <ul style="list-style-type: none"> • Integrated touch-screen and computer enclosure • Separate keyboard and mouse that are tethered • Contactless Smart Card Reader • Bank card processing module • Patron Display • TOM enclosure/cabinet • Receipt printer • Separate document scanner • Limited-Use/Paper Media printer/encoder • Uninterruptible power supply • Barcode reader • Communications Interfaces as necessary • Check scanner/endorser • Ancillary Equipment, including: <ul style="list-style-type: none"> ○ Separate digital camera and tripod ○ Cash Drawer <p>The EU card printer used to create personalized Media is out of scope of the NFPS.</p>	CDRL 17-6
17.2.1-5	The TOM design will support installation and use on the left or right of the ticket window. All TOM configurations and peripheral modules will be subject to the MTA's review and approval.	CDRL 17-6
17.2.1-6	The TOM will be compact with components (besides the keyboard, screen, and other items which must be positioned on a desk or surface) that must fit into an enclosed space (See Technical Specifications Section 17.2.2.1 (TOM Enclosure)).	CDRL 17-6
17.2.1-7	<p>The TOM will include all functions of the CS POS Terminal, and conduct a variety of transactions required to support each of MNR's and LIRR's fare policies, all as defined herein. At minimum, these transactions will include:</p> <ul style="list-style-type: none"> • Encode and Issue new LU-S Media and LU-R Media (with and without deposit), including Joint Media • Issue new Paper Media, including barcoded tickets 	CDRL 17-6

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Add stored value and Fare Products to an existing Transit Account Encode, print, and issue custom Media (when configured to do so) Conduct a read-only transaction and display the NFPS Account or card balance and transaction history Accept payments Allow for the acceptance of train crew cash remittances and Commissary cash remittances. 	
17.2.1-8	When checks are processed, they will be scanned and automatically endorsed as defined by MNR and LIRR, on an agency-specific basis.	CDRL 17-6

17.2.2 TOM Hardware

17.2.2.1 TOM Enclosure

Req. #	Requirement	Assigned CDRL(s)
17.2.2.1-1	The TOM cabinet will be constructed of stainless steel having the maximum dimension: Height : 965.2 mm/38", incl. Casters Width : 685.8 mm/27" Depth : 921.4 mm/36.3"	CDRL 17-7
17.2.2.1-2	The TOM construction material should be as follows: Frame: 20x20x2 mm stainless steel profile Sides and Top Panel: 2 mm stainless steel sheets (5/64" or .078") Bottom Panel: 3 mm stainless steel sheets (1/8" or .12")	CDRL 17-7
17.2.2.1-3	The interior of the TOM cabinet shall incorporate rails, guides, and/or tracks for ease of ticket agent servicing and maintenance servicing of the unit.	CDRL 17-7
17.2.2.1-4	The TOM cabinet shall be on casters to allow for easy mobility. The casters shall be capable of being locked into place.	CDRL 17-7
17.2.2.1-5	Doors for the TOM cabinet will be able to be installed right-handed or left-handed and will be secured with mechanical locks and keys that are not readily duplicated.	CDRL 17-7
17.2.2.1-6	All TOM cabinet locks shall be keyed alike. Each TOM cabinet shall be provided with three (3) keys.	CDRL 17-7

17.2.2.2 TOM Terminal

Req. #	Requirement	Assigned CDRL(s)
17.2.2.2-1	All configurations of the TOM will include an integrated flat panel touchscreen display with no less than 1280 x 768 resolution.	CDRL 17-7
17.2.2.2-2	The touchscreen will provide suitable touch sensitivity and resolution to satisfy operator selection and input requirements.	CDRL 17-7
17.2.2.2-3	The TOM will include integrated at minimum 10BaseT Ethernet, or external communications interfaces (such as an external USB hub) to satisfy the requirements of the configuration.	CDRL 17-7

17.2.2.3 TOM Keyboard and Pointing Device

Req. #	Requirement	Assigned CDRL(s)
17.2.2.3-1	The TOM will include a full-sized keyboard and a mouse with scrolling wheel.	CDRL 17-7
17.2.2.3-2	The TOM will be able to accommodate a securely tethered second keyboard for secure entry of a customer's password or other "security" information.	CDRL 17-7

17.2.2.4 TOM Contactless Smart Card Reader

Req. #	Requirement	Assigned CDRL(s)
17.2.2.4-1	The Contactless Smart Card Reader will be a separate module cabled to the TOM.	CDRL 17-7
17.2.2.4-2	The TOM will support the ability to interface with two Contactless Smart Card Readers, one each for the customer and the clerk.	CDRL 17-7

17.2.2.5 TOM Bank Card Processing Module

Req. #	Requirement	Assigned CDRL(s)
17.2.2.5-1	The Bank Card Processing Module (as further defined in this Technical Specifications Section 17.2.2.5 (TOM Bank Card Processing Module)) will be a single integrated module cabled to the TOM.	CDRL 17-7
17.2.2.5-2	The Bank Card Processing Module will include: <ul style="list-style-type: none"> • Magnetic stripe Reader • Contact Bank Card Reader (EMV certified) • Contactless Bank Card Reader (EMV, payWave®, PayPass®, ExpressPay®, and Zip® certified) • Signature capture pad • PCI compliant PIN pad 	CDRL 17-7
17.2.2.5-3	The TOM will support the ability to interface with two linked Bank Card Processing Modules, one each for the customer and the clerk.	CDRL 17-7

17.2.2.6 TOM Receipt Printer

Req. #	Requirement	Assigned CDRL(s)
17.2.2.6-1	The TOM receipt printer will print on a single roll of continuous thermal paper subject to the MTA's review and approval.	CDRL 17-7
17.2.2.6-2	The receipt printer will provide for easy loading of a new paper roll.	CDRL 17-7
17.2.2.6-3	The receipt printer will have a cutting edge that cleanly cuts the receipt and enables the operator to retrieve the receipt in a safe manner.	CDRL 17-7

17.2.2.7 TOM Patron Display

Req. #	Requirement	Assigned CDRL(s)
17.2.2.7-1	The Patron Display will convey transaction price, status and other pertinent information subject to the MTA's review and approval.	CDRL 17-7
17.2.2.7-2	The Patron Display will separately mount on a pole or other support for optimum visibility for all customers, including those in wheelchairs.	CDRL 17-7
17.2.2.7-3	The Patron Display will use backlit LCD, LED, vacuum fluorescent or other highly visible display technology suitable for the office environment.	CDRL 17-7
17.2.2.7-4	The Patron Display will provide no less than 2 lines of text, with minimum 24 characters per line, with each character no less than 0.5 inches high.	CDRL 17-7

17.2.2.8 TOM Digital Camera and Tripod

Req. #	Requirement	Assigned CDRL(s)
17.2.2.8-1	When configured to issue personalized Media, the TOM will include a digital camera and tripod for capturing customer photos.	CDRL 17-7
17.2.2.8-2	The camera will include a built-in flash and an image sensor of no less than two (2) megapixels. The camera will produce images of suitable resolution, clarity, and contrast to satisfy the requirements of photo ID cards.	CDRL 17-7
17.2.2.8-3	For each camera, the SI shall provide a tripod optimized for the specific TOM installation and photo capture location.	CDRL 17-7

17.2.2.9 TOM Scanner

Req. #	Requirement	Assigned CDRL(s)
17.2.2.9-1	When configured to issue personalized Media, the TOM will include a digital scanner for capturing customer eligibility documents in a format approved by the MTA.	CDRL 17-7
17.2.2.9-2	The digital scanner will support the capture of black & white and color images at a resolution of up to 1200 x 1200 dpi.	CDRL 17-7
17.2.2.9-3	The digital scanner will support the auto-feeding of documents and support double-side scanning at no less than 10 pages per minute.	CDRL 17-7

17.2.2.10 TOM LU/Paper Media Dispenser

Req. #	Requirement	Assigned CDRL(s)
17.2.2.10-1	The TOM LU/Paper Media Dispenser will be capable of printing, encoding, and dispensing LU Media and Paper Media. The LU/Paper Media Dispenser will be able to select, cut, print and dispense Media of different types, using at least two configurable ticket dispensers of LU Smart Card or Paper Media (see Technical Specifications Section 18 (Media)).	CDRL 17-7
17.2.2.10-2	The TOM LU/Paper Media Dispenser will have the capability for multiple feeds from both rolled and stacked fare Media.	CDRL 17-7

Req. #	Requirement	Assigned CDRL(s)
17.2.2.10-3	The following ticket stock capacities are required: <ul style="list-style-type: none"> At least 2,000 and up to 3,000 roll feed LU Media At least 2,000 and up to 3,000 stacked LU Media At least 2,000 and up to 3,000 roll feed Paper Media 	CDRL 17-7
17.2.2.10-4	The printer(s) will be of the direct thermal type, with the flexibility of being programmed to print tickets with the following: <ul style="list-style-type: none"> All alphanumeric characters in both upper and lower case and the standard symbols of the ASCII character set MNR- and LIRR-specified graphics, on an agency-specific basis Various print sizes on the same ticket Reverse printing (white characters on black background) Vertical and horizontal character orientation 2D Barcodes and/or QR codes 	CDRL 17-7
17.2.2.10-5	Ticket printing format, including information to be printed, print location, orientation, size and font, will be configurable by MNR and LIRR (on an agency-specific basis) using NFPS Software.	CDRL 17-7
17.2.2.10-6	The LU/Paper Media Dispenser will utilize one or more thermal print heads that provide no less than 100 dots per inch of resolution.	CDRL 17-7
17.2.2.10-7	Thermal print heads will be easily replaceable, and will produce no fewer than 250,000 NFPS Agency tickets without the loss of a single pixel due to wear or electronic failure.	CDRL 17-7
17.2.2.10-8	Printing will not degrade the physical or operational condition of the Media. There will be no extraneous marks placed on the Media as a result of the printing operation.	CDRL 17-7
17.2.2.10-9	The LU/Paper Media Dispenser will be able to encode Data onto each Smart Card prior to dispensing, including product type, fare category, expiration date, encryption keys, and other data as necessary to support the Media types and fare policies required herein.	CDRL 17-7
17.2.2.10-10	Prior to dispensing the ticket, the LU/Paper Media Dispenser will read the ticket to verify that all Data has been properly encoded.	CDRL 17-7
17.2.2.10-11	If the LU/Paper Media Dispenser cannot verify that a Smart Card has been properly encoded, the device will capture the Media in an LU Media reject bin and attempt to issue another Smart Card. The LU Media reject bin will have a capacity of no less than 50 Smart Cards.	CDRL 17-7
17.2.2.10-12	The LU/Paper Media Dispenser will be equipped with a self-sharpening cutting mechanism to cut individual Smart Cards from the roll supply.	CDRL 17-7
17.2.2.10-13	Each cutter will perform at least 1,000,000 cuts without requiring replacement or sharpening.	CDRL 17-7
17.2.2.10-14	All Media encoding and printing, including any MNR- or LIRR-specified graphics, will be completed within two (2) seconds from start of the print cycle.	CDRL 17-7
17.2.2.10-15	Media dispensed by the LU/Paper Media Dispenser will be deposited in a cup or bin capable of holding no less than 50 Smart Cards.	CDRL 17-7

Req. #	Requirement	Assigned CDRL(s)
17.2.2.10-16	Upon successful printing and encoding, the LU/Paper Media Dispenser will inform the TOM of the successful issuance of each Smart Card, and the identification number of each issued card.	CDRL 17-7

17.2.2.11 TOM Uninterruptible Power Supply

Req. #	Requirement	Assigned CDRL(s)
17.2.2.11-1	Each TOM will receive power from a dedicated Uninterruptible Power Supply (UPS) with sufficient battery capacity to operate all components of the TOM for a minimum of 10 minutes.	CDRL 17-7
17.2.2.11-2	In the event of an AC power failure or fault while the TOM is engaged in a transaction, the UPS will allow the transaction to be completed. The TOM will then perform an orderly shutdown, such that no Data loss occurs.	CDRL 17-7
17.2.2.11-3	The UPS will provide no less than 500 joules of overvoltage (surge) protection for all connected devices.	CDRL 17-7

17.2.2.12 Barcode Reader

Req. #	Requirement	Assigned CDRL(s)
17.2.2.12-1	The SI shall provide an optical barcode reader as a separate module cabled to the TOM. The barcode reader shall be a COTS Component.	CDRL 17-7
17.2.2.12-2	The optical barcode reader will be capable of reading all barcode types deployed within the NFPS (e.g., 1D, 2D, Aztec, and/or other format), including those on Paper Media with a printed barcode, and mobile apps that generate an electronic barcode.	CDRL 17-7
17.2.2.12-3	The SI shall provide all Software required for the barcode reader to perform the functions described herein.	CDRL 17-7

17.2.3 TOM Software

All NFPS Equipment Software will be subject to the MTA's review and approval at the Preliminary and Final Design Review.

17.2.3.1 TOM Operating System and Application Software

Req. #	Requirement	Assigned CDRL(s)
17.2.3.1-1	The TOM will employ a current version of COTS Operating System Software as approved by the MTA. The machine Operating System will be capable of performing all tasks necessary to support the machine and its Application Software, including the ability to perform multiple tasks concurrently and communicate with the NFPS Backend.	CDRL 17-8
17.2.3.1-2	The TOM will use Application Software that is developed with a high-level language and that supports all functions described herein.	CDRL 17-8

Req. #	Requirement	Assigned CDRL(s)
17.2.3.1-3	If Risk Mitigation lists (i.e., Positive/Negative Lists) are employed in the NFPS, then the TOM will receive from the NFPS Backend and store updated lists (see Technical Specifications Section 10.2 (Account Lists)). If a card presented for replenishment is on a Risk Mitigation list, the TOM will notify the Customer Service Agent.	CDRL 17-8
17.2.3.1-4	Once installed, the TOM will not enter service until it has communicated with the NFPS Backend to receive current fare table, Application Software, administrative and maintenance login IDs, Positive/Negative Lists, and other configurable Data.	CDRL 17-8
17.2.3.1-5	Authorized Users of the NFPS Backend will be able to remotely manage and administer TOMs. Remote management functions will include: <ul style="list-style-type: none"> • Changing configurable parameters • Enabling and disabling payment methods • Downloading Data • Extracting transaction and event records • Synchronizing date and time 	CDRL 17-8
17.2.3.1-6	On each TOM, the SI shall supply, install, and configure client versions of anti-virus and anti-malware Software approved by the MTA.	CDRL 17-8
17.2.3.1-7	The TOM shall fully comply with all PCI regulations.	CDRL 17-8
17.2.3.1-8	The SI shall submit descriptions of the TOM Software design for the MTA's review and approval. TOM Software design submittals will include: <ul style="list-style-type: none"> • TOM data registers • TOM transaction, event, log-in, etc. records • TOM operator interface • TOM configurable parameters and their value range • TOM Risk Mitigation list storage, update and processing (if applicable) • TOM transaction limitation procedures • TOM setup and administration procedures • TOM login types and permitted functions • TOM anti-virus and anti-malware Software and procedures 	CDRL 17-8

17.2.3.2 TOM Data Records

Req. #	Requirement	Assigned CDRL(s)
17.2.3.2-1	The TOM will generate transactions and events, including operator log-in and logout and diagnostics. Each data record will incorporate a unique identification number for that TOM and day, and will be date/time stamped.	CDRL 17-8

Req. #	Requirement	Assigned CDRL(s)
17.2.3.2-2	<p>Each TOM customer transaction record will, at minimum, consist of the following:</p> <ul style="list-style-type: none"> • Sequential transaction number (unique per TOM) • TOM number • Location (where available) • User ID • Serial number of card • Time and date • Transaction result (e.g., success, failure) • Transaction result reason (e.g., approved by NFPS Backend, denied by local risk list) • Fare category (e.g., full fare, reduced fare) • Transaction type (e.g., new card, account value, pass type) • Transaction value • Payment amount per payment method 	CDRL 17-8
17.2.3.2-3	<p>When a user signs on to the TOM, the following Data will be stored in a data record:</p> <ul style="list-style-type: none"> • TOM number • Location (where available) • User ID • Time and date • Log-in attempts <p>When the user logs off the TOM, the device will store a similar record.</p>	CDRL 17-8
17.2.3.2-4	<p>The TOM will be capable of detecting basic internal malfunctions and will annunciate failures directly on the operator display and to the Device Monitoring System (see Technical Specifications Section 21.2 (Device Monitoring System)). The malfunction detection will cover at least Failure of power or control circuitry, and any Failure of the Contactless Smart Card Reader that could result in a false, incomplete, or corrupted encoding of a Smart Card.</p>	CDRL 17-8
17.2.3.2-5	<p>The TOM will be capable of recording locally data representing no less than 3,000 events, including changes in status, communication problems, and problems detected during the automatic diagnostic testing. At a minimum, each event record will include:</p> <ul style="list-style-type: none"> • TOM number • Time and date • Event code • Any associated event data • Identifier of the failed test • Iteration number of test • Reason for test failure (unique code) • Additional information to define the nature of the Failure 	CDRL 17-8
17.2.3.2-6	<p>Each TOM will contain registers that track the following information:</p>	CDRL 17-8

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> The total number and value of all transactions completed by the TOM since Data was last uploaded to the NFPS Backend. The date and time of the last successful Data upload to the NFPS Backend. <p>These registers will be modified only by the TOM itself and will not be manually alterable.</p>	
17.2.3.2-7	The register totals for the cash value of transactions of each TOM uploaded to the back end will be available to the Revenue Facility Cash Settlement System (as defined in these Technical Specifications) for revenue servicing and processing requirements.	CDRL 17-8

17.2.3.3 TOM Offline Processing

Req. #	Requirement	Assigned CDRL(s)
17.2.3.3-1	For those transactions that may be completed while the TOM is offline (such as Railroad-only tickets), each TOM will have MNR- or LIRR-configurable limits (configurable on an agency-specific basis) that control the number and value of offline transactions that the device may conduct before Transaction Data will be uploaded to the NFPS Backend. As each transaction is completed, the TOM will increment internal data registers that track the number and value of completed transactions. Any Customer Data gathered during offline transactions will be encrypted.	CDRL 17-8
17.2.3.3-2	When either data register is within 75 percent of the defined limits for the device, the TOM will initiate data communications with the NFPS Backend.	CDRL 17-8
17.2.3.3-3	Upon successful completion of Data uploading, the data registers reflecting number and value of transactions since last Data upload will be zeroed.	CDRL 17-8
17.2.3.3-4	If the TOM cannot communicate with the NFPS Backend, then the TOM will make repeated attempts at communicating at an MNR- or LIRR-configurable interval, with such configuration on an agency-specific basis.	CDRL 17-8
17.2.3.3-5	If a TOM reaches the permitted limit of the number or value of offline transactions without Data uploading, the TOM will discontinue all sales and replenishment transactions until all Transaction Data is successfully transmitted to the NFPS Backend.	CDRL 17-8

17.2.3.4 TOM Fare Table Updates

Req. #	Requirement	Assigned CDRL(s)
17.2.3.4-1	The TOM will maintain a table(s) of fares which will include the list of all Fare Products to be sold or replenished, their prices, characteristic parameters (such as the validity periods for unlimited ride passes), and other dynamic information such as the text to display on the operating and Patron Displays and receipts. Fare table(s) must be able to handle each NFPS Agency's existing tariff(s).	CDRL 17-8
17.2.3.4-2	Each time the TOM communicates with the NFPS Backend, the NFPS Backend will transmit any updates to the fare table; the TOM will store all such updates. With each update of the fare table, the TOM will confirm that the list has been properly updated.	CDRL 17-8
17.2.3.4-3	The TOM will retain in Non-Volatile Memory the current and at least two future fare tables. Each future fare table will include all entries to reflect the intended fare structure and the date and time at which the new fare structure is to take effect.	CDRL 17-8
17.2.3.4-4	Any new fare table will be activated automatically in the TOM at the specified date/time as programmed by each of MNR and LIRR, on an agency-specific basis.	CDRL 17-8

17.2.3.5 TOM Software Updates

Req. #	Requirement	Assigned CDRL(s)
17.2.3.5-1	When required, modification of the TOM Software will be performed by downloading new Software from the NFPS Backend. The NFPS Backend will record and track the version number of all such Software in each TOM, and the date that the Software Versions were downloaded and installed.	CDRL 17-8
17.2.3.5-2	The TOM will accept and apply Software Updates from the NFPS Backend for the TOM Software.	CDRL 17-8
17.2.3.5-3	Each time the TOM communicates with the NFPS Backend, the NFPS Backend will transmit any Software Updates to the TOM's Software. The TOM will not commence installing Software Updates until it has received and verified the complete Software Update.	CDRL 17-8
17.2.3.5-4	The NFPS Backend will centrally manage the deployment of Software Updates to the TOM Operating System Software.	CDRL 17-8
17.2.3.5-5	Upon receipt and verification of the Software Update, the NFPS Backend will apply the Software Update (rebooting if necessary) at a time configurable by MNR and LIRR (on an agency-specific basis) for each TOM.	CDRL 17-8

17.2.3.6 TOM Configuration Control

Req. #	Requirement	Assigned CDRL(s)
17.2.3.6-1	Operating parameters, including EMV configuration parameters, will be downloadable to the TOM from the NFPS Backend via the wide area network provided by the MTA, as appropriate for each installation or TOM configuration.	CDRL 17-8
17.2.3.6-2	<p>The TOM will support configurability through numerous adjustable parameters. The TOM's Application Software will at minimum support configurability for:</p> <ul style="list-style-type: none"> • Fare Products available for sale and upgrade • Pricing • Payment method selection • Receipt content • All text and touchscreen region labels • Value of deposit to be collected for new or replaced Media • Authorized Users and passwords (if stored locally at the TOM) • All other relevant fare table entries 	CDRL 17-8

17.2.3.7 TOM Media Inventory Control

Req. #	Requirement	Assigned CDRL(s)
17.2.3.7-1	Upon issuance and/or initialization of an LU-S Smart Card or LU-R Smart Card, the TOM will record an issue record, including the date, time, fare category, card identification number, and other pertinent information of the Smart Card and any associated NFPS Account. The TOM will transmit this record to the NFPS Backend.	CDRL 17-8
17.2.3.7-2	The Inventory Management System (see Technical Specifications Section 21.3 (Inventory Management System)) will track all Media distributed to each MNR and LIRR sales location and device. Using the list of Media issued to each sales location and the issuance and/or initialization records previously transmitted to the NFPS Backend, it will be possible for authorized TOM users to query the NFPS Backend for the identification numbers and total quantity of Media that remain in the sale location's inventory.	CDRL 17-8

17.2.4 TOM Communications

Req. #	Requirement	Assigned CDRL(s)
17.2.4-1	The TOM will communicate with the NFPS Backend via secure network connection to send and receive Transaction Data, send event and status information, and receive clock synchronization information, Positive/Negative Lists, and configuration parameters. This will be possible both automatically at a scheduled time and manually, upon selection by Authorized Users.	CDRL 17-9
17.2.4-2	All communications between the NFPS Backend and the TOMs will be via a direct Ethernet cable connection.	CDRL 17-9

Req. #	Requirement	Assigned CDRL(s)
17.2.4-3	For transactions requiring NFPS Backend access to a Transit Account, or to establish a Customer Account, the TOM will communicate with the NFPS Backend in real-time.	CDRL 17-9
17.2.4-4	Transactions requiring NFPS Backend access to a Transit Account will be disabled if the TOM is unable to communicate with the NFPS Backend.	CDRL 17-9
17.2.4-5	For transactions that may occur offline, such as sales of Paper Media, communications may be deferred, but will normally be accomplished automatically, at MNR- and LIRR-specified times or time intervals (specified on an agency-specific basis).	CDRL 17-9
17.2.4-6	TOM communication with the NFPS Backend will be able to be initiated manually at the device at any time without affecting the automated procedures.	CDRL 17-9
17.2.4-7	If the TOM has missed a scheduled communication with the NFPS Backend, upon restoration of communications, the TOM will automatically initiate communications.	CDRL 17-9

17.2.5 TOM Operations

17.2.5.1 TOM Log-in and Logout

Req. #	Requirement	Assigned CDRL(s)
17.2.5.1-1	The TOM will remain inactive and unable to perform any functions unless a proper log-in has been completed.	CDRL 17-10
17.2.5.1-2	The TOM will enable log-in to be performed by manual entry or by tapping an employee ID on the Contactless Smart Card Reader and entering a PIN number.	CDRL 17-10
17.2.5.1-3	The TOM will support at least three levels of log-ins with assigned functionality configurable by MNR and LIRR (on an agency-specific basis).	CDRL 17-10
17.2.5.1-4	The TOM will require the operator to identify the initial funds bank (i.e., starting cash drawer balance) at the start of each shift.	CDRL 17-10
17.2.5.1-5	The TOM will support relief shifts. The TOM will also maintain statistics for the relief shift separately and will not affect the main shift information.	CDRL 17-10
17.2.5.1-6	If the TOM has not been used in a number of minutes configurable by MNR and LIRR (on an agency-specific basis), the user will be automatically logged out. The TOM will close all files and display the login prompt screen.	CDRL 17-10
17.2.5.1-7	Upon logging out or otherwise indicating an end-of-shift condition, the TOM will produce a report and receipt depicting the ending balance of the cash drawer.	CDRL 17-10
17.2.5.1-8	The TOM will store a data record for each successful log-in, each unsuccessful log-in, and each logout.	CDRL 17-10
17.2.5.1-9	The TOM will provide field audit reports and support reconciliation processes as defined by the MTA.	CDRL 17-10

17.2.5.2 TOM Sales

Req. #	Requirement	Assigned CDRL(s)
17.2.5.2-1	The TOM will function as an “intelligent cash register,” allowing patrons and clerks to interact in a manner that is as similar as possible to normal retail sales transactions. Sales transactions will include: <ul style="list-style-type: none"> • Purchase of new Media • Adding of value and passes to existing Media and Transit Accounts 	CDRL 17-10
17.2.5.2-2	When issuing a new Smart Card, the TOM will permit the clerk to select whether any MNR- or LIRR-configurable card fee (i.e., deposit) is to be collected, with such configuration on an agency-specific basis.	CDRL 17-10
17.2.5.2-3	The TOM will support Encoding and printing one or more new LU-R Smart Cards and/or LU-S Smart Cards from a roll or stacker, using the LU Media printer/encoder module.	CDRL 17-10
17.2.5.2-4	At no time will the TOM add a Fare Product to an NFPS Account if doing so would result in the NFPS Account having more than one pending Fare Product valid on the same service.	CDRL 17-10
17.2.5.2-5	The purchase of multiple Fare Products for a single Customer Account will be able to be performed in a single transaction, and with payment collected once.	CDRL 17-10
17.2.5.2-6	When configured to conduct sales, the TOM will support a variety of payment methods. These will include: <ul style="list-style-type: none"> • Cash • Bank cards (credit and debit) • Personal and/or Company checks • Any combination of the above 	CDRL 17-10
17.2.5.2-7	The TOM will provide means by which patrons may exchange unused Legacy Media as a means of payment for NFPS Fare Products. The TOM will track the value of exchanged Legacy Media used as payment.	CDRL 17-10
17.2.5.2-8	The TOM will support payments using including multiple bank cards, to be used for payment in a single transaction.	CDRL 17-10
17.2.5.2-9	For each sales transaction, the TOM will enable the clerk to select the payment method. If the clerk selects more than one payment method, then the TOM will prompt the clerk to enter the amount to be paid using each payment method.	CDRL 17-10
17.2.5.2-10	Cash transactions will provide the total amount due, allow the clerk to enter amount tendered, and display the change due.	CDRL 17-10
17.2.5.2-11	The TOM will control and monitor the cash drawer, and open the cash drawer upon calculation and display of the amount of change due if the cash drawer is used by the MTA.	CDRL 17-10
17.2.5.2-12	All credit and debit card transactions will be authorized via the TOM and its connection to the NFPS payment gateway (see Technical Specifications Section 21.7 (Payment Application)).	CDRL 17-10

Req. #	Requirement	Assigned CDRL(s)
17.2.5.2-13	The TOM will print a patron receipt for every completed sales transaction if required or if requested. Receipts will include the content specified in Technical Specifications Section 11.7.2 (Transaction Receipt Content) and the resulting status and value of the Transit Account, where applicable.	CDRL 17-10
17.2.5.2-14	For each completed transaction, a data record will be stored and transmitted to the NFPS Backend.	CDRL 17-10
17.2.5.2-15	The TOM will enable a clerk to display (and print via the receipt printer) totals of all completed transactions by that clerk for the current day including a listing of all personal or company checks accepted	CDRL 17-10
17.2.5.2-16	The TOM will enable an administrative user to display (and print via the receipt printer) totals of all conducted transactions for the current and each of the prior 7 days. These totals will be displayed on the operator's display, and will indicate daily totals by clerk and payment type. As necessary, the TOM may retrieve Data from the NFPS Backend. Alternatively, prior days' sales reports may be provided by network access to the NFPS Backend or from the TOM's browser interface.	CDRL 17-10

17.2.5.3 TOM Issuance of Personalized Media

Req. #	Requirement	Assigned CDRL(s)
17.2.5.3-1	When configured to do so, the TOM will include the necessary Software and peripherals (excluding the EU card printer) to enable the MTA to issue personalized cards to customers eligible for reduced fares, MNR and LIRR employees, and in support of other Special Programs. The EU card printer to support these activities will be procured independently of the NFPS.	CDRL 17-10
17.2.5.3-2	Personalized cards will include the cardholder's name and photograph printed on one side of the card, accompanied by other MNR- and LIRR-defined graphics and information, defined on an agency-specific basis.	CDRL 17-10
17.2.5.3-3	The SI shall supply printing templates (also known as "masks") using MNR- and LIRR-supplied graphic designs for all personalized card types. TOMs will support no less than 70 pre-loaded templates from which the user will select prior to printing. Where possible, template selection will be automatic based on card type.	CDRL 17-10
17.2.5.3-4	When printing a personalized card, the TOM will scale the photo image to fit within the area defined by the printing template without distorting the image or changing its native aspect ratio.	CDRL 17-10
17.2.5.3-5	The MTA will supply the graphics for printing templates within 90 days following NTP. The SI shall supply printing masks no later than 30 days before the commencement of TOM Factory Acceptance Testing.	CDRL 17-10
17.2.5.3-6	The TOM will support issuance of personalized cards in individual and bulk production modes.	CDRL 17-10

Req. #	Requirement	Assigned CDRL(s)
17.2.5.3-7	For individual card personalization, a digital camera controlled by the TOM will capture the customer images as necessary.	CDRL 17-10
17.2.5.3-8	Upon successful production of the personalized Smart Card, the TOM will store a transaction record, including all personalization Data, the identification number of the issued card, the digital photograph image and all other Transaction Data. The TOM will transfer the entire transaction record, and all accompanying Data, to the NFPS Backend.	CDRL 17-10
17.2.5.3-9	The TOM will support production runs (using data imported from an external source) for bulk card personalization in quantities of 1 to at least 100 cards per batch.	CDRL 17-10
17.2.5.3-10	For bulk card personalization production runs, the TOM will use Data files imported from an external source in an MNR- and LIRR-specified format, as specified on an agency-specific basis. The Data files will include the customer name, digital photograph, and other Data as required.	CDRL 17-10
17.2.5.3-11	The TOM will support selection of custom printing templates for bulk personalization production, which may be used to support corporate partner, university, and other institutional programs.	CDRL 17-10
17.2.5.3-12	Upon successful production of each card, the TOM will store a transaction record similar to those created for individually personalized cards, and transmit all records to the NFPS Backend.	CDRL 17-10
17.2.5.3-13	The MTA will issue customers who have reduced fare privileges Smart Cards with personalized information printed on one side of the card, including a digital photograph and the name of the cardholder. Using the appropriate customized printing template for reduced fare Media, the TOM will print and issue personalized cards.	CDRL 17-10
17.2.5.3-14	The TOM will support the capture of all Data needed to validate, register, and issue personalized Media for reduced fare customers.	CDRL 17-10
17.2.5.3-15	The TOM will support manual entry of reduced fare Customer Account Registration Data using a simple graphical user interface. The interface will be reviewed and approved by the MTA during Design Review.	CDRL 17-10
17.2.5.3-16	The TOM will capture physical reduced fare customer applications and submitted supporting documentation using the SI-provided document scanner.	CDRL 17-10
17.2.5.3-17	The TOM will capture reduced fare customer photographs using the SI-provided camera.	CDRL 17-10
17.2.5.3-18	All Customer Data captured and used by the TOM will be securely stored within the SI-provided CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)) using the APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)) and will not be stored locally on the TOM.	CDRL 17-10
17.2.5.3-19	Using a printing template customized for MNR and LIRR employee ID cards, pensioner ID cards, and Contractor ID cards, the TOM will print and issue personalized MNR and LIRR employee cards on relevant Media.	CDRL 17-10

Req. #	Requirement	Assigned CDRL(s)
17.2.5.3-20	All Data for the creation of employee and contractor badges will be captured directly by the CRM System through the SI-provided PeopleSoft Interface (see Technical Specifications Section 21 (NFPS Back Office)).	CDRL 17-10
17.2.5.3-21	During the issuance process, the TOM will prompt the operator to enter PII as required by MNR and LIRR (individual) personnel policies, including access privileges relevant to the NFPS.	CDRL 17-10
17.2.5.3-22	The selections for access privileges will be “check box” items on the operator display, and will be MNR- and LIRR-configurable (on an agency-specific basis). The TOM will support the selection of no less than 25 distinct employee access privileges as part of the employee ID issuance process.	CDRL 17-10

17.2.5.4 TOM Media Inquiry

Req. #	Requirement	Assigned CDRL(s)
17.2.5.4-1	Whenever an NFPS Smart Card (LU) is presented to the TOM Contactless Smart Card Reader, or a barcode (on Paper Media or in a mobile app) is presented to the TOM Barcode Reader, the TOM will read the Media and display the current status and value of the Media or in the associated Transit Account on the operator display and customer display.	CDRL 17-10
17.2.5.4-2	If the customer’s Smart Card or barcode is not readable, the TOM will permit the clerk to manually enter the Media identification number.	CDRL 17-10
17.2.5.4-3	Upon request, the TOM will query the NFPS Backend for details of the most recent transactions posted to the Media or associated Transit Account. Upon receipt of the transaction history, the TOM will display the results on the operator display.	CDRL 17-10
17.2.5.4-4	The TOM will be able to display at minimum 25 recent transactions, with the maximum number displayed as configurable by MNR and LIRR, on an agency-specific basis.	CDRL 17-10
17.2.5.4-5	For each prior transaction displayed, history details will include, at minimum: <ul style="list-style-type: none"> • Date and time of transaction • Transaction type (e.g., pas activation, pass usage, value usage, transfer, replenishment/purchase) • Transaction value • Usage location (e.g., station name) • Replenishment location (e.g., CVM, TOM, Autoload) 	CDRL 17-10
17.2.5.4-6	Upon request using the operator touchscreen, the TOM will print a receipt of the current status and value of the Media or associated Transit Account.	CDRL 17-10

17.2.5.5 TOM Customer Account Management

Req. #	Requirement	Assigned CDRL(s)
17.2.5.5-1	The TOM will enable operators to setup and modify Customer Accounts.	CDRL 17-10
17.2.5.5-2	The TOM will enable the operator to create a new Customer Account by registering an anonymous Transit Account.	CDRL 17-10
17.2.5.5-3	The TOM will enable the operator to modify any fields in the existing Customer Accounts that are deemed by the MTA to be user-alterable.	CDRL 17-10
17.2.5.5-4	The TOM will enable operators to establish, modify, and cancel patron subscriptions for Autoload.	CDRL 17-10
17.2.5.5-5	To prevent manual data entry error where possible, the identification number of the customer's Smart Card will be captured by the Contactless Smart Card Reader, and the bank card processor module will read any bank card data required for Autoload subscription.	CDRL 17-10

17.2.5.6 TOM Media Replacement

Req. #	Requirement	Assigned CDRL(s)
17.2.5.6-1	The TOM will support replacing registered LU Smart Cards or Paper Media by disassociating the lost or stolen Smart Card from the NFPS Account and linking a new LU Smart Card or Paper Media in its place.	CDRL 17-10
17.2.5.6-2	Prior to replacing a registered LU Smart Card or Paper Media, the TOM will require verification of the customer's identity through the entry of the Customer Account identifier, password and/or answers to secret questions, as recorded by the NFPS Backend.	CDRL 17-10
17.2.5.6-3	If the replacement Media requires no personalization, then the TOM will prompt the operator to present the new Smart Card to the Contactless Smart Card Reader.	CDRL 17-10
17.2.5.6-4	When replacing previously-issued personalized Media, the TOM will support use of the digital photograph, printing template, and other Data from the original issue record to facilitate replacement without requiring the cardholder's presence, or the use of the digital camera to create and store a new digital image.	CDRL 17-10
17.2.5.6-5	Upon reading or issuing the replacement Media, the TOM will transmit to the NFPS Backend an issue record containing the card's identification number, and a corresponding record to block use of the replaced Media.	CDRL 17-10
17.2.5.6-6	Replacing a malfunctioning Smart Card will be possible if the patron presents the malfunctioning Smart Card. Procedures to replace a defective Smart Card will be similar to those used to replace a lost registered Smart Card, but replacement of a defective Smart Card will not require the Smart Card to be registered.	CDRL 17-10
17.2.5.6-7	The replacement process will support entry of the defective Smart Card's identification number as the means to initiate replacement.	CDRL 17-10

17.2.5.7 TOM Refunds and Reversals

Req. #	Requirement	Assigned CDRL(s)
17.2.5.7-1	For refund or error correction purposes, the TOM will provide operators the ability to reverse the last replenishment transaction performed to a Transit Account if: <ul style="list-style-type: none"> • The same TOM conducted the replenishment transaction • The transaction occurred within an MNR- and LIRR-configurable period (initially set to 5 minutes, and configurable on an agency-specific basis) • The Transit Account has no usage transactions since the replenishment 	CDRL 17-10
17.2.5.7-2	Reversal transactions will require the deletion of the relevant Fare Product or deduction of the value added from the Transit Account during the replenishment transaction.	CDRL 17-10
17.2.5.7-3	The TOM will fully record and transmit to the NFPS Backend all reversal transactions.	CDRL 17-10

17.3 Customer Service Devices Required Submittals

The required submittals specified in this Technical Specifications Section 17 (Customer Service Devices) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 17-1	CS POS Terminal and Module Design	Section 17.1.1	✓	✓	✓	
CDRL 17-2	CS POS Terminal Hardware	Section 17.1.2	✓	✓	✓	
CDRL 17-3	CS POS Terminal Software	Section 17.1.3	✓	✓	✓	
CDRL 17-4	CS POS Terminal Communications	Section 17.1.4	✓	✓	✓	
CDRL 17-5	CS POS Terminal Transaction Process Flows	Section 17.1.5	✓	✓	✓	
CDRL 17-6	TOM and Module Design	Section 17.2.1	✓	✓	✓	
CDRL 17-7	TOM Hardware	Section 17.2.2	✓	✓	✓	
CDRL 17-8	TOM Software	Section 17.2.3	✓	✓	✓	
CDRL 17-9	TOM Communications	Section 17.2.4	✓	✓	✓	
CDRL 17-10	TOM Operations Process Flows	Section 17.2.5	✓	✓	✓	

18 Media

18.1 General Media Requirements

These requirements define the materials, manufacturing, handling, packaging, quality assurance, testing and delivery of EU, LU, and Paper Media to be used throughout the NFPS. All EU and LU Media will include an ISO/IEC 14443 Contactless interface. Paper Media will include visually-recognizable anti-fraud features approved by the MTA. The SI shall produce and supply the Media to the applicable NFPS Agency in accordance with these requirements. Final graphics artwork and printed text will be specified during design review.

Media for MNR and LIRR will be procured as an Option as further set out in Technical Specifications Section 35.13 (MNR and LIRR Media).

18.1.1 Production Requirements

Req. #	Requirement	Assigned CDRL(s)
18.1.1-1	The SI shall provide, and ensure manufacture and delivery of all EU, LU, and Paper Media specified under these Specifications and as required for successful deployment and operational maintenance of the NFPS.	CDRL 18-1
18.1.1-2	During design review, the SI shall work with the MTA to determine the necessary quantities and varieties of all Media to ensure successful deployment of all standard and Special Programs of the NFPS. This will include a supply of separately branded stored value EU Smart Cards and a single pre-encoded Fare Product EU Smart Card for retail distribution. The SI shall supply the BIN numbers for these retail Smart Cards for tracking within the NFPS.	CDRL 18-1
18.1.1-3	The SI shall deliver all graphics and related materials in electronic and other relevant forms, used in the manufacture of the Smart Cards, for the MTA's review and approval.	CDRL 18-1
18.1.1-4	The SI shall provide Media produced in a manufacturing facility which provides information security management compliant with ISO 27001. The Media will support the general security, Software and performance requirements in Technical Specifications Section 5 (General Design Requirements).	CDRL 18-1
18.1.1-5	The SI shall accommodate on-site inspections of the production facility by MTA staff.	CDRL 18-1
18.1.1-6	The SI shall provide the capability for Media in form factors other than the standard forms required herein (such as mini-cards, key fobs, or stickers). Alternative forms of Media are subject to the same performance, data, serialization, storage, usage, and delivery requirements described within this Technical Specifications Section 18 (Media).	CDRL 18-1
18.1.1-7	The SI shall provide the MTA with detailed specifications for all types of EU and LU Media and receipt stock including coefficients of friction and roll core requirements to allow purchase of equivalent Media by the MTA from a Third Party.	CDRL 18-1

18.1.2 Encoding

Req. #	Requirement	Assigned CDRL(s)
18.1.2-1	The SI shall support and provide pre-encoded Limited-Use and Extended-Use Media.	CDRL 18-2
18.1.2-2	The SI shall deliver all pre-encoded Media with sensitive Data specific to the NFPS, including the encryption keys.	CDRL 18-2
18.1.2-3	Data encoded to the Media will include a unique sequential serial number for the purposes of traceability.	CDRL 18-2
18.1.2-4	If MIFARE Smart Card format is chosen, a minimum 7 byte UID will be used for each Smart Card produced.	CDRL 18-2

18.1.3 Encryption Keys

Req. #	Requirement	Assigned CDRL(s)
18.1.3-1	All provided Media will support the most currently available robust cryptography, such as 3DES, Advanced Encryption Standard (AES) and RSA, and support offline cryptography as necessary.	CDRL 18-2
18.1.3-2	Key management services will be provided by the SI. Key management in this context includes, but is not limited to: <ul style="list-style-type: none"> • Key generation –the MTA may require derived key generation for each manufactured Smart Card. This may consist of a Smart Card manager key set, as well as multiple application related key sets. Key sets may consist of encryption and authentication keys. • Key management –the MTA may require key management services for the storage and retention of Smart Card and application key sets. • Key updates – The SI shall provide the ability to update, or roll, all cryptographic keys used within the NFPS. 	CDRL 18-2
18.1.3-3	The SI shall use the highest available security in defining, generating, deploying, transmitting, storing, and retiring encryption keys employed in the NFPS. The SI shall develop and submit procedures that follow all applicable standards, such as those outlined in ISO 27002, and NIST 800 55/57.	CDRL 18-2
18.1.3-4	If the NFPS design requires the Smart Card manufacturer to write the encryption keys onto the Smart Card Media, the security plan will be approved by the MTA. Under that plan, the SI shall use only trusted Smart Card manufacturers with appropriate security mechanisms in place to ensure that the MTA's keys remain safe and secure. The SI shall develop an MTA-approved certification plan for the Smart Card manufacturer.	CDRL 18-2
18.1.3-5	Any and all encryption keys will become property of the MTA at the time of Final Completion, and all algorithms that generate encryption keys will be licensed to the MTA in accordance with the Contract Documents.	CDRL 18-2

18.1.4 Protection of MTA Group Security Sensitive Information

Req. #	Requirement	Assigned CDRL(s)
18.1.4-1	The SI shall treat all Security Sensitive Information with the utmost care and security. The SI shall not release, share or expose Security Sensitive Information without the express written consent of the MTA.	CDRL 18-2
18.1.4-2	Security Sensitive Information includes, but is not limited to: <ul style="list-style-type: none"> • Card data encoding format and definitions • Card encoded data and field values • MTA-specific encryption keys 	CDRL 18-2
18.1.4-3	The SI shall be liable for all MTA Group costs to replace all Smart Media in circulation and inventory if the SI, through negligence or deliberate action, causes unauthorized release of some or all of Security Sensitive Information, and affected Media may include Third Party-supplied Media.	CDRL 18-2

18.1.5 Quality Control and Defects Allowed

Req. #	Requirement	Assigned CDRL(s)									
18.1.5-1	The SI shall verify proper functioning of all Media after manufacture prior to delivery to the applicable NFPS Agency or any Linked NFPS Entity.	CDRL 18-1									
18.1.5-2	Defective Media identified at time of manufacture will be replaced prior to delivery, and all serial numbers will be retained as sequential so that, at the time of delivery, there will be no gaps in the sequential serial numbers.	CDRL 18-1									
18.1.5-3	<p>Delivered Media will function properly when first presented to Frontend NFPS Equipment. Failure rates will not exceed the following values:</p> <table border="1"> <thead> <tr> <th>Media Type</th><th>Maximum First Tap Failure Rate</th><th>Maximum Premature Failure Rate</th></tr> </thead> <tbody> <tr> <td>EU Media</td><td>0.05%</td><td>1.0%</td></tr> <tr> <td>LU Media</td><td>0.1%</td><td>2.0%</td></tr> </tbody> </table> <p>The SI shall replace all Media that fail to function as defined above at no additional cost to the MTA Group. If the Failure rate exceeds the required rates, the MTA may reject the batch and the SI shall replace the entire batch at no additional cost to the MTA Group.</p>	Media Type	Maximum First Tap Failure Rate	Maximum Premature Failure Rate	EU Media	0.05%	1.0%	LU Media	0.1%	2.0%	CDRL 18-1
Media Type	Maximum First Tap Failure Rate	Maximum Premature Failure Rate									
EU Media	0.05%	1.0%									
LU Media	0.1%	2.0%									
18.1.5-4	Failures of customer circulated Media that occur upon first use (the “First Tap Failure Rate”), due to reasons other than abuse, will not exceed those specified in this Technical Specifications Section 18.1.5 (Quality Control and Defects Allowed).	CDRL 18-1									
18.1.5-5	Failures of customer circulated Media that occur prior to the expected useful life (the “Premature Failure Rate”), due to reasons other than abuse, will not exceed those specified in this Technical Specifications Section 18.1.5 (Quality Control and Defects Allowed).	CDRL 18-1									

18.1.6 Serialization

Req. #	Requirement	Assigned CDRL(s)
18.1.6-1	The NFPS will read and utilize the unique 7 byte UID that is pre-encoded on the embedded chip.	CDRL 18-1
18.1.6-2	The NFPS will also read and utilize a separate unique, sequential control number for the purposes of inventory control. This number will be assigned at the time of manufacture.	CDRL 18-1
18.1.6-3	All Media will have the 7 byte UID and the sequential inventory control indelibly and legibly printed on one side.	CDRL 18-1
18.1.6-4	Any printed UID or serial numbers will be printed on the lower portion of the Smart Card and will not interfere with or otherwise obscure graphics or other branding placed on the Smart Card.	CDRL 18-1
18.1.6-5	The SI shall propose a number sequence for inventory control during design review with proposal subject to the MTA's approval.	CDRL 18-1

18.1.7 Packaging and Deliveries

Req. #	Requirement	Assigned CDRL(s)
18.1.7-1	Media will be packaged in a manner to prevent package pilferage, facilitate storage, and prevent damage to the Media.	CDRL 18-1
18.1.7-2	The delivery of Media will be made under controlled conditions, with bundles in boxes or packages made to MTA standards. The packaging for each bundle will be sequentially numbered.	CDRL 18-1
18.1.7-3	<p>The package labeling will include the following, at a minimum:</p> <ul style="list-style-type: none"> • Date and location of manufacture • Media type and product description • Manufacturer part number • MTA part number • MTA batch number • MTA box number • MTA order number • Quantity • Sequence number • Range of Media sequential numbers in the package <p>Other packaging information may be defined by the MTA prior to delivery. Printing on the package label will include all items above in a standard barcode format.</p>	CDRL 18-1
18.1.7-4	The MTA may, at its discretion, request delivery of the contracted quantity of Media in discrete batches. For EU Media, each batch will contain the requested amount of Smart Cards or the entire contracted quantity of a given Media type, whichever is less. For die cut LU Media, each batch will contain the requested amount of Smart Cards or the entire quantity of a given Media type, whichever is less.	CDRL 18-1
18.1.7-5	For roll stock Media, each roll will contain at least 2,000 and up to 3,000 LU Media. As delivered to each NFPS Agency, on an NFPS Agency-specific basis, each roll will be individually fitted with bands to prevent unwinding of the roll.	CDRL 18-1

Req. #	Requirement	Assigned CDRL(s)
18.1.7-6	For each batch, the SI shall provide two (2) electronic files, in .csv and .xml formats, containing the UID and associated sequential serial number of all Media for processing into NFPS databases.	CDRL 18-3

18.1.8 Production, Storage and Storage Security

Req. #	Requirement	Assigned CDRL(s)
18.1.8-1	The SI and its suppliers will maintain security during the manufacture, production and storage of the Media, and maintain full compliance with ISO 27001 security measures.	CDRL 18-1
18.1.8-2	The SI shall be responsible for all tracking of materials used in the production of the Media. The Media will be manufactured in a secure area, accessible only to personnel involved in the manufacturing and handling of the Media.	CDRL 18-1
18.1.8-3	The SI shall maintain, and produce upon request by the MTA, a certified record of the Media fashioned on a form registered by the production equipment at the end of each production run.	CDRL 18-1
18.1.8-4	The SI shall ensure disposal of all scrap and rejected Media so that they are rendered unusable.	CDRL 18-1
18.1.8-5	The SI shall ensure the following storage environment environmental conditions: <ul style="list-style-type: none"> • Temperature 32 °F to 140 °F (0 °C to 60 °C) • Relative Humidity (RH) 30% to 65% (non-condensing) 	CDRL 18-1
18.1.8-6	The Media will be suitable for storage for up to 3 years under the conditions listed above. Cartons will be of sufficient strength to permit stacking 5 packages high, without damage to the Media or the packages, for a storage period of 3 years.	CDRL 18-1
18.1.8-7	The production, storage, or packaging of roll stock Media shall not damage or adversely affect Media towards the center of the roll. Issues regarding bend radius will be tested and resolved prior to delivery.	CDRL 18-1
18.1.8-8	The MTA, at its discretion, may perform unannounced inspections at all facilities involved with the production and storage of the Media.	CDRL 18-1

18.1.9 MTA Acceptance Testing

Req. #	Requirement	Assigned CDRL(s)
18.1.9-1	All delivered Media will be subject to Acceptance Testing by MTA staff as designated by the MTA.	CDRL 18-4
18.1.9-2	MTA staff will sample delivered Media and verify that the Media meets the requirements in Technical Specifications Section 18.1.5 (Quality Control and Defects Allowed) and works within the NFPS. If Media are found defective during this testing or not in compliance with any part of these requirements, then the MTA may reject the entire batch and return it to the SI for replacement at no additional cost to the MTA Group.	CDRL 18-4
18.1.9-3	The SI shall provide a list of any required associated Test Equipment.	CDRL 18-4

Req. #	Requirement	Assigned CDRL(s)
18.1.9-4	If the batch is rejected, the SI shall deliver replacement Media in no more than 4 weeks from time of notification by the MTA.	CDRL 18-4
18.1.9-5	The SI shall provide a Media acceptance test plan during preliminary design review for the MTA's review and approval.	CDRL 18-4

18.1.10 Replacement Media

Req. #	Requirement	Assigned CDRL(s)
18.1.10-1	The SI shall replace any first-tap defective Media found in a batch as described in req. # 18.1.5-3 at no additional cost to the MTA Group.	CDRL 18-1
18.1.10-2	The replacement Media will be included in the subsequent batch order and replacement Media will not use the sequential serial number of the defective Media, and sequential serial numbers of delivered Media shall always be unique.	CDRL 18-1

18.2 Extended Use Contactless Media

18.2.1 Physical Characteristics

Req. #	Requirement	Assigned CDRL(s)
18.2.1-1	Extended-Use Media will support the NFPS Agency-Issued Media general requirements (see Technical Specifications Section 8.2.1 (General Requirements)) and Extended-Use Smart Card requirements (see Technical Specifications Section 8.2.2 (Extended Use Contactless Smart Cards)).	CDRL 18-1
18.2.1-2	The EU Media will comply with ISO/IEC 14443 1 for physical characteristics and ISO/IEC 7810 ID1 size for dimensions.	CDRL 18-1
18.2.1-3	The Smart Card body will be comprised of a composite PVC/PET material.	CDRL 18-1
18.2.1-4	The Media will have a read/write performance of not less than 200,000 read/write cycles.	CDRL 18-1
18.2.1-5	The Media will be constructed of appropriate durable materials for a minimum useful life of 5 years. The Media will comply with the most recent versions of ISO/IEC 10373 and ANSI INCITS 322 for durability.	CDRL 18-1

18.2.2 Pre-printed Graphics

Req. #	Requirement	Assigned CDRL(s)
18.2.2-1	The EU Media will be printed with colors and designs as specified during design review with a minimum of 8 colors, and support edge to edge printing.	CDRL 18-5
18.2.2-2	All pre-printed graphics will be protected by a clear coat that covers the entire surface of the Smart Card.	CDRL 18-5

Req. #	Requirement	Assigned CDRL(s)
18.2.2-3	Prior to commencing full production, and within 30 days of approved graphic designs, the SI shall supply at least 20 proof samples of each Media type for the MTA's review and approval. The MTA will approve or reject the samples within 14 days of receipt of the samples. For each rejected sample, the SI shall provide 10 corrected proofs within 14 days of notification of rejection.	CDRL 18-5
18.2.2-4	The SI shall supply designs for all pre-printed graphics in electronic format for review and approval by the MTA.	CDRL 18-5

18.3 Die-Cut Limited Use Contactless Media (LU-S Media)

18.3.1 Physical Characteristics

Req. #	Requirement	Assigned CDRL(s)
18.3.1-1	Limited-Use Media will support the NFPS Agency-Issued Media general requirements (see Technical Specifications Section 8.2.1 (General Requirements)) and Limited-Use Smart Card requirements (see Technical Specifications Section 8.2.3 (Limited-Use Contactless Smart Cards)).	CDRL 18-1
18.3.1-2	The Limited-Use Smart Card body will be comprised of polyester paper laminate, plastic PVC, PET, or composite PVC/PET.	CDRL 18-1
18.3.1-3	Except for thickness, the Media dimensions will be compliant with ISO 7810 ID-1.	CDRL 18-1
18.3.1-4	The Media will comply with ISO/IEC 14443.	CDRL 18-1
18.3.1-5	The physical Media body will be coated with an appropriate durable material for a minimum useful life (in use, not storage) of 1 year.	CDRL 18-1
18.3.1-6	The Media will have a read/write performance of not less than 20,000 read/write cycles and have a minimum life expectancy of at least 180 days of normal daily use.	CDRL 18-1

18.3.2 Pre-printed Graphics

Req. #	Requirement	Assigned CDRL(s)
18.3.2-1	The LU Media shall include colors and designs as specified during design review with a minimum of 4 colors.	CDRL 18-5
18.3.2-2	Within 30 days of approved graphic designs, the SI shall supply at least 40 proof samples of each Media type for the MTA's review and approval prior to commencing full production. The MTA will approve or reject the samples within 14 days of receipt. For each rejected sample, the SI shall provide 20 corrected proofs within 14 days of notification of rejection.	CDRL 18-5
18.3.2-3	The SI shall supply designs for all pre-printed graphics in electronic format for review and approval by the MTA staff. All proofs will become the property of the MTA.	CDRL 18-5

18.4 Roll Stock Limited Use Contactless Media (LU-R Media)

If LU-R Media is employed for sales at the CVM, the following requirements will apply.

18.4.1 Physical Characteristics

Req. #	Requirement	Assigned CDRL(s)
18.4.1-1	The physical characteristics of LU-R Media will be identical to die-cut LU Media in Technical Specifications Section 18.3.1 (Physical Characteristics), with the exception that LU-R Media needs to be physically cut.	CDRL 18-1
18.4.1-2	CVM LU-R Media will be provided in rolls of not less than 2,000 and up to 3,000 Smart Cards per roll.	CDRL 18-1
18.4.1-3	After each LU-R Smart Card is cut, the LU Media will be functionally identical to the die-cut Media as described in Technical Specifications Section 18.3 (Die-Cut Limited Use Contactless Media (LU-S Media)).	CDRL 18-1
18.4.1-4	The LU-R Media will have a coating on the front side allowing printing by the CVM upon issuance, including the printing of 2D barcodes, if deemed necessary and as determined during design review.	CDRL 18-1
18.4.1-5	LU-R Media shall perform uniformly, no matter where the Smart Card is located in the roll. Bend radius and other physical storage constraints will not damage or adversely affect Media performance or reliability.	CDRL 18-1

18.4.2 Pre-Printed Graphics

Req. #	Requirement	Assigned CDRL(s)
18.4.2-1	The printed graphic requirements for LU-R Media will be identical to die-cut LU Media in Technical Specifications Section 18.3 (Die-Cut Limited Use Contactless Media (LU-S Media)).	CDRL 18-5
18.4.2-2	Prior to commencing production, and within 30 days of approved graphic designs, the SI shall supply one full roll for sampling by the MTA for review and approval. The Smart Cards will include all pre-printed graphics and serial numbers. The Smart Cards do not have to be functional Media otherwise.	CDRL 18-5
18.4.2-3	The SI shall supply designs for all pre-printed graphics in electronic format for review and approval by the MTA. All proofs will become the property of the MTA.	CDRL 18-5

18.5 Receipt Stock

Req. #	Requirement	Assigned CDRL(s)
18.5-1	Receipt stock for use in the CVM, TOM, and CS POS Terminal will be thermally sensitive plain paper roll stock that is a minimum of 2 inches wide. Each roll will have the capacity to provide no less than 2,000 receipts that are approximately 3 inches long.	CDRL 18-1
18.5-2	Receipt stock for use in the WVM will be thermally sensitive paper with pre-printed graphics in a single color to deter fraud. Each roll of WVM receipt stock will be no less than 2 inches wide and capable of dispensing no less than 2,000 receipts that are approximately 3 inches long.	CDRL 18-1
18.5-3	Receipt stock shall not contain Bisphenol A (BPA) and shall comply with all relevant regulations.	CDRL 18-1

18.6 Paper Media

If needed, Paper Media will be used for products that can be validated both visually and via encrypted 2D barcodes. Printed barcode usage will be determined during design review.

Req. #	Requirement	Assigned CDRL(s)
18.6-1	Paper Media shall include built-in visual security features such as serial and batch numbers, security foil and/or holograms so as to avoid fraud and duplication. The MTA will review the SI's Paper Media solutions during Design Review.	CDRL 18-1
18.6-2	The Media dimensions requirements for Paper Media will be identical to LU-R Media described in Technical Specifications Section 18.4 (Roll Stock Limited Use Contactless Media (LU-R Media)).	CDRL 18-1
18.6-3	The printed graphic requirements for Paper Media will be identical to the requirements in Technical Specifications Section 18.4.2 (Pre-Printed Graphics).	CDRL 18-1
18.6-4	The physical Paper Media body will be sufficiently durable to last for a minimum useful life (in use, not storage) of 90 days.	CDRL 18-1

18.7 Media Required Submittals

The required submittals specified in this Technical Specifications Section 18 (Media) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 18-1	Media Supply Plan	Sections 18.1, 18.2, 18.4, 18.5	✓	✓	✓	
CDRL 18-2	Encryption Keys and Data Security	Sections 18.1.2, 18.1.3, 18.1.4	✓	✓	✓	
CDRL 18-3	Media Serial Number Files	Section 18.1.7	✓	✓	✓	
CDRL 18-4	Media Acceptance Testing Plan	Section 18.1.9	✓	✓	✓	
CDRL 18-5	Media Graphics and Proofs	Sections 18.2.2, 18.3.2, 18.4.2	✓	✓	✓	

19 Network Infrastructure

19.1 NYCT Network Infrastructure and Installation Services

19.1.1 Fare Control Area Local Area Network (FCALAN)

The SI shall be responsible for surveying, designing, installing, integrating, testing and commissioning a TCP/IP Ethernet based communications network called FCALAN that will connect the NFPS Equipment in all NYCT subway stations' Fare Control Areas, including Staten Island Rapid Transit Operating Authority's Fare Control Areas.

This infrastructure will provide the NFPS Agencies with an IP/Ethernet network at all FCAs in the 473 subway stations (469 current stations, plus the four Second Ave Subway stations) and the 2 SIRTOA gated rail stations required for the NFPS.

The FCALAN will consist of junction boxes, pull boxes, conduits, FCALAN Cabinets, Ethernet Aggregation Switches (AGS), electric panels, data and power wires and all other necessary and desirable ancillary components.

The FCALAN will be used to connect turnstile arrays, ADA access gates, HEETs and Vending Machines together, and to forward communications traffic from the NFPS to NFPS Backend through Access Nodes (AN) of the Passenger Station Local Area Network provided by the MTA at the FCAs. There are approximately 941 FCAs within the 473 NYCT subway stations and 3 FCAs within the 2 SIRTOA gated stations.

The SI shall provide connectivity between the FCALAN and the switch inside the PSLAN at the same FCA. The SI will be provided one port on the PSLAN AN. However, for SIRTOA stations, there will be no PSLAN AN; the SI shall design, furnish and install network connections using Third Party network services provided by the MTA that extends communications from SIRTOA to the NFPS Backend.

19.1.2 Passenger Station Local Area Network

The Passenger Station Local Area Network (PSLAN) is the local area network used to support IP-based applications at stations. It is a layer 2 (Ethernet) network and is used as the access network for IP systems located in MTA stations to communicate with other end systems of the same application. These applications could be located either at the same station or at central sites.

The AN is the main building block of the PSLAN infrastructure. It is a hardened Power-over-Ethernet switch assembly, which is custom built for the PSLAN. The Access Node comes in 2 main configurations: large (16-Port) and small (8-port). The ANs house CAT6 panel, fiber panel, Power-over-Ethernet switch(s), environmental sensor, power supply unit, line filter unit, fan and controller unit, fuse and breaker. The ANs are interconnected with multi-strand single mode fiber optic cable for data and copper cable for power backup to the communications room.

The ANs are strategically located throughout the stations and terminate at the Station Communications Room for connection to the MTA's existing wide area network; SONET/ATM which is the backbone of the subways network.

The PSLAN brings communications into the subway stations, along the platforms and into the fare control areas. The PSLAN provides a base communications infrastructure to support a multitude of technology initiatives that will improve services throughout the subway system. PSLAN supports a variety of applications including HelpPoint, Station Advisory Information Displays (SAID), On-The-Go (OTG), Security Access Control Devices, IP CCTV and the NFPS.

The MTA will be the design approval and project management authority. The MTA will provide station layout diagrams for all NYCT subway stations. The SI shall provide the design and build out services.

19.1.3 General

The SI responsibilities include, but are not limited to:

Req. #	Requirement	Assigned CDRL(s)
19.1.3-1	The SI shall be responsible for all requirements and work included in Divisions 16, 19 and 20 (see req. # 19.1.4-8 for further details).	CDRL 19-9
19.1.3-2	The SI shall survey, design, install, integrate, test and commission the FCALAN. The SI shall use its own expertise and judgment to propose a FCALAN to best meet the requirements included in the Contract Documents. The SI responsibilities also include operational testing of end-to-end communications from the FCALAN to all required NFPS Backend locations.	CDRL 19-1
19.1.3-3	The MTA's approval is required for each stage of FCALAN development. The SI shall submit Documentation to allow the MTA to review and approve all stages of FCALAN development.	CDRL 19-6
19.1.3-4	Surveys of each fare control area shall be performed in coordination with NYCT's Stations Department, Stations Clearinghouse, Stations Lighting, Subways' Maintenance of Way (MOW) and Electronics Maintenance Division (EMD) and Fare Payment Programs. All material mounting in the station area (including junction boxes, pull boxes, conduits, FCALAN equipment, and electric panels) shall require approval by the MTA. The MTA will provide to the SI the configuration of existing and planned non-NFPS Station LAN and WAN (SONET/ATM/IP) equipment in subway stations.	CDRL 19-1
19.1.3-5	The MTA will work with the SI to provide details of the MTA network, network protocols and configuration requirements. The FCALAN will be subject to review and approval by the MTA.	CDRL 19-1
19.1.3-6	The SI shall furnish and install all required and approved Interfaces and other connections between FCALAN, NFPS Equipment within stations and fare control area electric system. Interfaces and other connections shall include all required materials to extend power from each fare control area's Electrical Panel (FCA Panel) and all required materials to extend network connection from the closest PSLAN AN. One (1) Ethernet connection is allocated for connecting each FCALAN to the PSLAN AN. It is the SI's responsibility to survey each fare control area and identify the respective FCA Panel and AN.	CDRL 19-3
19.1.3-7	Modifications and relocations of any existing communications and power cables/conduit are prohibited unless the SI acquires pre-approval from the MTA.	CDRL 19-1

19.1.4 FCALAN Survey and Design Requirements

NYCT's Capital Program Management (CPM) maintains a variety of specifications for work on electrical, mechanical, IT and other systems. These specifications are categorized into discipline specific Divisions. Sample Master Specifications and Design Guidelines are included in Appendix H. The Master Specifications and Design Guidelines provide guidelines and requirements for the level of activities required in order to furnish and install a complete FCALAN. The SI shall develop a project-specific design for the furnishing, installing and testing of the FCALAN, based upon and using the guidelines and requirements in the Master Specifications and Design Guidelines as parameters. The SI shall maintain all applicable requirements in the Master Specifications and Design Guidelines, and shall meet all requirements as stated in the MTA approved design. In the case that there is a discrepancy between the Master Specifications and Design Guidelines and the standards or reference values cited in these Technical Specifications, the more stringent requirement shall apply. Applicable Divisions at a minimum will include No.'s 16 (Electrical), 19 (Communications) and 20 (Networks).

Req. #	Requirement	Assigned CDRL(s)
19.1.4-1	The SI shall include FCALAN installation planning in the Deployment, Installation and Interface Plan.	CDRL 19-3
19.1.4-2	<p>The SI shall survey and design the FCALAN. The FCALAN design shall include the following components:</p> <ul style="list-style-type: none">• Conduits to extend power from existing fare control area Electric Panel (FCA Panel) to a new FCALAN electric panel<ul style="list-style-type: none">○ The SI shall make use of existing electrical subpanel in FCAs at 277 underground subway stations○ Power wires from existing FCA Panel to FCALAN electric panel• FCALAN electric panel with breaker positions to support FCALAN. There shall be minimum (2) spare breaker positions for future use<ul style="list-style-type: none">○ Conduits and power wires from FCALAN electric panel to FCALAN to power all active FCALAN equipment (such as Aggregation Switches (AGS))• Conduits to extend network connection from existing PSLAN AN. Conduit shall be run from PSLAN AN's pull box/transition box to the FCALAN's PullBox (FPB)<ul style="list-style-type: none">○ CAT6 cables from PSLAN's AN to AGS• FCALAN PullBox installed as the point where all conduits and CAT6 cables (from NFPS equipment to the AGS) shall route to the AGS• FCALAN with AGS mounted in fare control area to interconnect all NFPS Equipment. The SI shall submit proposal, for review and approval, for mounting locations of the AGS<ul style="list-style-type: none">○ Conduits and CAT6 cables from NFPS equipment to AGS (via the FPB)	CDRL 19-1

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Ethernet switches, CAT6 cables, patch panels, mounting facilities, power supplies and wires inside each NFPS Equipment (such as inside turnstile arrays) to interconnect required NFPS Equipment to each other and to the AGS Power backup and UPS system to back up the FCALAN for up to two (2) hours 	
19.1.4-3	FCALAN components installed in fare control area shall be rated NEMA-4X or compliant with EN60529 (1992) IP54 with full protection from power washing.	CDRL 19-1
19.1.4-4	FCALAN components shall be rated to operate within the temperature range from -15°F to 120°F.	CDRL 19-1
19.1.4-5	FCALAN will be connected to an existing MTA network management system, Solarwinds. The SI shall develop and integrate FCALAN equipment models into the Solarwinds. The SI shall configure Solarwinds with specific details to allow full management for all FCALAN equipment. The SI shall produce interface control Documentation.	CDRL 19-4
19.1.4-6	<p>The SI shall develop a schedule for survey of all FCALAN CAs. Such schedule shall be developed in coordination with NYCT's Stations Department, Stations Clearinghouse, MOW, EMD, CPM and Fare Payment Programs to ensure adequate staff support.</p> <ul style="list-style-type: none"> The SI shall develop a pre-survey set of drawings showing relevant routing and mounting of major components. These shall include junction boxes, pull boxes, conduit routes, FCALAN equipment cabinet mounts, electric panel mounts. Drawing shall be scaled representation of the CA, including all components as installed in the CA. During survey, the MTA will make final determination of approved routes and mounting locations. The SI shall document such decisions and shall redline the pre-survey drawings with updated information, and provide such Documentation to the MTA. The SI shall produce final Documentation (including drawing sets) that incorporates the changes made from survey, and submit such Documentation (along with marked redline drawings) to the MTA for approval. 	CDRL 19-3 CDRL 19-6 CDRL 19-7
19.1.4-7	For FCALAN components not covered by the Master Specifications and Design Guidelines, the SI shall create and submit for approval a new section for the Master Specifications and Design Guidelines that covers the requirements for such components that are not covered. Level of detail and requirements shall be commensurate with	CDRL 19-8

Req. #	Requirement	Assigned CDRL(s)
	Section 20BL of the Master Specifications and Design Guidelines.	
19.1.4-8	The SI shall submit Documentation, including Design Documentation and detailed Shop Drawings, to the MTA for review and approval. The SI shall incorporate comments from the MTA and re-submit as required. No work shall commence until the Documentation is approved by the MTA.	CDRL 19-6 CDRL 19-8
19.1.4-9	As part of design, the SI shall submit for approval a proposal for clear maintenance and troubleshooting demarcation point between the PSLAN and FCALAN, and between FCALAN and the NFPS. Approval will be needed from MOW Engineering, EMD Operations and AFC Maintenance Department. The demarcation shall take into account the operational and maintenance organization structure that supports these different systems.	CDRL 19-1

19.1.5 FCALAN Testing Requirements

Req. #	Requirement	Assigned CDRL(s)
19.1.5-1	The MetroCard System will be in operation alongside the NFPS; sharing conduits and potentially MetroCard System cabinet areas. The SI shall not damage, negatively affect or jeopardize the operation and performance of the Legacy Equipment and cable connection throughout the deployment of the FCALAN and the NFPS.	CDRL 19-10
19.1.5-2	Upon request, the SI will have the opportunity to witness demonstrations of successful operations of the existing MetroCard System before commencing the NFPS installation work.	CDRL 19-10
19.1.5-3	Following installation of the FCALAN equipment, and to ensure that the MetroCard System was not impacted, the MTA and the SI shall conduct operational testing of the MetroCard System.	CDRL 19-10
19.1.5-4	The SI shall submit FCALAN test plans and test procedures to the MTA for review and approval at least 120 calendar days before testing is scheduled to begin. Tests shall include all test plans and procedures as required under the MTA approved Divisions 16, 19 and 20. In addition to tests specified in Division specifications, all additional tests in these requirements shall be included.	CDRL 19-10
19.1.5-5	The SI shall submit and perform power test plans and procedures to the MTA for review and approval. Tests shall include ground/bond tests, power condition tests, voltage drop/level tests and UPS	CDRL 19-10

Req. #	Requirement	Assigned CDRL(s)
	charge/discharge tests.	
19.1.5-6	<p>The SI shall submit network test plans and procedures to the MTA for review and approval, for test stages First Article Inspection (FAI), Factory Acceptance Test (FAT), Site Acceptance Testing (SAT) and System Integration Test (SIT) as required in Divisions 19 and 20. The SI shall perform all network testing for FCALAN and submit results to the MTA. Test plans and procedures shall be based on the specific test requirements as included in Divisions 19 and 20, including the following tests at each test stage:</p> <ul style="list-style-type: none"> • FAI, FAT, SAT stage and SIT stage Individual FCALAN testing to ensure proper FCALAN installation and configuration • SIT stage: FCALAN testing to ensure end-to-end network management system integration to ensure proper configuration and integration to the MTA's network management system • FAT, SAT and SIT stage: NFPS Equipment communications testing within fare control area to ensure proper configuration and interfacing among fare control area and Station NFPS Equipment • FAT, SAT and SIT stage: NFPS communications testing to NFPS Backend management systems, operations systems and Third Party/banking systems to ensure proper configuration and interfacing among NFPS Equipment and NFPS Backend. This test shall include tests to verify proper encryption and tokenization mechanisms. 	CDRL 19-10

19.1.6 Station Requirements and Constraints

Req. #	Requirement	Assigned CDRL(s)
19.1.6-1	There is limited space in each fare control area for installation of equipment. The SI shall design FCALAN to ensure optimal use of available space, as directed and approved by the MTA. The FCALAN shall be designed specific for each fare control area to fit required components needed to support the NFPS at each fare control area.	CDRL 19-1
19.1.6-2	<p>SI shall adhere to the following requirements during the survey and design stage:</p> <ul style="list-style-type: none"> • SI shall follow NYCT's Stations Department, Stations Clearinghouse, MOW Engineering, Electronic Maintenance Division (EMD) and CPM Engineering direction on conduit routing and equipment mounting restrictions at each fare control area in each station, including any restrictions for cable routing above dropped ceilings 	CDRL 19-1

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> • FCALAN shall not obstruct any artwork in fare control area • FCALAN shall not obstruct passenger flow, specifically it shall not obstruct walkways, stairwells and corridors such that it prevents smooth passenger flow during peak rush hours • FCALAN equipment placement shall minimize the need for flagging during design, construction, and maintenance • FCALAN active equipment (such as AGS) shall not be mounted in hard to reach areas for operational purposes. For example, FCALAN Cabinet shall not be installed on ceilings or close to platform edges but shall be installed in locations to allow maintenance staff to access active equipment without using extension devices such as ladders or stools <ul style="list-style-type: none"> ○ FCALAN active equipment may be installed in non-communications/telephone rooms within or near a fare control area only with specific approval from NYCT's MOW Engineering, EMD Network Operations and Stations Department, if required. • The SI shall pay special attention to stations designated as historic landmark stations. For such stations, additional approval process from CPM's Historic Preservationist is required. This approval process will introduce additional approval time, and thus the SI shall prioritize to start survey and design work on such station ahead of other stations. The MTA will provide a list of Landmark Stations <ul style="list-style-type: none"> ○ Design constraints for such stations may include requirements to minimize and/or hide all conduits, boxes, fittings, cabinets from plain view. Directions for specific stations shall be provided by NYCT's Stations Department, Stations Clearinghouse, and CPM's Historic Preservationist • The SI shall pay special attention to stations that have recently completed major rehabilitation <ul style="list-style-type: none"> ○ Design constraints for such stations may include requirements to minimize and/or hide all conduits, boxes, fittings, cabinets from plain view. Directions for specific stations shall be provided by Stations Department, Stations Clearinghouse, and CPM's Historic Preservationist ○ For some stations hiding conduits may require routing and installing conduits underneath the mezzanine of an elevated station, i.e., underneath a CA 	
19.1.6-3	<p>The SI shall design connection between FCALAN and NFPS Equipment using new conduits, pullbox and penetrations. Existing conduit, pullbox and penetration shall not be assumed to be useable</p> <ul style="list-style-type: none"> • FCALAN connection to NFPS Equipment may utilize existing 	CDRL 19-5

Req. #	Requirement	Assigned CDRL(s)
	conduit and pullbox infrastructure with specific approval from the MTA for each instance. The SI shall identify and Documentation reflecting instances of re-use, document and submit design calculations and drawings showing how existing infrastructure will be used (that meets all applicable code requirements), include impacts to existing services, methods to minimize disruption and demonstration (in controlled environment) of the methods and procedures to enable re-use.	
19.1.6-4	The SI shall submit FCALAN installation plans and procedures to the MTA for review and approval at least 120 calendar days before installation is scheduled to begin. In addition, the SI shall adhere to the procedures as required, (included in Division 1 and the Contract Documents) during the installation stage.	CDRL 19-5

19.2 MNR and LIRR Network Infrastructure

The SI shall use existing MNR and LIRR network connectivity to support those portions of the NFPS applicable to MNR and LIRR that are dependent on such network connectivity. If existing connectivity is determined to be insufficient, then MNR and LIRR will work with the SI during design review to determine an appropriate course of action. The SI-provided CVMs shall include all hardware necessary to support all types of existing connectivity.

Currently, MTA-IT, MNR, and LIRR provide communications to a total of 236 stations (112 at MNR and 124 at LIRR). Please see Appendix R (MNR – LIRR Station Data) for details about the stations. MNR and LIRR provide a TCPIP/Ethernet-based communications network to the TVMs at all stations. The ticket selling network is segregated from the corporate network to meet PCI requirements using a combination of Virtual Router and Forwarding (VRF) and dedicated network equipment.

LIRR provides connectivity to all stations by its internal Fiber Optic Network (FON). LIRR stations have two (2) GB circuits for redundancy.

MNR provides 56kilobits in-house circuits to all stations, with the exception of Grand Central Terminal (GCT) which has fast Ethernet. There is one dedicated 56K circuit per station and all TVMs and TOMs in a station share the same 56K circuit.

Depending on the distance, each TVM or TOM connects through copper or fiber Ethernet to a network interface cabinet or to a communications room at each station. The interface cabinets are custom designed with aluminum covering, weather sealed, and temperature controlled. Each cabinet contains a local network switch, router, and Uninterruptable Power Supply. In addition, two (2) twenty amp dual outlet receptacles are located in each cabinet to provide power for the HVAC and network equipment.

19.3 Network Infrastructure Required Submittals

The required submittals specified in this Technical Specifications Section 19 (Network Infrastructure) are summarized below. They are described in detail in the referenced Technical Specifications Section. All required submittals must satisfy the Divisions' requirements.

Submittal No.	Description	Reference	Due Date
CDRL 19-1	FCALAN Design	Sections 19.1.3, 19.1.4, 19.1.6	60 days prior to FCALAN design review.
CDRL 19-2	FCALAN Testing Results	Section 19.1.5	Within 10 business days of completion of each successful test. All test results (pass or fail) shall be submitted.
CDRL 19-3	FCALAN Survey, Deployment, Installation and Interface Plan and Schedule	Sections 19.1.3, 19.1.4	60 days after NTP.
CDRL 19-4	Interface Control Document	Section 19.1.4	At least 120 calendar days before installation is scheduled to begin.
CDRL 19-5	FCALAN Installation Plans and Procedures	Section 19.1.6	At least 120 calendar days before installation is scheduled to begin.
CDRL 19-6	FCALAN Shop drawings	Sections 19.1.3, 19.1.4	No later than 90 days prior to installation.
CDRL 19-7	FCALAN As-built drawings and O&M Manuals	Section 19.1.4	Follow Division 19C requirements.
CDRL 19-8	Specifications	Section 19.1.4	See Divisions.
CDRL 19-9	Other Deliverables from Divisions 16, 19, and 20	Section 19.1.3	See Divisions.
CDRL 19-10	FCALAN Test Plans and Procedures	Section 19.1.5	120 calendar days before testing is scheduled to begin.

CHAPTER 3: NFPS BACKEND AND NFPS BACK OFFICE

20 NFPS Backend

The NFPS Backend is the centralized processor for the core fare collection system for the NFPS Agencies. It is comprised of the Account-based Transaction Processor that will create, maintain, configure Transit Accounts and process all transactions. The NFPS Backend also includes key Software configuration, and fare management tools, along with the operational production databases containing usage and sale Data, on an NFPS Agency-specific basis. There are several additional fare collection applications that supplement and support the NFPS Backend that are collectively referred to as the NFPS Back Office. Those NFPS Back Office applications and their requirements are specified in Technical Specifications Section 21 (NFPS Back Office). The NFPS Backend and NFPS Back Offices are closely tied, and work together to support these general functions:

- Account and Cash Management processing
- Risk and Fraud Management processing
- Payment Processing
- Settlement processing
- Post Settlement processing
- Reconciliation processing
- Data retention processing
- Report and data analytics processing

20.1 NFPS Backend General Requirements

Since the NFPS Backend is the primary fare engine for the fare collection system, there are basic requirements that govern its overall design to ensure performance, consistency, compatibility and cost effectiveness. The following general requirements will be applied to the NFPS Backend.

Req. #	Requirement	Assigned CDRL(s)
20.1-1	The SI shall develop and submit for the MTA's approval NFPS Backend Hardware Design Documentation that provides a detailed description of all of the Hardware components that will comprise the NFPS Backend and the purpose, functions, interdependencies, power, A/C cooling configurations and communication requirements for each component.	CDRL 20-1
20.1-2	The SI shall develop and submit for the MTA's approval NFPS Backend Software architecture Design Documentation that provides both graphical and narrative descriptions of each Software component of the NFPS Backend. The NFPS Backend Software Architecture Design Documentation will include at a minimum the following: <ul style="list-style-type: none">• Each Software component including functional description, purpose, OEM, and Version• Interfaces and communication flows between components• Installation, configuration and upgrade Documentation	CDRL 20-1

Req. #	Requirement	Assigned CDRL(s)
20.1-3	User interface access to all elements of the NFPS Backend will be controlled through the I-Vault System, the MTA's centrally-managed user authentication and access control platform. The SI shall be responsible for integration with this I-Vault System to support single sign-on. Individual users or user groups may also have access controlled by MTA/IT (or equivalent responsible party) within specific systems where appropriate to allow for standard business operations. All NFPS access control and user authentication will comply with MTA/IT Security Standards and be subject to the MTA's review and approval.	CDRL 20-1
20.1-4	Where applicable, NFPS Interfaces (including Open Architecture APIs) shall be provided that enable the NFPS Backend to interface with MTA Group assets that provide similar or related functionality.	CDRL 20-1
20.1-5	The NFPS Backend will adhere to the general design requirements in Technical Specifications Section 5 (General Design Requirements), especially those pertaining to: <ul style="list-style-type: none"> • Aesthetic Requirements and User Interfaces • System Security • Open Technology • Software Requirements • Performance Requirements • Codes, Regulations & Reference Standards 	CDRL 20-1
20.1-6	Software Updates to NFPS Backend Software, databases, and associated modules will be centrally managed. Software Versions will be accessible by authorized system administrators and version control will be put in place. This will include the ability to remotely update EMV processing configuration parameters from the NFPS Backend on an NFPS Agency-specific basis.	CDRL 20-1
20.1-7	All NFPS Backend will use a network time sync protocol to sync NFPS time to NIST time.	CDRL 20-1
20.1-8	All NFPS Backend Software will comply with the articulated MTA preference for COTS components, upgrade testing, and other general Software requirements detailed in Technical Specifications Section 5.12 (NFPS Software Requirements) and elsewhere in the Contract Documents.	CDRL 20-1
20.1-9	All NFPS Backend Software shall comply with the MTA's data retention policies and procedures.	CDRL 20-1

20.2 Account-Based Transaction Processor

The primary component of the NFPS Backend will be the ATP. The ATP will create and maintain all Transit Accounts, and perform fare calculation and validation for both Open - and Closed-Loop Payments. The ATP is a key component in an Account-Based architecture, since most transactions will be validated in real-time or near real-time. There will also be design considerations for offline

processing within the NFPS, or when NFPS components are temporarily unable to communicate with the ATP. Accurate and secure transaction processing and optimum customer throughput will be critical for the ATP. The ATP will also conform to the transit account management APIs specified in Technical Specifications Section 6.4.4 (Transit Account Management API).

Req. #	Requirement	Assigned CDRL(s)
20.2-1	<p>The Account-Based Transaction Processor will enable the fare processing capabilities in Technical Specifications Section 10 (Fare Accounts and Processing) and fare policies in Technical Specifications Section 7 (Fare Policies), including:</p> <ul style="list-style-type: none"> • Issuance of Closed-Loop Media and creation of new Transit Accounts • Loading of value and Fare Products to Closed-Loop Transit Accounts • Immediate availability of Transit Account balance and status • Maintenance of Closed-Loop Transit Account balances and transaction history • Inquiry of Closed-Loop Transit Account balances and transaction history (for all Media types) • Real-time or near real-time fare calculation for both Open- and Closed-Loop fare payments • Fare capping • Determination of which transactions require bank authorization • Fare payment validation for both Open- And Closed-Loop fare payments • Accurate accounting for negative balances upon purchase of new stored value or Fare Products • Support Autoload setup • Management of Card-Based Fare Products • Linking of Open-Loop Media with a Closed-Loop account • Processing of all fare categories, pricing, stored value, Fare Products, transfers, fare capping, and other structures in Technical Specifications Section 7.3 (Fare Structure and Pricing) • Fare processing for all Special Programs in Technical Specifications Section 7.4 (Special Fare Programs) • Accurate identification of all Media in Technical Specifications Section 8 (Media Types) • Support for NFPS Accounts in Technical Specifications Section 10 (Fare Accounts and Processing) • Accounting of unused value for which the NFPS Agencies have already been paid (i.e., Media liability) and developing methodology for calculating expired card value <p>The finalized functions for the ATP will be determined during design reviews.</p>	CDRL 20-2

Req. #	Requirement	Assigned CDRL(s)
20.2-2	The supporting NFPS Back Office, validation and distribution devices will access the functions described in this Technical Specifications Section 20 (NFPS Backend) using the NFPS Interfaces (including those APIs described in Technical Specifications Section 6.4 (Application Programming Interfaces)), and otherwise through a direct, real-time connection with the ATP.	CDRL 20-2
20.2-3	The ATP will support the processing of all payment methods set out in the Contract Documents, in real-time or near real-time, including both Closed-Loop and open fare payments. As customers use fare value or use PAYGO Open Payments, the Transit Accounts will reflect the updated balance. If communications are not available, Transit Accounts will be updated as soon as communications are re-established (see req. # 20.2-12).	CDRL 20-2
20.2-4	For Closed-Loop fare payments, the ATP will maintain a Transit Account storing all Closed-Loop value and Fare Products loaded by the customer, and deduct value in real-time from the Transit Account as it is used for payment.	CDRL 20-2
20.2-5	When accepting Open Payments, the ATP will create a Transit Account that allows for the tracking of payments, payment aggregation, and the conferring of discounts as permitted by each of the NFPS Agencies' and each of the Linked NFPS Entities' fare policies. See Technical Specifications Section 6.3 (Open Payment Architecture) for additional information.	CDRL 20-2
20.2-6	NFPS Backend fare processing will occur in real-time or near real-time for all Account-Based payment types. Performance requirements are specified in these Contract Documents, including Technical Specifications Section 5.14 (Performance Requirements) and Technical Specifications Section 6.3 (Open Payment Architecture).	CDRL 20-2
20.2-7	Prior to providing an authorization or a decline-response to the Field Device, the ATP shall: (i) query an existing Transit Account or create a new Transit Account; (ii) perform fare pricing; and (iii) submit the payment for authorization or update the Transit Account balance in real-time or near real-time to support applicable performance and risk mitigation requirements.	CDRL 20-2
20.2-8	For Closed-Loop payments (and Open-Loop payments when applicable), the authorization transaction generated by the ATP will include at minimum the account number, transaction date, transaction time, fare category, Fare Product, device ID, location and, where applicable, remaining balance (See Technical Specifications Section 10.1 (Transit and Customer Accounts)). Other relevant Transaction Data may be included based on the NFPS Agencies' needs during design review, as such needs are	CDRL 20-2

Req. #	Requirement	Assigned CDRL(s)
	indicated on an NFPS Agency-specific basis by the MTA.	
20.2-9	The ATP will support the immediate loading of Closed-Loop fare value through all fare distribution channels.	CDRL 20-2
20.2-10	The loading of fare value will require a connection to the ATP at all times. No loading of value to a Transit Account will be permitted without an active connection to the ATP. Notwithstanding the foregoing, each NFPS Agency, on an NFPS Agency-specific basis, shall have the right to grant exceptions to this prohibition for Limited-Use Media or other limited Card-Based Fare Products.	CDRL 20-2
20.2-11	Payments will be authorized prior to the loading of any value to a Transit Account or Card-Based Media. Following payment authorization, the NFPS will update the Transit Account or Card-Based Media (as applicable) to allow for immediate use of the value by the customer.	CDRL 20-2
20.2-12	Subject to req. # 20.2-10, when communication between applicable Field Devices and the ATP is not available, Transit Account balance and status shall be updated as soon as communications are re-established. See Technical Specifications Section 6.1.3 (Online Communications).	CDRL 20-2
20.2-13	Any offline authorizations will be recorded as part of ATP Transaction Data (including the fields in req. #20.2-8), so that offline transactions can be easily identified and tracked. See Technical Specifications Section 6.1.3 (Online Communications).	CDRL 20-2
20.2-14	The ATP will support Negative Lists, Positive Lists (see Technical Specifications Section 10.2 (Account Lists)) and other Risk Mitigation techniques for the purposes of fraud mitigation, accurate Transit Account information, and risk management as necessary. See requirements in Technical Specifications Section 6.1.4 (Risk Mitigation Techniques).	CDRL 20-2

20.3 Fare Configuration Management

The ATP will have built-in configuration management features that provide fare configuration control and management tools. The tools will support all the NFPS Account requirements in Technical Specifications Section 10 (Fare Accounts and Processing).

Req. #	Requirement	Assigned CDRL(s)
20.3-1	The configuration of fare tables, (or equivalent fare configuration files) for every Frontend NFPS Equipment type will be accessible from the NFPS Backend. Fare table data changes will be available immediately for publication and release by system administrators. Fare tables will propagate to all applicable Frontend NFPS Equipment in communication with the NFPS Backend. Fare table changes will support the fare pricing options in the Contract Documents, including in Technical	CDRL 20-3

Req. #	Requirement	Assigned CDRL(s)
	Specifications Section 7.3.2 (Fare Pricing), and as otherwise specified by the NFPS Agencies (on an NFPS Agency-specific basis). Contents and release procedures for fare tables will be finalized during design reviews.	
20.3-2	Frontend NFPS Devices that are not in communication with the NFPS Backend at the time of fare table updates will receive fare table updates as soon as communication is re-established. Download verification will be included.	CDRL 20-3
20.3-3	Positive and Negative Lists (see Technical Specifications Section 10.2 (Account Lists)) will be centrally managed in the NFPS Backend. The account list version, broadcast frequency, size and proliferation status will be accessible by each NFPS Agency on an NFPS Agency-specific basis. Download verification will be included.	CDRL 20-3
20.3-4	Maintenance of Transit Accounts (see Technical Specifications Section 20 (NFPS Backend)) and standard distribution channels (see Technical Specifications Section 9.1 (Distribution Channels)) shall be directly manageable from the NFPS Backend. Maintenance actions will be limited in nature, and will not include direct manipulation of Transit Account information. These actions may include Transit Account expiration, suspension and dormancy rules. Details will be determined by the MTA during design review.	CDRL 20-3
20.3-5	Data related to Risk Mitigation techniques (see Technical Specifications Section 6.1.4 (Risk Mitigation Techniques)) shall be viewable from the NFPS Backend. Any Card-Based Risk Mitigation Data or account list mirroring will be viewable (read-only) from the NFPS Backend for data analysis and troubleshooting purposes.	CDRL 20-3

20.4 NFPS Backend Monitoring System

Req. #	Requirement	Assigned CDRL(s)
20.4-1	The SI shall deliver a real-time performance and status monitoring system (the NFPS Backend Monitoring System, as further defined in this Technical Specifications Section 20 (NFPS Backend)) for the NFPS Backend.	CDRL 20-4
20.4-2	The NFPS Backend Monitoring System will monitor and show real-time status on all NFPS Backend applications, databases, subsystems, processes and general availability. Details of which processes will be monitored will be provided as part of the Software Architecture Design Documentation (see Technical Specifications Section 20.1 (NFPS Backend General Requirements)).	CDRL 20-4

Req. #	Requirement	Assigned CDRL(s)
20.4-3	Processor load, memory utilization, rogue processes, memory leaks and other performance indicators will be available in real-time to help prevent performance degradation, load balance, scale to meet increased demand and troubleshoot NFPS Backend issues and Errors.	CDRL 20-4
20.4-4	The NFPS Backend Monitoring System shall be available in a graphical dashboard format, accessible remotely by web browser or desktop/mobile application if required by the MTA.	CDRL 20-4
20.4-5	Status types reported by the NFPS Backend Monitoring System shall include performance indicators, outage alerts and other relevant monitoring metrics. Status and alert types shall be programmed to allow custom functions, which will be determined during design review.	CDRL 20-4
20.4-6	The NFPS Backend Monitoring System will automatically generate alerts via emails, text messages or other output files defined by the MTA. The initiation, frequency and cancellation of these alerts shall be configurable and will allow custom functions, which will be determined during design review.	CDRL 20-4
20.4-7	The NFPS Backend Monitoring System will support existing monitoring tools and processes, and not adversely impact the monitoring capabilities that are currently utilized by the MTA Group and the Linked NFPS Entities.	CDRL 20-4

20.5 NFPS Backend Required Submittals

The required submittals specified in this Technical Specifications Section 20 (NFPS Backend) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 20-1	NFPS Backend Requirements	Section 20.1	✓	✓	✓	
CDRL 20-2	Account Based Transaction Processor	Section 20.2	✓	✓	✓	
CDRL 20-3	Fare Configuration Management System	Section 20.3	✓	✓	✓	
CDRL 20-4	NFPS Backend Monitoring System	Section 20.4	✓	✓	✓	

21 NFPS Back Office

The NFPS Back Office is comprised of central system applications that support the operations and maintenance of both NFPS Backend NFPS Accounts and Frontend NFPS Equipment. These NFPS Back Office applications include tools for customer service and maintaining the NFPS. Some NFPS Back Office applications will interface or exchange Data with existing NFPS Agency assets. The NFPS Backend and NFPS Back Offices are closely tied, and work together to support these general functions:

- Account and Cash Management processing
- Risk and Fraud Management processing
- Settlement processing
- Post Settlement processing
- Reconciliation processing
- Data retention processing
- Report and data analytics processing

21.1 NFPS Back Office General Requirements

The NFPS Back Office requires the flexibility to integrate with existing systems and adapt to new ones. The legacy NFPS Back Office applications and systems may continue to operate over the life of the NFPS, or be replaced by newer applications. In both cases, Open Architecture design of the NFPS Back Office will be required. The following general requirements will be applied to all NFPS Back Office applications.

Req. #	Requirement	Assigned CDRL(s)
21.1-1	The SI shall develop and submit for the MTA's approval NFPS Back Office Hardware Design Documentation that provides a detailed description of all of the hardware components that will comprise the NFPS Back Office and the purpose, functions, interdependencies, power, A/C cooling configurations, and communication requirements for each component.	CDRL 21-1
21.1-2	The SI shall develop and submit for the MTA's approval an NFPS Back Office Software Architecture Design Documentation that provides both graphical and narrative descriptions of each Software component of the NFPS Back Office. The NFPS Back Office Software Architecture Design Documentation will include at a minimum the following: <ul style="list-style-type: none">• Each Software component including functional description, purpose, OEM and Version• NFPS Interfaces and communication flows between components• Installation, configuration and upgrade Documentation	CDRL 21-1

Req. #	Requirement	Assigned CDRL(s)
21.1-3	User interface access to all elements of the NFPS Back Office will be controlled through the I-Vault System, the MTA's centrally-managed user authentication and access control platform. The SI shall be responsible for integration with this I-Vault System to support single sign-on. Individual users or user groups may also have access to specific systems, with such access determined and controlled by MTA/IT throughout the Term. All NFPS access control and user authentication will comply with MTA/IT Security Standards and be subject to the MTA's review and approval.	CDRL 21-1
21.1-4	Where applicable, NFPS Interfaces (including Open Architecture APIs) shall be provided to enable the NFPS Back Office to interface with NFPS Agency assets that provide similar or related functionality.	CDRL 21-1
21.1-5	The NFPS Back Office will adhere to the general design requirements in Technical Specifications Section 5 (General Design Requirements), especially those pertaining to: <ul style="list-style-type: none"> • Aesthetic Requirements and User Interfaces • System Security • Open Technology • Software Requirements • Performance Requirements • Codes, Regulations & Reference Standards 	CDRL 21-1
21.1-6	Software Updates to NFPS Back Office Software, databases, and associated modules will be centrally managed. Software Versions will be accessible by authorized system administrators and version control will be put in place.	CDRL 21-1
21.1-7	All NFPS Back Offices will use a network time sync protocol to sync system time to NIST time.	CDRL 21-1
21.1-8	All NFPS Back Office Software will comply with the articulated MTA preference for COTS components, upgrade testing, and other general Software requirements listed in Technical Specifications Section 5.12 (NFPS Software Requirements) and elsewhere in the Contract Documents.	CDRL 21-1

21.2 Device Monitoring System

The NFPS Back Office shall include a Device Monitoring System (DMS) that will provide real-time monitoring of all NFPS Hardware down to the component level, as well as remote control of certain devices through the issuance of appropriate commands. For purposes of the DMS, components are defined as Line-Replaceable Units, such as bill modules, removable memory modules and other components that can be replaced for maintenance purposes. The DMS will interface with the MMS in an MTA-defined format, using an MTA-developed API. The SI shall support such MTA-developed API, and the SI shall also provide the device management API referenced in Technical Specifications Section 6.4.6 (Device Management APIs).

Req. #	Requirement	Assigned CDRL(s)
21.2.1-1	<p>The Device Monitoring System (DMS) will support real-time operational and performance status of Frontend NFPS Equipment devices and their components (which are LRUs as defined above), including new as well as Legacy Equipment. Devices to be monitored include but are not limited to:</p> <ul style="list-style-type: none"> • Bus Validators • Wayside Validators • Subway Validators • Configurable Vending Machines • Ticket Office Machines • Customer Service POS Terminals • Faregates (turnstiles, HEETs, and AutoGate devices) <p>Other devices monitored by the DMS may be defined during design reviews.</p>	CDRL 21-2
21.2.1-2	The DMS will provide sufficient Data to support a graphical interface that presents device status and alarms in a clear, organized format, using color graphics and text.	CDRL 21-2
21.2.1-3	The DMS will display several device attributes, including: device type, location, status, alerts and device ID. These attributes shall have the capability to be defined and modified by authorized NFPS Agency administrators.	CDRL 21-2
21.2.1-4	Status types reported by the DMS shall include performance status (operational, degraded, out of service, no communications, actual bill, coin, ticket stock counts, etc., where applicable) and revenue alerts (fully stocked, low stock, out of stock, etc. where applicable). Status types and resettable numerical alert parameters will be determined during design review.	CDRL 21-2
21.2.1-5	The DMS shall utilize a communications protocol designed to provide persistent status over an unreliable communications network using minimal bandwidth. Network management protocols shall comply with industry standards such as SNMP3, or modern functional equivalents. Devices that are not reporting status for any reason shall be easily identifiable, and the last known status and device history shall be available via the DMS.	CDRL 21-2
21.2.1-6	The DMS will output relevant Data to the MMS based on device events in an MTA-defined format. The generation of Data will be in real-time, and will not adversely impact the operation or functionality of Spear or any future Computerized Maintenance Management System.	CDRL 21-2

Req. #	Requirement	Assigned CDRL(s)
21.2.1-7	The DMS will automatically generate alerts via emails, text messages and/or other output files defined by the MTA. The initiation, frequency and cancellation of these alerts shall be configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 21-2
21.2.1-8	The DMS graphical view will display a system map that can be drilled-down by location or system component. The NFPS map will be dynamically updated when devices are added/removed, and configurable to allow editing of locations and location names as system expansion occurs.	CDRL 21-2
21.2.1-9	The DMS will support remote equipment configuration and viewing of system status, including drill-down capability to the LLRC and LLRU. The remote monitoring can occur in text and graphical format, and will support web access in both desktop and mobile forms.	CDRL 21-2
21.2.1-10	The DMS will support the real-time issuance of device commands to the LLRC and LLRU using the SI-provided device management APIs (see Technical Specifications Section 6.4.6 (Device Management APIs)).	CDRL 21-2
21.2.1-11	The DMS will issue commands to relevant devices for operational purposes. Command sets will vary by device, but will include configuration, maintenance, revenue and customer service functions. Commands will be defined during design review.	CDRL 21-2
21.2.1-12	DMS commands will utilize an appropriate command protocol based on industry standards (such as SNMP3, or a modern functional equivalent). The protocol chosen will be supported by all devices and systems within the NFPS, and take into account the expected network traffic and inconsistent wireless communications associated with an Account-Based fare collection system.	CDRL 21-2
21.2.1-13	The DMS will support any existing monitoring tools and processes as applicable, and not adversely impact the monitoring capabilities that are currently utilized by any NFPS Agency or Linked NFPS Entity.	CDRL 21-2
21.2.1-14	The DMS will provide clock synchronization services to all Field Devices. The DMS will synchronize its clock to NIST time.	CDRL 21-2

21.3 Inventory Management System

The NFPS Back Office shall include an Inventory Management System (IMS) that will maintain a full inventory of all NFPS Media issued by each NFPS Agency and each Linked NFPS Entity. The IMS may interface with an existing inventory system as required, or leverage other NFPS Agency tools that provide similar functionality.

The SI shall also provide a complete inventory of all NFPS Hardware and spare parts or modules (see Technical Specifications Section 29.5 (As-Installed Inventory)), which will be maintained within the MMS.

Req. #	Requirement	Assigned CDRL(s)
21.3-1	The SI shall provide all full inventory of all NFPS Hardware, including provided devices and equipment (see Technical Specifications Section 29.5 (As-Installed Inventory)). This installed inventory will be maintained within the MMS.	CDRL 21-3
21.3-2	The IMS will maintain an inventory of all NFPS Agency-Issued Media, regional partners or Third Party distributors, and issued to customers. The media inventory data will include information such as: media type, expiration date, batch ID, ship date and account status. Final fields for inventory management purposes will be determined during design review.	CDRL 21-3
21.3-3	The IMS shall track the current and historical status of all Card-Based Smart Cards in inventory. Whenever a transaction causes a card to change status, upon receipt of the transaction record, the IMS shall update all records of the card's status accordingly. All updates will maintain history of changes including audit trails.	CDRL 21-3
21.3-4	Per general NFPS Back Office requirements (see Technical Specifications Section 21.1 (NFPS Back Office General Requirements)), the SI shall provide NFPS Interfaces that enable the IMS to interface with existing NFPS Agency assets that provide similar inventory or maintenance management systems.	CDRL 21-3

21.4 Customer Relationship Management

The NFPS Back Office shall include a Customer Relationship Management System that provides web-based access to transit and Customer Account information, and the ability to track all customer service incidents from creation through resolution.

Req. #	Requirement	Assigned CDRL(s)
21.4-1	The SI shall deploy a COTS Software CRM System that allows for the central management of all Customer Data, customer service operations, order management and fulfillment, and the cradle-to-grave tracking of NFPS customer service incidents.	CDRL 21-4
21.4-2	The CRM System will be supported by an isolated customer database that, in addition to complying with the requirements set out in the Contract Documents, will be fully compliant with the latest PCI requirements, and compliant with agency, local and state policies for the handling of customer PII.	CDRL 21-4
21.4-3	The customer database will store all Customer Data for registered Transit Accounts and accounts set up for the automatic reloading of value (i.e., Autoload). In addition to the other information security requirements set out in the Contract Documents, Customer Data will be stored in a secure manner and payment information will be stored in an encrypted and Tokenized form, respectively.	CDRL 21-4

Req. #	Requirement	Assigned CDRL(s)
21.4-4	The customer database will serve as the repository for Data on all customers applying for a reduced fare classification and paratransit access, including applications and supporting documentation, eligibility parameters, and card personalization information, such as a customer photograph captured via the Customer Service POS Terminal (see Technical Specifications Section 17.1 (Customer Service Point of Sale Terminals)) or the Ticket Office Machine (see Technical Specifications Section 17.2 (Ticket Office Machines)).	CDRL 21-4
21.4-5	The customer database will serve as the repository for Data on all employees and contractors (including interns) who are issued transit access cards, including card personalization information, such as a photograph. Employee and contractor Data will be entered manually or electronically from forms provided by each NFPS Agency's HR department. Access to the customer database and related Data shall be configurable by the MTA so as to permit such access to only certain designated users.	CDRL 21-4
21.4-6	The core function of the CRM System will be to support customer service operations by providing a customer service tool that allows the creation, viewing and modification of customer service incidents stored within the CRM System, based on customer inquiries received and the actions taken to resolve those inquiries. The CRM System will support the classification of customer service incident type and severity using pre-defined selections, and incident descriptions in custom text fields.	CDRL 21-4
21.4-7	Customer service staff will be able to manually create incidents when responding to customer service inquiries over the web or phone.	CDRL 21-4
21.4-8	Customer service incidents will be created automatically based on customer-initiated actions performed through the NFPS Websites, NFPS Mobile Applications or IVR.	CDRL 21-4
21.4-9	Customer service incidents will be linked to a specific Customer Account when the customer generating the inquiry is registered.	CDRL 21-4
21.4-10	The CRM System will support Customer Call Center, Customer Service Centers, and in-person customer service operations by providing a complete view of Customer Accounts and related Transit Account activity, including activity associated with anonymous Transit Accounts.	CDRL 21-4
21.4-11	The CRM System will connect to the customer database using the SI-provided APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)), and shall otherwise provide a fully integrated interface for customer service staff to create, view and modify Customer Accounts within the NFPS.	CDRL 21-4

Req. #	Requirement	Assigned CDRL(s)
21.4-12	<p>The CRM System will allow customer service staff to perform Customer Account actions, including:</p> <ul style="list-style-type: none"> • Creation of a new Customer Account (i.e., registration of a Transit Account) • Association of an anonymous Transit Account to an existing Customer Account • Modification of Customer Account Registration Data • Addition and modification of payment data associated with a Customer Account 	CDRL 21-4
21.4-13	<p>The CRM System will connect to the ATP through using the SI-provided APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)), and shall otherwise provide a fully integrated interface for customer service staff to view and update Transit Accounts within the NFPS.</p>	CDRL 21-4
21.4-14	<p>The CRM System will enable customer service staff to perform Transit Account actions, including:</p> <ul style="list-style-type: none"> • Creation of a new Transit Account (i.e., issuance of Media) • Sale and loading of fare value • Signing up for Mail&Ride or modification of a Mail&Ride product or service • Viewing of transaction history and fare calculation for Open- and Closed-Loop payments • Modification of Transit Account balances through generation of Transit Account adjustments or refunds • Setup, modification and cancellation of Autoload services • Replacement of lost/stolen Closed-Loop Media and linking of the new Media to an existing Closed-Loop account • Linking of new Open Payment Media to an existing Closed-Loop account 	CDRL 21-4
21.4-15	<p>All actions resulting in a change to a Customer Account or Transit Account will be recorded in the CRM System.</p>	CDRL 21-4
21.4-16	<p>The CRM System will support the association of multiple Transit Accounts with a single Customer Account for account management and the loading of value and Fare Products.</p>	CDRL 21-4
21.4-17	<p>The CRM System will support the management of institutional programs, which will allow customers and the associated Transit Accounts to be linked to an institution (such as an employer, or school) for account management and the loading of value.</p>	CDRL 21-4
21.4-18	<p>The CRM System will provide central order management for the distribution of Media and value through all distribution channels, including institutional programs.</p>	CDRL 21-4
21.4-19	<p>The CRM System will interface with the IMS (see Technical Specifications Section 21.3 (Inventory Management System)) to maintain proper media inventory controls.</p>	CDRL 21-4

Req. #	Requirement	Assigned CDRL(s)
21.4-20	The SI shall support integration of the CRM System with a central user management system, if implemented by MTA/IT in the future, or the MTA's existing Oracle CRM System, to support single sign-on for customers accessing other NFPS Agency services.	CDRL 21-4
21.4-21	Access to the CRM System will be password-controlled with the displayed information and allowed functions restricted based on centrally defined user-access privileges. Access to all elements of the CRM System will be controlled through a centrally-managed user authentication and access control platform.	CDRL 21-4
21.4-22	The SI shall provide within the CRM System a restricted, web-based view and inquiry tool to be used by the Transit Adjudication Bureau to be maintained by the MTA and accessible through valid ID and password.	CDRL 21-4

21.5 Interactive Voice Response

To manage Customer Call Center staffing resources and support Customer Service Center operations, the NFPS Back Office shall include an Interactive Voice Response (IVR) system to provide customers with an automated interface to obtain up-to-date NFPS Account information and access account management features through the phone.

Req. #	Requirement	Assigned CDRL(s)
21.5-1	The SI shall provide a PCI compliant IVR that integrates with the Customer Call Center phone system. The Customer Call Center may be hosted and operated by the MTA or a Third Party (and, if the SI is required to provide Customer Call Center Services to MNR and LIRR, then such Customer Call Centers shall each be hosted and operated by MNR and LIRR (or Third Parties), respectively).	CDRL 21-5
21.5-2	The IVR will support touch tone entry and voice recognition to access all IVR functions.	CDRL 21-5
21.5-3	The IVR will not have a limit to the number of words recognized.	CDRL 21-5
21.5-4	The IVR design will support the use of teletype writing (TTY) and text-to-speech (TTS) devices for the hearing impaired.	CDRL 21-5
21.5-5	The IVR will support multiple languages and be compliant with all ADA and Title VI requirements.	CDRL 21-5
21.5-6	The IVR will support secure entry of credit and debit card information through the phone keypad consistent with all PCI-DSS requirements (see Technical Specifications Section 5.7 (System Security)).	CDRL 21-5

Req. #	Requirement	Assigned CDRL(s)
21.5-7	The IVR will provide answers to common customer questions to be defined during design review and configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 21-5
21.5-8	The IVR will support the transfer of customers to and from the NFPS Agencies' and the Linked NFPS Entities' phone systems used for general customer support.	CDRL 21-5
21.5-9	The IVR will provide an option to reach a live representative at any time.	CDRL 21-5
21.5-10	The IVR will provide customers with Account-Based Media an interface to obtain up-to-date transit and Customer Account information, and perform NFPS Account management functions.	CDRL 21-5
21.5-11	Customers who possess unregistered Account-Based Media will be able to access the IVR to determine Transit Account balances.	CDRL 21-2
21.5-12	Access to NFPS Account information (other than balance information as set out in req. # 21.5-12) and management functions via the IVR will require account registration and entry of a Personal Identification Number (PIN) that is selected at the time of registration.	CDRL 21-5
21.5-13	Following entry of the required security information, the IVR will present the customer with their Transit Account balance and an option to access their transaction history. The transaction history option will provide the details of the last five (5) transactions conducted by the customer.	CDRL 21-5
21.5-14	The IVR will allow a customer to enter Payment Data and initiate an immediate load of any Fare Product, or enable Autoload of any Fare Product, using the associated funding source.	CDRL 21-5
21.5-15	The IVR will allow a registered customer to report a card lost or stolen and close a Transit Account.	CDRL 21-5
21.5-16	When a customer is transferred to a customer service agent all relevant Data entered through the IVR (e.g., account number) will be auto-populated within the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)) used by the agent.	CDRL 21-5
21.5-17	The IVR will be fully configurable by each NFPS Agency (on an NFPS Agency-specific basis), including the IVR script, functions available to customers, and handoffs to and from external phone systems.	CDRL 21-5
21.5-18	The IVR will be subject to the MTA's review and approval at design review.	CDRL 21-5

21.6 Financial Clearing & Settlement System

The NFPS Back Office shall include a Financial Clearing and Settlement System (FCSS) that maintains a general ledger of all financial activity within the NFPS, tracks Accounts Receivable (AR), and supports the settlement and reconciliation of funds between all NFPS Agencies.

21.6.1 Financial System General Requirements

Req. #	Requirement	Assigned CDRL(s)
21.6.1-1	The FCSS will include COTS financial management Software to the greatest extent possible and, as necessary, NFPS Agency-configured Software modules.	CDRL 21-6
21.6.1-2	The FCSS will support the full auditing of all NFPS activity, including reconciliation of all NFPS Accounts and end-to-end tracking of NFPS revenue as it is generated and recognized by each NFPS Agency on an NFPS Agency-specific basis.	CDRL 21-6
21.6.1-3	User interface access to all elements of the FCSS will be controlled through a centrally-managed user authentication and access control platform. Individual users or user groups will have access configured by each NFPS Agency to allow for standard business operations.	CDRL 21-6

21.6.2 General Ledger

Req. #	Requirement	Assigned CDRL(s)
21.6.2-1	The FCCS will include a COTS general ledger Software and include accounts to track fare revenue, deferred revenue, AR, expenses, and other revenue offsets generated by the NFPS.	CDRL 21-6
21.6.2-2	As part of design review, the SI shall be responsible for mapping each transaction type generated by the NFPS to the appropriate general ledger entries to support automated categorization and summarization by the NFPS.	CDRL 21-6
21.6.2-3	Summary entries will be posted automatically to the general ledger no less than daily.	CDRL 21-6

21.6.3 Accounts Receivable

Req. #	Requirement	Assigned CDRL(s)
21.6.3-1	The FCSS will include a COTS AR Software module that supports the creation and management of accounts receivable within the general ledger.	CDRL 21-6
21.6.3-2	The AR module will support the establishment of accounts based upon billing source, event and time period, and transaction type, and the ability to record billing items (e.g., Fare Products) by line item in order to identify unique accounting classification codes.	CDRL 21-6

Req. #	Requirement	Assigned CDRL(s)
21.6.3-3	The AR module will track receivables for pre-bill and post-bill Media and value sales, such as those generated as part of institutional and transit benefit programs. The AR module will support the issuance of refunds for Media sales as needed.	CDRL 21-6
21.6.3-4	Receivables against individual customers will be supported in instances of funding source failures or negative Transit Account balances.	CDRL 21-6
21.6.3-5	The AR module will support the application of payments (full and partial), credit memos and adjustments against institutional and customer accounts. The process will support batch entry of receipts and lockbox functionality.	CDRL 21-6
21.6.3-6	The AR module will support the setting of configurable credit limits for institutional and individual customers.	CDRL 21-6
21.6.3-7	The AR module will support the automated generation of a credit hold and blocking of associated Media when the credit limit is reached.	CDRL 21-6
21.6.3-8	The AR module will support the automatic generation of interest charges on institutional and Customer Accounts that are past due, and generate dunning (collection) letters for overdue receivables when NFPS Accounts become delinquent.	CDRL 21-6
21.6.3-9	The AR module will support the aging of receivables and an automated, fully auditable, write-off process to be defined as part of design review.	CDRL 21-6
21.6.3-10	The AR module will support the automatic generation of monthly statements detailing institutional account activity, including consolidation of multiple accounts receivable on to a single customer statement.	CDRL 21-6
21.6.3-11	The AR module will provide standard AR reports, either directly or via the Data Warehouse, including: aged trial balance (with "as-of date" functionality), customer transaction, cash on account and customer listing reports.	CDRL 21-6
21.6.3-12	The AR module will provide the ability to perform online queries of NFPS Account activity (i.e., billing, collection, and adjustment) by customer and receivable.	CDRL 21-6
21.6.3-13	Printed statements will be made available in braille and large print upon request of individual or institutional customers.	CDRL 21-6

21.6.4 Funds Settlement

Req. #	Requirement	Assigned CDRL(s)
21.6.4-1	The settlement of revenue between the NFPS Agencies and Linked NFPS Entities will be based on fare reciprocity formulas to be defined during design review. The FCSS will perform the necessary revenue distribution calculations to enable the settlement of funds.	CDRL 21-6

Req. #	Requirement	Assigned CDRL(s)
21.6.4-2	The FCSS will be capable of initiating an automated transfer of funds between Linked NFPS Entity bank accounts.	CDRL 21-6

21.6.5 Interfaces and Reporting

Req. #	Requirement	Assigned CDRL(s)
21.6.5-1	The FCSS general ledger will serve as a sub-ledger to the Linked NFPS Entities' internal financial management systems.	CDRL 21-6
21.6.5-2	The FCSS will produce standard accounting reports, which accurately capture deferred and recognized revenue, in both summary and detail formats, for each Linked NFPS Entity.	CDRL 21-6
21.6.5-3	The FCSS reports will be used to make manual entries in the Linked NFPS Entities' internal general ledgers. No electronic interfaces between the FCSS and the Linked NFPS Entities' existing financial management systems will be required.	CDRL 21-6

21.7 Payment Application

The NFPS Back Office shall include a Payment Application that supports the secure processing of credit, debit, ACH and alternative (such as Apple Pay, Android Pay, Master Pass, and PayPal, as determined by the MTA) payment transactions generated within the NFPS. The Payment Application, to the greatest extent practicable, shall be COTS Software and include PCI certified hardware, firmware and Software.

21.7.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
21.7.1-1	The Payment Application will connect directly to the MTA's payment processors and card association networks for the secure processing of payments. Connections to multiple payment processors (e.g., unique ACH and direct connect services) will be supported in order to process all payment methods specified in Technical Specifications Section 21.7.2 (Accepted Payments Methods).	CDRL 21-7
21.7.1-2	The Payment Application will be capable of properly processing any payment transactions with the payment processor(s) that were originally authorized by the applicable Frontend NFPS Equipment or NFPS Backend while in "stand-in" (i.e., offline) mode due to communication outages or other issues.	CDRL 21-7
21.7.1-3	The SI shall identify any capabilities or services expected of the MTA's payment processors necessary to support the implementation and operation of the NFPS, and note in particular any capabilities or services that are not considered industry norms.	CDRL 21-7
21.7.1-4	The SI shall conduct any system testing and certifications required to process payments through the MTA's payment processor.	CDRL 21-7

Req. #	Requirement	Assigned CDRL(s)
21.7.1-5	The SI shall demonstrate that the Payment Application is compliant with the latest standards, and provide all necessary PCI and payment brand testing and certification for the Payment Application.	CDRL 21-7
21.7.1-6	The Payment Application will use the SI-supplied payment API (see Technical Specifications Section 6.4 (Application Programming Interfaces)) to capture payment transactions from all Frontend NFPS Equipment and other relevant NFPS components.	CDRL 21-7
21.7.1-7	<p>The Payment Application will be used to process payments generated by the following Frontend NFPS Equipment and other NFPS components:</p> <ul style="list-style-type: none"> • (Bus Validators and Subway Validators)/ATP (Open Payment of fares and Autoloads) • CVMs, TOMs and WVMs (Media and value sales) • Onboard Sales and Validation Devices • Customer Website (Media and value sales) • B2B Portal (Media and value sales) • NFPS Mobile Applications (fare value sales) • CRM System (Media and value sales, adjustments and refunds) • IVR (fare Media and value sales, adjustments and refunds) <p>EMV (and MSD if available) offline data authentication (i.e., CDA and DDA) will also be supported by all Frontend NFPS Equipment and other NFPS components that process payments in a card-present environment.</p>	CDRL 21-7
21.7.1-8	The Payment Application will support, at a minimum, robust configurable velocity checking, based on payment frequency, usage frequency, and value, across all sales channels, Frontend NFPS Equipment and other applicable NFPS components.	CDRL 21-7
21.7.1-9	The Payment Application will allow acceptance or denial of non-EMV cards based on configuration by each NFPS Agency on an NFPS Agency-specific basis.	CDRL 21-7
21.7.1-10	The Payment Application will include sufficient transaction logging to assist in revenue reconciliation, settlement and fraud analysis.	CDRL 21-7
21.7.1-11	The Payment Application will enable the automated reconciliation of settlement files received for all payments processed through the Payment Application.	CDRL 21-7
21.7.1-12	The Payment Application will communicate as needed with SI-provided Hardware Security Modules (HSMs) to decrypt/encrypt Customer PIN Data in compliance with ANSI TR-39 guidelines.	CDRL 21-7

Req. #	Requirement	Assigned CDRL(s)
21.7.1-13	If provided within the Card Data or by messaging with card brands/issuers, the Payment Application will support the automatic identification of Contactless Bank Cards, including virtual cards issued in mobile wallets, upon Card Data entry to the NFPS or otherwise captured via all sales and customer service channels.	CDRL 21-7
21.7.1-14	The NFPS shall comply with all rules and operating regulations for ACH transactions at the time of Final System Acceptance.	CDRL 21-7
21.7.1-15	The NFPS shall comply with all rules and operating regulations for bank card transactions at the time of Final System Acceptance.	CDRL 21-7

21.7.2 Accepted Payments Methods

Req. #	Requirement	Assigned CDRL(s)
21.7.2-1	The Payment Application will support the processing of bank card payments for all major card brands, including Visa, MasterCard, American Express, and Discover and debit networks.	CDRL 21-7
21.7.2-2	The Payment Application will support the processing of EMV - compliant payment transactions. The NFPS will default to EMV processing for all EMV-compliant bank cards, issued inside and outside of the U.S.	CDRL 21-7
21.7.2-3	The Payment Application will support the processing of Electronic Benefit Transfer (EBT) cards.	CDRL 21-7
21.7.2-4	The Payment Application will support the processing of alternative e-commerce payment methods, such as Apple Pay, Android Pay, MasterPass and PayPal.	CDRL 21-7
21.7.2-5	The Payment Application will support the processing of ACH payments for online, mobile and Autoload sales channels. This functionality will be configurable and may be enabled or disabled based on sales channel and purchase criteria.	CDRL 21-7
21.7.2-6	The NFPS will be capable of supporting split payments for all one-time and recurring payments through all sales channels including the use of two bank cards, or a bank card and any other payment method accepted by the associated sales channel.	CDRL 21-7
21.7.2-7	Any payment made using a pretax debit or credit card shall be identified as such when feasible and/or supported by bank card transaction messaging. The NFPS shall comply with all applicable IRS regulations for pretax commuter benefits.	CDRL 21-7

21.7.3 Tokenization

Req. #	Requirement	Assigned CDRL(s)
21.7.3-1	The NFPS will not use full Payment Card Data for internal processing and storing of transactions.	CDRL 21-7
21.7.3-2	The NFPS will use a secure token in place of Payment Card Data, during fare payment processing, Media and value sales, Autoload processing and customer service inquiries. The Payment Card Data will be stored in a Token Vault and associated with the secure token.	CDRL 21-7
21.7.3-3	Tokenization may be performed within the NFPS, or using a Third Party solution external to the NFPS (provided that the SI complies with all required information security practices).	CDRL 21-7
21.7.3-4	If performed within the NFPS, Tokenization will be performed by the Payment Application, and may also be performed by the Front NFPS Equipment or other NFPS components accepting Payment Card Data. All Tokenization shall be completed using a secure, irreversible algorithm. No un-Tokenized Payment Card Data, encrypted or otherwise, will be stored in the ATP at any time.	CDRL 21-7
21.7.3-5	The SI-provided Software for completing Tokenization shall support PAN lookup for all Open Payment Media, including mobile wallets, which make use of alias PANs or other card/device tokens. The same token will be returned for both the PAN and alias PAN (or other token).	CDRL 21-7
21.7.3-6	The SI-provided Software for completing Tokenization will support the linking of an issuer-provided token to an individual customer that may access the NFPS using multiple payment instruments from that issuer. This feature will be supported for all issuers that provide customer-specific tokens in the future.	CDRL 21-7

21.7.4 Fraud Prevention

Req. #	Requirement	Assigned CDRL(s)
21.7.4-1	The Payment Application will employ measures to detect and prevent the fraudulent use of bank cards within the NFPS. Fraud prevention measures will be subject to the MTA's review and approval during design review.	CDRL 21-7
21.7.4-2	<p>The Payment Application will support cardholder verification methods, including address verification and all methods defined by EMV, to allow each NFPS Agency to manage risk. For any given transaction, a customer may be prompted to enter a PIN, billing ZIP code, full billing address, or nothing, depending on the sales channel and NFPS Agency-configurable parameters (with such parameters configurable on an NFPS Agency-specific basis), including:</p> <ul style="list-style-type: none"> • Country of card issuance (e.g., U.S., Canada, etc.) • Card brand (e.g., Visa, MasterCard) 	CDRL 21-7

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Card type (e.g., EMV, prepaid, Contactless, transit benefit, specific IIN, etc.) 	
21.7.4-3	For any bank card transaction determined to be fraudulent, the Payment Application shall immediately send a notification to the ATP, and addition of the associated bank card to the system-wide Negative List (if used).	CDRL 21-7
21.7.4-4	The Payment Application will make use of auto-update and validation services for customer bank card and ACH payment sources kept on file. The auto-update service will enable the automatic updating and notification of bank card data changes, such as expiration date and PAN, when a card is replaced by the issuer. The ACH validation service will periodically verify that bank accounts are in an active state.	CDRL 21-7
21.7.4-5	The Payment Application will support a configurable re-presentment feature for Open Payment transactions that initially result in a decline. The re-presentment functionality will enable the NFPS to automatically reattempt authorization of the declined transaction over a configurable period of time or number of retries.	CDRL 21-7

21.7.5 Chargebacks and Reversals

Req. #	Requirement	Assigned CDRL(s)
21.7.5-1	The Payment Application will maintain records for no less than seven years to support the research, documentation and auditing of payments processed for dispute and chargeback resolution.	CDRL 21-7
21.7.5-2	The Payment Application will support chargeback processing, including automated retrieval, reconciliation, and response for chargeback notifications, as well as automated media Negative Listing (subject to each NFPS Agency's Business Rules) and reversal of load transactions within the NFPS.	CDRL 21-7
21.7.5-3	The Tokenization Software provided by the SI will allow for refunds and tracking of chargebacks without having to store bank card data.	CDRL 21-7

21.8 Data Warehouse

The NFPS Back Office shall include a Data Warehouse (DW) that will serve as a repository for all NFPS Data specified below, including fare collection Data. The primary NFPS Backend database and other supporting databases for maintenance, reporting and customer service will feed into and pull from the DW. The DW will be the basis for data analytics, archiving and NFPS Back Office processing.

Req. #	Requirement	Assigned CDRL(s)
21.8.1-1	The DW will store all Data generated by the NFPS, including Data generated by the NFPS Backend, all other NFPS Back Office Software Applications and all Frontend NFPS Equipment.	CDRL 21-8
21.8.1-2	The core database engine within the DW shall be an enterprise ODBC-compliant relational database that can scale larger than NFPS Agency transaction volumes. The DW will utilize the most recent version of Oracle or an MTA-approved equivalent.	CDRL 21-8
21.8.1-3	At minimum, the DW will also collect Data from: <ul style="list-style-type: none"> • NFPS Backend • Device Monitoring System (DMS) • Inventory Management System (IMS) • Customer Relationship Management (CRM) System • Financial Clearing & Settlement System (FCSS) • Legacy Systems Other Data sources may be defined based on design reviews.	CDRL 21-8
21.8.1-4	By way of clarification, and not limitation, Data captured in the DW will include at minimum: <ul style="list-style-type: none"> • NFPS Backend Open and Closed-Loop fare payment transactions • Device Closed-Loop Transit Account sales transactions • Device events and alarms from the DMS • NFPS Backend and NFPS Back Office monitoring events and alarms • Device Audit Register data • Device location and inventory Data from the IMS • Customer service incidents from the CRM System • Actions within the CRM System affecting Transit Account value or status (e.g., credits, refunds and adjustments) • Media and value orders created through the CRM System and stored in the IMS, including those associated with special/institutional programs • Accounting entries generated by the FCSS • Other analytics Data to support fraud detection and prevention • Real-time website and mobile application analytics and metrics, based on industry best practices, including to identify access attempts from unsupported devices, platforms, browsers, etc., and details on website/application “crashes” 	CDRL 21-8
21.8.1-5	The DW will be able to pull additional Data sources as required by operational needs.	CDRL 21-8
21.8.1-6	The DW will be fully compliant with MTA security, PCI, EMV, and PII requirements specified in Technical Specifications Section 5.7 (System Security).	CDRL 21-8

Req. #	Requirement	Assigned CDRL(s)
21.8.1-7	For Open Payment transactions, the Data Warehouse will store a Tokenized version of the Primary Account Number (PAN), which will prevent the need to store the Payment Card Data, but still allow for the querying of transactions generated using a particular payment instrument.	CDRL 21-8
21.8.1-8	NFPS Data maintained in the DW will be maintained in an individual event, record or transactional format. If Data elements are aggregated, consolidated or combined within the DW, they will be organized in such a way as to allow standard Structured Query Language (SQL) query tools to extract events and transactions discretely. Normalization and de-normalization for purposes of improving database efficiency will be acceptable.	CDRL 21-8
21.8.1-9	The DW will retain and provide online access to detailed Transaction Data for analysis for the lesser of (i) seven (7) years following the date that a transaction is generated, and (ii) such other period as required by MTA data retention policies (if any). Summary Data will be retained and available for the lesser of (a) ten (10) years, and (b) such other period as required by MTA data retention policies (if any). Detailed and summary Data will be defined during design reviews, and will meet the MTA's approval with respect to data retention policies and procedures.	CDRL 21-8
21.8.1-10	The SI shall archive and maintain detailed and summary Data from the DW in an MTA-approved format, and the SI shall maintain such Data in compliance with MTA data retention policies and procedures.	CDRL 21-8
21.8.1-11	The SI shall supply database queries and tools to enable the MTA to clean up and remove old or unwanted Data from the DW. This will be an administrative function that would permanently delete Data in a specified date range or other criteria. The functionality set out in this req. # 21.8.1-11, including the queries and tools, shall comply with and otherwise support MTA data retention policies and procedures.	CDRL 21-8
21.8.1-12	As part of implementation, the SI shall deliver a full and complete data dictionary and schema for the DW. The SI will also provide details for the extract, transform and load (ETL) process for mapping to outside Data sources.	CDRL 21-8
21.8.1-13	All NFPS Data within the DW shall be accessible by standard SQL query tools and shall be retrievable as standard ASCII or binary Data using a standard SQL query. All database features and supported formats will be available for use by each NFPS Agency.	CDRL 21-8

Req. #	Requirement	Assigned CDRL(s)
21.8.1-14	An interface to the DW will provide the ability to query the database directly, export the Data in a variety of formats including ASCII text, CSV, and Excel formats. A direct connection to the reporting system (see Technical Specifications Section 21.9 (Reporting System)) and other Third Party reporting tools will be provided for predefined and custom reporting.	CDRL 21-8
21.8.1-15	<p>The SI shall provide a preliminary design for the DW, including:</p> <ul style="list-style-type: none"> • Data fields, length of fields, etc. • Data to be stored, including the total amount of data storage available, data compaction schemes, etc. • Time required for transmission of Data to the DW • Communications protocols • Test procedures to ensure that all capabilities specified are indeed present • DW operating procedures • Specific means of transmitting data to other applications • Format of the data for transmission to other applications <p>This information will be submitted and refined during design reviews.</p>	CDRL 21-8
21.8.1-16	All such Data will be transmitted to the DW in real-time, or on a configurable frequency that can be set depending on the source. The transmit frequency of such Data not sent in real-time will occur no less than daily, and will be configurable in increments of at most one minute.	CDRL 21-8
21.8.1-17	All NFPS Interfaces requiring access to real-time Data, including the ATP, NFPS Websites, NFPS Mobile Applications, Onboard Sales and Validation Devices, Device Monitoring System and CRM System, will modify the source production databases directly, if possible. That Data will be transmitted in the DW as soon as possible, at a frequency and format to be determined during design reviews.	CDRL 21-8
21.8.1-18	The NFPS will support the ability to completely anonymize the Transaction Data stored in the Data Warehouse by masking and/or replacing the original account number and any PII contained in a transaction after a configurable period of time (e.g., seven years from the date of generation).	CDRL 21-8

21.9 Reporting System

The NFPS Back Office shall include a Reporting System that provides an interface to run pre-defined reports or custom reports. The primary data source for the Reporting System shall be the DW, though other sources of Data may be utilized depending on the reporting need.

Req. #	Requirement	Assigned CDRL(s)
21.9.1-1	The SI shall provide a COTS Reporting System that interfaces with the DW for the generation of predefined and customized reports. The Reporting System will allow the viewing, running and scheduling of predefined reports, with a querying interface to define and save custom reports. The Reporting System will be subject to the MTA's review and approval.	CDRL 21-9
21.9.1-2	The Reporting System will be robust enough to perform analytical and statistical queries against very large volumes of Data using in-memory data aggregation.	CDRL 21-9
21.9.1-3	<p>Predefined reports will include, but are not limited to:</p> <ul style="list-style-type: none"> • Ridership reports • Sales reports • Revenue reports • Deferred revenue reports • Financial settlement reports • Maintenance reports • Device and system performance reports • Customer service reports • Exception reports • Fraud detection reports • Device Errors and alerts • Service planning reports • System and device availability reports <p>A list of predefined reports will be defined with the MTA during design review.</p>	CDRL 21-9
21.9.1-4	The SI shall provide up to 100 predefined reports, defined by the MTA, for review and approval at Final Design Review.	CDRL 21-9
21.9.1-5	The Reporting System will have the capability to define and run custom reports by NFPS Agency users. These reports will be able to be saved and shared across user types and accessed by users of the Reporting System depending on their access permissions.	CDRL 21-9
21.9.1-6	Custom reports will be defined using a query design tool or equivalent custom query tool. Custom reports will be able to access all fields of the DW.	CDRL 21-9
21.9.1-7	Reports will be able to be run through a web interface, and results will be provided in several formats, including: Adobe Acrobat, Microsoft Excel, Microsoft Word, comma separate value or plain ASCII text. All file formats will include the same Data and general layout where possible. Data files (Excel and CSV) will be generated such that Data can be extracted without formatting, and can be imported into other Third Party tools without manipulation.	CDRL 21-9

Req. #	Requirement	Assigned CDRL(s)
21.9.1-8	The Reporting System web interface shall be available across multiple browsers and platforms. Desktop and mobile browsers to be supported include, but are not limited to: Internet Explorer, Microsoft Edge, FireFox, Safari, Chrome and Opera.	CDRL 21-9
21.9.1-9	Access to the Reporting System will be controlled through a password-controlled web interface. The execution and creation of reports will be configurable by user type. User accounts will be set up with custom access levels that define which reports can be viewed and what fields can be queried for custom reports. All access will be controlled through a centrally-managed user authentication and access control platform, which supports a usage audit trail. All access control and user authentication will comply with MTA/IT Security Standards and could potentially integrate with other NFPS Agency authentication systems.	CDRL 21-9
21.9.1-10	The SI shall be responsible for delivering all pre-defined customized reports at designated intervals, and such reports and intervals shall be defined and developed with the NFPS Agencies and Linked NFPS Entities during design review and system implementation.	CDRL 21-9
21.9.1-11	The Reporting System will provide robust Business Intelligence (BI) reporting.	CDRL 21-9
21.9.1-12	The Reporting System will generate web-based dashboards to display NFPS Agency-defined data visualizations (defined on an NFPS Agency-specific basis), including system performance indicators or metrics.	CDRL 21-9

21.10 Legacy Systems Interfaces

The SI shall support NFPS Interfaces to Legacy Systems. Except as otherwise set out in the Contract Documents, development and use of the Software Interfaces for Legacy Systems will be the responsibility of the MTA, and will include a data repository (using an agreed-upon format) from which the MTA can retrieve and import necessary Data into Legacy Systems. The SI shall make defined Data available in real-time or at appropriate intervals for migration to the Software Interfaces where it will be used by the Legacy Systems. All data fields, formats, and timing shall be defined during design review and subject to the MTA's review and approval.

21.10.1 Maintenance Management Interface

The SI shall provide a maintenance management interface (MMI) capability to the MTA MMS or EAMS (the MMS and EAMS are collectively referred to in this Technical Specifications Section 21.10.1 (Maintenance Management Interface) as the "MMS"). This MMS will track all system maintenance issues from identification through resolution, and is reliant on accurate updates from all Frontend NFPS Equipment and relevant other equipment. The SI shall provide a standardized data format and associated APIs to ensure compatibility with current and future MMSs.

Req. #	Requirement	Assigned CDRL(s)
21.10.1-1	The SI shall support a maintenance management interface (MMI) capability based on the supplied APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)) for the central management and tracking of NFPS maintenance activity in the current MMS.	CDRL 21-10
21.10.1-2	The MMI will enable comprehensive system performance monitoring and support analytics necessary to improve maintenance performance.	CDRL 21-10
21.10.1-3	The MMI will support updates to device status in the MMS when change in status occurs or the device location changes.	CDRL 21-10
21.10.1-4	The MMI will automatically transmit device events and alarms received through the Device Monitoring System (see Technical Specifications Section 21.2 (Device Monitoring System)) to support appropriate actions in the MMS. The MMI will also support automatically generated alerts via emails, text messages or other output files sent via the NFPS when these events occur.	CDRL 21-10
21.10.1-5	The MMI will automatically transmit device location changes received through the DMS (see Technical Specifications Section 21.2 (Device Monitoring System)) or other systems to support a master device inventory maintained in the MMS.	CDRL 21-10
21.10.1-6	The MMI will support existing MMS tools and processes, and not adversely impact maintenance activities that are currently performed by the NFPS Agencies and Linked NFPS Entities.	CDRL 21-10
21.10.1-7	Current and future versions or upgrades of the MMS shall be accommodated by updating or repurposing the maintenance management interface (MMI).	CDRL 21-10

21.10.2 Claims System Interface

The SI shall provide an interface capability to each of the NFPS Agencies' existing claims systems to support all customer service functions under the NFPS.

Req. #	Requirement	Assigned CDRL(s)
21.10.2-1	The SI shall support the claims system interfaces based on the supplied APIs (see Technical Specifications Section 6.4 (Application Programming Interfaces)) for central management of all customer claims Data using MTA-Provided Systems.	CDRL 21-11
21.10.2-2	The claims system interfaces will enable MTA-Provided Systems to perform all customer claims functions specified to be supported by the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 21-11

21.11 NFPS Back Office Monitoring System

Req. #	Requirement	Assigned CDRL(s)
21.11-1	The SI shall deliver a real-time performance and status monitoring system for all NFPS Back Office Software.	CDRL 21-12
21.11-2	The NFPS Back Office monitoring system will monitor and show real-time status on all NFPS Back Office Software, including applications, databases, subsystems, processes, and general availability. Details of which processes will be monitored will be provided as part of the Software Architecture Design Document (see Technical Specifications Section 21.1 (NFPS Back Office General Requirements)).	CDRL 21-12
21.11-3	Processor load, memory utilization, rogue processes, memory leaks and other performance indicators will be available in real-time to help prevent performance degradation, load balance, scale to meet increased demand and troubleshoot NFPS Backend issues.	CDRL 21-12
21.11-4	The NFPS Back Office monitoring system shall be available in a graphical dashboard format, accessible remotely by web browser or desktop/mobile application.	CDRL 21-12
21.11-5	Status types reported by the monitoring system shall include performance indicators, outage alerts and other relevant monitoring metrics. Status and alert types can be programmed to allow custom functions, which will be determined during design review.	CDRL 21-12
21.11-6	The monitoring system will automatically generate alerts via emails, text messages or other output files defined by each NFPS Agency, on an NFPS Agency-specific basis. The initiation, frequency, and cancellation of these alerts shall be configurable.	CDRL 21-12
21.11-7	The monitoring system will not adversely impact the monitoring capabilities that are currently utilized at the NFPS Agencies.	CDRL 21-12

21.12 NFPS Back Office Required Submittals

The required submittals specified in this Technical Specifications Section 21 (NFPS Back Office) are summarized below. They are described in detail in the referenced Technical Specifications Section.

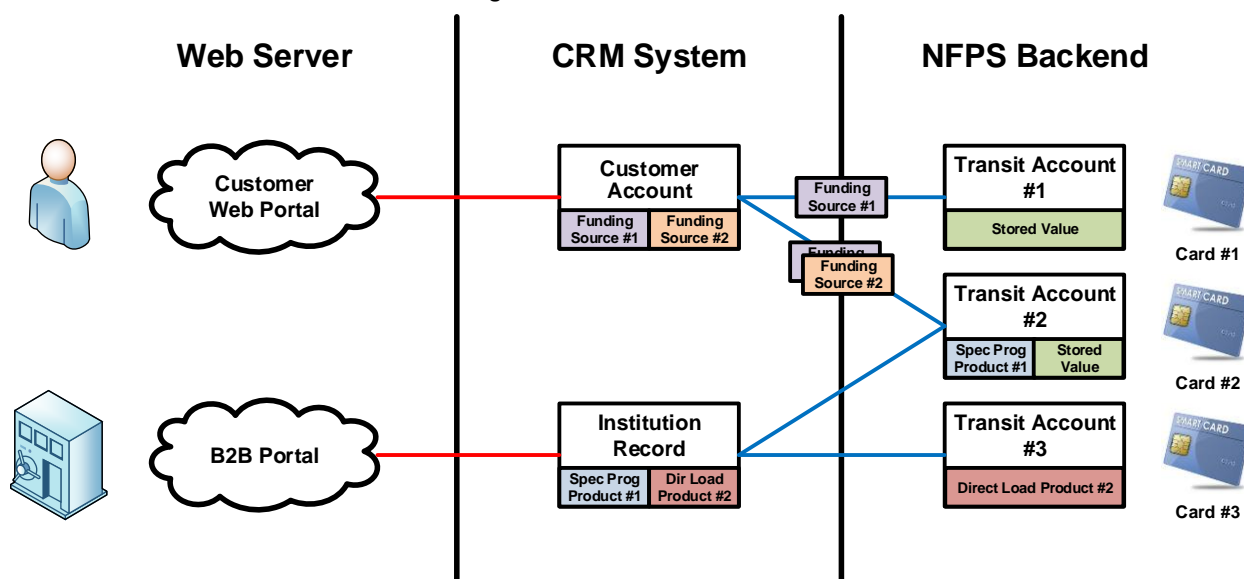
Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 21-1	NFPS Back Office General Requirements	Section 21.1	✓	✓	✓	
CDRL 21-2	Device Monitoring System	Section 21.2	✓	✓	✓	
CDRL 21-3	Inventory Management System	Section 21.3	✓	✓	✓	

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 21-4	Customer Relationship Management	Section 21.4	✓	✓	✓	
CDRL 21-5	Interactive Voice Response	Section 21.5	✓	✓	✓	
CDRL 21-6	Financial Clearing & Settlement	Section 21.6	✓	✓	✓	
CDRL 21-7	Payment Application	Section 21.7	✓	✓	✓	
CDRL 21-8	Data Warehouse	Section 21.8	✓	✓	✓	
CDRL 21-9	Reporting System	Section 21.9	✓	✓	✓	
CDRL 21-10	Maintenance Management Interface	Section 21.10.1	✓	✓	✓	
CDRL 21-11	Claims System Interface	Section 21.10.2	✓	✓	✓	
CDRL 21-12	NFPS Back Office Monitoring System	Section 21.12	✓	✓	✓	

22 NFPS Websites

The SI shall include a website to be used by both the general public and businesses for the distribution of Media and value, and the management of Transit Accounts, as described in Technical Specifications Section 9.1.2 (Web), and shown in Technical Specifications Figure 22.1 (NFPS Accounts). The SI will also provide Website Hosting Services, specified in Technical Specifications Section 24.2 (Web Hosting).

Figure 22.1: NFPS Accounts



22.1 Website Design

22.1.1 Web Design Criteria

Req. #	Requirement	Assigned CDRL(s)
22.1.1-1	The NFPS Websites will be compliant with all applicable ADA and Title VI regulations.	CDRL 22-1
22.1.1-2	The NFPS Websites will be provided in multiple languages, including English, Spanish and up to thirteen other languages to be identified by the MTA prior to the completion of FDR.	CDRL 22-1
22.1.1-3	The NFPS Websites will be built using latest web design and e-commerce best practices, including dynamic design via HTML5, AJAX, and server-side programming languages. The development tools and design for the NFPS Websites will be subject to the MTA's review and approval during design review. The SI shall work closely with the MTA's marketing, IT and web services teams to develop an approved user interface design for all iterations of website design and testing throughout implementation.	CDRL 22-1

Req. #	Requirement	Assigned CDRL(s)
22.1.1-4	The SI shall team or contract with a web design firm with extensive experience developing e-commerce, retail and social media websites. All Interfaces between the NFPS Websites and the NFPS will be the responsibility of the SI.	CDRL 22-1
22.1.1-5	The NFPS Websites will adhere to the general design requirements in Technical Specifications Section 5 (General Design Requirements), especially those pertaining to: <ul style="list-style-type: none"> • Aesthetic Requirements and User Interfaces • System Security • Open Technology • Software Requirements • Performance Requirements • Codes, Regulations & Reference Standards 	CDRL 22-1
22.1.1-6	The NFPS Websites will be designed and tested for cross platform compatibility, including: <ul style="list-style-type: none"> • Platforms: Windows, Apple, Linux and Unix • Browsers: Internet Explorer, Safari, Chrome, Firefox and Opera Other platforms and browsers may be specified by the MTA during design reviews.	CDRL 22-1
22.1.1-7	The SI shall provide detailed screen flows depicting wireframes and, at appropriate stages of design, mock-ups of each screen layout arranged as a logical flow chart for the MTA's review and approval. The flow charts will depict all web screen flows as they will be configured for revenue service, and as configured to support all transaction types decided during design review. Screen flows available to users during transactions will be logical and straightforward. The SI shall provide storyboarding and prototyping of the NFPS Websites during iterative development and design reviews.	CDRL 22-1
22.1.1-8	The NFPS Websites will be developed using an agile or iterative design process, whereby design requirements are continually refined and improved with NFPS Agency feedback. Wireframes and mockups will be utilized and updated during the iterative design process.	CDRL 22-1
22.1.1-9	NFPS Websites testing will employ ongoing end-user testing with an established test group to validate display and operation across all supported PC and mobile platforms prior to the release of any changes. If specialized design and/or user interface firms are employed, the MTA will be able to access firm resources and design data, including mockups and test results.	CDRL 22-1

22.1.2 Website Payment Processing

Req. #	Requirement	Assigned CDRL(s)
22.1.2-1	All payments initiated via the NFPS Websites will be accepted using e-commerce best practices and processed through the Payment Application (see Technical Specifications Section 21.7 (Payment Application)) in a manner compliant with the latest PCI requirements and the MTA's policies and procedures. Payments will be accepted based on configurable velocity checks.	CDRL 22-1
22.1.2-2	All Payment Card Data will be encrypted for transmission employing the Triple Data Encryption Algorithm (TDEA) and Transport Layer Security (TLS), at a minimum. All portions of the NFPS Websites that transmit or receive Customer Data will be TLS-encrypted.	CDRL 22-1
22.1.2-3	The NFPS Websites will support Address Verification System (AVS) in a configurable manner that allows the AVS feature to be turned on or off by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 22-1
22.1.2-4	The NFPS Websites will prompt users when a payment is declined and allow entry of an alternate funding source. Failed payments will be recorded in a separate credit/debit card exception file (with denial code) by the Payment Application.	CDRL 22-1
22.1.2-5	If a payment authorization is not completed within a configurable time period, or is interrupted, the NFPS Websites will cancel the transaction and notify the customer. Any canceled transactions will be recorded in NFPS system monitoring logs.	CDRL 22-1
22.1.2-6	Users will be e-mailed a receipt for all successfully completed sales, including the fulfillment of an Autoload. Users will have the option of opting-out of e-mail notifications.	CDRL 22-1

22.2 Customer Website

The SI shall deliver a Customer Website and provide all hardware and Software necessary to support website operations, and all NFPS Interfaces to NFPS systems and external systems needed to perform the required functions and process payments.

22.2.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
22.2.1-1	<p>The Customer Website will allow customers to perform the following functions, at minimum:</p> <ul style="list-style-type: none"> • Login using MTA-specific credentials and third-user authentication/login services, such as Facebook, Google and Amazon. • Purchase Extended-Use Media or Limited-Use Media • Register a Closed-Loop Transit Account • Associate Open Payment Media with a Closed-Loop Transit Account • Load value and a Fare Product to a Closed-Loop Transit Account • Set up, modify and cancel Autoload transactions • Set up, modify, and cancel Mail&Ride transactions • View and download transaction and usage history for both Closed-Loop and Open Payment Media • Manage account settings and customer profile • Report a lost or stolen card • Initiate a customer service request (e.g., refund request) • Transfer transit value between Transit Accounts, as allowed by MTA Business Rules (both for lost/stolen Media and customer convenience purposes) • Pay Invoice for Fare Not Paid charges • Perform basic product purchase analytics, refund and missing transaction inquiry functions, as allowed by MTA Business Rules • Receive notifications via text, email, and other available methods, for certain events such as password changes, low balance, pass expiration, credit card expirations, etc. 	CDRL 22-2
22.2.1-2	The Customer Website shall be fully integrated with the NFPS Agencies' websites with schedules, fares and other general transit information, and otherwise comply with the MTA's privacy policies and other online practices.	CDRL 22-2
22.2.1-3	The SI shall provide each NFPS Agency with all requested access to NFPS Agency-specific reports and other tools to fulfill purchase and other transaction requests from individuals. Each NFPS Agency shall have access to administrative pages and functions to facilitate operations and management of the NFPS Websites.	CDRL 22-2
22.2.1-4	The Customer Website will track multiple failure attempts by the customer to purchase Media or add Fare Products by listing those charges in the customer's account temporarily until they clear.	CDRL 22-2

22.2.2 Media Orders and Account Registration

Req. #	Requirement	Assigned CDRL(s)
22.2.2-1	The Customer Website will allow ordering of NFPS Agency-Issued Media to be delivered by mail, either on an ad-hoc basis or through Mail&Ride. Ordering of Media via the Customer Website shall provide the ability to register the associated Transit Account at the time the order is placed.	CDRL 22-2
22.2.2-2	The Customer Website will allow registration of a Transit Account associated with previously issued Closed-Loop Media, which will create an associated Customer Account in the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 22-2
22.2.2-3	The Customer Website will allow registration of Open Payment Media, which will create a new Transit Account associated with the Media, or link an existing Transit Account if the Media has been used previously within the NFPS. In both cases, a new Customer Account will be created in the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 22-2
22.2.2-4	During registration the Customer Website will capture all necessary Customer Data and create a Customer Account that requires the setting of a username (or e-mail address), password (or other appropriate security credential), Personal Identification Number (PIN) that will be used to access account management features via the IVR (see Technical Specifications Section 10.1 (Transit and Customer Accounts) and Technical Specifications Section 21.5 (Interactive Voice Response)), and answers to security questions that will support the resetting of a password or PIN. Customers will be able to create a Customer Account without an email address if desired by the MTA. All Customer Account Data, including username, email, answers to security questions, passwords and PINs, will be stored in an encrypted form in the CRM System's customer database.	CDRL 22-2
22.2.2-5	The Customer Website will support the linking of multiple Transit Accounts to a single Customer Account. Registered customers will be able to register new Transit Accounts under an existing Customer Account, and add a single funding source to support the loading of value to all associated Transit Accounts.	CDRL 22-2

Req. #	Requirement	Assigned CDRL(s)
22.2.2-6	Registered customers will be required to login using their username and password (or other appropriate security credential agreed during design review), to access account management and loading features of the Customer Website.	CDRL 22-2

22.2.3 Value Loading

Req. #	Requirement	Assigned CDRL(s)
22.2.3-1	Registered and unregistered customers will be able to initiate a one-time load of value to their Transit Account using an accepted NFPS payment method (credit, debit, ACH, etc.), as determined during design review. The Customer Website will support the selection of Fare Products and pre-defined stored value amounts, and the entry of custom stored value amounts (subject to configurable minimum and maximum limits).	CDRL 22-2
22.2.3-2	Registered customers will be able to enable, modify and disable Autoload of Fare Products and stored value (see Technical Specifications Section 9.1.3 (Autoload)). As part of the Autoload setup process, the customer will select the Fare Product or amount of the Autoload (pre-defined and custom values) and the type of Autoload (threshold or periodic).	CDRL 22-2
22.2.3-3	New Autoload setup will require the adding of a funding source in the form of a credit card, debit card, or bank account (i.e., ACH). Funding source information will be stored securely within the CRM System in a Tokenized form (see Technical Specifications Section 21.4 (Customer Relationship Management)).	CDRL 22-2
22.2.3-4	For one-time and Autoload sales, the Customer Website will provide customers an option to split the payment between a minimum of two funding sources.	CDRL 22-2

22.2.4 Balance and Transaction History

Req. #	Requirement	Assigned CDRL(s)
22.2.4-1	Registered and unregistered customers will be able to view balance information, and up to 12 months of prior transaction history, showing all replenishment, usage, reversals and other transactions for both Closed-Loop and Open Payment Media, as allowed by MTA Business Rules. The transaction history will be viewable and sortable on the Customer Website, and able to be exported in PDF and Excel formats.	CDRL 22-2

Req. #	Requirement	Assigned CDRL(s)
22.2.4-2	Account balance transfers will be possible between Transit Accounts that are associated with the same Customer Account. If permitted by MTA Business Rules, balance transfers may be initiated as part of lost/stolen Media replacement or per customer request.	CDRL 22-2

22.2.5 Customer Service

Req. #	Requirement	Assigned CDRL(s)
22.2.5-1	Registered customers will have the option of initiating a customer service request. The request will generate and incident within the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)) and assign the incident to the appropriate customer service staff.	CDRL 22-2
22.2.5-2	The Customer Website will allow registered customers to report a card lost or stolen. Initiating this action will immediately result in the associated Media being blocked from further use.	CDRL 22-2
22.2.5-3	The Customer Website will include general information on use of the NFPS, including an FAQ section, information on where to acquire media, how to pay, the cardholder agreement and general program information and updates.	CDRL 22-2
22.2.5-4	The Customer Website will allow registered and unregistered customers to automatically resolve issues related to charging of a fare against an instrument other than that intended. This feature will allow customers to transfer existing charges to a designated alternative Open Payment Card or Transit Account, as allowed by each NFPS Agency's Business Rules (on an NFPS Agency-specific basis).	CDRL 22-2

22.2.6 Mobile-Optimized Website

Req. #	Requirement	Assigned CDRL(s)
22.2.6-1	The SI shall provide a mobile optimized version of the Customer Website that supports all the functionality described in this Technical Specifications Section 22.2.6 (Mobile-Optimized Website). Customers will be automatically redirected to the mobile version when accessing the Customer Website using a mobile device, or customers shall have the option of viewing the full Customer Website from their mobile device.	CDRL 22-2

Req. #	Requirement	Assigned CDRL(s)
22.2.6-2	<p>The mobile optimized version of the Customer Website shall include popular mobile platforms and browsers, and versioning for various screen dimensions, including:</p> <ul style="list-style-type: none"> • Platforms: Android, iOS, Blackberry, Windows Phone • Browsers: Safari, Chrome, Firefox, Opera, Internet Explorer • Screens: Mobile phones, tablets, PDAs <p>Other platforms and browsers may be specified by the MTA during design reviews.</p>	CDRL 22-2
22.2.6-3	<p>The mobile optimized version of the Customer Website shall include all the functions and features specified for the PC browser-based Customer Website, unless otherwise noted by the MTA.</p>	CDRL 22-2

22.3 Business-to-Business (B2B) Portal

The SI shall deliver a business-to-business website (B2B Portal) and provide all hardware and Software necessary to support website operations, and all NFPS Interfaces to the NFPS and external systems needed to perform the required functions and process payments.

22.3.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
22.3.1-1	<p>The B2B Portal will allow the MTA, employers, schools, social service agencies and other businesses to administer Transit Accounts on behalf of participants in Special Programs (see Technical Specifications Section 7.4 (Special Fare Programs)) or Mail&Ride (see Technical Specifications Section 7.4.4 (Mail&Ride)).</p>	CDRL 22-3
22.3.1-2	<p>The B2B Portal will provide the following functions, at minimum:</p> <ul style="list-style-type: none"> • Register a new institution (i.e., employer, social service agency, school, etc.) • Add participants to an institutional account • Delete participants from an institutional account • Initiate value or Fare Product loads to participants' Transit Accounts • Initiate a bulk order of Extended-Use or Limited-Use Media • Configure a Fare Product subsidy • Make a payment • View invoicing and payment status • Compile Mail&Ride customer and product information for fulfillment by a third party vendor 	CDRL 22-3

Req. #	Requirement	Assigned CDRL(s)
22.3.1-3	All Data associated with institutional accounts will be stored securely in the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)). Funding source information will be stored in a Tokenized form.	CDRL 22-3
22.3.1-4	The SI shall provide each NFPS Agency with all requested access to NFPS Agency-specific reports and other tools to fulfill purchase and other transaction requests from groups (such as employers, retail sales locations and other B2B Portal users). Each NFPS Agency shall have access to administrative pages and functions to facilitate operations and management of the NFPS Websites and the B2B Portal. Reports and functions shall be configurable by each NFPS Agency (on an NFPS Agency-specific basis).	CDRL 22-3

22.3.2 Business Registration

Req. #	Requirement	Assigned CDRL(s)
22.3.2-1	Prior to using the B2B Portal, institutions will need to be approved by the MTA and have a Transit Account setup within the B2B Portal. Each NFPS Agency shall have the ability to use the B2B Portal to add new institutions and remove those who are no longer participating, and configure what Fare Products are available to them and payment terms, with such ability on an NFPS Agency-specific basis.	CDRL 22-3
22.3.2-2	Following approval, a Special Program administrator from the institution will be able login to the B2B Portal to perform all program administration functions.	CDRL 22-3
22.3.2-3	Each NFPS Agency will be able to use the B2B Portal to serve as administrators for its own programs as necessary.	CDRL 22-3
22.3.2-4	An MTA Mail&Ride Administrator from both MNR and LIRR will be able to use the B2B Portal to perform all Mail&Ride administration functions and initiate the transfer of Mail&Ride information to a third party vendor for fulfillment.	CDRL 22-3

22.3.3 Adding and Deleting Participants

Req. #	Requirement	Assigned CDRL(s)
22.3.3-1	Special Program administrators will be able to add participants under their institutional account individually, or through a bulk upload process.	CDRL 22-3

Req. #	Requirement	Assigned CDRL(s)
22.3.3-2	New and existing customers (with a registered Transit Account) will be able to be added as a participant to an institutions account. All new customers will be registered as part of the process.	CDRL 22-3
22.3.3-3	Special Program administrators will be able to delete participants under the institutional account, individually or through a bulk process.	CDRL 22-3

22.3.4 Placing Orders

Req. #	Requirement	Assigned CDRL(s)
22.3.4-1	Special Program administrators and Mail&Ride administrators will be able initiate the loading of value to participants' Transit Accounts individually, or through a bulk process using an imported file (in a defined format) with information on each Transit Account and product being ordered.	CDRL 22-3
22.3.4-2	When adding value to participant Transit Accounts, Special Program administrators will be able to select from the Fare Products configured for their Transit Account, and choose whether to initiate a one-time or recurring load, on an individual participant basis. The periods available for recurring loads will be configured as part of setting up the institutional account.	CDRL 22-3
22.3.4-3	If setup to do so, Special Program administrators will be able to place bulk orders for Extended-Use and Limited-Use Media to be delivered by mail.	CDRL 22-3

22.3.5 Payment

Req. #	Requirement	Assigned CDRL(s)
22.3.5-1	Payment terms for institution customers will be configured as part of the institution account setup. Each NFPS Agency will be able to configure (on an NFPS Agency-specific basis) Transit Accounts such that payment is required at the time an order is placed, or so that the institution is invoiced based on established payment terms.	CDRL 22-3
22.3.5-2	Institutions where immediate payment is configured will be required to provide a funding source in the form of a credit card, debit card, or bank account (i.e., ACH). The funding source information provided will be able to be saved for future use.	CDRL 22-3

Req. #	Requirement	Assigned CDRL(s)
22.3.5-3	For institution orders where invoicing is configured, an invoice will automatically be generated by the FCSS (see Technical Specifications Section 21.6 (Financial Clearing & Settlement System)), and sent electronically or via mail to the institution.	CDRL 22-3
22.3.5-4	Each NFPS Agency will be able to configure (on an NFPS Agency-specific basis) the placing of automatic holds on institution accounts, and the loading of value to participant accounts, based on the status of outstanding receivables.	CDRL 22-3
22.3.5-5	Special Program administrators will be able to view at least 12 months of invoice and payment history via the B2B Portal. The history will be viewable and sortable on the B2B Portal, and able to be exported in PDF and Excel formats.	CDRL 22-3
22.3.5-6	The B2B Portal will support the administration of transit benefit programs by Third Party administrators through agreements with the NFPS Agencies. Institutions configured as transit benefit providers will be required to indicate whether loads are funded with pre-tax or post-tax dollars. Stored value and Fare Products funded with any pre-tax dollars will be segregated within the participant's Transit Account and flagged as a pre-tax load.	CDRL 22-3
22.3.5-7	The B2B Portal will support invoice-only "no value" transactions for institutions where funding is provided in bulk or where the NFPS Agencies absorb the costs.	CDRL 22-3

22.4 Website Performance Requirements

The SI shall ensure that the NFPS Websites meet all requirements for website performance contained in the Contract Documents, including those set out in this Technical Specifications Section 22.4 (Website Performance Requirements). The performance requirements for the NFPS Websites include periodically measured Key Performance Indicators (KPIs), which will also be part of Acceptance Testing. These KPIs are inclusive of applicable performance requirements in Technical Specifications Section 5.14 (Performance Requirements), in addition to the specific requirements below and as otherwise set out in the Contract Documents. Note that performance may depend on user computer hardware, and that testing will be performed on standard hardware specified by the MTA.

	KPI	Definition and Measurement	Requirement	Period of Measurement
NFPS Websites	Response Time	Time from user action (click) to NFPS Website response	99% of actions less than 1 sec	Per week

	KPI	Definition and Measurement	Requirement	Period of Measurement
NFPS Websites	Workload	Number of concurrent users performing account modifications	Support 100,000 concurrent users, including peak period adjustments	Per day
NFPS Websites	Scalability	Ability to increase workload capacity dynamically to match increased demand	Support up to 2X workload	Per day

22.5 NFPS Websites Required Submittals

The required submittals specified in this Technical Specifications Section 22 (NFPS Websites) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 22-1	General NFPS Websites Design	Section 22.1	✓	✓	✓	
CDRL 22-2	Customer Website	Section 22.2	✓	✓	✓	
CDRL 22-3	Business to Business Portal	Section 22.3	✓	✓	✓	

23 NFPS Mobile Software

23.1 NFPS Mobile Applications

The NFPS will provide a best-in-class, secure mobile experience for the NFPS Agencies' customers. The NFPS Mobile Applications will utilize innovative, user-friendly designs that support a customer's end-to-end travel experience in the region. This will combine NFPS-specific features such as account management and Contactless payment, with robust non-NFPS features such as trip planning, service alerts and utilization of NFPS Data and other data. NFPS-specific features shall also be capable of being integrated into apps not developed by the SI, such as those developed by, or on the behalf of, the MTA.

The NFPS Mobile Applications will also enable integration with other Third Party mobile applications, as well as use protocols such as BLE to enhance the customer experience (e.g., opening of the app when encountering a BLE beacon). The MTA expects the NFPS Mobile Applications, and the related iterative design processes, to utilize design best practices and make use of emerging mobile trends at the time of design.

23.1.1 Mobile Platform Requirements

Req. #	Requirement	Assigned CDRL(s)
23.1.1-1	The SI shall team or contract with mobile application developers with experience in mobile transit applications, or have equivalent internal expertise. All Software Interfaces between the NFPS Mobile Applications and the NFPS will be the responsibility of the SI.	CDRL 23-1
23.1.1-2	The NFPS Mobile Applications will adhere to the general design requirements in Technical Specifications Section 5 (General Design Requirements), especially those pertaining to: <ul style="list-style-type: none">• Aesthetic Requirements and User Interfaces• System Security• Open Technology• Software Requirements• Performance Requirements• Codes, Regulations & Reference Standards	CDRL 23-1
23.1.1-3	The NFPS Mobile Applications will be developed as a native application for major mobile platforms as agreed to during design review. Supported platforms will be determined using analytics of the NFPS Agency website(s) and other applications, and include at a minimum, support for the top 10 devices identified. It is envisioned that Android and iOS will be supported, although other mobile platforms may be specified during design reviews.	CDRL 23-1
23.1.1-4	Backwards compatibility with no less than three required OS versions will be maintained as new platform versions are released, unless otherwise specified by the MTA.	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.1-5	The Source Code for NFPS Mobile Applications will be written to maintain portability to alternative mobile phone platforms.	CDRL 23-1
23.1.1-6	The SI, or approved Subcontractor, shall develop and provide for the NFPS Mobile Applications all required servers, databases, services and connections to the NFPS Backend to ensure the functionality specified in this Technical Specifications Section 23.1.1 (Mobile Platform Requirements).	CDRL 23-1
23.1.1-7	The SI-provided Mobile Hosting Services will have the same redundancy requirements as the NFPS Back Office (see Technical Specifications Section 24 (Hosting)) and will satisfy the performance requirements in Technical Specifications Section 5.14 (Performance Requirements).	CDRL 23-1
23.1.1-8	The NFPS Mobile Applications will be able to support concurrent users specified in Technical Specifications Section 6.1.1 (Account-Based System). The NFPS Mobile Applications will be scalable to support growth based on increasing adoption of the application.	CDRL 23-1
23.1.1-9	The NFPS Mobile Applications will utilize the same login/password information as the Customer Website (see Technical Specifications Section 22.2 (Customer Website)). Customers will have their personalized Account Information and settings synchronized between the Customer Website and NFPS Mobile Applications, as applicable.	CDRL 23-1

23.1.2 Application Distribution

Req. #	Requirement	Assigned CDRL(s)
23.1.2-1	The SI will provide standalone versions of the NFPS Mobile Applications for testing and pilot purposes prior to public release. To support this, development environments shall be maintained separately from the production environment.	CDRL 23-1
23.1.2-2	<p>The SI will test, submit, and manage the submittal of all NFPS Mobile Applications to respective application stores, such as:</p> <ul style="list-style-type: none"> • Apple App Store • Google Play Store <p>All NFPS Mobile Applications will be free, and submitted to the MTA for approval prior to submission and comply with each NFPS Agency's requirements.</p>	CDRL 23-1
23.1.2-3	Software Updates will be provided as required to address bug fixes, performance issues, and missing functionality. Software Updates will also incorporate feedback from the public and each NFPS Agency.	CDRL 23-1

23.1.2-4	The MTA retains the right to assume application store management for all NFPS Mobile Applications, and manage end user comments as appropriate.	CDRL 23-1
23.1.2-5	The SI shall provide standalone versions of each NFPS Mobile Applications that can be installed directly without access to a handsets app store, subject to each phone's "side loading" capability.	CDRL 23-1
23.1.2-6	Third Party firms that specialize in mobile application security and testing will be utilized to ensure application performance and end to end security on a variety of devices, including PCI compliance.	CDRL 23-1

23.1.3 Mobile Design Requirements

Req. #	Requirement	Assigned CDRL(s)
23.1.3-1	The NFPS Mobile Applications will adhere to the general Aesthetic and User Interfaces requirements in Technical Specifications Section 5.10 (Aesthetic Requirements and User Interfaces) in addition to the requirements in this Technical Specifications Section 23.1.3 (Mobile Design Requirements).	CDRL 23-1
23.1.3-2	The NFPS Mobile Applications will be subject to the MTA's review and approval of design and branding.	CDRL 23-1
23.1.3-3	The mobile user interface, instructions and selection keys will be easy to read, understand and use. Text will have a high contrast color to its background to ensure legibility.	CDRL 23-1
23.1.3-4	The NFPS Mobile Applications will follow all applicable ADA, Title VI and accessibility guidelines, including: <ul style="list-style-type: none"> • iOS Developer Accessibility Programming Guide • Android Developer Accessibility 	CDRL 23-1
23.1.3-5	The NFPS Mobile Applications screen layouts will be designed for intuitive navigation and minimal UI elements to avoid customer confusion. The SI shall provide detailed screen flows depicting wireframes and, at appropriate stages of design, mock-ups of each screen layout arranged as a logical flow chart for the MTA's review and approval. All design elements will be subject to the MTA's approval during design reviews.	CDRL 23-1
23.1.3-6	The NFPS Mobile Applications will be developed using an agile or iterative design process, whereby design requirements are continually refined and improved with agency feedback. Wireframes and mockups will be utilized and updated during the iterative design process.	CDRL 23-1
23.1.3-7	NFPS Mobile Applications testing will employ ongoing end-user testing with an established test group to validate display and operation across all supported platforms prior to the release of any changes. If specialized design and/or user interface firms are employed, the MTA will be able to access firm resources and design data, including mockups and test results.	CDRL 23-1

23.1.4 Mobile Security Requirements

Req. #	Requirement	Assigned CDRL(s)
23.1.4-1	The NFPS Mobile Applications will adhere to the security requirements set out in the Contract Documents, including those in Technical Specifications Section 5.7 (System Security) and as otherwise set out in this Technical Specifications Section 23.1.4 (Mobile Security Requirements).	CDRL 23-1
23.1.4-2	The NFPS Mobile Applications and related Data will be secured from unauthorized access or use from client devices, including protected from viruses and malware.	CDRL 23-1
23.1.4-3	The security features of the NFPS Mobile Applications will be maintained and all security issues will be addressed as they arise. Software Updates, including Operating System updates, Software patches, bug notifications, and refinements to address identified security issues will be provided.	CDRL 23-1
23.1.4-4	Data transmission between the NFPS Mobile Applications and servers will be secured using TLS or equivalent strong encryption protocol.	CDRL 23-1
23.1.4-5	PII (including Payment Card Data) stored by the NFPS Mobile Applications will be secured from unauthorized access or use through strong encryption methodologies, i.e., AES, TDES or equivalent technologies.	CDRL 23-1
23.1.4-6	In accordance with the security requirements in Technical Specifications Section 5.7 (System Security), the NFPS Mobile Applications will be fully compliant with all applicable PCI and EMV standards. The SI shall provide continual updates throughout the Warranty Period, plus potential options, to maintain compliance as new versions of the security standards are published.	CDRL 23-1

23.1.5 Mobile Account Management Requirements

Req. #	Requirement	Assigned CDRL(s)
23.1.5-1	<p>The NFPS Mobile Applications will provide the account management features available in the ATP in Technical Specifications Section 20.2 (Account-Based Transaction Processor) including:</p> <ul style="list-style-type: none"> • Creation of a new Transit Account • Registration of Customer Account • Loading of value and Fare Products to a Transit Account • Immediate availability of Transit Account balance and status • Viewing of Closed-Loop Transit Account balances and transaction history • Setup and maintenance of Autoload (see Technical Specifications Section 9.1.3 (Autoload)) • Setup and maintenance of Mail&Ride (see Technical 	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
	<p>Specifications Section 3.2.4.3 (Mail&Ride))</p> <ul style="list-style-type: none"> Cancel purchased fares (within the NFPS Agencies' cancellation policies, on an NFPS Agency-specific basis) <p>Details of account management features and design will be determined during design reviews.</p>	
23.1.5-2	All account management functions available in the Customer Website (see Technical Specifications Section 22 (NFPS Websites)) will be available in the NFPS Mobile Applications. The NFPS Mobile Applications will provide improved performance, user interface and account management with access to the mobile phone's features and internal memory.	CDRL 23-1
23.1.5-3	All account changes made on the NFPS Mobile Applications will occur in real-time or near real-time to the NFPS Backend such that users will be able to add value to their Transit Account immediately prior to payment via Frontend NFPS Equipment.	CDRL 23-1
23.1.5-4	Logging in to a registered Customer Account will require a password. The NFPS Mobile Applications will retain login until a user logs out or changes Customer Accounts, or a period of time (configurable by each NFPS Agency, on an NFPS Agency-specific basis) passes after which a customer must re-enter their password. Users will be able to change Customer Accounts by switching Customer Accounts and re-entering the Customer Account password. Login will be supported using MTA-specific credentials and potentially third-user authentication/login services, such as Facebook, Google and Amazon.	CDRL 23-1
23.1.5-5	The user may choose to utilize an authentication method (PIN, fingerprint, etc.) to access the NFPS Mobile Applications, (separate from the account password) that is required each time the NFPS Mobile Applications are opened. The PIN will be stored securely and may be changed.	CDRL 23-1
23.1.5-6	The NFPS Mobile Applications will support all Fare Products and structures specified in Technical Specifications Section 7.3 (Fare Structure and Pricing), and support the modification of available Fare Products by the NFPS Agencies' administrators, with such modification available on an NFPS Agency-specific basis.	CDRL 23-1
23.1.5-7	Account management features will be available to registered Customer Accounts. The NFPS Mobile Applications will support switching between multiple Customer Accounts (by logging off and on), and multiple Media per Customer Account.	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.5-8	The NFPS Mobile Applications will provide limited functionality in areas without cellular service, or where internet service is intermittent. A clear message will indicate that limited functionality is available due to no internet connection. Real-time account management will not be available, but purchase history, transaction history and static account information will be available. Details of offline functionality will be determined during design reviews.	CDRL 23-1
23.1.5-9	<p>The NFPS Mobile Applications will accept the following payment methods, including:</p> <ul style="list-style-type: none"> • Visa, MasterCard, American Express and Discover credit cards and their mobile wallet equivalents • Visa, MasterCard, American Express and Discover debit cards and their mobile wallet equivalents • Automated Clearing House (ACH) • In-app payments (e.g., PayPal, Android Pay, Apple Pay) <p>Other payment types may be defined during design reviews. Storage and access to payment information will follow the security requirements in Technical Specifications Section 5.7 (System Security).</p>	CDRL 23-1
23.1.5-10	Payment transactions on the NFPS Mobile Applications will be processed through the SI-provided Payment Application, or one of the MTA acquirers or processors. All testing and certification of the acquirer or processor Interface will be performed by the SI.	CDRL 23-1
23.1.5-11	Customer account notifications and receipts will be automatically reflected in their online account, and customers can have the option to receive push notifications or receipts after purchases via email and text.	CDRL 23-1
23.1.5-12	<p>The NFPS Mobile Applications will include a function for users to manage their account registration details, similar to the Customer Website (see Technical Specifications Section 22 (NFPS Websites)). These functions include, but are not limited to:</p> <ul style="list-style-type: none"> • Add/delete/modify email address and contact information • Retrieve/modify password • Add/delete/modify payment instruments • View active accounts • View transactions • Retrieve/view receipts • Setup favorite locations, routes or stations • Setup notifications (email/phone notifications) for usages, account status and expiration reminders <p>The final set of account management functions will be specified during design reviews.</p>	CDRL 23-1

23.1.6 Mobile Contactless Payment Requirements

Req. #	Requirement	Assigned CDRL(s)
23.1.6-1	The NFPS Mobile Applications will have the capability to directly validate a Fare Product or deduct stored value using a smartphone or other device (e.g., wearables, etc.) via an NFC or equivalent Contactless interface compatible Field Device. A smartphone without NFC or equivalent Contactless interface may be able to utilize external NFC hardware to support payment functionality.	CDRL 23-1
23.1.6-2	The payment feature will allow the smartphone to be used as Media, without a separate Contactless Card. All account management functions specified in Technical Specifications Section 23.1.5 (Mobile Account Management Requirements) shall be available, with the smartphone acting as the Media.	CDRL 23-1
23.1.6-3	The NFC interface on the smartphone may operate in any mode required to achieve payment functionality, including reader/writer, peer-to-peer and card emulation.	CDRL 23-1
23.1.6-4	The direct pay function shall be available for all NFC compatible mobile platforms, including iOS and Android. Future devices with NFC capabilities will have the direct pay function enabled via NFPS Mobile Applications updates.	CDRL 23-1
23.1.6-5	Direct payment with the smartphone will require a separate Transit Account, limited to one direct pay account per phone. Existing accounts associated with cards will not have the smartphone direct-pay feature, to prevent duplicate pass use. The account management of other registered Media will be possible by the logout/login function specified in Technical Specifications Section 23.1.5 (Mobile Account Management Requirements).	CDRL 23-1
23.1.6-6	The direct pay account on the phone will be distinct and separate from other registered Transit Accounts in the NFPS Mobile Applications, as shown in Technical Specifications Figure 22.1. The direct pay functionality will be tied to each phone, subject to Business Rules determined during design reviews.	CDRL 23-1
23.1.6-7	The account credential used for direct pay will be secured and protected via a secure element or other equivalent method (such as Host Card Emulation, HCE) to prevent duplication or unauthorized access. The SI shall provide a security architecture plan that includes payment credential storage and provisioning plans.	CDRL 23-1
23.1.6-8	The direct pay function will work without an active internet connection, and will be functional in typical subways conditions. Limited functionality constraints may be put in place to minimize risk, such as allowing existing Fare Products/value to be used but not adding new Fare Products. Details will be determined during design review.	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.6-9	The mobile payment credential shall be available for the MTA and authorized Third Parties to use in other applications if required. Security methods regarding transfer and storage shall be provided.	CDRL 23-1
23.1.6-10	Other validation interfaces, such as Bluetooth low energy and visual barcode validation (see Technical Specifications Section 23.1.7 (Mobile Visual/Optical Validation Capability)) shall be possible to add/incorporate. The validation interface (NFC, BLE, barcode) shall be a separate and secure layer that interfaces with the core mobile payment engine in this Technical Specifications Section 23.1.6 (Mobile Contactless Payment Requirements).	CDRL 23-1
23.1.6-11	The direct payment feature will be available for Closed-Loop Transit Accounts only. Open-Loop mobile wallets (Apple Pay, Android Pay) shall be functional alongside the NFPS Mobile Applications.	CDRL 23-1
23.1.6-12	The direct payment feature will also support reduced-fare accounts and the displaying of a photograph and other reduced-fare identification within the NFPS Mobile Applications. The registration of a reduced-fare direct-pay account will be secure and prevent duplication or other types of fraud. Final details of the reduce-fare process will be determined during design reviews.	CDRL 23-1
23.1.6-13	Bluetooth low energy and other wireless proximity technologies may be used to launch the mobile payment application, provide payment or wayfinding instructions, or setup a phone to perform a mobile payment.	CDRL 23-1

23.1.7 Mobile Visual/Optical Validation Capability

Req. #	Requirement	Assigned CDRL(s)
23.1.7-1	The NFPS Mobile Applications will have the capability to display a “virtual ticket” for visual and optical validation of payment, including display of 1D or 2D (Aztec or QR) barcodes.	CDRL 23-1
23.1.7-2	Visual and optical validation will be able to be activated for the NFPS Agencies, Linked NFPS Entities, or other regional partners, including commuter rail, suburban bus and ferry services (see Technical Specifications Section 4.4 (NFPS Agencies and Linked NFPS Entities)), with such activation on an NFPS Agency-specific basis. The ability to launch other related applications, including affiliate applications, will be possible.	CDRL 23-1
23.1.7-3	Visual and optical validation will be an extension of the Closed-Loop direct payment function.	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.7-4	Ticket activation will be able to occur in areas of limited or no cellular service. When service is restored, backend notification of activation will occur immediately. A clear message will indicate that limited functionality is available due to no service. Details of offline functionality will be determined by the MTA during Design Review.	CDRL 23-1
23.1.7-5	The information provided in the displayed barcode will provide enough information to be validated by an industry standard 2D barcode reader (see Technical Specifications Section 35.5 (Optical Barcode Readers)) within the performance and security requirements specified in Technical Specifications Section 5 (General Design Requirements).	CDRL 23-1
23.1.7-6	<p>The NFPS Mobile Applications will contain a variety of security features to minimize fraud and prevent use of invalid, expired or fraudulent barcodes. These features will include, but are not limited to:</p> <ul style="list-style-type: none"> • Real-time server and local device (subject to Design Review) authorization of barcodes upon scanning • Animated screens to prevent screenshot fraud • Dynamically generate barcodes that change periodically (with the period configurable) • Dynamically generate colors or text that change periodically • Randomly generated codes that accompany barcodes • Manual screen response on validation screens to prevent recording video fraud • Periodic device authentication to validate that an NFPS Account is linked to only one device at a time • Disabling of the app if out of communication for a configurable period of time <p>These security features will be available in offline mode, and will be subject to approval by the MTA.</p>	CDRL 23-1
23.1.7-7	In order to optimize mobile displays for visual and optical validation, when the barcode is shown the NFPS Mobile Applications will be able to increase the barcode image size, rotate-lock the screen, and set to 100 percent brightness (or optimal level to be set during design reviews). The previously set brightness will return after validation or next screen.	CDRL 23-1
23.1.7-8	Additional NFPS Backend fraud detection capabilities will include velocity checking, and immediate identification of Media tied to duplicate accounts.	CDRL 23-1
23.1.7-9	The visual and optical validation feature of the NFPS Mobile Applications shall be configurable by each NFPS Agency (on an NFPS Agency-specific basis) to be activated or deactivated at a later date.	CDRL 23-1

23.1.8 Other Mobile Features

Req. #	Requirement	Assigned CDRL(s)
23.1.8-1	<p>The NFPS Mobile Applications will include a “help” section containing customer service features such as:</p> <ul style="list-style-type: none"> • Frequently Asked Questions (FAQ) • Application help screens • Tutorial that walks through NFPS Mobile Applications features upon installation or major upgrade • Terms and Conditions • Application information (version, build, etc.) • Device Information (OS version, manufacturer, etc.) • The NFPS Agencies' and the Linked NFPS Entities' contact information • Ability to submit issues/bugs/application feedback 	CDRL 23-1
23.1.8-2	<p>The NFPS Mobile Applications will include a “settings” or “preferences” section that will allow the users to modify application specific settings related to configurable features, security features (PIN), payment instruments, primary routes/stations and notifications.</p>	CDRL 23-1
23.1.8-3	<p>The NFPS Mobile Applications will include a Retail Merchant Locator that provides the five nearest locations based on the mobile device’s GPS location or an entered address or ZIP code.</p>	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.8-4	<p>The NFPS Mobile Applications will include the following non-fare functions and integration with existing NFPS Agency mobile services, including:</p> <ul style="list-style-type: none"> • Trip planning capabilities • Fare prices and calculators • Service alerts, including existing alert feeds and NFPS specific alerts • Service Maps (searchable by mode, route, and line) • Station information and alerts (including escalator/elevator status, construction and service information) • Nearest bus stop, subway and rail locations • Schedules (searchable by mode, route and line) • Real-time arrivals (e.g., for each NFPS Agency, including: MTA Bus Time, MNR Train Time and LIRR Train Time) • Social media feeds and input • Customer feedback tools • Security alerts and feedback (See Something/Say Something) • Special deals/offers, loyalty programs and local coupons • Information from related services including parking information, Citi Bike locations and affiliate schedules • In-app advertising provided by the MTA or the MTA's Third Party contractor <p>Features that are provided by existing NFPS Agency Mobile Applications and services will be implemented as priority to ensure continuity of customer experience. The final NFPS Mobile Applications features will be determined during design reviews, and may require appropriate data feeds from the NFPS Agencies and the Linked NFPS Entities.</p>	CDRL 23-1
23.1.8-5	<p>Bluetooth Low Energy and other wireless proximity technologies may be used for non-payment or passive purposes, including: launching the NFPS Mobile Applications, displaying instructions, or launching an agency website.</p>	CDRL 23-1
23.1.8-6	<p>The features listed in this Technical Specifications Section 23.1.8 (Other Mobile Features) will be provided for the NFPS Agencies and expanded to support mobile ticketing for other Linked NFPS Entities.</p>	CDRL 23-1
23.1.8-7	<p>It will be possible to link to other agency, affiliate and third party mobile applications, as well as provide links to specific pages inside the NFPS Mobile Applications.</p>	CDRL 23-1

Req. #	Requirement	Assigned CDRL(s)
23.1.8-8	The NFPS Mobile Applications shall integrate seamlessly with other MTA and MTA-approved Third Party mobile applications. The SI shall work directly with MTA developers and/or Third Party contractors to integrate with other MTA and MTA-approved Third Party applications using open APIs. Linking to other Third Party applications is not a substitution for developing the required functions of the NFPS Mobile Applications.	CDRL 23-1

23.2 Onboard Sales and Validation Devices

23.2.1 Onboard Sale and Validation Device Software Requirements

MNR and LIRR onboard crews historically use handheld devices (called Ticket Issue Machines (TIMs), Onboard Ticket Issue Machines (OBTIMs) and Station Ticket Issue Machines (STIMs)) to sell and validate tickets. Current handheld units accept payment using cash, credit and debit (no PIN). They issue receipts for payments as well as "Invoices for Fare Not Paid" for customers who are unable to purchase tickets. These hand held devices are historically COTS mobile phones connected to a sled and portable printer which are carried by the crew member at all times, as well as by customer service agents and other staff to provide sales and customer service functions.

As part of the NFPS, these legacy handheld devices will be replaced with a single Onboard Sales and Validation Device (OSVD). The SI shall provide the Software to manage onboard sales, validation, and printing functions (the "**OSVD Software**") that will be used in connection with MTA-provided COTS OSVD hardware (the "**OSVD Hardware**"). The MTA will also supply the mobile wireless service. The SI shall be responsible for ensuring that the OSVD functionality set out in these Contract Documents is met except to the extent that such functionality relates exclusively to the MTA-provided OSVD Hardware. By way of clarification, and not limitation, the SI shall be responsible for ensuring that the OSVD Software permits the OSVD to provide the functionality described in req. # 23.2.6-2.

Following the Open Architecture principles described in Technical Specifications Section 5.4 (Open Technology) the SI shall develop all necessary OSVD Software to integrate the MTA-supplied OSVDs into the NFPS, and to otherwise ensure that the OSVDs perform as contemplated in these Contract Documents, including in Technical Specifications Section 23.2 (Onboard Sales and Validation Devices). By way of clarification, and not limitation, OSVD Software shall be considered NFPS Software for all purposes, including for purposes of compliance with all requirements applicable to NFPS Software.

Req. #	Requirement	Assigned CDRL(s)
23.2.1-1	Open Source Software shall be used to the greatest extent possible in the design and deployment of OSVD Software. To the extent that the use of Open Source Software is not feasible, the SI shall use COTS Software to the greatest extent possible in the design and deployment of the OSVD Software. To the extent possible, all parameters, values, and rules will be configurable and downloadable by each of the MTA, MNR, and LIRR from the NFPS Backend, with such functionality available on an agency-specific basis.	CDRL 23-2
23.2.1-2	The SI shall supply, design, configure, test, and deploy all OSVD	CDRL 23-2

Req. #	Requirement	Assigned CDRL(s)
	Software in compliance with standards as listed in Technical Specifications Section 5.15 (Codes, Regulations & Reference Standards). The SI shall test and install all Software necessary for OSVD operation that successfully provides adherence to the specifications and performance requirements herein.	
23.2.1-3	As delivered to the MTA, the OSVD Software shall have the capacity to support transaction volumes described in Technical Specifications Section 3 (Existing System Description).	CDRL 23-2
23.2.1-4	The OSVD Software shall meet all applicable requirements stipulated in Technical Specifications Section 5.12 (NFPS Software Requirements).	CDRL 23-2
23.2.1-5	The OSVDs (i.e., the hardware itself) will be supplied by the MTA using commercially available mobile phones/sleds. The SI shall be responsible for integrating such OSVD Hardware into the NFPS. The SI will support OSVD Software refreshes every 3 to 5 years or when required to meet security requirements set out in these Contract Documents (PCI, etc.).	CDRL 23-2
23.2.1-6	The OSVD Software will be designed to maximize battery life, enabling a minimum of eight (8) hours of use on a single charge.	CDRL 23-2
23.2.1-7	OSVD Software Updates will be centrally managed and fully regression tested prior to installation. The OSVDs shall be able to roll-back to previous OSVD Software Versions without adversely impacting operations.	CDRL 23-2
23.2.1-8	The SI shall submit a description of the OSVD Software, depicting all functions and transaction flows, for the MTA's review and approval. Functions and parameters that currently exist within the current TIMs/OBTIMs/STIMs devices will be duplicated or replaced with like functionality as determined by the MTA during Design Review.	CDRL 23-3
23.2.1-9	The SI shall submit a complete listing of all variable operational parameters for the OSVD Software for the MTA's review and approval.	CDRL 23-3
23.2.1-10	The OSVD Software will adhere to the general design requirements in Technical Specifications Section 5 (General Design Requirements), especially those pertaining to: <ul style="list-style-type: none"> • Aesthetic Requirements and User Interfaces • System Security • Open Technology • Software Requirements • Performance Requirements • Codes, Regulations & Reference Standards 	CDRL 23-2
23.2.1-11	The OSVD Software will be developed as a native application for one of the major mobile platforms as selected by the MTA during design review. Proposed platforms will be determined by the MTA during design review.	CDRL 23-2

Req. #	Requirement	Assigned CDRL(s)
23.2.1-12	Backwards compatibility with at least the four previous OS versions will be maintained as new platform versions are released, unless otherwise specified by the MTA.	CDRL 23-2
23.2.1-13	The Source Code for the OSVD Software will be written to maintain portability to alternative mobile phone platforms.	CDRL 23-2
23.2.1-14	The SI, or approved Subcontractor, shall develop and provide for the OSVD Software all required servers, databases, and services within the NFPS Backend to ensure the functionality specified in this Technical Specifications Section 23.2 (Onboard Sales and Validation Devices).	CDRL 23-2
23.2.1-15	The OSVD Software and NFPS interfaces will be designed to support a minimum 2,000 concurrent OSVD users.	CDRL 23-2
23.2.1-16	The OSVD Software will support secure sign in of NFPS Agency employees to the OSVD including their ID, password, and job number if required. The OSVD Software will support fingerprint login and authentication utilizing native mobile OS features.	CDRL 23-2
23.2.1-17	The NFPS Backend, will import the most current crew scheduling train crew book assignment list for both MNR and LIRR (updated approximately four times per year by the NFPS Agencies) from the designated crew software system for download to the OSVD. This will facilitate, using an OSVD, line/branch and station information selection targeted to a particular job. Details of selection and flow will be determined by the MTA during design review.	CDRL 23-2
23.2.1-18	The OSVD Software will be capable of selling all MNR and LIRR Fare Products distributed on Paper Media, including barcoded Media, as configured based on the user ID.	CDRL 23-2
23.2.1-19	The OSVD Software will enable OSVDs to electronically validate Fare Media through scanning of a barcode or using NFC. BLE will be supported to facilitate the launching of customer applications and similar uses to streamline workflow.	CDRL 23-2
23.2.1-20	Onboard sales and validation transactions shall be capable of being associated with a Transit Account. The OSVD will use the Transit Account Management API as necessary to achieve the association between onboard sales and validation transactions and Transit Accounts.	CDRL 23-2
23.2.1-21	The OSVD Software will support the acceptance of multiple payment methods for the sale of Fare Products, including cash, credit/debit cards, pre-paid cards, NFPS stored value, IOU (Promise to Pay), credit value associated with validated Fare Products (upgrade fares), and split payments across all of these payment methods. The OSVD Software will also support Open Payments (Fare Product sale and validation in single transaction) if desired in the future.	CDRL 23-2

Req. #	Requirement	Assigned CDRL(s)
23.2.1-22	The OSVD Software will support a close shift function that can be performed manually by a user, or automatically on a configurable basis. The close shift function will allow the user to enter comments about the shift, and will generate a transaction report that can be displayed, printed, and e-mailed. Screen flows will be determined during design review.	CDRL 23-2
23.2.1-23	The NFPS will support the sending of push notifications to OSVD users from an SI-provided central management tool. Messages will be able to be sent to specific logged in users, or as a blast to all users. The instances and frequency at which messages are displayed will be configurable, and read receipts will be generated and captured by the system.	CDRL 23-2
23.2.1-24	The NFPS will support detailed revenue control reporting associated with OSVD sales and validations. Up to twenty-five (25) reports will be able to be defined by MNR and LIRR during design review.	CDRL 23-2

23.2.2 Fare Tables

Req. #	Requirement	Assigned CDRL(s)
23.2.2-1	The OSVD Software will be designed to accommodate MNR's and LIRR's existing fare structure and other fare policies defined in Technical Specifications Section 7 (Fare Policies).	CDRL 23-2
23.2.2-2	Fare tables used by the OSVDS will be configurable by MNR and LIRR (each on an NFPS Agency-specific basis) from the NFPS Backend, and will include selectable parameters including, but not limited to, fare table selection by: <ul style="list-style-type: none"> • Station • Line • Specific NFPS Agency • Onboard or platform use • Others as determined by the MTA during design review 	CDRL 23-2
23.2.2-3	When new fare tables are created in the NFPS Backend, it will be possible to download such fare tables from the NFPS Backend to the OSVDs via the cellular communications link. New fare tables will also be transferable onto removable storage media for import into the OSVDs.	CDRL 23-2
23.2.2-4	Once fare tables are downloaded into the OSVD, the new fare table will be activated automatically or use an activation date depending on parameters configured in the NFPS Backend by each of the MNR and LIRR, on an agency-specific basis.	CDRL 23-2
23.2.2-5	The OSVD Software will allow the OSVDs to alert crews to stations with CVMs that are down or functioning in degraded mode. If CVMs are not available at a particular station, fares will automatically calculate as the lower, station fare. This ability to automatically calculate station fares will be configurable by, and available to, either MNR or LIRR or both.	CDRL 23-2

23.2.3 OSVD Screen Flow

Req. #	Requirement	Assigned CDRL(s)
23.2.3-1	The progression of screens presented to onboard crew personnel during transactions will be logical and straightforward.	CDRL 23-3
23.2.3-2	The SI shall provide screen flows via wireframes and, at appropriate stages of design, detailed mock-ups of each screen layout arranged as logical flow diagrams for the MTA's review and approval. All design elements will be subject to the MTA's approval during design reviews.	CDRL 23-3
23.2.3-3	Similar to fare tables, schedule data will be downloaded from the NFPS Backend to the OSVDs via the cellular communications link. The OSVD Software will use the schedule data to allow the user to select their train or station. The OSVD Software will use this data in a streamlined sales process design, which will be reviewed and approved by the MTA during design review.	CDRL 23-3

23.2.4 Bank Card Processing Unit

The OSVD Software will accommodate processing of bank cards for the purchase/validation of fares through a swipe reader, EMV Contact card reader and EMV Contactless card reader.

Req. #	Requirement	Assigned CDRL(s)
23.2.4-1	The bank card components will be attached to the OSVD and will be supplied by the MTA. The expectation is that the provided NFPS solution will work with the existing bank card component hardware (Infinite Peripherals LP5/LP6 2D PCI Sled). If this hardware is not compatible, or during future hardware refreshes, then the MTA will work with the SI to select compatible hardware components.	CDRL 23-2
23.2.4-2	The OSVDs will make use of the Fare Payment API for processing bank card payments.	CDRL 23-2
23.2.4-3	The bank card transaction will be processed through the NFPS and the MTA Merchant Acquirer.	CDRL 23-3

23.2.5 OSVD Processing Transaction Procedures

Req. #	Requirement	Assigned CDRL(s)
23.2.5-1	The OSVDs will generate, store and forward to the NFPS Backend a discrete data record for each transaction performed. The OSVD will immediately transmit each transaction record to the NFPS Backend upon completion of the transaction. When communications with the NFPS Backend are disabled, the OSVD will transmit Transaction Data as soon as communications are restored. This ability to store and forward will be configurable by each of the MTA, MNR and LIRR, on an agency-specific basis.	CDRL 23-2
23.2.5-2	Each transaction record will be unique within the NFPS and will include the following information, at a minimum: <ul style="list-style-type: none"> • Date and Time of transaction • User ID and Name • OSVD ID • Direction (if applicable) • Media Type ID • Transit Account number • Third Party account number (if applicable) • Action performed • Transaction value • Transaction number (which will be unique per day per device) • Machine Sequence number 	CDRL 23-3
23.2.5-3	The OSVDs will, within the limitations of the hardware provided by the MTA, store three (3) days of fare payment transactions, and all Risk Mitigation lists as determined during design review.	CDRL 23-2
23.2.5-4	The OSVDs will, within the limitations of the hardware provided by the MTA, be capable of supporting storage of sales and Transaction Data in Non-Volatile Memory. OSVDs will continuously retain sales and Transaction Data records for the current and at least three (3) previous days in the primary and secondary Non-Volatile Memory.	CDRL 23-2

23.2.6 Events Data and Device Monitoring

As part of the Device Monitoring System, the OSVD will provide real-time OSVD status of device errors and events, using the Device Management API (see Technical Specifications Section 6.4.6 (Device Management APIs)). The Onboard Sales and Validation Device will also maintain local event and error logs in the event that communications to the NFPS Backend is unavailable.

23.2.6-1	<p>Each event record will include, at minimum:</p> <ul style="list-style-type: none"> • Date and Time of event • OSVD ID as assigned by the NFPS Backend configuration. • Other unique identifier such as the IMEI, MEID, or ESN. 	CDRL 23-3
23.2.6-2	The OSVD will display service status messages and post messages to the OSVD display screen with different levels of priority.	CDRL 23-2
23.2.6-3	<p>At a minimum, the OSVD will generate, store and forward to the NFPS Backend an event record for each of the following events:</p> <ul style="list-style-type: none"> • Power On • Power On Self-Test complete • Power On Self-Test failure • Power Off • Maintenance parameter changed, including parameter and new value • Default fare (service level) changed, including new fare set • End of transit business day • Communication between the NFPS Backend and OSVD failed • Communication between the NFPS Backend and OSVD restored • New downloaded list(s) received, including list type and version number • New downloaded list(s) activated, including date/OSVDs of activation, list type, and version number • New fare table received, including version number • New fare table version activated, including date/OSVDs of activation and version number • New Software Version received, including Version number • New Software activated, including date/OSVDs and Version number • New configuration Data received, including Version number • New configuration Data activated, including date/OSVDs and version number • Internal clock reset for an OSVD discrepancy greater than 1 minute • Data memory nearing capacity (data near full percentage will be configurable) • Data memory full • OSVD unscheduled reset • Other Errors and Failures as will be applicable and determined by the MTA during Design Reviews 	CDRL 23-3

23.2.6-4	Duration of OSVD stored event records will be configurable by each of the MTA, MNR, and LIRR, on an agency-specific basis. The OSVD Software will have capacity to store a minimum of 1,000 event records. Configuration control parameters will have the ability to turn off recording of events at the discretion of each of the MTA, MNR, and LIRR, on an agency-specific basis.	CDRL 23-2
23.2.6-5	As part of the Technical and Software Support Services, the SI shall provide all assistance requested by the MTA in connection with any root cause analyses relating to OSVD Hardware that the MTA performs.	CDRL 23-2

23.2.7 Non-Payment Management, Tracking and IOU issuance

Req. #	Requirement	Assigned CDRL(s)
23.2.7-1	In the event of non-payment, OSVDs will be able to gather customer information and the amount of the fare owed as an IOU transaction for tracking purposes.	CDRL 23-3
23.2.7-2	Customer information can be gathered by scanning a registered Transit Account credential, scanning a driver's license, or manual entry.	CDRL 23-2
23.2.7-3	When an IOU transaction is generated, the outstanding debt will be recorded in the CRM System (see Technical Specifications Section 21.4 (Customer Relationship Management)) against the customer's account. If no customer account exists, one will be created based on the customer information captured by the OSVD. The debt will also be recorded as a receivable against that customer in the Financial Clearing & Settlement System (see Section Technical Specifications Section 21.6 (Financial Clearing & Settlement System)). Methods of clearing the receivable will be determined during design review.	CDRL 23-2
23.2.7-4	The OSVD will have the capability of blocking issuance of additional IOUs if an IOU is outstanding for a customer whose information is on record. The OSVD will alert the onboard staff (see req. # 20.8-1). This may be via a local list and/or online as determined by the MTA during Design Review.	CDRL 23-2
23.2.7-5	Handling of other IOU data within the NFPS Backend will be determined by the MTA during Design Review.	CDRL 23-2

23.2.8 Ticket and Receipt Printing

Req. #	Requirement	Assigned CDRL(s)
23.2.8-1	OSVDs will support printing of tickets, receipts, and IOUs on rolled receipt paper with formats as determined by the MTA during Design Review.	CDRL 23-2
23.2.8-2	After printing, the OSVD Software shall be capable of allowing user to confirm printing was successfully completed or select to reprint.	CDRL 23-2

23.2.9 Refunds and Reversals

Req. #	Requirement	Assigned CDRL(s)
23.2.9-1	For refund or error correction purposes, the OSVD will provide operators the ability to reverse the last replenishment transaction performed to a Transit Account if: <ul style="list-style-type: none"> • The same OSVD conducted the replenishment transaction • The transaction occurred within an MNR- and LIRR-configurable period (initially set to five (5) minutes, and configurable on an agency-specific basis) • The Transit Account has no usage transactions since the replenishment 	CDRL 23-2
23.2.9-2	Reversal transactions will require the deletion of the relevant Fare Product or deduction of the value added from the Transit Account during the replenishment transaction.	CDRL 23-2
23.2.9-3	The OSVD will fully record and transmit to the NFPS Backend all reversal transactions.	CDRL 23-2

23.2.10 Mobile Security Requirements

Req. #	Requirement	Assigned CDRL(s)
23.2.10-1	The OSVD will adhere to the security requirements set out in the Contract Documents, including those in Technical Specifications Section 5.7 (System Security) and as otherwise set out in Technical Specifications Section 23.2.9 (Mobile Security Requirements).	CDRL 23-2
23.2.10-2	The OSVD Software and related Data will be secured from unauthorized access or use from client applications or devices, including protection from viruses and malware.	CDRL 23-2
23.2.10-3	The SI shall maintain all security features of the OSVD Software and address all OSVD Software issues that arise throughout the Term as part of the Technical and Software Support Services. Software Updates, including Operating System updates, Software patches, bug notifications, and refinements to address identified security issues will also be provided by the SI as part of the Technical and Software Support Services.	CDRL 23-2
23.2.10-4	Data transmission between the OSVDs and NFPS Backend will be secured using strong encryption protocols.	CDRL 23-2
23.2.10-5	PII (including Payment Card Data and driver's license information) stored by the OSVD will be secured from unauthorized access or use through strong encryption methodologies. The SI acknowledges that the OSVDs collect PII and, in addition to the other requirements set out herein, the SI shall ensure that the OSVD Software (and the OSVD itself) collects, transmits, stores, uses, protects, and destroys all such PII in compliance with Applicable Law and Good Industry Practice.	CDRL 23-2

Req. #	Requirement	Assigned CDRL(s)
23.2.10-6	In accordance with the security requirements in Technical Specifications Section 5.7 (System Security), the SI shall ensure that OSVD Software is fully compliant with all applicable PCI and EMV standards. The SI shall provide continual OSVD Software Updates throughout the Software Warranty Period and as part of the Technical and Software Support Services to maintain compliance as new versions of the security standards are published.	CDRL 23-2

23.2.11 Onboard Sales and Validation Devices Required Submittals

The required submittals specified in this Technical Specifications Section 23.2 (Onboard Sales and Validation Devices) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference				
			CDR	PDR	FDR	Other
CDRL 23-1	Mobile Application Requirements	Section 23.1	✓	✓	✓	
CDRL 23-2	Onboard Sales and Validation Device Software and Security Design and Configuration	Sections 23.2.1, 23.2.2, 23.2.4, 23.2.5, 23.2.6, 23.2.7, 23.2.9	✓	✓	✓	
CDRL 23-3	Onboard Sales and Validation Device Transaction and Maintenance Process Flows	Sections 23.2.1, 23.2.3, 23.2.4, 23.2.5, 23.2.6, 23.2.7		✓	✓	

24 Hosting

A fully functioning and available NFPS Backend is mission critical to NFPS operations. The SI shall provide turnkey Hosting Services for comprehensive, redundant, secure, highly available, geographically distributed NFPS Backend with comprehensive Maintenance Services that provides the MTA (and other NFPS Agencies to the extent contemplated in these Contract Documents) with the ability to control, support and monitor the NFPS, including NFPS Equipment. Redundant operations shall enable uninterrupted operation of critical functions with high availability and no single point of failure. A dynamic load balancing/scaling up approach will allow redundant locations to support full NFPS operations and recovery from disaster. The SI shall also provide Hosting Services for the NFPS Websites. The base period for all Hosting Services will be seven (7) years commencing upon Substantial Completion, with optional extensions (see Technical Specifications Section 35.1 (NFPS Extended Hosting Services) and Technical Specifications Section 35.2 (Extended Web Portal Hosting Services)).

Since the NFPS Backend and NFPS Back Office are mission critical services that will run 24 hours per day, data redundancy and disaster recovery are critical services. The functional requirements for a fully redundant hosted solution are specified in this Technical Specifications Section 24 (Hosting). With respect to Hosting Services, the MTA will consider either outsourced Hosting Services or those provided directly by the SI.

24.1 NFPS Backend Hosting

24.1.1 General Requirements

Req. #	Requirement	Assigned CDRL(s)
24.1.1-1	The SI shall provide an NFPS Backend that is load balanced and includes data redundancy (see Technical Specifications Section 24.3 (Data Redundancy)) and disaster recovery (see Technical Specifications Section 24.4 (Disaster Recovery)) practices, as further set out in the Contract Documents.	CDRL 24-1
24.1.1-2	The SI shall provide a detailed NFPS Backend hosting plan and proposed architecture for the MTA's review and approval that describes all tasks, timeframes, process flows and performance measurements.	CDRL 24-1
24.1.1-3	These two NFPS Backends (e.g., the mirrored NFPS Backends) shall be synchronized and have identical mirrored NFPS Data located in the two discrete locations at all times. There shall be no differences in NFPS Data at any time between the mirrored NFPS Backends.	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.1.1-4	<p>The SI shall supply dedicated servers (both development and production), including:</p> <ul style="list-style-type: none"> • Database servers and storage • Application servers • Integration servers • Domain and authentication servers • Reporting servers • Websites servers • Mobile Applications servers • Appropriate network management servers (as required) • Data warehouse (including separation of development and production Data) • All other hardware required for the NFPS, at secure facilities with sufficient communications infrastructure to support the performance requirements stated in Technical Specifications Section 24.1.5 (Service Level Requirements) 	CDRL 24-1
24.1.1-5	<p>The SI shall procure the Data Center facilities and provide all necessary power, environmental controls, UPS, associated cabinets, cabling, network communications and other necessary equipment to outfit a fully functional Data Center. This will include generators and fuel to ensure onsite power for no less than 48 hours if a power outage occurs.</p>	CDRL 24-1
24.1.1-6	<p>The Data Centers will be staffed to provide 24/7/365 operational support. The operators will be trained and designated to carry out regularly-recurring computer operations specified in this Technical Specifications Section 24.1.1 (General Requirements), including:</p> <ul style="list-style-type: none"> • System startup, shutdown, monitoring of, and response to, console messages from subsystems and processes. • Media management to ensure Data collection and transmission to off-site vaulted storage is completed, as required. • Coordination and performance of Preventative Maintenance for hardware located at the Data Centers. • Batch job execution and monitoring of processor jobs for problem reporting and job re-initialization. • Facilities and environmental management for systems on the Data Center floor, including the UPS, Generator and HVAC. 	CDRL 24-1
24.1.1-7	<p>The NFPS shall have at least 100 percent excess storage and processing capacity, to be demonstrated by actual NFPS operation. Each NFPS Backend shall support a minimum daily Data transactions to support operations specified in these Contract Documents, including the MTA's data retention requirements.</p>	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.1.1-8	The hardware shall support and effectively process all events, messages and transactions from the Field Devices that are being furnished and shall provide sufficient capacity to accommodate a 50 percent increase in the number of devices (across all device types) and transactions.	CDRL 24-1
24.1.1-9	The NFPS shall have enough capacity to retain Data for a minimum of seven (7) years until redundant copies have been made and verified elsewhere.	CDRL 24-1
24.1.1-10	NFPS Backend Hardware configuration shall support the Frontend NFPS Equipment as initially configured at start of revenue service, and additional locations and equipment as needed without requiring expansion of the NFPS Backend Hardware.	CDRL 24-1
24.1.1-11	The NFPS Backend shall perform Data processing, report generation, system monitoring, data communications, database updates and all other required functions at speeds and response times suitable for the required task. Users shall perceive no response or functional delays due to equipment interaction with the NFPS Backend, and users shall not experience unreasonable delays based on the required task (i.e., a reasonable response for credit/debit payment processing will be no more than a few seconds, whereas transaction history queries may take longer).	CDRL 24-1
24.1.1-12	Any changes to the NFPS shall be in adherence with an effective configuration management plan, which the SI shall submit for approval as part of the Quality Assurance Program (see Technical Specifications Section 25.4 (Quality Assurance Program)).	CDRL 24-1

24.1.2 Hosting Location, Security and Environment

Req. #	Requirement	Assigned CDRL(s)
24.1.2-1	The SI or approved Subcontractor shall provide Hosting Services that include a secure and reliable facility where NFPS Backend Hardware may be housed and operated.	CDRL 24-1
24.1.2-2	The SI or approved Subcontractor shall provide two designated geographically discrete, but functionally identical hosting locations, and such locations shall be reviewed and approved by the MTA.	CDRL 24-1
24.1.2-3	The proposed NFPS Hosting System will be securely hosted and accessed in Data Centers that minimally meets the following standards: <ul style="list-style-type: none"> • TIA 942 Tier 3 • Uptime Institute Tier 3 	CDRL 24-1
24.1.2-4	The Data Centers may be at the SI's locations or subcontracted and shall meet all PCI security requirements.	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.1.2-5	The SI shall provide and maintain two discrete network connections to each Data Center. The connection points, "NFPS Demarcation Points", shall be the transition from the MTA's enterprise network to the SI-provided network connections. The SI shall also provide redundant connections between the two (2) SI-provided Data Centers.	CDRL 24-1
24.1.2-6	The SI shall use generally accepted industry standards (for critical infrastructure) to implement and operate the NFPS (including the Data Centers), to ensure that the NFPS is operating and is audited under SAS70 framework (or updated equivalent such as SSAE No. 16), and meet the requirements and performance standards for the indicated tiers, based on appropriate, accepted industry standard (for critical infrastructure) controls and control objectives. This will include the use of auditable procedures for NFPS system operations, change control, capacity planning, performance management, physical security and problem management. The SI shall use SSAE SOC 2 reports to provide the MTA assurance as to: <ul style="list-style-type: none"> • Security • Confidentiality and Privacy • Availability • Processing Integrity 	CDRL 24-1
24.1.2-7	The NFPS will be scalable to accommodate future expansion.	CDRL 24-1
24.1.2-8	The NFPS Hosting Systems and the Data Centers will be accessible to designated MTA personnel for inspection and other activities.	CDRL 24-1
24.1.2-9	Hosting Services will include (among other things): provisioned computer rack space, conditioned electrical power and multiple access paths to the Internet.	CDRL 24-1
24.1.2-10	Hosting Services will include the ability for authorized MTA and SI personnel to establish a VPN connection into either hosted environment for management purposes via the Internet.	CDRL 24-1
24.1.2-11	Hosting Services will include the resources to power cycle the physical systems on demand, and provide physical access to authorized MTA personnel upon demand. Hosting Services will also provide privacy for equipment.	CDRL 24-1
24.1.2-12	Hosting Services will include appropriate climate control and facility security as well as necessary staffing to monitor each Data Center.	CDRL 24-1
24.1.2-13	Hosting Services will include the following: <ul style="list-style-type: none"> • Monitoring and management of system uptime • Monitoring and management of system response time. • Monitoring and management of application servers • Hardware configuration and updates • Performance of backups or system level Disaster Recovery 	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.1.2-14	User interface access to all elements of Hosting Services will be managed using one of two user authentication and access control platforms. Individual users or user groups will have access configured to allow for standard business operations.	CDRL 24-1

24.1.3 Outage Management

Req. #	Requirement	Assigned CDRL(s)
24.1.3-1	The Data Centers will maintain a common Network Operations Center (NOC) and a Help Desk that provide 24/7 problem identification, tracking, communication and resolution. These groups will provide timely support services as needed and upon request.	CDRL 24-1
24.1.3-2	<p>The SI shall provide monthly and otherwise upon the MTA's request, a service level report in a form to be agreed upon between the SI and the MTA, that measures the following for both systems and Data Centers:</p> <ul style="list-style-type: none"> • Response times statistics (e.g., average, mean, high, low, etc.) as measured from the server when responding to an http/https request for various data system transactions. • Scheduled maintenance, including the date and time performed, a detailed explanation of the maintenance performed and the duration of each occurrence of maintenance. • All measures of sustained system utilization, including system availability, network capacity and bandwidth utilization. • Downtime (both scheduled and unscheduled) presented by date, time and duration of each occurrence. 	CDRL 24-1

24.1.4 Server and Network Management Services

Req. #	Requirement	Assigned CDRL(s)
24.1.4-1	The SI shall maintain a group of server specialists to provide production support for overall standards, architecture guidance, direction and technical support so that production systems will remain fully available, highly efficient with Data integrity maintained on a 24/7/365 basis.	CDRL 24-1
24.1.4-2	The SI shall maintain a group of network specialists to oversee, maintain, and troubleshoot networks so that production systems will remain fully available, highly efficient with Data integrity maintained on a 24/7/365 basis.	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.1.4-3	<p>The Server and Network group shall:</p> <ul style="list-style-type: none"> • Perform local and remote backups • Maintain server Documentation to ensure integrity and recoverability • Test and evaluate technology, platform and network systems • Monitor NFPS performance, including Software and hardware components • Provide 24/7 coverage for internal and remote systems • Maintain and update network policies, procedures, standards and checklist • Maintain servers and switches local switches • Administer and forward reports, as scheduled and or requested by the MTA 	CDRL 24-1

24.1.5 Service Level Requirements

The service levels that the SI or approved Subcontractor shall meet are set forth below. Terms will be used in defining and measuring compliance with these service levels are set out in Technical Specifications Section 5.14.1 (Applicable KPI and Service Level Definitions). Subject to req. # 5.14.2-7, the Credit Base for these KPIs shall be: Website Hosting Services and Backend Hosting Services Fees.

Req. #	Requirement	Assigned CDRL(s)										
24.1.5-1	<p>The SI guarantees that the Hosting System and Hosted System will have an Availability of ninety-nine and ninety-nine/one hundredth percent (99.99%) each calendar month. If the SI fails to meet this guarantee, then the SI shall provide a credit to the MTA at the applicable Service Credit percentage of the Credit Base as follows:</p> <table><tr><th>System Availability</th><th>Credit Percentage</th></tr><tr><td>≥ 99.99 %</td><td>0%</td></tr><tr><td>99.8-99.99%</td><td>8%</td></tr><tr><td>99.6-99.8%</td><td>12%</td></tr><tr><td><99.6%</td><td>15%</td></tr></table>	System Availability	Credit Percentage	≥ 99.99 %	0%	99.8-99.99%	8%	99.6-99.8%	12%	<99.6%	15%	CDRL 24-1
System Availability	Credit Percentage											
≥ 99.99 %	0%											
99.8-99.99%	8%											
99.6-99.8%	12%											
<99.6%	15%											

24.2 Web Hosting

Req. #	Requirement	Assigned CDRL(s)
24.2-1	The SI or approved Subcontractor shall provide Website Hosting Services in a secure and reliable facility.	CDRL 24-1
24.2-2	The SI shall provide Website Hosting Services for all SI-developed pages for the NFPS Websites (see Technical Specifications Section 22 (NFPS Websites), and all associated APIs.	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.2-3	All hosted servers utilized to support the NFPS shall be dedicated to the MTA Group, and use of shared virtual servers (i.e., supporting other customers) is prohibited.	CDRL 24-1
24.2-4	The MTA considers the NFPS Websites to be mission-critical. As such, the SI shall provide Website Hosting Services that are highly reliable and provide performance standards outlined in Technical Specifications Section 5.14 (Performance Requirements).	CDRL 24-1
24.2-5	The SI shall provide Website Hosting Services that can process all sales volume, including maximum peak sales volumes experienced by the NFPS Websites, without unduly slowing the transaction speed as perceived by the end user. Throughout the Term, the SI shall also expand the capacity of the NFPS Websites as necessary to support sales volume increases without limitation.	CDRL 24-1

24.3 Data Redundancy

The SI shall provide two (2) designated geographically discrete, but functionally identical hosting locations that will provide immediate, automatic failover between sites to ensure the NFPS Backend remains available whenever unplanned or planned outages of the production NFPS Backend occur. Redundant operations shall enable uninterrupted operation of critical security, Data, application, reporting and transaction functions even in the event of a complete failure of one site or system without performance degradation.

Req. #	Requirement	Assigned CDRL(s)
24.3-1	The SI will employ two separate, fully functional Hosting Systems each able to handle more than 100 percent of the NFPS Agencies' peak daily processing load. These Hosting Systems shall process transactions in parallel to optimize performance. In the event that one Hosting System fails or goes into a degraded mode, the second Hosting System shall perform all required processing with no impact to performance.	CDRL 24-1
24.3-2	The Hosting Systems will utilize two geographically separate Data Centers that employ Active-Active load balancing.	CDRL 24-1
24.3-3	The load balancing architecture will be designed such that a failure of one location will have no impact to performance across the NFPS. The SI will propose a failover plan (distributed architectures, spare load balancers, etc.) to achieve this requirement, which will be approved by the MTA.	CDRL 24-1
24.3-4	The two Data Center locations will be positioned with sufficient distance between them such that a natural disaster is highly unlikely to affect both locations concurrently. Sites will be reviewed and approved by the MTA during Design Review.	CDRL 24-1

Req. #	Requirement	Assigned CDRL(s)
24.3-5	The active failover process will be tested and approved by the MTA that demonstrate multiple failover scenarios and mirrored Data Warehouses that are synchronized to avoid lost transactions.	CDRL 24-1
24.3-6	All Transaction Data will be 100 percent protected against loss. Each identical and independent Hosting System will be equipped with appropriate systems and procedures (e.g., RAID) to assure this requirement, subject to acceptance by the MTA.	CDRL 24-1

24.4 Disaster Recovery

Req. #	Requirement	Assigned CDRL(s)
24.4-1	The SI shall provide a disaster recovery plan that allows for the efficient recovery of NFPS Data in the event of catastrophic data loss or NFPS system failure. The disaster recovery plan will be designed as required by MTA/IT.	CDRL 24-2
24.4-2	The SI shall provide an evaluation of the types of disasters which may impact the NFPS' operations and detail the steps to be taken to survive and recover from such disaster.	CDRL 24-2
24.4-3	The SI shall be required to document and train NFPS Agency staff in the procedures to restore NFPS operations.	CDRL 24-2
24.4-4	The SI shall identify the resources (i.e., people, systems, communication lines, etc.) that will be committed to implement the disaster recovery plan.	CDRL 24-2
25.4-5	The Disaster Recovery plan shall be tested annually with the schedule and procedures approved by the MTA during Design Review.	CDRL 24-2

24.5 Hosting Required Submittals

The required submittals specified in this Technical Specifications Section 24 (Hosting) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 24-1	NFPS System Hosting Plan	Section 24.1	✓	✓	✓	
CDRL 24-2	Disaster Recovery Plan	Section 24.2	✓	✓	✓	

CHAPTER 4: PROJECT IMPLEMENTATION & SUPPORT

25 Management

The SI shall establish a robust management structure and team to support the NFPS throughout the Term. The SI shall have sufficient management resources and ability and the necessary support staff to assure the NFPS Agencies that the NFPS will be properly coordinated and managed and will be completed on schedule and within budget.

NYCT's Capital Program Management maintains a variety of specifications for program management, quality management, drawings and other processes. These specifications, called Divisions, are included in Appendix H for reference, and govern all relevant work described herein. In the case that there is a discrepancy between the Divisions and the requirements in these Technical Specifications, the more stringent requirement shall apply.

Metro-North Railroad Station Standards and Guidelines (Appendix P) and Long Island Railroad Service Guidelines (Appendix Q) guide work performed on MNR and LIRR property, as further set out in Technical Specifications Section 5 (General Design Requirements).

25.1 Project Management

25.1.1 Deputy Project Managers & Lead Engineer

The SI's Deputy Project Manager (DPM) – NYCT ("**DPM-NYCT**") and Deputy Project Manager – MNR/LIRR ("**DPM-MNR/LIRR**") shall possess full authority to render project technical and commercial decisions on behalf of the SI for the NFPS. The SI's Lead Engineer shall possess a command of the systems and technologies that will be utilized within the NFPS and shall participate in all meetings and preparation of Deliverables that include topics and/or content of a technical nature.

Req. #	Requirement	Assigned CDRL(s)
25.1.1-1	The SI shall designate responsible and experienced individuals to serve as the DPM-NYCT, DPM-MNR/LIRR, and Lead Engineer for the entire Term.	CDRL 25-1
25.1.1-2	The DPM-NYCT and DPM-MNR/LIRR shall be located in the New York City metropolitan area beginning no later than 30 calendar days following NTP and continuing through Substantial Completion. The DPMs shall be fluent in English and possess demonstrable, recent and sufficient experience managing electronic payment system projects of similar size that include multiple points of integration with Third Party systems and devices.	CDRL 25-1
25.1.1-3	The Lead Engineer shall be fluent in English and possess demonstrable, recent and sufficient experience serving in a lead technical role on electronic payment system projects of similar size and objective as the NFPS project and that include multiple points of integration with Third Party systems and devices.	CDRL 25-1
25.1.1-4	The designated DPMs and Lead Engineer shall be subject to the MTA's review and approval.	CDRL 25-1

Req. #	Requirement	Assigned CDRL(s)
25.1.1-5	The SI shall designate a Network Engineer (as defined herein) to oversee any and all network and communications aspects of the NFPS design, installation and deployment for the entire Term. The Network Engineer will have sufficient experience overseeing large, complex networking projects in a transit environment comparable to that of the NFPS Agencies' transit environment.	CDRL 25-1
25.1.1-6	Removal or replacement of either DPM or the Lead Engineer by the SI requires prior approval by the MTA. The SI's request to remove or replace the DPM or the Lead Engineer shall be made in writing and include the reason for removal or replacement.	CDRL 25-1
25.1.1-7	In the event that any key SI staff (DPM-NYCT, DPM-MNR/LIRR, Lead Engineer, Safety Engineer, Network Engineer or Quality Engineer) is found unacceptable or needs to be replaced for any reason, the SI shall provide a replacement within 30 calendar days.	CDRL 25-1

25.1.2 Management Plan

The SI shall submit a comprehensive management plan that describes project organization, controls, planning and schedules.

Req. #	Requirement	Assigned CDRL(s)
25.1.2-1	The SI shall submit a management plan no more than 30 calendar days following NTP, which will be subject to the MTA's review and approval.	CDRL 25-1
25.1.2-2	<p>The management plan will include, but not be limited to, the following:</p> <ul style="list-style-type: none"> • Organization chart identifying key project personnel and contact information • Methodology to control program schedule • Master program schedule identifying key program milestones and activities • Schedule for the items of design and manufacture that require the MTA's approval • Configuration management plan for all submittals and subsequent revisions • Subcontractor management and communications plan outlining the SI's methods and procedures for organizing and communicating with Subcontractors. This will include an outline of activities to be performed by M/WBE firms, an identification of the portion of the revenues to be allocated to such firms for these activities, and the means of encouraging, tracking and controlling M/WBE participation throughout the duration of the Term • Procedures and processes to be followed for the replacement of any Subcontractors throughout the Term • A comprehensive and detailed description of all guidelines, 	CDRL 25-1

Req. #	Requirement	Assigned CDRL(s)
	standards, tools, methodologies, Documentation requirements and submittals associated with Software development lifecycle processes and activities for the Project	
25.1.2-3	The SI shall ensure that any engaged suppliers or Subcontractors are informed of all specified requirements within the Contract Documents and that appropriate engineering and project management tools are utilized to coordinate and provide communication between the SI and its Subcontractors and suppliers.	CDRL 25-1
25.1.2-4	All NFPS Hardware shall be suitable for the intended purposes within the NFPS – no hardware shall be used within the NFPS if the use of such hardware for its intended purposes exceeds any recommended limits, restrictions or guidelines for such hardware.	CDRL 25-1
25.1.2-5	The SI shall have key Subcontractors and suppliers available when required for meetings, production problems, testing, resolution of design deficiencies and all other similar situations. During all phases of this Project and after the Warranty Period, the MTA will have access to all Subcontractors and suppliers.	CDRL 25-1
25.1.2-6	The SI shall implement an Earned Value Management (EVM) reporting tool in accordance to the latest version of the Project Management Institute's Project Management Body of Knowledge (PMBOK). The EVM reporting tool shall not be used for managing payments to the SI pursuant to the Contract Documents.	CDRL 25-1
25.1.2-7	The SI shall incorporate the following into the EVM reporting tool: <ul style="list-style-type: none"> • A Work Breakdown Structure (WBS) to summarize scope elements for review and approval by the MTA. • Based on the developed WBS, the SI shall assign a value and a timeline to each work package. This will become the basis of the Planned Value (PV) curve. 	CDRL 25-16
25.1.2-8	The SI shall report to the MTA the Earned Value of work achieved to-date on a monthly basis. The Earned Value report will include at a minimum Earned Value, Planned Value, Actual Cost, Cost Performance Index and Schedule Performance Index with Earned Value calculated and reported on a dollars or hours basis. The SI is responsible for all Earned Value calculations, but the MTA reserves the right to request underlying data used to calculate EV parameters and used in the preparation of the EVM report.	CDRL 25-16
25.1.2-9	The format of the EVM report will be provided to the MTA for review and approval within 30 calendar days of NTP.	CDRL 25-16

Req. #	Requirement	Assigned CDRL(s)
25.1.2-10	The SI shall submit for the MTA's approval the Graphical User Interface (GUI) and Prototyping Plan, to be reviewed, evaluated and approved by the MTA. The GUI and Prototyping plan will consider all aspects and NFPS users including both customers and internal NFPS Agency staff. The plan will be performed in an iterative fashion to gather and incorporate user feedback and comments, which are among the principal mechanisms by which users provide feedback into system design.	CDRL 25-17
25.1.2-11	The SI shall plan and perform two types of prototyping activities: GUI or static (look and feel, symbol catalogs, GUI layout, colors, dialogs, data entry and output forms, etc.) and functional or interactive to demonstrate NFPS behavior and capabilities. Prototyping of all functions or features shall be completed at least twice and shall be documented in the Master Program Schedule and completed and approved by the end of Final Design Review.	CDRL 25-17
25.1.2-12	The SI shall submit a Requirements Traceability Matrix (RTM) that identifies and traces each Software, hardware and other NFPS requirement. The SI shall provide bi-directional tracing that includes all requirements for the MTA's review and approval. RTM reports will be used by the MTA to verify that all requirements of these Technical Specifications have been addressed within the submitted Deliverables. The SI shall keep the RTM up to date at all times.	CDRL 25-18

25.1.3 Master Program Schedule

Req. #	Requirement	Assigned CDRL(s)
25.1.3-1	The SI shall develop and submit within 30 calendar days of NTP a Master Program Schedule that identifies all program activities and milestones.	CDRL 25-2
25.1.3-2	The Master Program Schedule will be cost loaded and submitted in Microsoft (MS) Project format.	CDRL 25-2
25.1.3-3	The listing of activities in the Master Program Schedule will be in sufficient granularity and detail to identify all predecessor and dependent activities, including the activities of other entities that impact the SI's delivery of the NFPS.	CDRL 25-2
25.1.3-4	SI's submitted Master Program Schedule approved by the MTA will become the baseline schedule, against which subsequent schedule updates will show performance.	CDRL 25-2
25.1.3-5	The Master Program Schedule will designate intermediate program milestones and target dates to track ongoing performance against schedule.	CDRL 25-2
25.1.3-6	The SI shall update the Master Program Schedule on a monthly or more frequent basis and submit the updated schedules for the MTA's review and approval.	CDRL 25-2

25.1.4 Safety Assurance Program

Req. #	Requirement	Assigned CDRL(s)
25.1.4-1	SI shall develop and submit within 30 calendar days of NTP a Safety Assurance Plan (as further explained herein) that identifies all safety processes and procedures for review and approval by the MTA.	CDRL 25-3
25.1.4-2	The Safety Assurance Plan will identify and document program risks, owners and mitigation plans throughout the project, and will be reviewed and updated on a monthly basis or as requested by the MTA.	CDRL 25-3
25.1.4-3	The SI shall designate a responsible and experienced Safety Engineer to serve as the Safety Assurance Program Manager for the entire Term. Additional requirements are specified in Division 1S.	CDRL 25-1
25.1.4-4	The designated Safety Assurance Program Manager shall be subject to the MTA's review and approval.	CDRL 25-1
25.1.4-5	The Safety Engineer shall document and review all system safety analyses and all safety verification processes to ensure all hazards are adequately identified, and their impact on the fully integrated and interoperable systems is eliminated or controlled to the satisfaction of the Safety Engineer and the MTA.	CDRL 25-3

25.1.5 Risk Management Plan

The risk management plan will document the process(es) that the SI shall follow to identify and manage potential risks that threaten to increase Project costs, lengthen the project schedule or compromise Project performance.

Req. #	Requirement	Assigned CDRL(s)
25.1.5-1	The SI shall submit a risk management plan to the MTA for approval within 30 calendar days of NTP.	CDRL 25-4
25.1.5-2	The risk management plan will address risk planning, risk identification, risk assessment and risk control, and will be reviewed and updated on a monthly basis or as requested by the MTA.	CDRL 25-4
25.1.5-3	The risk management plan will identify the process that the SI shall follow for handling risk from the Project, and how identified risk items will be evaluated for severity and reported to the MTA.	CDRL 25-4
25.1.5-4	The risk management plan will include a process for developing and implementing corrective action plans for lessening the impact that an event might have on the Project and for returning the Project to steady state.	CDRL 25-4
25.1.5-5	The SI shall maintain a comprehensive program Risk Register comprised of the following data fields: Risk Title, Risk Statement, Risk Owner, Responsible Party, Due Date, Risk Status, Risk Consequence, Initial Probability Score, Initial Impact Score, Initial Risk Rating, Current Risk Rating, Handling Approach, Handling Strategy and Latest Update.	CDRL 25-4

25.1.6 Transition and Change Management Plan

The SI shall support the transition from current MetroCard System, and both the MNR and LIRR Central Support Systems, operations to the NFPS both within the NFPS Agencies as well as with external stakeholders and the public. Managing change and supporting communications and information will be critical to the Project's success.

Req. #	Requirement	Assigned CDRL(s)
25.1.6-1	SI shall submit a Transition and Change Management plan to the MTA for review and approval during FDR.	CDRL 25-5
25.1.6-2	The Transition and Change Management plan will document critical changes to program stakeholders as well as change management and mitigation procedures.	CDRL 25-5
25.1.6-3	The plan will document plans to transition from the MetroCard System, and both the MNR and LIRR Central Support Systems, Mail&Ride, and TIMs/OBTIMs/STIMs, to the NFPS including potential temporary/special/additional equipment and/or staffing requirements for review and approval by the MTA. The plan will document the SI's approach to eventually working with the NFPS Agencies to decommission the MetroCard System.	CDRL 25-5

25.2 Project Document Control

The SI shall store and maintain all program documents, meeting materials, submittals, and correspondence in electronic form to provide robust and secure document control.

Req. #	Requirement	Assigned CDRL(s)
25.2-1	The SI shall establish and maintain program document control using a web-based system that will restrict access to authorized NFPS Agency and SI personnel. The SI shall supply the Software, such as MS SharePoint or a similar solution, subject to the MTA's approval.	CDRL 25-15
25.2-2	The document control system will be available for use with appropriate access configuration within 30 days of NTP.	CDRL 25-15
25.2-3	All Documentation, including program documents will be categorized and numbered according to documented scheme.	CDRL 25-15

25.2.1 Issue List and Action Item Log

Req. #	Requirement	Assigned CDRL(s)
25.2.1-1	The SI shall maintain a current list of issues for ongoing tracking and management electronically on the SharePoint site. These issues will be identified and updated at design review meetings, monthly Progress Review Meetings, and through correspondence.	CDRL 25-6
25.2.1-2	The SI shall document and maintain a list of all identified Project action items. These action items will be identified and updated at design review meetings, monthly Progress Review Meetings, and through correspondence.	CDRL 25-6

Req. #	Requirement	Assigned CDRL(s)
25.2.1-3	<p>The action item log will track the following for each entry at a minimum:</p> <ul style="list-style-type: none"> • Item Number • Description • Requesting Party • Assigned Party • Status (open/closed/in progress/deferred/etc.) • Date Opened • Date Closed • Progress Notes <p>No action item will be assigned to any NFPS Agency without the MTA's knowledge and prior consent.</p>	CDRL 25-6

25.2.2 Correspondence Log

Req. #	Requirement	Assigned CDRL(s)
25.2.2-1	The SI shall maintain a log of all written and electronic Project correspondence with the NFPS Agencies.	CDRL 25-7
25.2.2-2	<p>For each piece of correspondence between the NFPS Agencies and the SI, the SI shall track:</p> <ul style="list-style-type: none"> • Sequential Reference Number • Date Issued • Issuing Party • Topic • Keywords • Author • References to other Contract Documents • References to other Contract Correspondence 	CDRL 25-7

25.3 Project Meetings

25.3.1 Contract Kickoff Meeting

The purpose of the contract kickoff meeting is to allow all parties to understand the scope and schedule of the Project and to confirm expectations and responsibilities.

Req. #	Requirement	Assigned CDRL(s)
25.3.1-1	Approximately 21 calendar days following NTP, the SI shall participate in the Project kickoff meeting to be held at the MTA's offices.	CDRL 25-8

Req. #	Requirement	Assigned CDRL(s)
25.3.1-2	<p>The SI shall work with the MTA to assemble an agenda for the meeting that at a minimum covers the following topics:</p> <ul style="list-style-type: none"> • Introductions of key client and SI staff/points of contact and review of responsibilities • Review of the SI's scope of Work • Presentation of draft Project baseline schedule 	CDRL 25-8

25.3.2 Progress Review Meetings

Req. #	Requirement	Assigned CDRL(s)
25.3.2-1	Progress reviews will be held on a monthly basis at the MTA's facilities, or via live conference call if agreed to by the MTA.	CDRL 25-8
25.3.2-2	The SI shall prepare and submit an agenda at least five (5) business days prior to all progress review meetings for review and approval by the MTA.	CDRL 25-8
25.3.2-3	<p>The topics to be discussed and reviewed will include, at a minimum:</p> <ul style="list-style-type: none"> • Minutes of the previous Progress Review Meeting • Updated Master Program Schedule • Updated CDRLs • Updated Submittal List and Submittal Schedule • Updated action item log • Work accomplished since previous meeting, including: design status, fabrication problems, delivery problems, schedule slippages, problems arising from proposed changes and other circumstances which might affect progress of the work • Sequence of critical work and schedule of manufacturing using the Master Program Schedule and Monthly Progress Reports • Engineering, manufacturing and quality control summary • Contract budget, milestone payment and invoice status and schedule • Any needed corrective measures to maintain Program Schedule • Assessment, review and update of the Safety Assurance Program • Assessment, review and update of the Risk Management Plan and Risk Register • Earned Value Management (EVM) status reporting • Any other issues related to the Project 	CDRL 25-8
25.3.2-4	<p>The SI shall prepare and submit to the MTA a monthly progress report that addresses the following topics and serves as the agenda for the progress review meeting:</p> <ul style="list-style-type: none"> • Review and status of actions from previous meeting(s) • Updated Master Program Schedule showing progress against the baseline schedule 	CDRL 25-8

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Status of all current key activities, upcoming activities, issues and corrective actions Update of all identified Project risks and the actions taken and progress made toward mitigating each identified risk, and the updated Risk Register Updated CDRL list indicating current status of each CDRL 	
25.3.2-5	The SI shall document the minutes of each monthly meeting and submit them for the MTA's review within three (3) business days following each meeting.	CDRL 25-8

25.3.3 Weekly Project Coordination & Ad Hoc Meetings

The purpose of weekly project coordination meetings is to provide a standing forum for items and topics to be discussed or decisions that need to be made that cannot hold until the monthly progress reviews. The MTA will work with the SI to prepare weekly meeting agendas and the SI will be responsible for preparing meeting minutes. Other ad hoc meetings will also be necessary to facilitate Project delivery. Meetings shall take place at a designated NFPS Agency facility.

Req. #	Requirement	Assigned CDRL(s)
25.3.3-1	The SI's DPM-NYCT, DPM-MNR/LIRR and other designated SI and NFPS Agency staff shall participate in weekly project coordination meetings.	CDRL 25-8
25.3.3-2	The SI's DPM-NYCT, DPM-MNR/LIRR and other designated SI and NFPS Agency staff shall participate as required in other ad hoc meetings to facilitate Project coordination and decision making.	CDRL 25-8
25.3.2-3	The SI shall document the minutes of each weekly and ad-hoc meeting and submit them for the MTA's review within three (3) business days following each meeting.	CDRL 25-8

25.4 Quality Assurance Program

25.4.1 General

The SI shall establish, implement and maintain an effective Quality Assurance (QA) Program to manage, control, document and assure that the work complies with the requirements of the Contract Documents. The QA Program will define methods for planning, implementing and maintaining quality, schedules and cost. If damage, defect, error or inaccuracy is found in any specified item or Work, the MTA Group has the right to reject or to require correction to bring the item or work into conformance with Contract Document requirements.

Req. #	Requirement	Assigned CDRL(s)
25.4.1-1	The SI shall plan, establish and maintain a QA Program governing the SI as well as all Subcontractors whenever Work is performed.	CDRL 25-9
25.4.1-2	The SI shall designate a responsible and experienced Quality Engineer having sufficient experience to serve as the QA Program Manager for the entire Term.	CDRL 25-1

Req. #	Requirement	Assigned CDRL(s)
25.4.1-3	The designated QA Program Manager shall be subject to the MTA's review and approval.	CDRL 25-1
25.4.1-4	The SI shall include the quality function as an integral part of its design development and review process.	CDRL 25-9
25.4.1-5	The SI shall identify design variances from Contract Document requirements and document and report variances to the MTA before procurement, fabrication or installation.	CDRL 25-9
25.4.1-6	The SI shall solely bear all costs incurred in correcting rejected items or Work.	CDRL 25-9
25.4.1-7	The SI shall remove rejected items from the Work Site unless in-place correction is reviewed and accepted by the MTA, with input from any other impacted MTA Group entity.	CDRL 25-9

25.4.2 Quality Assurance Program Plan

Req. #	Requirement	Assigned CDRL(s)
25.4.2-1	Within 30 calendar days of NTP, the SI shall submit the QA Program Plan to the MTA for approval.	CDRL 25-9
25.4.2-2	SI shall not commence performance of any design, manufacturing or construction work until the MTA has approved the QA Program Plan.	CDRL 25-9
25.4.2-3	The QA Program Plan will include written descriptions of quality assurance and control policies, procedures, methods and instructions, including the process and procedures that the SI shall follow to ensure that control and detailed Documentation is maintained throughout Software development and configuration changes.	CDRL 25-9
25.4.2-4	The QA Program Plan will describe the overall quality processes and responsibilities that will ensure the quality of Work performed for each phase of Work.	CDRL 25-9
25.4.2-5	The QA Program Plan will address all participating Subcontractors and their relationship to the SI.	CDRL 25-9
25.4.2-6	The QA Program Plan will 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 and requirements.	CDRL 25-9
25.4.2-7	<p>The QA Program Plan will at minimum include procedures for the following activities:</p> <ul style="list-style-type: none"> • Factory inspection and test procedures and records • Configuration Management Program, procedures and records for change control and version management • Procedures and records for: (i) equipment handling; (ii) inventory; (iii) storage; (iv) delivery; (v) design control; (vi) changes to Documentation, drawings, Data, and 	CDRL 25-9

Req. #	Requirement	Assigned CDRL(s)
	<p>specifications; (vii) release for shipment; (viii) shipping; (ix) evidence of compliance; (x) corrective action; and (xi) calibration/verification of measuring equipment and audit</p> <ul style="list-style-type: none"> • 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 • Quality Assurance Program requirements for Subcontractors • System test procedures and records • Surveillance over all Work, including Subcontractors, for conformance and verification thereof with all Contract Document requirements • Discrepancy control • Evaluation and assessment of Subcontractors' QA programs • Feedback of problems, their resolutions to the SI's engineering and production departments and corrective action • Qualification and certification of all personnel performing Work • In-service test procedures and records. • Provision of technical Documentation, drawings, specifications, handbooks, manuals, data flow diagrams and other technical publications for the NFPS. 	

25.4.3 MTA Quality Assurance

Req. #	Requirement	Assigned CDRL(s)
25.4.3-1	The MTA will, at its own discretion, perform QA monitoring of Work, including monitoring of the SI's or Subcontractor's QA activities.	CDRL 25-9
25.4.3-2	The SI's QA records will be made available to the MTA for inspection upon request.	CDRL 25-9
25.4.3-3	Such QA activities performed (or not performed) by the MTA will not reduce nor alter the SI's QA responsibilities or its obligation to meet the requirements of the Contract Documents.	CDRL 25-9
25.4.3-4	At any time during the manufacturing process, the MTA's representatives may choose to schedule or perform an unannounced visit to the SI's facility or a Subcontractor's facility during normal working hours to audit the manufacturing and QA processes.	CDRL 25-9

25.5 Version Control and Configuration Management

Throughout the Term, the SI shall implement and maintain a configuration control system that encompasses the entire NFPS. Changes to released and approved documents, drawings and data will be controlled by the processing of Engineering Change Requests (ECRs).

In an effort to maximize effectiveness of the design process, the SI and the MTA will mutually agree

upon a date for design freeze. The date will be chosen to reflect a point when the design of the NFPS is substantially complete. The SI and Subcontractors are not required to submit every in-process change to the MTA for review and approval prior to the design freeze date. This requirement does not relieve the SI and Subcontractors from meeting all requirements set out in the Contract Documents.

Changes requiring approval will be defined as hardware, material or Software changes which affect previously approved Documentation and drawings, or interchangeability with previously produced components. Changes that would modify specification requirements or any other aspects of these Contract Documents will be processed as Change Orders.

Req. #	Requirement	Assigned CDRL(s)
25.5-1	The SI's change control system and procedures will be documented in a System Configuration Control Plan and include provision for the MTA's review and approval of changes.	CDRL 25-12
25.5-2	<p>The SI's Configuration Control procedures shall include:</p> <ul style="list-style-type: none"> • Mechanisms for requesting and documenting changes to controlled Work • Requirements for performing impact analysis for each requested change • Mechanisms for informing the MTA of the change requests, soliciting the MTA's input to the impact analysis and obtaining the MTA's approval. • An identified authority for making decisions on accepting or rejecting change requests • Tracking requested changes from submission through final disposition shall be performed in an MTA-approved tool (req. # 25.5.3-1) • Mechanisms for verifying the change 	CDRL 25-12
25.5-3	<p>The SI shall establish with the MTA a Hardware and Software Configuration Control Board (CCB) consisting of members from both the SI and the MTA that possess the appropriate level of expertise and authority to carry out the responsibilities of the CCB. The core members (titles and responsibility) of the CCB shall be the defined in the System Configuration Control Plan. The Hardware and Software Configuration Control Board shall:</p> <ul style="list-style-type: none"> • Convene for all Hardware and Software Change Control Board meetings or at a minimum of a monthly meeting to review planned changes etc. • Approve all hardware and Software changes • Ensure change authorization before change implementation • Define the Software change control process • Evaluate and approves the impact analysis • Require adequate resource allocation • Maintain and monitor the Software development process • Obtain the MTA's approval for all design changes, requirement changes and document changes <p>Under no circumstances shall a proposed change be approved by</p>	CDRL 25-12

Req. #	Requirement	Assigned CDRL(s)
	the CCB without express agreement from all MTA members of the CCB and receipt of all other formal approvals as required pursuant to the Contract Documents.	
25.5-4	<p>At a minimum the following information shall be required for each hardware or Software change request record:</p> <ul style="list-style-type: none"> • Change request identifier • Summary of change • Originator of the change request and contact information • Severity/priority status • Creation date • “From” and “To” configuration status • Detailed description of the change <ul style="list-style-type: none"> ○ For product enhancement - the requirements specification, MTA Contract Document modification, etc. ○ For Problem reports - problem description plus <ul style="list-style-type: none"> ▪ Inputs ▪ Expected results/Actual results ▪ Anomalies ▪ Occurrence and date and time ▪ Steps to reproduce the failure ▪ Environment ▪ Attempts to repeat ▪ Tester/User ▪ Observers • Status (open, resolved, closed) and status dates • Impact analysis • CCB Disposition (approved, rejected, deferred) • Work around if required • Resolution description • List of components/units modified • Test status • Target product and versions 	

25.5.1 Component Identification & Serial Numbers

The SI shall develop and submit for the MTA's approval an Equipment Identification and Labeling Plan that identifies how the NFPS will comply with the following requirements.

Req. #	Requirement	Assigned CDRL(s)
25.5.1-1	All NFPS Hardware will be permanently identified with a supplier's name, part number and serial number.	CDRL 25-13

Req. #	Requirement	Assigned CDRL(s)
25.5.1-2	The SI shall assign unique serial numbers to NFPS Hardware enabling tracking of components for maintenance, repair and warranty and to provide sufficient identification ability to analyze Failure Data for declaring fleet defects.	CDRL 25-13
25.5.1-3	The serial number format will be submitted for the MTA's approval and, where possible, serial numbers for like NFPS Hardware components will be sequential and unique.	CDRL 25-13
25.5.1-4	Identification will be by engraved metal labels riveted in place or other approved permanent method.	CDRL 25-13
25.5.1-5	All NFPS Hardware will also be labeled in duplicate with its own unique barcode labels to further facilitate tracking of the NFPS Hardware. Labels will be placed in areas where they are likely to avoid wear and fading. The location of the nameplate and bar coding data shall be chosen for readability and scanning without disassembly of NFPS Hardware components.	CDRL 25-13
25.5.1-6	The visible serial number will match the Electronic Serial Number (ESN) in all instances where an ESN is assigned.	CDRL 25-13
25.5.1-7	Serial numbers of all NFPS Hardware components will be presented to the MTA in the form of an MS Excel spreadsheet included with the shipment.	CDRL 25-13
25.5.1-8	At a minimum, the following NFPS Hardware will have serial numbers applied: <ul style="list-style-type: none"> • BVs, SVs, WVMs and major internal components, especially those that are subject to field replacement • CVMs and all major internal components and modules • RF Workstations • TOMs • Customer Service POS Terminals • NFPS Back Office Hardware, including redundant system Hardware • Test Facility hardware and devices 	CDRL 25-13
25.5.1-9	The SI shall establish serialized identification procedures for use in identifying part numbers and serial numbers of parts and equipment furnished by the SI and all Subcontractors. The serial numbering schemes to be utilized shall be subject to approval by the MTA. The NFPS Agencies may each have their own scheme.	CDRL 25-13
25.5.1-10	Within 30 calendar days after the Final Design Review, the SI shall furnish a list of the items to be serial numbered for the MTA's review and approval.	CDRL 25-13

25.5.2 Hardware Versions

Req. #	Requirement	Assigned CDRL(s)
25.5.2-1	<p>The SI shall submit an NFPS Hardware update plan for the MTA's review and approval. Each Hardware update plan will contain at least the following:</p> <ul style="list-style-type: none"> • A description of the change • Affected equipment and modules • A listing of all defects corrected, including references to MTA correspondence where applicable • A listing of all new features included • Copies of all test procedures and test results documentation • Complete installation instructions, including steps to verify proper installation and steps to remove the updated Software. 	CDRL 25-10
25.5.2-2	Upon the MTA's approval of the Hardware update plan, the SI shall then implement the approved hardware change according to the approved Hardware update plan.	CDRL 25-10
25.5.2-3	After completing an approved Hardware update, the SI shall submit an updated listing of the serial numbers and version numbers of the affected NFPS Hardware components in an approved format; this listing will include the date the revision was applied to each item.	CDRL 25-10
25.5.2-4	Throughout the Hardware Warranty Period, the SI shall maintain accurate records of the versions of all serialized components of the NFPS Hardware, including all spare parts in inventory.	CDRL 25-10
25.5.2-5	All Hardware configuration items shall be under System Configuration control and cannot be revised, replaced or altered in any way without the SI's Hardware Configuration Control Board's and the MTA's approval when the system design or system requirement is affected.	CDRL 25-10

25.5.3 Software Versions and Configurations

Software changes may be necessary during the Software development lifecycle as a result of Software defects, enhancement requests or technology improvements. The SI shall implement a deliberate and systematic process that ensures that all Software Updates are sufficiently described and all Software Updates are:

- Properly identified
- Documented
- Evaluated for impact
- Approved by the appropriate level of authority
- Incorporated
- Verified

Throughout the Term, the SI shall adhere to the Software quality and version control procedures submitted and approved as part of the QA Program Plan described in Technical Specifications Section 25.4.2 (Quality Assurance Program Plan). The version identifiers for all Application Software will be unique.

Req. #	Requirement	Assigned CDRL(s)
25.5.3-1	The SI shall prepare, deliver and maintain a detailed inventory of all NFPS Software in a Software Configuration Item List (SCIL). As Software development progresses, the lowest level to which the Software is defined during that phase shall be the level to which the Software inventory is documented. The SCIL shall document the evolution and/or changes that occur to each Software control item. The SI shall update the SCIL as each Software control item changes, throughout the Term.	CDRL 25-11
25.5.3-2	The SI shall utilize an MTA-approved tool to version control all Software baselines and changes throughout the project Software lifecycle and ensure that all Software baselines and changes have been officially processed. The SI shall maintain the build files and upon request make these files available to the MTA during audits.	CDRL 25-11
25.5.3-3	The SI shall include in the System Configuration Control Plan methods to address the following contingencies, which coordinates and complies with the MTA policy: <ul style="list-style-type: none"> • Emergency Software Changes (including firmware updates) • Patch Installation • Database Parameter Change • System Tuning 	CDRL 25-12
25.5.3-4	The SI shall submit all post-Factory Integration Testing (FIT) Software changes to the MTA for review and approval. Accompanying each proposed Software change, the SI shall submit comprehensive Software Release Notes for each proposed Software release containing at least the following: <ul style="list-style-type: none"> • A description of the change • Affected equipment and modules • A listing of the Software modules updated by the release, including file names, version numbers, sizes and checksums • A listing of all defects corrected, including references to MTA correspondence where applicable • A listing of all features tested • A listing of all new features included • Copies of all test procedures and test results Documentation • Complete installation instructions, including steps to verify proper installation and steps to remove the updated Software • Complete build instructions • List of Software tools used • Back out procedures if the new Software fails to update or load 	CDRL 25-11

Req. #	Requirement	Assigned CDRL(s)
25.5.3-5	Upon approval, the NFPS Agencies will install the proposed Software change in each of their respective Test Facilities described in Technical Specifications Section 28.1 (Test Facilities). Upon successful verification of the Software change, the MTA shall authorize the SI to deploy the Software change according to the approved deployment plan included in the Software Release Notes. Deployment will be confirmed by written report provided by the SI.	CDRL 25-11

25.6 Management Required Submittals

The required submittals specified in this Technical Specifications Section 25 (Management) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 25-1	Management Plan	Sections 25.1.1, 25.1.2, 25.1.4	✓	✓		Within 30 days after NTP
CDRL 25-2	Master Program Schedule	Section 25.1.3	✓	✓	✓	Within 30 days after NTP
CDRL 25-3	Safety Assurance Program Plan	Section 25.1.4	✓	✓	✓	Within 30 days after NTP
CDRL 25-4	Risk Management Plan	Section 25.1.5	✓	✓		Within 30 days after NTP
CDRL 25-5	Transition and Change Management Plan	Section 25.1.6	✓	✓	✓	For the MTA's approval during FDR
CDRL 25-6	Issues List and Action Item Log	Section 25.2.1	✓	✓	✓	30 days after NTP, and monthly
CDRL 25-7	Correspondence Log	Section 25.2.2	✓	✓	✓	30 days after NTP, and as requested
CDRL 25-8	Progress Review Meeting Materials	Section 25.3	✓	✓	✓	30 days after NTP, and per Contract requirements
CDRL 25-9	Quality Assurance Program Plan	Section 25.4	✓	✓	✓	Within 30 days after NTP
CDRL 25-10	Hardware Management Plan	Section 25.5.2		✓	✓	After approval of post-FAI Hardware changes
CDRL 25-11	Software Management Plan	Section 25.5.3		✓	✓	After approval of post-FIT Software changes
CDRL 25-12	System Configuration Control Plan and Procedures	Section 25.5		✓	✓	For the MTA's approval during FDR

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 25-13	Equipment Identification and Labeling Plan	Section 25.5.1		✓	✓	For the MTA's approval during FDR
CDRL 25-14	INTENTIONALLY OMITTED					
CDRL 25-15	Document Control Scheme and System	Section 25.2	✓			Within 30 days after NTP
CDRL 25-16	Earned Value Management Report	Section 25.2.2	✓	✓	✓	Within 30 days after NTP, and monthly
CDRL 25-17	GUI and Prototyping Plan	Section 25.1	✓	✓	✓	30 days prior to design review
CDRL 25-18	Requirements Traceability Matrix	Section 25.1	✓	✓	✓	30 days prior to design review

26 Design Reviews

The following three “Formal Design Review Phases” will be conducted throughout this Project: (i) Conceptual Design Review; (ii) Preliminary Design Review; and (iii) Final Design Review. For each of these Design Review Phases, the SI shall submit Documentation, samples and demonstrations to the MTA for review and approval. For each of these Design Review Phases, the SI will also include a review and assessment of the project design principles and goals listed in Technical Specifications Section 4.2 (Project Goals & Objectives).

The SI may take an iterative approach to system design whereby a design review cycle (each, a “**Design Review Cycle**”), consisting of the three Design Review Phases, is conducted in association with the delivery of a specific Beneficial Use milestone or set of milestones (see Technical Specifications Section 4.9 (Project Schedule)). The SI shall propose a system design approach that enables the most effective and efficient delivery of the Project, which may include anywhere from one (1) to five (5) Design Review Cycles.

The requirements in these Technical Specifications, including those relating to the delivery of CDRLs and other Deliverables, apply to all Design Review Cycles proposed by the SI. Any references to a specific Design Review Phase shall be considered as referring to the Design Review Cycle conducted for the Beneficial Use milestone where the associated functionality is being delivered. Any general references to a Design Review Phase shall be considered as referring to the first Design Review Cycle conducted as part of the Project.

The SI shall be required to submit or resubmit applicable CDRLs and other Deliverables during any Design Review Cycle for which documented functionality is being delivered. The SI shall map all Deliverables to the proposed Design Review Cycles as part of the Design Review plan submitted to the MTA for review and approval.

26.1 Design Review Requirements

Req. #	Requirement	Assigned CDRL(s)
26.1-1	Formal Design Reviews will be conducted between the MTA and the SI to evaluate progress and the technical, functional and programmatic adequacy of the NFPS design in accordance with the performance requirements of the Contract Documents.	CDRL 26-1
26.1-2	The SI shall submit a Design Review plan for the MTA's review and approval within 30 calendar days of NTP. This plan will describe the scope, schedule and deliverable format for each of the formal Design Reviews.	CDRL 26-1
26.1-3	The SI shall submit a Design Review packages that includes CDRLs and other required items prior to each design review meeting. Design Review meetings shall take place at a designated NFPS Agency facility.	CDRL 26-1
26.1-4	Design Review packages will be provided to the MTA at least 30 calendar days before a Design Review meeting.	CDRL 26-1

Req. #	Requirement	Assigned CDRL(s)
26.1-5	<p>Design Reviews will consist of the following key activities:</p> <ul style="list-style-type: none"> • Design Review packages will be reviewed by the MTA and consultant staff. • A Master Issues List (MIL) will be created by the SI as a result of the Design Review and will be provided to the MTA at least two (2) business days prior to the scheduled Design Review meeting. • The Design Review meeting, or series of meetings, will be held with the SI and the MTA. The SI shall confirm the requirements with detailed explanations of how the SI is complying with the requirements. The MTA will then verify that the SI met the applicable requirements. Where possible, issues will be resolved during the Design Review meetings. • All issues discussed during the meetings will be identified and included in Documentation by the SI, including status (i.e., open or closed), and provided to the MTA. The MTA will determine the appropriate action to close the issue, giving consideration to where the Project is in the overall Design Review process. This determination may require resubmission of Design Review packages. • The submittal will be approved upon the MTA's determination that there are no open issues. 	CDRL 26-1
26.1-6	<p>The SI shall provide Documentation of the approach for Software verification and validation. Such Documentation will determine whether (i) developed products for a given activity conform to the applicable requirements set out in the Contract Documents; and (ii) the Software satisfies its intended use and the user's needs. This Software Verification and Validation Plan will be reviewed and approved by the MTA.</p>	CDRL 26-7

26.2 Conceptual Design Review

The primary objectives of the Conceptual Design Review (CDR) are to acquaint the MTA with the SI's intended design and procurement activities, resolve any open items related to NFPS Interfaces, and provide the basis for proceeding to Preliminary Design Review (PDR).

Req. #	Requirement	Assigned CDRL(s)
26.2-1	<p>At a minimum, the CDR will accomplish the following:</p> <ul style="list-style-type: none"> • Confirm the structure of the SI's management team and the scope of any Subcontractors • Provide narrative descriptions of the major systems and subsystems proposed by the SI for the NFPS • Provide preliminary specifications for the NFPS Validators, CVMs, and retail POS terminals and Customer Service POS Terminals • Identify all NFPS Interfaces • Identify responsibilities and a schedule for completion of the detailed Interface definitions • Provide system block diagrams showing the functionality of and Interfaces between NFPS components, including external systems that will not be provided by the SI, but will interface with the NFPS, and External Interfaces to such external systems, and the list of such external systems will be provided by the MTA during the design sessions • Provide a Software conceptual design, including Software block diagrams for key NFPS components (i.e., those components used by the riding public and for the sale of fares) • Confirm the SI's understanding of the intended operations and maintenance environment • Identify key information and decisions required from the MTA 	CDRL 26-2
26.2-2	The SI will be required, as part of CDR in addition to the items listed above, to provide specific submittals to the MTA. The MTA will identify the additional submittals that will need to be provided by the SI. Each submittal will conform to the requirements specified herein.	CDRL 26-2
26.2-3	Each submittal will include documents in electronic format (searchable PDF) in the SharePoint project document control system with the appropriate access controls and one reproducible hard copy.	CDRL 26-2

26.3 Preliminary Design Review

The objective of the PDR is to review the progress of the Project and evaluate specification compliance of the completed work and work in progress. The SI shall categorize the PDR information into logical topics. The PDR may be conducted in a series of meetings in locations relevant to the topics discussed. Ideally, the formal PDR meetings will be limited to confirmation of previously reviewed, commented on, and approved-in-principle submittals and the resolution of open issue items.

Req. #	Requirement	Assigned CDRL(s)
26.3-1	PDR will occur when the SI has completed approximately 75 percent of the total engineering and organizational design.	CDRL 26-3
26.3-2	The PDR will cover the following:	CDRL 26-3

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Schedule compliance review and discussion of variances or delays Assessment of compliance with new system design principles as stipulated in Technical Specifications Section 4.2 (Project Goals & Objectives). Power diagrams and functional block diagrams for each piece of NFPS Equipment Detailed hardware and Software Design Documentation for all NFPS Equipment, including mounting arrangements and installation methods Complete customer and operator user interface Design Documentation, flow charts, and messages for all NFPS Equipment, including accommodations of all boundary and error conditions Detailed Interface and communication Design Documentation for all Internal and External Interfaces List of special tools and diagnostic test equipment needed for maintenance of each component of the NFPS Detailed Software flow charts for the NFPS Backend and NFPS Back Office Detailed Software flow charts for OSVD Software Detailed flow charts for end-to-end processing of all events from Frontend NFPS Equipment through to complete NFPS Backend and NFPS Back Office processing Detailed flow charts for all Mail&Ride transactions and processing Detailed Design Documentation for Software version and configuration control systems Detailed Design Documentation for access control systems supporting NFPS Backend and NFPS Back Office operations Detailed description of NFPS data backup and recovery procedures 	
26.3-3	The submittals will be required as part of PDR in addition to the items listed above, including a detailed Human Factors Analysis and ADA compliance review of the appropriate system components. Each submittal will conform to the requirements specified herein.	CDRL 26-5, CDRL 26-6
26.3-4	Each submittal will include Documentation in electronic format (searchable .PDF) and one reproducible hard copy.	CDRL 26-3

26.4 Final Design Review

The objective of the Final Design Review (FDR) is to determine whether the detailed NFPS design will satisfy all of the design requirements established in the Contract Documents.

Req. #	Requirement	Assigned CDRL(s)
26.4-1	The SI shall notify the MTA when the SI believes that the detailed design is complete and that production Design Documentation and drawings are ready for release. FDR will be conducted when such Design Documentation and drawings have been delivered to the MTA, and the MTA subsequently approves the same.	CDRL 26-4
26.4-2	Data submitted for the PDR will be updated by the SI to a level of detail consistent with the completed design and submitted as part of FDR.	CDRL 26-4
26.4-3	<p>FDR will include but not be limited to the following:</p> <ul style="list-style-type: none"> • Schedule compliance review and discussion of variances or delays • Assessment of compliance with new system design principles as stipulated in Technical Specifications Section 4.2 (Project Goals & Objectives). • Assembly drawings for all NFPS Hardware, down to the LLRU • Electrical schematic drawings for all NFPS Hardware • Preliminary “as-built” drawings and prototypes for all NFPS Hardware mounting configurations • Final system architecture drawings • Detailed Software Design Documentation for the NFPS Backend and NFPS Back Office, consisting of structured data flow diagrams to the lowest level of decomposition with Software module descriptions in a structured narrative format • Detailed API Documentation for all APIs supporting front end, NFPS Backend and NFPS Back Office operations • Detailed Design Documentation for all system transaction formats not included in the API Documentation • Interface control Documentation for the NFPS • Detailed Design Documentation of all messaging formats and data elements for all NFPS Hardware and NFPS messaging • Complete data dictionary and detailed database Design Documentation, including all tables, views and materialized views, for all database schemas in the NFPS, in electronic (browsable) format (ER Studio, for example) • Above requirement will include Design Documentation of database programming and administration features, including: queries, query formats, triggers, jobs, functions and procedures 	CDRL 26-4
26.4-4	FDR will also include a review of the spare parts required to support the NFPS. The SI and the MTA shall jointly review the spare parts listed in the Contract Documents and reallocate, delete and add parts as necessary.	CDRL 26-4
26.4-5	Specific submittals will be required as part of FDR in addition to the items listed above, including a detailed Human Factors Analysis and ADA Compliance Review of the appropriate system components. Each submittal will conform to the requirements specified herein.	CDRL 26-5, CDRL 26-6

Req. #	Requirement	Assigned CDRL(s)
26.4-6	Each submittal will include Documentation in electronic format (searchable PDF) and one reproducible hard copy.	CDRL 26-4

26.5 Design Reviews Required Submittals

The required submittals specified in this Technical Specifications Section 26 (Design Reviews) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 26-1	Design Review Plan	Section 26.1				30 days prior to CDR
CDRL 26-2	Conceptual Design Review Package	Section 26.2	✓			30 days prior to CDR
CDRL 26-3	Preliminary Design Review Package	Section 26.3		✓		30 days prior to PDR
CDRL 26-4	Final Design Review Package	Section 26.4			✓	30 days prior to FDR
CDRL 26-5	Human Factors Analysis	Section 26.4		✓	✓	30 days prior to design review
CDRL 26-6	ADA Compliance	Section 26.4		✓	✓	30 days prior to design review
CDRL 26-7	Software Verification and Validation Plan	Section 26.1	✓	✓	✓	30 days prior to design review

27 Factory Testing and Inspection

The SI shall plan for, perform, monitor and document all tests required to prove the design and acceptability of the NFPS, including all elements, subsystems and the NFPS as a whole. The SI shall furnish NFPS components, including Media, that meets the criteria specified for all Tests. Testing will not commence until all designs affecting the respective equipment and all related testing procedures have been approved.

The SI shall begin no portion of the inspection and testing regimen unless all prerequisite Tests and Design Reviews have been successfully completed and approved in writing by the MTA. In the event that some elements of the NFPS are rolled out prior to complete system development of the NFPS, all testing phases will be completed in their entirety for each set of completed functionality as deployed.

27.1 Inspection and Testing Plan

Req. #	Requirement	Assigned CDRL(s)
27.1-1	SI shall submit an Inspection and Testing Plan for the MTA's review and acceptance, to be used in connection with all inspections and Tests as described in Technical Specifications Section 27 (Factory Testing and Inspection) and Technical Specifications Section 30 (Post-Installation Testing and System Acceptance) of these Specifications.	CDRL 27-1
27.1-2	SI shall submit a schedule for all factory tests and inspections for the MTA's review and approval no less than 60 calendar days prior to the start of any testing.	CDRL 27-1
27.1-3	No inspections or tests will be performed before the MTA accepts the SI's Inspection and Testing Plan.	CDRL 27-1
27.1-4	The Inspection and Testing Plan will cover all SI, supplier and Subcontractor inspections and tests to be performed, including those performed under the SI's QA Program Plan as described in Technical Specifications Section 25.4.2 (Quality Assurance Program Plan).	CDRL 27-1
27.1-5	The Inspection and Testing Plan will include a detailed schedule indicating the sequence of each test and where and when each test will take place, and the number of the SI provided staff who will be covering each test.	CDRL 27-1
27.1-6	The Inspection and Testing Plan will detail the number and range of tests as well as the number and type of failures allowed for acceptance for each phase of testing. The Inspection and Testing Plan will also contain a list of pass/fail criteria that will be used as the basis for acceptance. All performance measurement procedures and acceptable results including the number and type of failures allowed in each test phase to qualify as passing will be subject to the MTA's review and approval.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.1-7	<p>The SI shall allow minimum time for testing during each stage, subject to approval by the MTA. The MTA anticipates the following minimum testing durations:</p> <ol style="list-style-type: none"> 1. First Article Inspection (FAI): 1-2 days per device type 2. Factory Acceptance Testing (FAT): 2-3 months including functional testing, cycle testing and environmental testing 3. Factory Integration Testing (FIT): 4 months 4. Production Inspection & Testing: determined during Design Review 5. Post-Production Testing: determined during Design Review 6. Systems Integration Lab Testing: determined during Design Review 7. Systems Integration Field Testing: determined during Design Review 8. Pilot Testing: 2 months per Pilot 9. Revenue Service Acceptance Testing: determined during Design Review 10. Ad-hoc testing: as required 	CDRL 27-1
27.1-8	The Inspection and Testing Plan will include a description of the SI's system for control and calibration of the test equipment throughout the entire Project, including parts lists, drawings, Software versions, inspection and test records, networks and maintenance records.	CDRL 27-1
27.1-9	All NFPS components and subsystems will be tested individually and in an integrated environment (i.e., all functionality for the NFPS components and subsystems is complete and integrates with the NFPS as designed) to ensure that they meet all technical and functional requirements.	CDRL 27-1
27.1-10	Testing will incorporate all requisite integration with the NFPS Agencies' systems as described in the Contract Documents.	CDRL 27-1
27.1-11	The SI shall provide all labor, all materials (including Closed-Loop, Extended-Use, Limited-Use and Open Payment Media), and all support services including facilities required to completely stage, inspect and test all hardware and Software being supplied.	CDRL 27-1
27.1-12	Testing will be conducted at device, systems, and integration levels as further specified in Technical Specifications Section 27 (Factory Testing and Inspection) and Technical Specifications Section 30 (Post-Installation Testing and System Acceptance).	CDRL 27-1
27.1-13	All tests and inspections will be monitored and signed off by the MTA or its representative as well as the SI or its representative, and documented by the SI.	CDRL 27-1
27.1-14	The Inspection and Testing Plan will identify those requirements the SI intends to meet by means other than testing.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.1-15	The SI shall design the system to utilize the MTA-provided communications network successfully for deployment of the NFPS as designed.	CDRL 27-1
27.1-16	Any and all hardware or Software not passing inspection or test will be replaced, or otherwise corrected by the SI and rescheduled for inspection and testing.	CDRL 27-1
27.1-17	The SI shall establish the Test Facilities as specified in Technical Specifications Section 28.1 (Test Facilities) no later than the commencement of Systems Integration Lab Testing, specified in Technical Specifications Section 30.1.1 (Systems Integration Lab Testing).	CDRL 27-1
27.1-18	The SI shall update all Test Facilities throughout Quality Assurance, Inspection and Testing period to maintain a duplicate instance of the SI Test Facility, as necessary.	CDRL 27-1
27.1-19	Prior to the start of any formal testing, the SI shall conduct “dry-run” testing (i.e., a test/check of the major functions before full testing begins to test the functionality) to identify and resolve any issues that arise before formal testing.	CDRL 27-1
27.1-20	The Inspection and Testing Plan will include plans for each type of testing defined in this Technical Specifications Section 27.1 (Inspection and Testing Plan), including: <ol style="list-style-type: none"> 1. First Article Inspection (FAI) 2. Factory Acceptance Testing (FAT) 3. Factory Integration Testing (FIT) 4. Production Inspection & Testing 5. Post-Production Testing 6. Systems Integration Lab Testing 7. Systems Integration Field Testing 8. Pilot Testing 9. Revenue Service Acceptance Testing 	CDRL 27-1
27.1-21	Successful completion of each phase of testing will be subject to the MTA's approval against approved performance requirements.	CDRL 27-1

27.1.1 Inspection and Test Procedures

Req. #	Requirement	Assigned CDRL(s)
27.1.1-1	The SI shall prepare and submit to the MTA a detailed procedure for each inspection and test to be performed along with the pass/fail criteria.	CDRL 27-2

Req. #	Requirement	Assigned CDRL(s)
27.1.1-2	Detailed inspection and test procedures will be submitted to the MTA for review and acceptance a minimum of 30 days prior to the corresponding test performance, unless otherwise specified herein. Detailed inspection and test procedures will include mapping or references to the Design Documentation or functional requirement related to the test. If inspection and test procedures are not approved, the SI shall resubmit according to the MTA feedback and comments.	CDRL 27-2
27.1.1-3	The SI shall conduct no inspection or test until acceptance of the corresponding detailed test procedure has been given by the MTA.	CDRL 27-2
27.1.1-4	The SI shall submit operations manuals for the MTA's review and approval or approval with comments prior to the start of any testing procedures.	CDRL 27-2
27.1.1-5	Detailed inspection and test procedures will include the procedure to be followed, as well as a description of the resolution of problems and failure recurrence.	CDRL 27-2
27.1.1-6	A re-test will be performed for all NFPS components affected by adjustments resulting from testing, up to and including the entire NFPS if the MTA determines such is needed.	CDRL 27-2
27.1.1-7	The Inspection and Testing Procedures will include procedures for each type of testing defined in this Technical Specifications Section 27.1 (Inspection and Testing Plan), including: <ol style="list-style-type: none"> 1. First Article Inspection (FAI) 2. Factory Acceptance Testing (FAT) 3. Factory Integration Testing (FIT) 4. Production Inspection & Testing 5. Post-Production Testing 6. Systems Integration Lab Testing 7. Systems Integration Field Testing 8. Pilot Testing 9. Revenue Service Acceptance Testing 	CDRL 27-2

With the MTA's prior approval, the SI shall submit existing procedures that differ from this format. The MTA will accept test procedures only if they are inclusive and thoroughly test each NFPS component, both independently and collectively.

The MTA reserves the right to develop additional test procedures to be performed by the SI or other designated organizations.

27.1.2 Inspection and Test Reports

Req. #	Requirement	Assigned CDRL(s)
27.1.2-1	The SI shall submit a written report for each inspection and test, including copies of all inspection/test data for the MTA's acceptance. All reports and records will be provided in Excel format for easy migration of serial numbers and other details to other database formats.	CDRL 27-3
27.1.2-2	Inspection/test reports will include all historical Data, such as inspections and tests performed, failures, detailed transaction data, and modifications or repairs pertaining to the item, NFPS component or system tested.	CDRL 27-3
27.1.2-3	Reports will be submitted to the MTA for review and acceptance within 30 calendar days of the completion of any test. These reports will be maintained in the SharePoint project document control system with the appropriate access controls. The access controls shall be approved by the MTA.	CDRL 27-3
27.1.2-4	The Inspection and Test Reports will include reports for each type of testing defined in this Technical Specifications Section 27.1 (Inspection and Testing Plan), including: <ol style="list-style-type: none"> 1. First Article Inspection (FAI) 2. Factory Acceptance Testing (FAT) 3. Factory Integration Testing (FIT) 4. Production Inspection & Testing 5. Post-Production Testing 6. Systems Integration Lab Testing 7. Systems Integration Field Testing 8. Pilot Testing 9. Revenue Service Acceptance Testing 	CDRL 27-3

27.1.3 Test Waivers

Req. #	Requirement	Assigned CDRL(s)
27.1.3-1	If an NFPS component or subsystem in question is considered by the MTA to be identical to equipment previously deployed in other applications similar to, or more stringent than the MTA's environment, specific tests on that system component may not be necessary. To obtain this waiver, the SI shall provide a formal request for a testing waiver for each applicable component or subsystem.	CDRL 27-4
27.1.3-2	If the SI desires a waiver of testing, the SI shall submit required information for each applicable component or subsystem to the MTA 60 calendar days prior to the date of planned testing.	CDRL 27-4
27.1.3-3	Required information for waiver of testing will include the following: <ul style="list-style-type: none"> • List of the locations and quantities of current equipment installations, including duration of revenue service • Description of all relevant differences among the other 	CDRL 27-4

Req. #	Requirement	Assigned CDRL(s)
	installations and the requirements of applicable specifications <ul style="list-style-type: none"> • Description of all differences between the currently installed equipment and the system components intended for the applicable specifications • Test results of any relevant tests that have been conducted on this equipment • Reliability data for previously installed equipment, verifiable through purchasers • Cost credit to the MTA for the waiver 	
27.1.3-4	Based on submitted Data (and any additional Data requested by the MTA), the MTA will determine if the requirements for testing will be waived.	CDRL 27-4
27.1.3-5	Specific requirements for each NFPS component will be considered individually, and waivers will be issued on an individual basis; it is possible that the MTA may grant a waiver for certain tests while others will still be required.	CDRL 27-4
27.1.3-6	No waiver will be granted for any integrated testing of components.	CDRL 27-4

27.2 First Article Inspection (FAI)

FAI will allow inspection and verification by the MTA that NFPS production components comply with these Specifications, and that the quality and design is acceptable to the MTA. Because COTS components are mandated (to the greatest extent possible that COTS Components can be used), it will be necessary to view and approve the various devices and their Interfaces.

Req. #	Requirement	Assigned CDRL(s)
27.2-1	FAI will take place at the point of assembly after completion of the first production run for each of the NFPS components, including NFPS Validators, Configurable Vending Machines, CS POS Terminals, TOMs, RF Workstations and the NFPS Backend and NFPS Back Office, including all subsystems.	CDRL 27-1
27.2-2	At FAI, the MTA will have the right to inspect any or all of the units produced to date.	CDRL 27-1
27.2-3	Quality of workmanship for the production of subsequent NFPS components will be established at the FAI. The quality of workmanship will be determined by the MTA and its assigned QA personnel.	CDRL 27-1
27.2-4	The MTA will be notified not less than 30 calendar days before the FAI; subsequently, the SI shall be advised regarding the MTA's attendance.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.2-5	FAI will verify that NFPS production components comply with the applicable specifications, including design configuration and drawings as accepted during the final design review, or the latest revision thereof. By way of clarification, and not limitation, the MTA shall have the right to make reasonable design changes to NFPS components during FAI.	CDRL 27-1
27.2-6	The SI shall provide Documentation of quality inspections performed at Subcontractor facilities or of the SI's quality inspections of components manufactured by others, which will be available for the MTA's review at the FAI.	CDRL 27-3
27.2-7	The SI shall deliver Data that include the latest drawings, design test procedures, specifications and quality documentation required for adequate completion of the adequate completion of the FAI of system components under inspection a minimum of 30 calendar days prior to FAI.	CDRL 27-3
27.2-8	The list of drawings will be identified by revision and be complete to the Lowest-Level Replaceable Unit (LLRU).	CDRL 27-3

27.3 Factory Acceptance Testing (FAT)

The purpose of FAT will be to demonstrate that all NFPS components to be furnished meet all requirements contained in these Specifications.

In the event the SI has already conducted substantially similar tests to those described herein, the MTA may be willing, but is not obligated, to accept the results of those tests as satisfying some of the requirements of this Technical Specifications Section 27.3 (Factory Acceptance Testing (FAT)).

Req. #	Requirement	Assigned CDRL(s)
27.3-1	Successful completion of the FAI, including the MTA's approval of all inspection reports, is a pre-requisite to commencement of FAT.	CDRL 27-1
27.3-2	The SI shall prepare and submit FAT procedures within 21 calendar days of the completion of the FAI for review and acceptance by the MTA.	CDRL 27-1
27.3-3	The NFPS components to be tested in the FAT will be from the first run of production units, which may be chosen by the MTA. Once chosen, the units shall not be modified without the express consent of the MTA. Once a particular series of tests begins on a particular unit, it will be completed for that unit.	CDRL 27-1
27.3-4	FAT will be conducted by the SI at the SI's facility.	CDRL 27-1
27.3-5	All Media (including Paper Media and receipt stock) required for FAT will be supplied by the SI. Currency and coins used will be in "street condition" and supplied by the SI.	CDRL 27-1
27.3-6	The MTA will, at its discretion, assign staff or representatives to witness and/or periodically audit FAT progress.	CDRL 27-1
27.3-7	All FAT reports will be subject to the MTA's review and acceptance.	CDRL 27-3

Req. #	Requirement	Assigned CDRL(s)
27.3-8	FAT functional and cycling tests will demonstrate all base functions of the NFPS components.	CDRL 27-1
27.3-9	The human factors test will verify device compliance with the general design requirements in Technical Specifications Section 5 (General Design Requirements) and as otherwise set out in these Contract Documents.	CDRL 27-1
27.3-10	The environmental test will demonstrate compliance with the environmental requirements contained in Technical Specifications Section 5.6 (Environmental Conditions).	CDRL 27-1
27.3-11	The maintainability test will demonstrate compliance with the maintainability requirements set forth in Technical Specifications Section 5.13 (Maintainability and Serviceability).	CDRL 27-1
27.3-12	The First Article Inspection of NFPS components will be representative of the final production item.	CDRL 27-1
27.3-13	If the SI has already conducted substantially similar tests to those described herein the SI shall submit procedures and results of those tests to the MTA for consideration.	CDRL 27-1
27.3-14	The test procedures will be submitted to the MTA for review, modification, and approval at least 60 calendar days prior to scheduled conduct of the FAT.	CDRL 27-3
27.3-15	The SI shall be responsible to maintain a complete log of all FATs conducted under this Technical Specifications Section 27.3 (Factory Acceptance Testing (FAT)), showing each test conducted and results.	CDRL 27-3
27.3-16	The log will be submitted to the MTA at conclusion of the FAT for review and acceptance.	CDRL 27-3
27.3-17	The SI shall certify the accuracy of all submitted test results.	CDRL 27-3
27.3-18	Results not meeting specification requirements will be fully documented and explained by the SI, and a plan for corrective action will be submitted by the SI.	CDRL 27-1
27.3-19	The MTA may delay delivery of any NFPS components until FAT procedures are successfully completed and documented.	CDRL 27-1
27.3-20	A separate test region of the NFPS Backend and NFPS Back Office will be created and logically separated from production Data for testing.	CDRL 27-1
27.3-21	Factory acceptance testing of NFPS components will be connected to the test region of the NFPS Backend and NFPS Back Office for data transfer in a manner simulating the installed system throughout functional and cycling tests.	CDRL 27-1
27.3-22	All NFPS Interfaces with the NFPS Backend and NFPS Back Office will be tested as an integral part of the FAT.	CDRL 27-1
27.3-23	Contactless Media to be used in the FAT will be those provided for testing purposes by the SI as specified in Technical Specifications Section 18.1.9 (MTA Acceptance Testing). The SI shall document, inventory and track types of Media and usage during testing.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.3-24	Smart Cards and other Contactless Media will be the same as those planned for revenue service.	CDRL 27-1
27.3-25	Smart Cards to be used for the tests will be a mix of freshly issued cards and those representing typical conditions resulting from handling by the public.	CDRL 27-1
27.3-26	Open Payment Media to be used in FAT will be those provided for testing purposes by the SI as specified in Technical Specifications Section 18.1.9 (MTA Acceptance Testing).	CDRL 27-1
27.3-27	If at any time after the FAT results have been accepted a design change is made, the SI will re-test after the design change and verify the performance of the modified NFPS components will be demonstrated as conforming to the applicable specifications and the re-test results will be submitted to the MTA for acceptance.	CDRL 27-1
27.3-28	Successful completion of FAT will be a prerequisite for manufacturing of production NFPS components.	CDRL 27-1
27.3-29	The SI shall provide all necessary supplies for the FAT.	CDRL 27-1

27.3.1 Field Devices

Testing for all Field Devices will cover all SVs, BVs, WVMs, CS POS Terminals, TOMs, RF Workstations, OSVDs, and CVMs, and will include the following tests. Successful completion of the testing requires no Failures or discrepancies in function to those as agreed at the FDR.

Req. #	Requirement	Assigned CDRL(s)
27.3.1-1	The SI shall complete Functional Testing for all Field Devices to verify proper performance of all functions, measure and report all conditions and demonstrate correct operation for devices as defined in the Contract Documents. The SI and the MTA shall jointly develop the structure, timing and pass/fail criteria of the Functional Testing.	CDRL 27-1
27.3.1-2	After completing the device Functional Test, the SI shall conduct the device cycling tests, which will consist of completed transactions using all Media types and fare transactions. Cycle testing will be comprised of at least 8,000 NFPS Validator, 8,000 CVM, 4,000 CS POS Terminal, and 4,000 TOM transactions. OSVD cycle testing transactions will be determined during design review.	CDRL 27-1
27.3.1-3	Subsequent to successful completion of the Functional Test, the SI shall conduct an Environmental Test. The Environmental Test will subject each type of Field Device to the environmental extremes specified in Technical Specifications Section 5.6 (Environmental Conditions), and a scaled down version of the cycling test, to demonstrate the capability of the device to operate successfully within these extreme conditions.	CDRL 27-1

27.3.2 NFPS Backend, NFPS Back Office, and NFPS Websites and NFPS Mobile Applications

Testing for the NFPS Backend, NFPS Back Office, and NFPS Websites and NFPS Mobile Applications will include the following tests. Successful completion of the testing requires no failures or discrepancies in function to those as agreed at the FDR, and 100% accuracy of all data exchanges and display.

27.3.2.1 Functional Tests

Req. #	Requirement	Assigned CDRL(s)
27.3.2.1-1	The SI shall submit test procedures for NFPS Backend, NFPS Back Office, NFPS Websites and NFPS Mobile Applications to the MTA for review, modification and approval at least 90 days prior to scheduled conduct of the functional tests. The MTA will assign staff and/or representatives to witness, approve and modify functional test as required.	CDRL 27-1
27.3.2.1-2	The SI shall complete Functional Testing for the NFPS Backend, NFPS Back Office, NFPS Websites and NFPS Mobile Applications which will demonstrate, exercise and verify all functions of the NFPS Backend and integration with other systems including external commercial systems, financial and Media fulfillment entities as well as all user-accessible screens and commands.	CDRL 27-1
27.3.2.1-3	The SI shall conduct import and export testing to demonstrate, exercise and verify all manual data loading from all devices, upload of configuration and fare structures to each of the various device types and import and export of various data sets.	CDRL 27-1
27.3.2.1-4	The SI shall test all applicable NFPS Interfaces. This testing will include transmission of Data from the NFPS Backend and/or NFPS Back Office to other systems, and import of Data where appropriate. The MTA shall provide parameters for acceptable data rates and confirm proper Data transfer and adherence to rates.	CDRL 27-1
27.3.2.1-5	The SI shall generate samples of all available reports for review and approval by the MTA as compliant with the designs approved at the FDR. Contents of the reports will be compared with the known contents of the data and verified for accuracy.	CDRL 27-1

27.4 Factory Integration Test

When all FATs for the devices and NFPS Backend and NFPS Back Offices have been successfully completed, the SI shall conduct a Factory Integration Test (FIT). The FIT will confirm that when installed, all NFPS Equipment will perform and communicate as required as a complete system.

With successful completion of the FIT, all Software and configuration files will be “frozen” and the SI shall make no changes without the MTA's authorization.

Req. #	Requirement	Assigned CDRL(s)
27.4-1	For the FIT, all Software modifications will be reviewed with the MTA, demonstrated and tested. The SI shall record version information for all Software modules including the date and time the Software was created, size of each file and version number.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.4-2	The SI shall connect all FAT Frontend NFPS Equipment (and other necessary NFPS Equipment) to additional equipment or simulators as necessary to create a functional model of the NFPS. The SI shall conduct a series of detailed transactions and other operations that will fully emulate a broad spectrum of transaction and operating scenarios, in sufficient quantity to ensure the validity of the test results. The SI shall provide a list of operating scenarios for the MTA's review and approval.	CDRL 27-1
27.4-3	The SI shall provide the "as-tested" Software Documentation to the MTA at the conclusion of the FIT.	CDRL 27-1
27.4-4	The MTA will, at its discretion, assign staff or representatives to witness and/or periodically audit FIT progress.	CDRL 27-1

27.5 Production Inspection & Testing

Req. #	Requirement	Assigned CDRL(s)
27.5-1	The SI and Subcontractors shall perform production inspections and tests on each NFPS component that is produced as an integral part of their QA program. The SI shall submit production inspection test procedures for the MTA's review and approval.	CDRL 27-1
27.5-2	Inspections and tests will verify, and the SI shall certify, that all NFPS components contain the correct materials, are assembled properly, and function all in accordance with specifications. Testing will include key performance indicators and ensure that the KPIs are met.	CDRL 27-1
27.5-3	The MTA may choose to observe, participate in, conduct or repeat testing on any item to confirm the validity of the SI's test procedures and results. The MTA may also perform, at its discretion, ad-hoc tests to ensure quality of the NFPS. The SI shall provide information, Documentation and appropriate access to assist in ad-hoc testing, if required. The SI shall maintain a test facility in which all Frontend NFPS Equipment is owned by the MTA; the MTA reserves the right to participate/observe and conduct ad-hoc testing at the SI's facility.	CDRL 27-1
27.5-4	The SI shall perform production inspections and tests at the point of manufacture on all NFPS components and on each completed device prior to each shipment.	CDRL 27-1
27.5-5	Inspections and tests will verify that each unit is produced to at least the same quality level as the unit presented for the FAI and FAT.	CDRL 27-1

Req. #	Requirement	Assigned CDRL(s)
27.5-6	At a minimum and as applicable, these tests will include: <ul style="list-style-type: none"> • Performance tests of all validators, CVMs, WVMs, TOMs, OSVDs, RF Workstations and CS POS Terminals, which test operation in all modes • Data reporting and transfer • Alarms and alarms communication • Control keypad functions • Displays 	CDRL 27-3
27.5-7	The SI shall update production inspection and testing sheets and procedures based upon experience gained from subsequent testing or NFPS component operation.	CDRL 27-3
27.5-8	Test procedures will be expanded to focus on areas that demonstrate, or have historically demonstrated, higher levels of failure or reduced performance.	CDRL 27-2
27.5-9	The SI may submit requests in writing for test simplification in areas where a high degree of confidence is developed.	CDRL 27-2
27.5-10	Test simplification requests will be subject to the MTA's approval.	CDRL 27-2
27.5-11	The SI shall keep complete records of all production inspections and tests that are performed.	CDRL 27-3
27.5-12	The SI shall note any failures, subsequent corrective measures and retests.	CDRL 27-3
27.5-13	The SI shall submit all production inspection and testing records to the MTA upon completion, wherever possible in Excel format.	CDRL 27-3
27.5-14	Successful completion of the production inspections and tests on all NFPS Validators, CVMs, WVMs, TOMs, OSVDs, RF Workstations and CS POS Terminals will be a prerequisite for installation of the NFPS components on the NFPS Agencies' properties.	CDRL 27-1

27.6 Post-Production Testing and Pre-Shipment Inspection

Req. #	Requirement	Assigned CDRL(s)
27.6-1	Each production unit of NFPS equipment will be subjected to a functional test similar to the cycling tests in Technical Specifications Section 27.3.1 (Field Devices) and after assembly, performed at ambient temperature conditions. The Post-Production test will also include a 72-hour idle burn-in, where the equipment is confirmed operational after being left powered on in an idle state for at least 72 hours. The SI shall submit post-production test procedures for the MTA's review and approval. See Agreement Section 34.8 (Risk of Loss to the Work) for the required Equipment Review Notice process and the SI's obligations regarding the same.	CDRL 27-1
27.6-2	The SI shall notify the MTA at least 10 business days in advance of all scheduled shipments of applicable NFPS equipment. The MTA retains the right to conduct pre-shipment inspections.	CDRL 27-5

27.7 Factory Testing and Inspection Required Submittals

The required submittals specified in this Technical Specifications Section 27 (Factory Testing and Inspection) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 27-1	Inspection and Testing Plan	Sections 27.1, 27.2, 27.3, 27.4, 27.5, 27.6		✓	✓	At least 90 days prior to the start of any planned testing
CDRL 27-2	Inspection and Testing Procedures and Scripts	Sections 27.1.1, 27.5			✓	At least 60 business days prior to the start of each test.
CDRL 27-3	Inspection and Testing Reports	Sections 27.1.2, 27.2, 27.3, 27.5				Within 10 business days of completion of each successful test/inspection
CDRL 27-4	Waiver of Testing	Section 27.1.3				At least 90 days prior to the start of planned testing
CDRL 27-5	Shipment Schedule and Bill of Lading (BOL)	Section 27.6				At least 10 days prior to each shipment

28 Support Systems

28.1 Test Facilities

The MTA shall identify and provide a secure facility for the placement of three separate SI-furnished MTA Test Facilities—one each for NYCT, MNR and LIRR (as described in this Technical Specifications Section 28.1 (Test Facilities)) (each, a "**Test Facility**," and collectively, the "**Test Facilities**"), where NYCT, MNR, and LIRR may each test NFPS Hardware and Software, on an agency-specific basis. NYCT, MNR, and LIRR will each be responsible for providing and maintaining network communications to the applicable Test Facility, on an agency-specific basis. Hardware quantities for the Test Facilities will be sourced from the spares for each NFPS Agency. The SI shall provide all maintenance support of the Test Facilities, systems, and interfaces until either Revenue Acceptance is achieved for the fielded system or the MTA offers to take on the Test Facilities maintenance responsibilities.

Req. #	Requirement	Assigned CDRL(s)
28.1-1	The SI shall furnish three Test Facilities, one for each of NYCT, MNR, and LIRR on the property of each agency for such agency's use on an agency-specific basis.	CDRL 28-1
28.1-2	Scope and functionality of the Test Facilities will be a duplicate of that found at the SI's test facility.	CDRL 28-1
28.1-3	The NYCT Test Facility environments will be established at the commencement of system integration lab testing, which shall be at least six (6) months prior to the receipt of the Beneficial Use Certificate for Beneficial Use #1, and such environment will include at a minimum: functional NFPS Backend and NFPS Back Office (all components on systems separate from production systems), at least two each BV, SV and WVMs, CVMs, CS POS Terminals, RF Workstation, IVR, NFPS Websites and NFPS Mobile Applications.	CDRL 28-1
28.1-4	The MNR Test Facility and LIRR Test Facility environments will be established at the commencement of system integration lab testing and will include at least three CVMs each for LIRR and MNR, three TOMs for MNR, four TOMs for LIRR, and two Revenue Facility Workstations each for LIRR and MNR. The MNR and LIRR Test Facilities will connect to the test NFPS Backend and NFPS Back Office installed as part of the NYCT Test Facility.	CDRL 28-1
28.1-5	The Test Facilities will have the ability to connect directly to the Merchant Acquirer or any other processing entity to fully test the processing of Open Payments.	CDRL 28-1
28.1-6	The SI shall provide all special tools, test and inspection equipment necessary for maintaining, exchanging, troubleshooting, testing, repairing, calibrating and inspecting all NFPS Equipment, down to the LLRU, in addition to Documentation on each of these pieces of NFPS Equipment for backshop testing and repairs. This will include a golden chassis, any breakout boxes, test jigs, test fixtures and other supporting power and signal connections for diagnostic test and adjustment of all modules.	CDRL 28-1

28.1-7	The SI shall provide simulation Software that can be installed on a PC so that different Field Device screens can be tracked and screen flow on the Field Device selected (simulating a customer's screen selection) can be simulated using a mouse and/or keyboard.	CDRL 28-1
28.1-8	The NYCT Test Facility will include a dedicated work station for use by the Third Party tester (see Technical Specifications Section 30.2 (API Testing and Certification)) for the purposes of independent testing of the NFPS, including testing of the integration of an alternate COTS NFPS Validator as described in Technical Specifications Section 30.2 (API Testing and Certification), and all APIs as described in Technical Specifications Section 6.4 (Application Programming Interfaces).	CDRL 28-1
28.1-9	The SI shall provide special tools and equipment to each of the applicable agencies (NYCT, MNR, and LIRR), on an agency-specific basis, as specified in Technical Specifications Section 4.9 (Project Schedule).	CDRL 28-1

28.2 Smart Card Certification Workstations

The SI shall provide the NFPS Agencies with Smart Card Certification Workstations (SCCWs) to allow the NFPS Agencies to confirm that the NFPS Equipment is properly processing Smart Card Media, and that the NFPS Equipment is capable of detecting improperly encoded, expired, counterfeit and defective Smart Card Media.

Req. #	Requirement	Assigned CDRL(s)
28.2-1	<p>The SI shall provide Smart Card Certification Workstations as described herein, including in Technical Specifications Section 28.2 (Smart Card Certification Workstations), Section 4.10.1 (NYCT NFPS Equipment), and Section 35.12.1 (NFPS Equipment Quantities and Locations). Such SCCWs shall otherwise have the following functions:</p> <ul style="list-style-type: none"> • Reads Smart Card Media and displays the contents of all data fields encoded on the Smart Card Media in a readable form • Verifies that a Smart Card Media or other Media is valid according to fare policies and other requirements • Readily identifies any data fields and elements that are invalid • Creates and modifies Smart Media with valid or invalid Data, including Media of types and categories not in revenue service but supported by the Smart Card Media encoding format • Processes all Contactless Media 	CDRL 28-2

Req. #	Requirement	Assigned CDRL(s)
28.2-2	The SCCWs shall incorporate a data analysis tool that will automatically read, interpret and display a readable version of the encoding format of the Smart Card Media being evaluated via a simple graphical user interface on latest Microsoft Windows platform. The design and layout of all SCCW screens will be subject to the MTA's review and approval.	CDRL 28-2
28.2-3	The SCCWs will be comprised of a PC desktop computer interfaced with a Contactless Smart Card processor subject to the MTA's review and approval.	CDRL 28-2
28.2-4	The SCCWs will include a secure method of receiving and storing the encryption keys used to read from and write to Smart Card Media. The SI shall propose a security architecture and key management plan for the management, distribution, controlled use, revocation and replacement of security keys. The method of transporting and securing the encryption keys will be subject to the MTA's review and approval.	CDRL 28-2
28.2-5	The SI shall deliver an installation package for the SCCWs that will be installed and tested on SI-delivered desktops and/or laptops. The installation package will include all necessary Hardware and Software.	CDRL 28-2

28.3 Revenue Facility (RF) Workstation

The SI shall provide configurable RF Workstations to be used to receive and track cash boxes that are transported to each NFPS Agency's Revenue Facility from field locations. Each box will be tagged with an electronically readable code (see Technical Specifications Sections 11.5.4 (Coin System Security Interlocks) and 16.10.6 (Bill System Security Interlocks)) and will have (i) an associated "said to contain" value of the cash inside the box documented in the NFPS Backend; and (ii) records of the box's movements and employees involved with each movement. RF Workstations equipped with a cash box scanner module will check in boxes by scanning the barcodes upon arrival. After physical counting of the cash from the boxes, the cashier workstations will reconcile the actual cash in the boxes with the "said to contain" amounts in the NFPS Backend. The RF Workstations are an integral component for input of Data into the RF cash settlement processes reporting to the NFPS Backend which functions as a proof, reconciliation and reporting system for physical cash, working fund, cash on hand, inventory control and reporting system of shipments of cash and Media to/from each NFPS Agency-designated Revenue Facility and control of receipt and tracking of full/empty bill boxes, coin boxes, coin hoppers, etc. required to support revenue servicing functions at each Revenue Facility.

The cashier and receiving RF Workstations will include a peripheral barcode scanner for scanning, receiving and processing boxes, hoppers, etc.

Req. #	Requirement	Assigned CDRL(s)
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28.3-1	The RF Workstation will be a modular, PC-based device which shall include the NFPS cash box scanner module. The RF Workstation Hardware will be optimized for its intended use and configuration.	CDRL 28-3
28.3-2	The RF Workstation will be designed such that repairs and adjustments will be performed in shop facilities and no special tools or instruments will be required for exchange of modules. Minor repairs and adjustments will be capable of being performed in the field.	CDRL 28-3
28.3-3	The RF Workstation design will be subject to the MTA's review and approval.	CDRL 28-3
28.3-4	The RF Workstation will use Windows®-based personal computers, and will be connected to the NFPS Backend.	CDRL 28-3
28.3-5	Received cash boxes will have an associated "said to contain" amount of cash inside based on all tracked cash transactions at the Field Device.	CDRL 28-3
28.3-6	RF Workstations will be connected to each NFPS Agency's existing high volume bill and coin counters at each Revenue Facility. Cash counted will be tracked as an "actual" figure associated with the cash box; this amount will be compared to the "said to contain" amount. All Data will be transmitted to and stored in the NFPS Backend.	CDRL 28-3
28.3-7	Counting and reconciliation transactions will be tracked using the common, unique barcode number identifier, which can be either entered manually or using the cash box scanner. Transactions will also contain employee information for all points of interaction with the cash box journey from initial placement through transport to the CRF through receiving through counting and reconciliation.	CDRL 28-3
28.3-8	Unreconciled amounts in a cash box will trigger an alert to appropriate NFPS Agency personnel.	CDRL 28-3
28.3-9	Counting transactions and receiving of boxes, etc. will be permitted if the RF Workstation is unable to communicate with the NFPS Backend. Each of the NFPS Agencies' Cash Settlement Systems will locally store the applicable transactions to permit operations to continue and will communicate stored information when NFPS Backend communication is restored.	CDRL 28-3
28.3-10	RF Workstations will allow search, generation and printing of audit reports daily, by transaction and by configurable timeframe.	CDRL 28-3
28.3-11	The SI shall be responsible for providing a standard API set to be used by the Revenue Facilities. The MTA will be responsible for the integration of the Revenue Facilities using this API set.	CDRL 28-3

28.3.1 Cash Box Scanner Module

Req. #	Requirement	Assigned CDRL(s)
28.3.1-1	The cash box receiving scanner will be connected to the RF Workstation and will enable scanning of cash box tracking barcodes upon their arrival at the CRF.	CDRL 28-3

Req. #	Requirement	Assigned CDRL(s)
28.3.1-2	Use of the scanner will require appropriate security clearance through employee log on and other access control features configurable by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 28-3

28.4 Acquiring Captured Data

Req. #	Requirement	Assigned CDRL(s)
28.4-1	All SCCW and RF Workstations described herein will be capable of uploading NFPS Data captured from failed NFPS Equipment. For example, if a BV has failed, and maintenance personnel have loaded the BV Data to the SCCW or RF Workstations, then Software will upload the captured NFPS Data to the NFPS Backend automatically. The SI shall provide each NFPS Agency any Software or Hardware necessary to accomplish this task. Additionally, any device used for Data capture as described in Technical Specifications Sections 11.9.2 (Data Memory) and 12.2.3 (Transaction Records and Storage) will be capable of automatically uploading the Data to the NFPS Backend when connected to the applicable NFPS Agency LAN. The LAN connection will be both wired and wireless and final configuration will be determined by the MTA during design review.	CDRL 28-4

28.5 Support Systems Required Submittals

The required submittals specified in this Technical Specifications Section 28 (Support Systems) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 28-1	Test Facilities Hardware and Software Design	Section 28.1	✓	✓	✓	
CDRL 28-2	Smart Card Certification Workstation Design	Section 28.2	✓	✓	✓	
CDRL 28-3	Revenue Facility Workstation Design	Section 28.3	✓	✓	✓	
CDRL 28-4	Device Data Recovery and Processing Procedures	Section 28.4	✓	✓	✓	

29 Deployment and Installation Services

All installation Work performed at MNR and LIRR must adhere to and be governed by the policies and practices described in the MNR Station Standards and LIRR Station Standards, respectively.

29.1 Deployment, Installation and Interface Plan

Req. #	Requirement	Assigned CDRL(s)
29.1-1	The SI shall provide a detailed Deployment, Installation and Interface Plan as described herein that describes all aspects of NFPS Equipment installation, including: site preparation, prototype installations, antenna testing, surveys, pre-wiring, NFPS Equipment staging and movements, scheduling and quality control. It will include an installation operational test for all NFPS Equipment and components. In addition, it will also detail installation and configuration of all Software including the NFPS Backend, NFPS Interfaces, NFPS Websites and NFPS Mobile Applications and their respective schedules.	CDRL 29-1
29.1-2	<p>The Deployment, Installation and Interface Plan Deliverables include but are not limited to:</p> <ul style="list-style-type: none">• The NFPS Backend and NFPS Back Office• BVs and SVs• WVMs• CVMs• CS POS Terminals• TOMs• OSVDs• RF Workstations• NFPS Websites and NFPS Mobile Applications• Interfaces (including APIs)• OSVD Software• Mail&Ride Support equipment• Contracted support services• Smart Card and Paper Media• Spare parts• Training• Documentation• Any optional items as exercised by the MTA (including those Options detailed in Technical Specifications Section 35 (Options))	CDRL 29-1

29.2 General Installation Requirements

The SI shall deliver and install all fare collection system components in accordance with these Technical Specifications and Divisions that directly relate to specific areas of installation Work. The SI shall not

work during peak periods and holidays unless approved by the MTA.

Req. #	Requirement	Assigned CDRL(s)
29.2-1	The SI shall be responsible for all required testing and corrective actions demonstrating that installation and NFPS Equipment operation are in compliance with these Technical Specifications. The SI shall conduct installation operational tests using FIT level (or later version) Software or a tested, and MTA-approved, alternative.	CDRL 29-1
29.2-2	Each installation will be inspected and tested in accordance with the requirements specified in Technical Specifications Section 29 (Deployment and Installation Services), and Agreement Section 34.8 (Risk of Loss to the Work) for the required Equipment Review Notice process and the SI's obligations with respect to the same. Each installation will be subject to the MTA and each Linked NFPS Entity's acceptance.	CDRL 29-1
29.2-3	<p>At a minimum and as defined by the MTA, installation operational tests will include:</p> <ul style="list-style-type: none"> • Tests of all CVMs, TOMs, and OSVDs which test operation in all modes for at least 25 transactions but no greater than 50. • Sales functions of all Media types • Payment functions for all payment types accepted (including change dispensing, both coin and bill) • Revenue servicing • Data reporting and transfer • Alarms and alarms communication • Control keypad functions • Displays <p>Specific testing functions to be completed will be determined by the MTA during design review.</p>	CDRL 29-1
29.2-4	The SI shall work with the MTA to identify suitable locations, install and test bus NFPS Equipment on the NFPS Agencies' buses as well as CS POS Terminals on the Mobile Sales Fleet (which may not have the onboard capabilities in place that passenger buses have). The SI shall provide all required wiring and service loops, cabling and hardware necessary to properly install and secure the NFPS Equipment in its planned location.	CDRL 29-2
29.2-5	The SI shall work with the MTA to identify suitable locations, install and test all SVs, CVMs, CS POS Terminals and WVMs on each of the MTA's, NYCT's, SIRTOA's, MTA Bus Company's, and each Linked NFPS Entity's subway platforms or stations, office facilities and vehicles and along the wayside for SBS buses. The SI shall perform all electrical Work as required to Field Devices from available power at the point of entry or currently used by Legacy Equipment.	CDRL 29-2

Req. #	Requirement	Assigned CDRL(s)
29.2-6	The SI shall work with the NFPS Agencies to identify suitable locations, install and test CVMs and TOMs in applicable stations. The SI shall provide all required wiring and service loops, cabling and hardware necessary to properly install and secure the NFPS Equipment in its planned location. MNR and LIRR will run communications wiring and make final termination to each CVM and TOM. MNR and LIRR will run conduit and make final power termination at each CVM and TOM.	CDRL 29-2
29.2-7	The SI shall install and test the SCCWs, and RF Workstations at locations specified by each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 29-2
29.2-8	The SI shall install, configure, document and test the NFPS Backend and NFPS Back Office and all components. These systems will be installed at two designated, geographically discrete hosting locations reviewed and approved by the MTA.	CDRL 29-2
29.2-9	The SI shall install and test the Test Facilities (as described in Technical Specifications Section 28.1 (Test Facilities)) including all components at the location designated by the MTA.	CDRL 29-2
29.2-10	SI shall comply with and be responsible for all regulatory requirements applicable to design, installation and construction and testing, including applicable permits.	CDRL 29-2
29.2-11	All SI's and Subcontractor's employees working within operating rail stations, platforms, rights-of-way and bus divisions will comply with applicable rail and bus operations rules and procedures, including safety rules and regulations. All on-site personnel engaged in installation activities shall attend an NFPS Agency safety training and briefing session(s) before working on-site.	CDRL 29-2
29.2-12	Any holes that must be created in bus vehicles that extend into bus flooring or through vehicle exterior will be sealed using wiring grommets to the satisfaction of the MTA.	CDRL 29-3
29.2-13	The SI shall perform survey and prototype installation of each vehicle type in the NFPS Agencies' bus fleets. The survey and installation results documentation will be submitted to the MTA for review and approval.	CDRL 29-3
29.2-14	The mounting of the Bus Validator will be positioned such that it minimizes encroachment on passengers, and does not obstruct the driver's field of vision and view, including the view of the front door, as approved by the MTA.	CDRL 29-3
29.2-15	Installation operational testing shall be performed on all NFPS component spare parts that the SI is required to obtain and maintain pursuant to the Contract Documents, and such testing shall be performed on said spare parts prior to their storage.	CDRL 29-3

Req. #	Requirement	Assigned CDRL(s)
29.2-16	The SI shall be responsible for removal and disposal of any Legacy Equipment (MEMs, MVMs, TVMs, TOMs, CFCs and MFCs) that are physically located where the NFPS Equipment will be positioned. Prior to the SI's removal, the applicable NFPS Agency will disconnect power and network connections from these machines and remove any necessary components, including all revenue containers and Media.	CDRL 29-3
29.2-17	The NFPS Agencies' goal for WVM implementation is to first ensure there is at least one WVM at every SBS location during the bus system launch of NFPS rollout while customers continue to use MetroCards. The SI shall install WVMs in two separate phases: (1) while the MetroCard System and operations are still in place, and (2) after Revenue Acceptance Testing, when the MTA has agreed to decommission MetroCard, which will trigger the final replacements of remaining Legacy System SBS equipment with WVMs. The MTA will work with the SI during Design Review to strategize exactly which Legacy System SBS equipment will be replaced during the first phase of WVM implementation.	CDRL 29-3
29.2-18	The SI is prohibited from transporting NFPS Equipment on elevators and escalators at NFPS installation locations.	CDRL 29-3

29.2.1 Site Preparation

NYCT, MTA Bus Company, and SIRTOA will be responsible for providing power to the points of entry in stations that will then be accessible to the SI, and the SI will be responsible for providing power to each applicable installed NFPS Equipment from that available at the point of entry and/or used by Legacy Equipment. For MNR and LIRR installations, MNR and LIRR will each run conduit and make final power termination at relevant NFPS Hardware installed at locations operated by the relevant agency (MNR or LIRR), as applicable.

Req. #	Requirement	Assigned CDRL(s)
29.2.1-1	The SI shall survey rail stations, bus stops and other NFPS Agency locations to identify any existing provisions that may be used to support BVs, SVs, WVMs, CVMs, RF Workstations, TOMs, and CS POS Terminals.	CDRL 29-4
29.2.1-2	The SIRTOA and SBS bus stop survey will be completed as a part of the design process and submitted to the MTA for acceptance.	CDRL 29-4
29.2.1-3	Use of mounting pedestals or stanchions to support platform and Wayside Validators and CVMs will be subject to advance approval by the MTA.	CDRL 29-4
29.2.1-4	The SI shall provide and install all platform and Wayside Validator and CVM support structures such as bases, pedestals and mounting brackets, as needed.	CDRL 29-4
29.2.1-5	The SI shall identify any modifications needed, including installation provisions necessary for installation of the NFPS Equipment and all related system components.	CDRL 29-4

Req. #	Requirement	Assigned CDRL(s)
29.2.1-6	The SI shall provide as part of FDR the installation details including mounting bolt patterns and Design Documentation for all equipment installation types.	CDRL 29-4
29.2.1-7	The SI shall be responsible for installation of all needed provisions, including terminations, connections, mounting brackets and special hardware, for all NFPS Validators, CVMs, TOMs and CS POS Terminals, except where otherwise stated.	CDRL 29-4

29.2.2 New Equipment Installation and On-Site Work

Req. #	Requirement	Assigned CDRL(s)
29.2.2-1	The SI shall supply all labor, supervision and materials required for installation of all new NFPS Equipment. The SI shall also be responsible for all connected and integral equipment and Software for required Interfaces with other systems, including the NFPS Agencies' existing data networks.	CDRL 29-2
29.2.2-2	The SI shall plan and execute safe access to the Work Site for on-site Work. Such safe access will be afforded to construction equipment, vehicles and personnel in accordance with the NFPS Agencies' policies and OSHA regulations. All access plans will be subject to review and approval by the MTA. Additional requirements are specified in Division 1E, Division 1K and Division 1S.	CDRL 29-2
29.2.2-3	Installation of new NFPS Equipment and removal of Legacy Equipment will take place outside peak operating hours. The applicable NFPS Agency will disconnect communication and power terminations to the relevant NFPS Equipment.	CDRL 29-2
29.2.2-4	Parking and loading spaces at the stations where Work is performed must be approved by the MTA for each location.	CDRL 29-2

29.2.3 Installation Procedures

The MTA will provide applicable installation rules and requirements as part of the design review process.

Req. #	Requirement	Assigned CDRL(s)
29.2.3-1	The SI installation procedures will be in accordance with approved installation plan and the NFPS Agencies' rules and guidelines. Additional requirements are specified in Division 1E.	CDRL 29-2
29.2.3-2	The SI shall provide a proposed methodology and schedule for the NFPS Backend, NFPS Back Office and NFPS Equipment installations.	CDRL 29-1
29.2.3-3	The SI's proposed installation methodology will seek to maximize the efficiency with which the installation is performed while minimizing the impact on the MTA Group's transit operations.	CDRL 29-1

Req. #	Requirement	Assigned CDRL(s)
29.2.3-4	For NFPS Hardware on MNR and LIRR properties, applicable MNR and LIRR staff shall be responsible for connecting and/or disconnecting all communications and power connections to the applicable NFPS Hardware. For NYCT subway and SBS environments, the SI shall be responsible for connecting and disconnecting all communications and power connections to the applicable NFPS Hardware. In all cases, the SI shall be responsible for all tests of the applicable NFPS Hardware, including those tests required after communications and power have been connected.	CDRL 29-1

29.3 Prototype Installations

Req. #	Requirement	Assigned CDRL(s)
29.3-1	The SI shall perform a prototype installation for each Field Device in different field environments and each vehicle type. The prototype installations will be subjected to at least one week of service to ensure the robustness and integrity of the installation design. All prototype installations are subject to the MTA's review and approval before installation in other locations.	CDRL 29-1

29.4 Shop and As-Built Drawing Requirements

Req. #	Requirement	Assigned CDRL(s)
29.4-1	The SI shall submit shop drawing Documentation for the MTA's review and approval in its manufacturing facility, assembly facility, or shop, to fabricate, assemble, and/or install parts of the NFPS, whether manufactured by the MTA from raw materials or purchased from others in a ready-to-use condition. Shop drawings and their projected delivery dates will be noted on the Master Program Schedule (as described in Technical Specifications Section 25.1.3 (Master Program Schedule)).	CDRL 29-3
29.4-2	Shop Drawings shall be signed by, and bear the seal of, a professional engineer licensed by New York State or the State of Connecticut, as applicable.	CDRL 29-3
29.4-3	Shop Drawings shall be submitted in a format designated by the MTA not less than 45 days in advance of installation for the MTA's review and approval.	CDRL 29-3
29.4-4	The SI shall revise and resubmit drawings that have been reviewed by the MTA and indicated as "Disapproved" or "Unacceptable for Evaluation" within MTA-defined timeframes until the drawings have been indicated as "Approved" or "Approved as Noted." No Work indicated by any shop drawings shall be commenced until drawings have been designated as such.	CDRL 29-3

Req. #	Requirement	Assigned CDRL(s)
29.4-5	The SI shall provide Documentation of each NFPS Equipment installation in the form of as-built drawings. The as-built Documentation will identify NFPS Equipment location information, wiring traces and details and all additional information needed to maintain the newly installed infrastructure. As-built Documentation will reside in the SharePoint project document control system with the appropriate access controls.	CDRL 29-6
29.4-6	The SI shall submit for each set of as-built drawings the following: <ul style="list-style-type: none"> One copy of all drawings on electronic media, in a format approved by the MTA no later than 30 days after each equipment installation. One reproducible CAD-generated hardcopy. 	CDRL 29-6
29.4-7	All drawings will contain dimensions, physical details, connections, and other information pertinent to system diagnostics, maintenance and troubleshooting.	CDRL 29-6
29.4-8	A master index of drawings will be submitted that clearly indicates the organization of the as-built drawings, listed by drawing number. The master drawing index will also provide cross-references to related drawings, and will indicate the hierarchy of all drawings and drawing layers.	CDRL 29-6
29.4-9	For each vehicle type on which NFPS Equipment is installed, the SI will supply as-built drawings showing the routing of all wires and the method and location of all device mounting installations. As necessary, these drawings may include digital photographs of sufficient detail and clarity to convey the necessary information. Where variations are identified within a given vehicle type, the SI will submit additional drawings depicting the variations and the vehicles to which the variations apply.	CDRL 29-6

29.5 As-Installed Inventory

As described in Technical Specifications Section 3.1.5.2 (Non-MetroCard System Interfaces), NYCT uses Spear to track the configuration of the NFPS Equipment and manage the Warranty and inventory for the NFPS Equipment. MNR and LIRR are in the process of implementing an Enterprise Asset Management System which will manage overall system inventory for both MNR and LIRR. The SI's solution shall accommodate MNR's and LIRR's MMS or EAMS through open APIs and adherence to the following requirements.

Req. #	Requirement	Assigned CDRL(s)
29.5-1	The SI shall provide at least the following information in the electronic formats .dgn (where appropriate) and .pdf: <ul style="list-style-type: none"> The asset and component hierarchy for all NFPS Equipment The attribution information associated with the asset and 	CDRL 29-5

Req. #	Requirement	Assigned CDRL(s)
	<p>component master data</p> <ul style="list-style-type: none"> • The problem cause and remedy codes for assets and components • System relationships for each asset and component • Troubleshooting guides and maintenance practices or job plans • The materials and inventory master data set (i.e., serial numbers and location) • All Warranty related information <p>All Data will be in electronic format and will be capable of migration to MTA-designated MMS or EAMS as needed.</p>	

29.6 Section Deployment and Installation Services Required Submittals

The required submittals specified in this Technical Specifications Section 29 (Deployment and Installation Services) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 29-1	Deployment, Installation & Interface Plan and Schedule	Sections 29.1, 29.2, 29.2.2, 29.3	✓	✓	✓	
CDRL 29-2	Installation Procedures	Sections 29.2, 29.2.2, 29.2.3	✓	✓	✓	
CDRL 29-3	Shop Drawings	Sections 29.2, 29.4				No later than 45 days prior to installation
CDRL 29-4	Site Preparation Plan	Section 29.2.1	✓	✓	✓	
CDRL 29-5	As-installed inventory	Section 29.5				Within 10 business days of installation
CDRL 29-6	As-built Documentation	Section 29.4				No later than 30 days following each NFPS Equipment install

30 Post-Installation Testing and System Acceptance

30.1 System Integration Testing

Upon review and approval by the MTA, the SI shall conduct an on-site System Integration Test (SIT), as described in this Technical Specifications Section 30.1 (System Integration Testing), wherein all or an MTA-approved representative sample of NFPS Equipment, the NFPS Backend and the NFPS Back Office, all NFPS Websites and NFPS Mobile Applications and portals, Interfaces and all other aspects of the NFPS are exercised and tested in what will become the production environment. The SIT will demonstrate that the system is ready to enter revenue service. In the event that some elements of the NFPS are rolled out prior to complete system development, all testing phases for such elements will be completed in their entirety before deployment.

30.1.1 Systems Integration Lab Testing

Systems Integration Lab Testing as described in this Technical Specifications Section 30.1.1 (Systems Integration Lab Testing) is to demonstrate the control and data monitoring and reporting functions with full integration of all NFPS components with the NFPS Backend and NFPS Back Office subsystems, the NFPS Agencies' networks, and/or an outside Third Party network and data transmission system.

Req. #	Requirement	Assigned CDRL(s)
30.1.1-1	The SI shall submit the SIT plan to the MTA for review and approval no later than 60 calendar days prior to commencement of the SIT.	CDRL 30-1
30.1.1-2	The SI shall perform the SIT upon successful completion of the FAT.	CDRL 30-1
30.1.1-3	SIT will occur in two parts: (1) test bed integration testing as outlined in Technical Specifications Section 30.1.1 (Systems Integration Lab Testing) and (2) Systems Integration Field Testing outlined in Technical Specifications Section 30.1.2 (Systems Integration Field Testing).	CDRL 30-2
30.1.1-4	Prior to SIT, the NFPS Backend and NFPS Back Office will be connected to the NFPS Agencies' networks, and/or an outside Third Party network. A Software installation plan and system configuration diagram will be submitted to the MTA as part of the Systems Integration Test plan prior to SIT.	CDRL 30-2
30.1.1-5	The SI shall assemble a test bed that fully integrates all NFPS components, including the NFPS Back Office, any work stations associated with NFPS Back Office subsystem operations, and any NFPS Agency system integrations required in these Technical Specifications.	CDRL 30-2
30.1.1-6	The SIT plan shall contain a system audit and settlement which will include an organized procedure to follow all transactions through the system, reports review and settlement breakdown to show where funds reside once settled. Revenue Service will absolutely not be granted prior to the review and approval of the SIT plan by the MTA and a successful test demonstration by the SI.	CDRL 30-1
30.1.1-7	The SI's test facility will be connected directly to the Merchant Acquirer or any other processing entity and/or each NFPS Agency's payment gateway to fully test the processing of Open Payments.	CDRL 30-2

Req. #	Requirement	Assigned CDRL(s)
30.1.1-8	The NFPS will be provisioned with test Data simulating the NFPS Agencies' operational databases for purposes of testing the NFPS under full operational load. Full operational load and stress data levels will be determined and approved by the MTA prior to performing the SIT.	CDRL 30-2
30.1.1-9	At a minimum, the SIT will include: <ul style="list-style-type: none"> • Five (5) days of continuous testing of all system components, during which all system components will be operational 24 hours a day; • Five hundred (500) transactions minimum, CVM, POS, WVM, and NFPS Websites and NFPS Mobile Applications to be completed; • All alarm and boundary conditions to be tested at a minimum fifty (50) times each; and • Specifics of SIT will be included in the Systems Integration Test Plan to be reviewed/approved by the MTA. 	CDRL 30-2
30.1.1-10	Systems Integration Field Testing and inspection will not take place until the SI obtains the MTA's approval of Systems Integration Lab Testing.	CDRL 30-2

30.1.2 Systems Integration Field Testing

Systems Integration Field Testing as described in this Technical Specifications Section 30.1.2 (Systems Integration Field Testing) will take place prior to each Beneficial Use.

Req. #	Requirement	Assigned CDRL(s)
30.1.2-1	Installation of the system components at each NFPS Agency's properties will commence upon the MTA's acceptance of test reports of the Systems Integration Lab Testing for each specific NFPS Agency.	CDRL 30-1
30.1.2-2	The SI shall provide detailed inspection sheets and test procedures for installation inspection and testing.	CDRL 30-2
30.1.2-3	Detailed inspection sheets and test procedures will include installation checklists, identifying the NFPS components, Software, installation configurations and settings and other characteristics applicable to the installation process and parameters. All wiring service loops and tie-in points will be included in commissioning check off.	CDRL 30-2
30.1.2-4	Procedures will also identify and describe all necessary tests to verify proper interfacing and installation of the NFPS components with other system facilities.	CDRL 30-2
30.1.2-5	The SI shall submit pre-and post-installation checklists and test procedures to the MTA a minimum of 60 calendar days prior to scheduled installation subject to the acceptance by the MTA.	CDRL 30-2

Req. #	Requirement	Assigned CDRL(s)
30.1.2-6	The SI shall perform a complete installation operational test and Systems Integration Field Test upon verification of proper installation of the NFPS components. While the installation of some NFPS Equipment may continue to occur following the start of Systems Integration Field Testing, all required devices will be installed and tested prior to the start of each Beneficial Use period.	CDRL 30-2
30.1.2-7	All functional characteristics of the installed NFPS components at each location will be tested to ensure operation of all the NFPS components as specified, including those involving interfaces with the NFPS Backend or the NFPS Back Office and integrating with Legacy Systems.	CDRL 30-2
30.1.2-8	The Systems Integrated Field Testing will be witnessed by the MTA, and the MTA must approve that installation is successful before such installation is completed.	CDRL 30-2
30.1.2-9	The NFPS Agencies' participation will be required for the successful completion of field inspection and testing.	CDRL 30-2
30.1.2-10	The SI shall notify the MTA a minimum of 21 calendar days prior to the scheduling of any inspection or test.	CDRL 30-2
30.1.2-11	The MTA reserves the right to specify and/or perform installation inspections and tests in addition to those identified by the SI in the inspection and testing plan.	CDRL 30-2
30.1.2-12	The SI shall submit all inspection and testing reports to the MTA for approval.	CDRL 30-3
30.1.2-13	The SI shall complete all installation testing prior to revenue service.	CDRL 30-1
30.1.2-14	In the event a particular problem has not been resolved, the NFPS Agencies, at their option, may proceed on an NFPS Agency-specific basis with Revenue Service under whatever temporary arrangements that have been mutually agreed between the MTA and the SI.	CDRL 30-1
30.1.2-15	Ad hoc testing may, at the MTA's sole discretion, include limited public testing. This may include a controlled friendly user test conducted by each NFPS Agency.	CDRL 30-1

30.2 API Testing and Certification

Req. #	Requirement	Assigned CDRL(s)
30.2-1	The SI shall contract with an independent Third Party for review and testing of APIs. Testing will occur in coordination with external entities (including card brands and issuers), in addition to Legacy Systems. The Third Party vendor shall be subject to MTA review and approval.	CDRL 30-10
30.2-2	The initial certification of all APIs shall be provided by the end of RSAT. Throughout the Warranty Period, APIs will be retested and recertified by the Third Party whenever any significant change is made. A "significant change" will be defined by the MTA during	CDRL 30-10

Req. #	Requirement	Assigned CDRL(s)
	Design Review, and the MTA will consider SI input when determining what constitutes a "significant" change.	
30.2-3	Substantial Completion shall be contingent upon build out and certification of all APIs by the selected independent Third Party based on SI Documentation. The independent Third Party must certify the completeness of SI Documentation and functionality of APIs in order to receive Substantial Completion.	CDRL 30-10
30.2-4	The MTA will select an alternate COTS Third Party Validator for use in testing APIs. The SI shall provide all necessary Documentation and any Hardware or Software for devices or systems other than the alternate Validator necessary to support integration testing. The Third Party tester will use this information, Hardware and Software to support their independent validation and testing of this alternate Validator without the assistance of the SI.	CDRL 30-10

30.3 Pilot Testing

The MTA will conduct two Pilot Tests as described in this Technical Specifications Section 30.3 (Pilot Testing) with a limited and controlled user population, to exercise all or some NFPS Fare Products, policies and functions. The Open Payment Pilot Test will take place prior to BU #1 on one NYCT bus line and 10 subway stations using all forms of Open Payment Media (Smartphones, Contactless Bank Cards, etc.) for two months, and will be conducted by a controlled set of “friendly” users. The Closed-Loop Payment Pilot Test will take place prior to BU #3 on one NYCT bus line and 10 subway stations, as well as on one line or branch each for MNR and LIRR with a minimum of five (5) stations on each selected line or branch, using all forms of Closed-Loop Media (Smartphones, EU Media, LU Media, and Paper Media) for two months, and will be conducted by a controlled set of “friendly” users.

The SI is responsible for all elements of the Pilot Tests including Media, funds loading, mailings and so on as appropriate. These Pilot Tests may be run independently with the schedule to be determined by the MTA.

Req. #	Requirement	Assigned CDRL(s)
30.3-1	At least 120 calendar days prior to the scheduled start of the Pilot Tests, the SI and the MTA shall jointly develop the structure, timing, and measurable pass/fail criteria of the Pilot Tests. The SI shall develop and submit a comprehensive Pilot Test plan for the MTA's review and approval no less than 90 days prior to the scheduled start of the Pilot Test.	CDRL 30-4
30.3-2	During the performance of the Pilot Tests, the MTA and the SI shall meet no less than two (2) times per week at an MTA location to discuss testing progress, issues and results. The SI shall provide written status reports against established criteria.	CDRL 30-4
30.3-3	Measurable Pilot Test Data will be of a statistically significant proportion of projected total system data to ensure adequate	CDRL 30-5

Req. #	Requirement	Assigned CDRL(s)
	analysis of Pilot Test Data.	
30.3-4	The Pilot Tests will continue for their scheduled durations unless critical or urgent Failures cause the Pilot Tests' suspension. When the issue is resolved, the suspended Pilot Test will resume for a duration defined by the MTA, up to and including a complete repeat of such suspended Pilot Test.	CDRL 30-5
30.3-5	After the completion of the Pilot Tests, the SI shall provide data analysis for review and approval of data integrity and system performance by the MTA. The SI shall record any issues encountered and corrective actions executed. The SI shall not proceed to Beneficial Use or Revenue Service Acceptance Testing (as described in Technical Specifications Section 30.4 (Revenue Service Acceptance Testing)) until the Pilot Test performance has been approved by the MTA.	CDRL 30-5

30.4 Revenue Service Acceptance Testing

The SI shall perform the Revenue Service Acceptance Testing (i.e., Acceptance Testing) as described in this Technical Specifications Section 30.4 (Revenue Service Acceptance Testing), which shall verify that the NFPS, including all NFPS Equipment, satisfies the MTA's requirements for reliability, system accuracy and availability.

Req. #	Requirement	Assigned CDRL(s)
30.4-1	The Revenue Service Acceptance Testing period will commence upon successful completion of the final Beneficial Use period.	CDRL 30-1
30.4-2	Revenue Service Acceptance Testing will be performed with all NFPS components, subsystems, and Third Party networks that are completely functional, operational, online and in service.	CDRL 30-1
30.4-3	Revenue Service Acceptance Testing will be comprised of a 90 consecutive day period in which all NFPS components meet or exceed the performance requirements defined in Technical Specifications Section 5.14 (Performance Requirements).	CDRL 30-1
30.4-4	Revenue Service Acceptance Testing will include transaction volume simulation testing by an independent Third Party to validate that the NFPS can maintain performance under a variety of transaction volume scenarios (including use of EMV bankcard formats). The Third Party will be subject to the MTA's review and approval.	CDRL 30-1
30.4-5	The SI shall submit the procedures to be followed for the resolution of test problems, failure recurrence control and general test rules at least 60 calendar days prior to the commencement of NFPS revenue service. These procedures shall be subject to approval by the MTA.	CDRL 30-1

Req. #	Requirement	Assigned CDRL(s)
30.4-6	If the reliability, system accuracy and availability requirements specified herein are not attained during the Revenue Service Acceptance Testing, the SI shall be liable to redesign, provide retrofit kits and furnish labor to correct or change the equipment at no additional cost to the MTA Group. The corrective action and the resolution of the problem(s) shall be subject to the MTA's approval.	CDRL 30-1
30.4-7	The SI shall provide MTA-designated personnel database access to all database schemas via a database tool like TOAD for the purpose of data analysis.	CDRL 30-1
30.4-8	Any NFPS component or system failures or conditions not meeting these requirements, or not reported by the SI, will subject the Revenue Service Acceptance Testing period for any such system component to be restarted. The MTA reserves the right to require all or part of the Revenue Service Acceptance Testing to be repeated to prove out the NFPS Equipment performance.	CDRL 30-1
30.4-9	The SI shall identify and implement remedial action at no cost to the MTA Group or the affected Linked NFPS Entity in the event that a system component does not meet the performance requirements during the Revenue Service Acceptance Testing.	CDRL 30-1
30.4-10	The SI shall submit an acceptance test plan to the MTA for approval at least 30 calendar days prior to the commencement of the final Beneficial Use period.	CDRL 30-1
30.4-11	Commencement of Revenue Service will not begin until the MTA's approval of the acceptance test plan has been achieved.	CDRL 30-1
30.4-12	Periodically during Revenue Service Acceptance Testing, the MTA shall audit reports generated by the NFPS 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 the NFPS reports.	CDRL 30-6
30.4-13	Within 10 business days following the completion of Revenue Service Acceptance Testing, the SI shall provide all testing Data, Documentation, reports and all other related testing information in electronic and hard copy to the MTA for approval.	CDRL 30-3

30.4.1 Chargeable Failures

Req. #	Requirement	Assigned CDRL(s)
30.4.1-1	<p>A Chargeable Failure includes but is not limited to any of the following:</p> <ul style="list-style-type: none"> A malfunction which prevents the NFPS component from performing its designated function or meeting its performance criteria, when used and operated under the environmental and operational conditions stated in these Technical Specifications 	CDRL 30-6

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> • A malfunction that might cause a threat to the NFPS components, passengers, employees or others • A random occurrence that does not cause the NFPS component to be inoperable, but would normally require some form of maintenance attention to restore normal function • Any occurrence where data is not successfully transmitted between elements of the NFPS • Planned Software Updates or fixes that adversely affect operation or performance of the NFPS • Scheduled maintenance or repair activities that adversely affect operation or performance of the NFPS 	
30.4.1-2	<p>The following specific conditions, at minimum, will be considered Chargeable Failures in any NFPS components:</p> <ul style="list-style-type: none"> • Software anomalies and bugs (every incident of a Software anomaly or bug causing a malfunction will be considered a failure) • Hardware Failures that are not clearly a result of conditions outside the requirements of these Technical Specification • Data storage Failures, including those due to the disk space provided • Data storage and/or alarm transmission failure • Data download/upload Failure • Partial or complete failure of passenger display • Failure to accurately read and/or process Media • Failure of mounting or mounting hardware • Failure to properly register and report any transaction • Undesired shutdown of the NFPS • All module replacements • For Hardware repeat issues, at minimum, first and last work orders (excluding cases of vandalism or misuse) 	CDRL 30-6
30.4.1-3	All other Failures will be considered relevant and Chargeable Failures unless determined to be non-chargeable by the failure review process.	CDRL 30-6

30.4.2 Non-Chargeable Failure

A Non-Chargeable Failure is a malfunction caused by a condition external to the NFPS component under consideration, which is neither a functional, environmental, nor a test requirement in these Technical Specifications, and is not expected to be encountered during normal and correct operation of the NFPS components in revenue service, and exceeds the requirements as described in these Specification and otherwise in the Contract Documents.

Req. #	Requirement	Assigned CDRL(s)
30.4.2-1	Non-Chargeable Failures will not affect the Acceptance Testing	CDRL 30-6

Req. #	Requirement	Assigned CDRL(s)
	reliability, accuracy or availability calculations.	
30.4.2-2	<p>Non-Chargeable Failures will include the following, at a minimum:</p> <ul style="list-style-type: none"> • Accident or mishandling of an NFPS Validator, inspection device, CVM, TOM, retail sales terminal or NFPS Back Office components • Failure of Test Facility or test instrumentation, except where Test Facility or instrumentation is under the control of the SI • Any Failures caused by externally applied stress conditions outside normal operating conditions in excess of the accepted requirements contained within these Technical Specifications • Dependent Failures occurring with the independent Non-Chargeable Failure that caused them • Failures caused by incorrectly exercised operating, maintenance or repair procedures where correct procedures have been documented by the SI (failures resulting from any maintenance or repair by the SI shall be chargeable) • Failure caused by vandalism • Failures caused by out-of-specification Media • Communications failures beyond the control of the SI • Third Party equipment and services not required to be provided by the SI or Subcontractor under the Contract Documents • Downtime due to scheduled maintenance • Heater or battery adjustments • Other items as defined by the MTA 	CDRL 30-6

30.4.3 Failure Severity Definitions

Req. #	Requirement	Assigned CDRL(s)
30.4.3-1	<p>The MTA shall be the sole arbiter of failures and their severity. For incidents declared Failures, the Engineer shall assign severities according to the following general guidelines, subject to modification by the MTA.</p> <ul style="list-style-type: none"> • <u>Level 1 – Critical</u>: A widespread incident that produces a major business impact, including significant loss of revenue or expense; negative impact to many customers and/or internal users; system-wide issue impacting devices or production applications; the NFPS is operating at a seriously degraded level such that normal business operations cannot be conducted. • <u>Level 2 – Urgent</u>: Incident produces substantial business impact with non-trivial loss of revenue or expense; negative impact to multiple customers and/or end users; device or production application functionality is severely limited, or is experiencing continual or repeated incidents; NFPS is operating at a degraded 	CDRL 30-6

Req. #	Requirement	Assigned CDRL(s)
	<p>level such that normal business operations are severely impacted.</p> <ul style="list-style-type: none"> • <u>Level 3 – Important</u>: Incident produces limited business impact and negligible loss of revenue or expense; little negative impact to customers and/or internal users; incident limited to a discrete number of devices or component of production application functionality; NFPS is operating at a degraded level such that normal business operations are minimally impeded (e.g., device out of service). • <u>Level 4 – Low</u>: Incident produces little or no business impact with no loss of revenue or expense; little or no negative impact to customers and/or internal users. Incident limited to a discrete number of devices or component of production application functionality, and does not prevent revenue collection; the NFPS is operating at a degraded level such that normal business operations are barely affected (e.g., device operating in degraded more or experiencing a non-revenue issue). 	

30.4.4 Fleet and Latent Defects

Req. #	Requirement	Assigned CDRL(s)
30.4.4-1	The MTA shall identify a “fleet defect” when the same Hardware Failure is observed in a given NFPS module or device in 10% all such NFPS module or device types (e.g., BVs, SVs, WVMs, CVMs, TOMs) within the first 12 months of revenue service. Fleet defect analysis shall apply only to device types with 50 or more units installed. The MTA shall have the final and binding decision to declare a fleet defect.	CDRL 30-6
30.4.4-2	Defects not part of normal equipment operations wear and tear that were not detectable during the inspections, testing and early operations will be declared “latent defects” if they occur on more than 10% of installed devices before the end of the Warranty Period.	CDRL 30-6

Req. #	Requirement	Assigned CDRL(s)
30.4.4-3	If a fleet or latent defect is declared, the SI shall commence a modification program to repair or replace all such components at the direction of and at no cost to the MTA Group, including any spare parts. The SI shall provide all necessary personnel, tools and materials at its own expense, and provide any additional components and devices to minimize the effects of repairs on normal NFPS Agency operations. The repair schedule and procedures will be subject to the MTA's review and approval. A fleet defect will be considered resolved when the installed devices meet or exceed the KPIs described in Technical Specifications Section 5.14 (Performance Requirements) and upon the MTA's approval. Any module or device remedied by the SI under these circumstances shall have its Warranty extended for 180 calendar days.	CDRL 30-6

30.5 Disaster Recovery Plan

Req. #	Requirement	Assigned CDRL(s)
30.5-1	The SI shall provide an NFPS that offers availability and protection against Data loss and system failure.	CDRL 30-7
30.5-2	The SI shall provide means in data system design to ensure complete recovery from loss of NFPS components or Data at any point.	CDRL 30-7
30.5-3	The SI shall provide an evaluation of the types of disasters which may impact NFPS operations and detail the steps to be taken to survive and recover from such disaster.	CDRL 30-7
30.5-4	The SI shall develop and submit for the MTA's approval a Disaster Recovery Plan as described in this Technical Specifications Section 30.5 (Disaster Recovery Plan) and procedures that ensure that no Data is lost in the event of a catastrophic event.	CDRL 30-7
30.5-5	The Disaster Recovery Plan will include provisions to ensure that all information continues to be accessible by NFPS participants.	CDRL 30-7
30.5-6	The SI shall identify the resources (i.e., people, systems, communication lines, etc.) that will be committed to implement the Disaster Recovery Plan.	CDRL 30-7
30.5-7	The SI's Disaster Recovery Plan will contain or reference detailed procedures to be followed to restore the primary system in the event of a disaster and from a fail-over event.	CDRL 30-7

30.6 Substantial Completion

Prior to achieving Substantial Completion, the NFPS will meet the performance requirements contained in this Technical Specifications Section 30.6 (Substantial Completion). Achievement of the Substantial Completion milestone is subject to the MTA's review and written approval.

Substantial Completion of the NFPS is based upon successful completion of acceptance testing and delivery of all Work, equipment and required Documentation. The MTA will issue a certificate upon

approval of the SI's request for Substantial Completion.

Req. #	Requirement	Assigned CDRL(s)
30.6-1	The SI shall submit a request for Substantial Completion upon verification of final NFPS inspection and testing and determination that all Work has been completed including all Documentation and NFPS Equipment delivered, and Software deficiencies fixed in accordance with these Technical Specifications and requirements.	CDRL 30-8
30.6-2	<p>The SI and the MTA agree that Substantial Completion of the NFPS shall be contingent on satisfying all of the following conditions. The MTA shall grant Substantial Completion of the NFPS when:</p> <ul style="list-style-type: none"> • All requisite Deliverables have been delivered to and accepted by the MTA • All NFPS devices are delivered, installed (where applicable), and operational • All NFPS Backend and NFPS Back Office Software, including all required reports and Legacy System Interfaces, is installed and fully functional • All NFPS Websites and NFPS Mobile Applications are hosted, live and fully functional (see Technical Specifications Sections 22 (NFPS Websites) and 23 (NFPS Mobile Software)) • All support systems and special tools are delivered, fully functional and accepted by the MTA (see Technical Specifications Section 28 (Support Systems)) • All initial batches of Media have been delivered and accepted by the MTA (see Technical Specifications Section 18.1 (General Media Requirements)) • The Revenue Acceptance Testing has been successfully completed and approved by the MTA (see Technical Specifications Section 30.4 (Revenue Service Acceptance Testing)) • Equipment Removal Work has been successfully completed and accepted by the MTA (see Technical Specifications Section 34 (Equipment Removal)) • The Disaster Recovery Plan has been successfully completed and approved by the MTA (see Technical Specifications Section 30.4.4 (Fleet and Latent Defects)) • Technical and Software support services are active and accepted by the MTA (see Technical Specifications Section 31 (Technical and Software Support Services)) • All required training has been provided and accepted by the MTA (see Technical Specifications Section 33 (Training Services)); • All required Intellectual Property Rights have been assigned or licensed to the MTA Group or the escrow agent, all as further set out in the Contract Documents • All spare parts have been delivered • Final resolutions of all identified critical and urgent issues (as 	CDRL 30-9

Req. #	Requirement	Assigned CDRL(s)
	<p>classified by the Failure Review Board) are fully implemented and accepted by the MTA</p> <ul style="list-style-type: none"> The MTA and the SI have agreed on the known outstanding Hardware and Software deficiencies to be addressed during the Warranty Periods <p>Items excluded from the Substantial Completion milestone include the base Hardware Warranty and Software Warranty and base Hosting periods, both of which will commence upon Substantial Completion.</p>	
30.6-3	Prior to Substantial Completion, the SI shall supply quality reproducible Documentation of drawings of all fabrication assemblies, subassemblies, circuit diagrams and arrangements of the NFPS Equipment, as finally furnished, accepted and modified. These drawings will include those from the SI's Suppliers.	CDRL 30-9
30.6-4	<p>The SI shall supply quality reproducible original Documentation for the following items:</p> <ul style="list-style-type: none"> All SI's and suppliers' drawings, details, bills of material and catalog cuts that are required by the NFPS Agencies for future installation, maintenance and repair purposes All assemblies, subassemblies and arrangements of the equipment All items which are special purpose or fabricated by the SI All materials furnished by the SI and by its suppliers, down to and including the module and circuit board level 	CDRL 30-9
30.6-5	All Documentation will include all revisions made during manufacture and installation as well as reflect as-built and as-installed configurations for each NFPS Agency, on an NFPS Agency-specific basis.	CDRL 30-9

30.7 Post-Installation Testing and System Acceptance Required Submittals

The required submittals specified in this Technical Specifications Section 30 (Post-Installation Testing and System Acceptance) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 30-1	Systems Integration and Revenue Service Acceptance Test Plan	Sections 30.1, 30.3, 30.4				At least 60 calendar days prior to the start of testing

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 30-2	Systems Integration and Revenue Service Acceptance Testing Procedures and Scripts	Section 30.1				At least 10 business days prior to the start of each test
CDRL 30-3	Inspection and Testing Reports	Section 30.1				Within 10 business days of completion of each successful test/inspection
CDRL 30-4	Pilot Test Plan	Section 30.3				At least 120 calendar days prior to the start of Pilot testing
CDRL 30-5	Pilot Test Reports	Section 30.3				Within 10 business days of completion of each successful test/inspection
CDRL 30-6	Failure Review Processes and Procedures	Section 30.4			✓	
CDRL 30-7	Disaster Recovery Plan and Procedures	Section 30.5		✓	✓	An updated Disaster Recovery Plan will be delivered at the start of NFPS Backend training
CDRL 30-8	Substantial Completion Plan Request	Section 30.6				Upon verification of final NFPS inspection and completion of all open items
CDRL 30-9	Substantial Completion Documentation	Section 30.6				Prior to Substantial Completion
CDRL 30-10	API Certification Plan	Section 30.2			✓	

31 Technical and Software Support Services

Throughout the life of the NFPS, Software Updates and upgrades may be specified, procured, installed and tested as further set out in the Contract Documents. Periodically, as required, a complete NFPS Software refresh and/or re-platforming will be performed to ensure that the latest technology will be deployed and MTA Group requirements will be met. The SI shall install server, database, application and Operating System Software Updates, upgrades and patches as required herein and with prior written approval by the MTA. Where possible, any such installations will be made during periods of low activity.

Req. #	Requirement	Assigned CDRL(s)
31-1	In addition to the technical services described below, the SI shall provide Technical and Software Support Services as described in the Contract Documents.	CDRL 31-1
31-2	For Severity Level 3 and 4 incidents, SI Software technical support personnel shall be available by telephone to the MTA Group during the hours of 8 a.m. to 5 p.m., Eastern time, Monday through Friday, excluding holidays. See Agreement Section 19.4.2 (Helpdesk and Phone Support) for additional information. Response times for such Severity Level 3 and 4 incidents shall be as provided in Agreement Section 19.6.5. (Error Response and Resolution Times).	CDRL 31-1
31-3	The SI shall respond to reports of Severity Level 1 and 2 incidents twenty-four (24) hours a day, seven (7) days per week. See Agreement Section 19.4.2 (Helpdesk and Phone Support) for additional information.	CDRL 31-1
31-4	Response times for such Severity Level 1 and 2 incidents shall be as provided in Agreement Section 19.6.5. (Error Response and Resolution Times).	CDRL 31-1
31-5	The system shall be restored to service or a work around provided within three (3) hours of the MTA's approval of the SI's Software Corrective Maintenance Proposal. A final correction of the defect with a Software Update shall occur within sixty (60) work days.	CDRL 31-1
31-6	If the correction for Software Error(s) for a Severity Level 1 or Severity Level 2 incident will take longer than (3) hours, the SI shall report to the MTA the status of the Software Error(s) as soon as the situation becomes evident and provide status reports at least every two (2) hours thereafter until the Error(s) is corrected or a Workaround is established.	CDRL 31-1
31-7	The SI shall retain qualified and knowledgeable technical support and Software development personnel who are familiar with the NFPS (including NFPS Hardware and Software).	CDRL 31-1

Req. #	Requirement	Assigned CDRL(s)
31-8	The SI shall provide a Technical and Software Support Services Plan at the Conceptual Design Review for the MTA's review and approval, and such Plan shall detail how the SI shall comply with its Technical and Software Support Services required herein. In addition to any revisions required by the MTA based on its review of the submitted Plan, the SI shall also subsequently revise such Plan during Preliminary Design Review and Final Design Review to meet MTA's requirements.	CDRL 31-1
31-9	The SI shall submit to the MTA no less than once every three (3) months a status update setting forth Errors in and modifications and Software Updates to the Software, upgrade schedules, vendor changes to systems worldwide, a matrix of key dates for NFPS changes (e.g., PCI upgrade) for the following quarter and beyond and information setting forth details regarding deployed Software Versions.	CDRL 31-2

31.1 Technical and Software Support Services Required Submittals

The required submittals specified in this Technical Specifications Section 31 (Technical and Software Support Services) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 31-1	Technical and Software Support Services Plan	Section 31	✓	✓	✓	At least 30 days prior to the start of revenue service.
CDRL 31-2	Quarterly Status Update	Section 31			✓	Format to be submitted at FDR. Quarterly reports beginning with the start to the Software maintenance agreement.

32 Manuals

32.1 General

The SI shall provide instruction manuals and other Documentation (all in paper and electronic format) on how to manage, operate and maintain the entire NFPS, including Documentation for all equipment, devices and Software, and such manuals and Documentation shall be provided on an NFPS Agency-specific basis as determined by the applicable NFPS Agency. Block diagrams, illustrated parts breakdowns and schematic drawings will be used to facilitate descriptions of assemblies and the relationships of all NFPS components, subsystems and systems. The format of such Documentation will be determined as agreed upon by the SI and the MTA, and the SI shall submit the final format to the MTA for approval.

Req. #	Requirement	Assigned CDRL(s)
32.1-1	A schedule for development of the required manuals with time allotted for the MTA's review will be submitted 120 calendar days after NTP.	CDRL 32-1

32.2 Manual Requirements

Req. #	Requirement	Assigned CDRL(s)
32.2-1	The manuals will contain all the text, step-by-step procedures, illustrations, drawings, block diagrams, schematics, parts lists, troubleshooting guides and repair and replacement procedures to allow the NFPS Agencies to operate, maintain, diagnose and repair the NFPS and NFPS Equipment on an NFPS Agency-specific basis.	CDRL 32-1
32.2-2	All manuals will be written in clear and concise English, will use English and/or metric units of measurement and will assume the reader has no more than a high school education unless otherwise directed by the MTA.	CDRL 32-1
32.2-3	Care will be taken to provide easily understood directions and explanations and step-by-step instructions with cross-references to all drawings, diagrams and photographs.	CDRL 32-1
32.2-4	Training Documentation will be separate from the operation and maintenance manuals, but may reference those manuals.	CDRL 32-1
32.2-5	The SI shall furnish the following approved manuals for each NFPS device and system, as applicable: <ul style="list-style-type: none">• Operation manuals• Repair, First-, Second-, and Third-Call Maintenance, and installation manuals• Illustrated parts catalogs• Special tools manuals• OEM manuals for all subassemblies	CDRL 32-1

Req. #	Requirement	Assigned CDRL(s)
32.2-6	In addition to the SI's other obligations to provide Documentation, the SI shall also provide one (1) complete set of Documentation to the MTA prior to the start of Revenue Service Acceptance Testing, and such complete set of Documentation shall include all previously-provided Documentation and all other Documentation that is required to be provided to the MTA prior to the start of Revenue Service Acceptance Testing.	CDRL 32-1
32.2-7	Information gathered during installation and acceptance testing and during the Warranty Period will be incorporated into the manuals for final submittal. Additionally, internal procedures will be added to select manuals (Operations, Repair, etc.) as applicable and as directed by the MTA. NFPS Agency-specific internal procedures can be provided on request after NTP.	CDRL 32-1
32.2-8	Revisions to manuals will be recorded on a control list in the front of each manual. The list will be issued with each revision and will show the date of each revision and the page reference. Updated lists and revisions will be maintained in the documents by the SI until the later of (i) the expiration of the last-to-expire Warranty Period for all NFPS Hardware components, and (ii) the expiration of the Optional Maintenance Term if the MTA exercises the Option for the SI's provision of Preventative, Remedial, and Lifecycle Maintenance Services) pursuant to Technical Specifications Section 35.15 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services)). The MTA will review and comment on each manual submission as required.	CDRL 32-1
32.2-9	The content of the various manuals will meet the requirements specified in the Contract Documents.	CDRL 32-1
32.2-10	<p>The operation manuals will include the following content at a minimum:</p> <ul style="list-style-type: none"> • General field equipment familiarization material • Location, function and operation of all controls and indicators • Field equipment setup, login and shutdown procedures • Trouble symptoms, diagnostic methods and procedures for isolating minor faults • Description of all user messages and enunciations 	CDRL 32-2
32.2-11	The repair, maintenance and installation manuals will provide all information needed for troubleshooting service failures, performing NFPS Equipment replacements and installations and for performing periodic maintenance for each NFPS component, including general servicing and inspecting.	CDRL 32-2

Req. #	Requirement	Assigned CDRL(s)
32.2-12	The repair, maintenance and installation manuals will expand on the information furnished in the operation instruction manual and will include basic wiring block diagrams to provide fault diagnosis information appropriate for maintenance, including a complete listing of error codes as provided for individual sub-components.	CDRL 32-2
32.2-13	The repair, maintenance and installation manuals will provide all information needed for trouble diagnosis to the LLRU.	CDRL 32-2
32.2-14	The Documentation will be presented in terms that are meaningful to users. They will include functional explanations and descriptions of each Software Application and its use. Step-by-step procedures will be provided that explain how each parameter is configured and the effects obtained by varying each parameter. All user guidance, alarms and error messages will be described, along with the steps necessary for recovery from Error.	CDRL 32-2
32.2-15	Security-Sensitive Information that is not to be distributed to all departments will be contained in Documentation marked "Confidential" and delivered only to the designated representative(s) of the MTA. The nature of this information will be mutually agreed upon between the SI and the MTA.	CDRL 32-2
32.2-16	Operating instructions will describe procedures to be followed as a result of system restarts or failures. The Documentation will contain sufficient information to enable the user to restart or re-configure the NFPS and take diagnostic data dumps.	CDRL 32-2
32.2-17	Disaster recovery procedures will be clearly specified in sufficient detail to consider all possible scenarios. Operating instructions will describe procedures to be followed as a result of disaster recovery.	CDRL 32-2
32.2-18	The SI shall provide detailed proposed Data backup requirements and procedures to the MTA for the MTA's review and approval.	CDRL 32-2

32.3 Manual Format

Req. #	Requirement	Assigned CDRL(s)
32.3-1	All manuals and other Documentation will be submitted to the MTA in hardcopy and electronic format.	CDRL 32-2

Req. #	Requirement	Assigned CDRL(s)
32.3-2	Electronic versions of all manuals will be able to be deployed individually, or the contents can be hosted on a server to allow multiple users to access the same manuals. Unless the contents otherwise dictate encryption, manuals will not be encrypted. Manuals will be developed and delivered using standard authoring tools such as MS Word, Excel, Visio and PowerPoint, or Adobe Acrobat. The following formats also apply: <ul style="list-style-type: none"> Manuals and illustrated parts catalogues will be provided in Portable Document File (PDF) format and in a modifiable electronic format (MS Word) Electrical Computer-Aided Design (CAD) files will be provided in .PDF format Schematic drawing will be provided in .PDF format 	CDRL 32-2
32.3-3	Electrical wiring diagrams and other diagrams necessary for operation of the equipment will be provided for NFPS Equipment. No single diagram will show more than one system, or parts thereof, and diagrams will be complete and legible in all respects.	CDRL 32-2

32.4 Required Manuals

The following manuals will be required at a minimum, and the complete set of Documentation will be submitted by the SI and approved by the MTA during design review. Additional manuals and DIBs may be requested by the NFPS Agencies and shall be provided by the SI upon such a request. All required manuals shall cover all NFPS Hardware and Software (including OSVD Software); provided, however, that the SI shall not be required to provide hardware-specific manuals for OSVD Hardware. By way of clarifying example, the SI shall provide an OSVD User Quick Reference Guide, but shall not provide an OSVD Hardware Parts Manual.

NFPS Manuals (including BVs, SVs, WVMs, CVMs, TOMs, Customer Service POS Terminals, RF Workstations, OSVDs)	Hardcopies Required – MTA and NYCT	Hardcopies Required – MNR and LIRR
Operating Instruction Manual	10	10
Preventive Maintenance Manual	10	10
Corrective/Field Maintenance Manual	10	10
Shop Repair and Overhaul Manual	10	10
Parts Manual	10	10
Software and Programming Manual	10	10
Software Source Code Manual	10	10

User Quick Reference Guides	10	10
Field Maintenance Quick Reference Guide	10	10
OEM Manuals – As supplied by the OEMs	10	10
NFPS Backend and NFPS Back Office Manuals		
Administrator’s Manual	10	10
User’s Manual	10	10
Fare Table Configuration Manual	10	10
Report Formatting Manual	10	10
Database Design and Structure Manual	10	10
Pricing Engine, System Configuration and Business Rule Management Manual	10	10
External Interface Manual	10	10
Bankcard Clearing House Interface Manual	10	10
Software Source Code Manual	10	10
OEM Manuals - As supplied by the OEMs	10	10
Support System Manuals ¹⁵		
Operations and Maintenance Manual - Per support system and tool	10	10
OEM Manuals - As supplied by the OEMs	10	10
Other Manuals		
NFPS Customer Website and NFPS Mobile Applications Design and Administration Manual	10	10
B2B Portal Design and Administration Manual	10	10

32.4.1 Electrical, Illustrated Parts Catalog

Req. #	Requirement	Assigned CDRL(s)
32.4.1-1	The SI shall submit an illustrated parts catalog including all installation hardware, wiring assemblies and LLRUs. The illustrated parts catalog may be a subset of the maintenance materials.	CDRL 32-3
32.4.1-2	Each listed part will be referenced by the SI by assigned part number and, where applicable, OEM part number.	CDRL 32-3

¹⁵ All support systems, special tools and test equipment defined in Technical Specifications Section 28 (Support Systems) will be accompanied with operation and maintenance manuals to the same level of detail as that supplied for the NFPS Equipment. Manuals for each of these systems will be supplied in the quantities indicated.

After conclusion of the Hardware Warranty Period, it is the MTA's intent to have the capability of ordering and purchasing NFPS Equipment down to the component level, (e.g., LCD screens), and not just the ability to swap out entire modules or specific pieces of NFPS Equipment (e.g., CVMs, TOMs, WVMs).

32.4.2 Application Programming Interfaces and Interface Control Documents

Req. #	Requirement	Assigned CDRL(s)
32.4.2-1	For each API provided by the SI under these Technical Specifications, the SI shall supply separate Documentation in .PDF form.	CDRL 32-4
32.4.2-2	The API Documentation will specify in detail: <ul style="list-style-type: none"> • A functional description of the Interface • All functions of the Interface with examples • All communication types with examples • Use cases with sample code • Security functions to be built into the NFPS 	CDRL 32-4
32.4.2-3	The SI shall meet the detailed API requirements further specified in Technical Specifications Section 6.4 (Application Programming Interfaces).	CDRL 32-4
32.4.2-4	The SI shall provide Interface Control Documentation (ICDs) for all system interfaces within the NFPS.	CDRL 32-4

32.5 Manuals Required Submittals

The required submittals specified in this Technical Specifications Section 32 (Manuals) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 32-1	Manuals Schedule	Sections 32.1, 32.2, 35.15		✓	✓	
CDRL 32-2	All Required Manuals	Sections 32.2, 32.3				Per manuals delivery schedule
CDRL 32-3	Illustrated Parts Catalog	Section 32.4				Per manuals delivery schedule
CDRL 32-4	API and ICD Documentation	Section 32.4.2				Per approved schedule

33 Training Services

33.1 General Training Requirements

The SI shall provide a comprehensive program to educate, train and teach the NFPS Agencies' personnel in all details of the NFPS, including properly operating, servicing and maintaining the NFPS and each of its components throughout its Design Life. Some training may be separately for each NFPS Agency at each of the NFPS Agency's facilities and tailored to specific functions and staff as determined by the MTA.

Req. #	Requirement	Assigned CDRL(s)
33.1-1	The SI shall propose the actual courses to be delivered to the NFPS Agency staff. The course curriculum will include educating each NFPS Agency and its staff in at least the areas listed in Technical Specifications Section 33.3 (Training Courses).	CDRL 33-1
33.1-2	The SI shall develop and deliver "Train-the-Trainer" courses that provide each NFPS Agency's training instructors with the necessary instruction to deliver the NFPS training without the need for SI instructors where appropriate.	CDRL 33-1
33.1-3	Course sizes will be designed to assure all trainees have hands-on training with NFPS Equipment and NFPS Software.	CDRL 33-2
33.1-4	The SI's training program will include classroom training provided by the SI's staff.	CDRL 33-2
33.1-5	When appropriate, training will occur in the field or location of service. The SI shall allow MTA Group staff to shadow SI staff during service, operation, maintenance and warranty activities in order to gain a better understanding of how to properly operate and maintain the NFPS.	CDRL 33-1
33.1-6	The SI shall supplement training, as appropriate, by providing OEM representatives to train NFPS Agency staff on the OEM's Software, subassemblies and NFPS Equipment.	CDRL 33-1
33.1-7	The SI's training program will include formal and informal instruction, working NFPS Equipment, manuals and diagrams as instructional tools.	CDRL 33-1
33.1-8	All materials used in the training programs, such as training jigs, Media, manuals, simulators and drawings, will be of durable construction and will become the property of the MTA upon completion of the training.	CDRL 33-3
33.1-9	Training materials will be updated as required during the course of instruction.	CDRL 33-4
33.1-10	The SI shall assume that NFPS Agency staff does not have knowledge of any NFPS features. However, the SI may assume that NFPS Agency maintenance personnel have the basic skills pertinent to their crafts.	CDRL 33-1
33.1-11	Courses will be limited to a maximum of eight (8) hours per day.	CDRL 33-2

Req. #	Requirement	Assigned CDRL(s)
33.1-12	During the applicable Warranty, any active software maintenance agreement, and while the SI is providing MNR and LIRR NFPS Preventative, Remedial, and Lifecycle Maintenance Services, the SI shall provide updated course instruction and materials of any type as needed.	CDRL 33-1
33.1-13	<p>The NFPS Agencies will furnish the following training-related items upon the SI's request at least two (2) weeks prior to the scheduled classes:</p> <ul style="list-style-type: none"> • Space for classroom lectures and practical training on NFPS Equipment. Location and class times will be set by the MTA. • Projectors, screens, white boards and similar equipment. • Shop space as needed. • Bus or station with installed NFPS Equipment. 	CDRL 33-1
33.1-14	The SI may use installed revenue equipment or spare parts as training aids in lieu of mock ups and for demonstration of and practical exercises in replacing, testing, disassembly and assembly of equipment. However, the SI shall be responsible for ensuring that such parts are not damaged or modified in any way. In addition, the SI shall ensure that these parts will pass re-inspection and acceptance tests before they are returned to the applicable NFPS Agency.	CDRL 33-1

33.1.1 Training Materials & Equipment

Req. #	Requirement	Assigned CDRL(s)
33.1.1-1	<p>The SI shall provide all necessary training materials for delivery of each course discussed in the training program plan. The SI shall reflect all changes and revisions to the installed NFPS in all training materials, whether supplied to NFPS Agency personnel, or used in SI-conducted training courses. The SI is required to provide any hard-copies used for training purposes for all expected attendees, plus five (5) spare copies for each NFPS Agency that is scheduled to be in attendance. At a minimum the following training materials will be provided for each course in sufficient quantities:</p> <ul style="list-style-type: none"> • Course agenda and objectives • Resources and facilities required for the course • Detailed lesson plans or outlined presentations and discussion guides • Pre- and post-training assignments • Instructions for using any audiovisual support and equipment • Student guides and handouts • Quick reference guides • Operational NFPS Equipment 	CDRL 33-4

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> Computer-based presentations 	
33.1.1-2	Draft training materials will be submitted at FDR. Final training materials will be submitted to the MTA at least 30 calendar days before classes are scheduled to begin. All Documentation and training material will be submitted in an electronic form as specified by the MTA. A directory of all files on the disk will be listed in a root directory ("read me" file) showing filenames, date, file size and appropriate annotation to cross-reference the chapter and section.	CDRL 33-4
33.1.1-3	The MTA may reproduce portions or all of the training materials for internal use. If the SI produces an update or new training aids (e.g., video recordings, manuals, etc.) within two (2) years following the completion of all NFPS Hardware installation, the MTA will receive copies of the updated material for its sole use in MTA Group training programs at no cost to the MTA Group. The SI will provide video of all training sessions to the NFPS Agencies.	CDRL 33-4
33.1.1-4	The SI shall provide device training units that enable students to receive hands-on NFPS Equipment operation and maintenance instruction while in a classroom setting. The training units will be powered by a standard 110v AC power source.	CDRL 33-4
33.1.1-5	The SI shall provide records of training provided on a weekly basis to the MTA.	CDRL 33-3

33.2 Training Curricula

Req. #	Requirement	Assigned CDRL(s)
33.2-1	A training schedule will be included in the SI's training program plan. The schedule will consider the sequence of training, hours of instruction, trainee availability and limitations on course sizes and venue for the training.	CDRL 33-2
33.2-2	The SI shall submit a training program plan in accordance with the criteria outlined below.	CDRL 33-1
33.2-3	The SI shall develop and submit for the MTA's approval a narrative description that documents the design for training NFPS Agency personnel.	CDRL 33-1
33.2-4	NFPS Agency staff to be trained includes MTA/IT and finance professionals, supervisors, maintenance and repair personnel, auditors, planners, field operations and command center personnel, customer service and transit store personnel, managers and trainers.	CDRL 33-1
33.2-5	<p>In addition to including the general training program plan information, the training program plan will include at a minimum the following for each course:</p> <ul style="list-style-type: none"> Identification and summary descriptions of all training courses 	CDRL 33-1

Req. #	Requirement	Assigned CDRL(s)
	including course lengths <ul style="list-style-type: none"> • The methods of training to be used (e.g., lecture, CBT, hands-on, etc.) • Learning objectives and learning outcomes • The sequence of learning activities • Targeted trainees for each course • Maximum number of trainees per course • Methods and criteria for evaluating performance, including an objective grading system to report progress of trainees during the training • Resources required, such as equipment, shop space, video recorders, etc. 	
33.2-6	The training program plan will also address the SI's approach for training NFPS Agency trainers to deliver training subsequent to the SI's involvement. It will describe the SI's approach, resources and hours required, and any training aids that might be included.	CDRL 33-1

33.3 Training Courses

The SI shall provide the following training courses and provide all course content and training materials in an MTA-approved format.

NFPS Field Device Training	
Course	Content
Field Maintenance and Servicing	All NFPS Agency maintenance personnel who may be required to perform scheduled maintenance and support activities will attend a training course. This course will provide the employee all knowledge necessary for operation, troubleshooting, maintenance, repair, component change-out and scheduled maintenance of all NFPS Equipment.
Backshop Repair	A selection of mechanics and electricians who will perform the periodic overhaul, remedial repair and adjustment of NFPS components, will be given a comprehensive instruction course in the operation, troubleshooting, maintenance, repair and overhaul of the NFPS components.
Operation, Configuration, and Administration	Supervisory personnel who will manage the NFPS Equipment and the service technicians will receive specialized training in the operation, configuration and administration of the Field Devices. This class will provide instruction on those activities that are limited to administrative and maintenance logs on the NFPS Equipment, as well as those infrequent activities governing the configuration of the Field Devices.
NFPS Backend Training	
Course	Content
NFPS Backend	Personnel who will use the NFPS Backend will be trained in the use of all Software

User Training	<p>Applications and functions provided by the NFPS. The SI shall structure this training as a series of logically arranged topics so that individual users may attend only those portions of the course of interest. This training will at minimum include:</p> <ul style="list-style-type: none"> • General NFPS Backend user procedures • Device management functions • Device configuration parameters • Status monitoring functions • Media inventory management • Customer account management • Generation of all standard reports • Fare Table management • Action List management • Autoload List management • Third Party-Issued List management • Bankcard authorization operations and configuration • Backup memory module data retrieval procedures • NFPS Interfaces
NFPS Backend Accounting	<p>Those management personnel who will generate and use revenue and ridership reports from the NFPS and Data from the Financial Clearing and Settlement System (as described in Technical Specifications Section 21.6 (Financial Clearing & Settlement System)) will receive specialized training to be familiar with revenue and ridership report contents and uses. Using sample data created from testing intervals or other sources, reports will be generated from the NFPS and used to explain the resulting data output.</p>
NFPS Backend Administration	<p>Systems personnel who will be responsible for administration and systems maintenance will be trained in all aspects of NFPS administration and to ensure optimal performance as well as correcting minor system problems. Content will include:</p> <ul style="list-style-type: none"> • Backup and restore • Disaster recovery • User login administration • Anti-virus definition updates • Load balancing • Networking configurations • Interfaces with other MTA Group and Linked NFPS Entity computer systems • Merchant Acquirer Interfaces
Report and Query Generation and Customization	<p>The SI shall instruct users and administrators how to use report and query generation and customization, including use of the report writer tool.</p>
Support Systems Training	
Course	Content

Support Systems and special tools	The SI shall provide training on the use, operation and maintenance of all Support Systems (as described in Technical Specifications Section 28 (Support Systems)) and special tools.
Web, Mobile, and B2B Portal Administration	
Course	Content
B2B Portal Administration	<p>The SI shall provide training on the B2B Portal administrative functions. At minimum, the course will:</p> <ul style="list-style-type: none"> • Instruct the administrators in how to configure all pages of the B2B Portal • Review all procedures to modify NFPS database tables that affect B2B Portal content • Discuss the underlying B2B Portal design and linking to other sites • Demonstrate how to monitor the status and operating conditions
Web and Mobile App Administration	<p>The SI shall provide training on the NFPS Websites and NFPS Mobile Payment Applications administrative functions. At minimum, the course will:</p> <ul style="list-style-type: none"> • Instruct the administrators in how to configure and maintain the NFPS Websites and NFPS Mobile Applications • Review all procedures to modify NFPS database tables that affect content • Discuss the underlying NFPS Website and NFPS Mobile Application design and linking to other sites • Demonstrate how to monitor the status and operating conditions
Special Program Liaison Training	
Course	Content
Special Programs	<p>The SI shall develop and provide a course for NFPS Agency staff responsible for managing Special Programs and administering these programs using the B2B Portal:</p> <ul style="list-style-type: none"> • MTA Fare Products, policies and transactions • MNR and LIRR Fare Products, policies and transactions • Use of the B2B Portal • Creating, modifying and deleting Special Program accounts • Assigning, modifying and deleting Fare Products • Bulk upload process for new NFPS Accounts • Payment methods (where relevant) • Administration of functions for third party Mail&Ride fulfillment
MTA Customer Service Training	
Course	Content
Customer Service Training	<p>The SI shall provide Customer Service training on all aspects of the NFPS that will be visible to and used by the public, and the NFPS Websites and NFPS Mobile Applications and tools that the NFPS Agency staff will employ. The course will cover, at minimum, the following topics:</p> <ul style="list-style-type: none"> • All NFPS Fare Products, policies and transactions • TOM functionality and user interfaces • Customer Service POS Terminal functionality and user interfaces • Use of the NFPS Websites and NFPS Mobile Application

- NFPS Account management features and functions

33.4 Training Services Required Submittals

The required submittals specified in this Technical Specifications Section 33 (Training Services) are summarized below. They are further described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 33-1	Training Program Plan	Sections 33.1, 33.2	✓	✓	✓	
CDRL 33-2	Training Schedule	Sections 33.1, 33.2			✓	Training schedule updates will occur weekly beginning 1 month prior to the commencement of training.
CDRL 33-3	Training Records	Sections 33.1, 33.1.1				Weekly during the time training is provided.
CDRL 33-4	Training Materials and Equipment	Sections 33.1, 33.1.1	✓	✓	✓	All materials and equipment will be identified in the Training Program Plan. All necessary materials and equipment will be available for use at the time of training instruction.

34 Equipment Removal

After decommissioning the MetroCard System, the SI shall remove any remaining MetroCard System equipment that had not been incorporated into the NFPS or previously replaced or planned to be replaced by NFPS Equipment or as part of the NFPS final transition plan. The SI shall provide this service for all MetroCard System equipment in the subway and SBS environments. This work will commence upon successful completion of Revenue Service Acceptance Testing and shall be completed in no more than nine (9) months.

34.1 Equipment Removal Plan

Req. #	Requirement	Assigned CDRL(s)
34.1-1	The SI shall provide a detailed Equipment Removal Plan (as described in this Technical Specifications Section 34 (Equipment Removal) that details removal of all remaining Legacy Equipment in the NYCT subway system and the SBS bus stop locations.	CDRL 34-1
34.1-2	<p>Planned removals of all Legacy Equipment including, but not limited to:</p> <ul style="list-style-type: none">• MVMs• MEMs• HEET Equipment (components, modules, cables, etc.)• AutoGate Equipment (components, modules, cables, etc.)• SBS equipment including CFCs and MFCs• Passenger information units• Removal of all legacy token booth MetroCard equipment including any equipment and modules, monitors, keyboards, cables and computers• Associated cabling and conduit to the nearest ceiling junction box <p>The complete list of Legacy Equipment to be removed and locations will be subject to the MTA's review and approval.</p>	CDRL 34-1
34.1-3	SI shall recognize subway stations designated as historic landmark stations. For such stations, additional approval from the Landmark Department is required. This may introduce additional approval time.	CDRL 34-1
34.1-4	The SI shall provide a detailed schedule of Legacy Equipment removals for review and approval by the MTA, and such schedule will also identify all needed participation from departments within the NFPS Agencies.	CDRL 34-1

Req. #	Requirement	Assigned CDRL(s)
34.1-5	Prior to removal service performed by the SI pursuant to this Technical Specifications Section 34 (Equipment Removal), the MTA will be responsible for disconnecting all communications and power connections at their respective properties and environments, and will disconnect and remove any needed or sensitive components, including all revenue containers and Media. Therefore, the removal plan will require scheduling coordination with the appropriate MTA department.	CDRL 34-1
34.1-6	SI shall submit removal procedures for the MTA's review and approval.	CDRL 34-2
34.1-7	The SI shall be responsible for all Legacy Equipment disposal and/or salvage after removal. This will include transportation from the equipment area to the disposal site. The disposition of the equipment will conform to all local and state government environmental and legal requirements.	CDRL 34-2

For estimating purposes, the SI shall utilize the table below which shows anticipated remaining Legacy Equipment that will need to be removed as part of the SI's Equipment Removal Services set out herein. The exact quantities will be finalized by the MTA during design review:

Legacy Equipment	Number of Legacy Equipment	To be Replaced	Projected NFPS Quantities	Equipment to be Removed
AutoGate (internal components/electronics and wiring)	414	Not previously replaced as part of NFPS Equipment installation		414
CFC (Parkeon units)	478	Replaced by the WVMs	478	
MFC (SBS units)	957	Replaced by the WVMs	479	478
End cabinet equipment (internal components/electronics and wiring)	732	Not previously replaced as part of NFPS Equipment installation		732
HEET equipment (internal components/electronics and wiring)	575	Not previously replaced as part of NFPS Equipment installation		575
MCR/PIU (units)	816	Not previously replaced as part of NFPS Equipment installation		816
MEM (units)	555	Replaced by the CVMs	1,600	608
MVM (units)	1,653	Replaced by the CVMs		

Legacy Equipment	Number of Legacy Equipment	To be Replaced	Projected NFPS Quantities	Equipment to be Removed
TBT equipment (equipment, electronics and wiring)	522	Not previously replaced as part of NFPS Equipment installation		522

34.2 Equipment Removal Required Submittals

The required submittals specified in this Technical Specifications Section 34 (Equipment Removal) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 34-1	Equipment Removal Plan and Schedule	Section 34.1				To be finalized no later than 90 days prior to completion of NFPS Revenue Service Acceptance Testing
CDRL 34-2	Station and SBS Removal Procedures	Section 34.1				90 days prior to start of equipment removal

35 Options

Pricing for each of the Options listed in this Technical Specifications Section 35 (Options) shall be those amounts submitted by the SI in its Proposal and those that were accepted by the MTA during the procurement process. The timeframes for exercise of the Options is covered in the Contract Documents, including Agreement Section 21 (Optional Services).

35.1 NFPS Extended Hosting Services

The MTA may choose to continue to have all hosting services for the NFPS performed by the SI.

Req. #	Requirement	Assigned CDRL(s)
35.1-1	The MTA shall have the option to extend services for Backend Hosting Services (as defined in Technical Specifications Section 24.1 (NFPS Backend Hosting)) for a period of five (5) years (plus an additional five-year option) commencing upon the MTA's exercising of the applicable Option.	CDRL 35-1
35.1-2	Upon conclusion of the Backend Hosting Services (including any optional extensions), the SI shall migrate the Hosted System (including all NFPS Data) and configurations to production and disaster recovery facilities of the MTA's choice.	CDRL 35-1
35.1-3	Upon demonstrating the proper functioning of the migrated Hosted System, the SI shall activate the migrated Hosted System in the MTA's chosen facilities and discontinue all functioning of the previously-hosted Hosted System. At that time, the SI shall remove all data storage media containing NFPS Data, including all data backup storage media, from the previous Data Centers and deliver the data storage media to the MTA.	CDRL 35-1

35.1.1 NFPS Extended Hosting Services Required Submittals

The required submittals specified in this Technical Specifications Section 35.1 (NFPS Extended Hosting Services) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-1	Hosting Migration Plan	Section 35.1				Upon notification of termination of hosting services

35.2 Extended Web Portal Hosting Services

Req. #	Requirement	Assigned CDRL(s)
35.2-1	The MTA shall have the option to extend Website Hosting Services, as defined in Technical Specifications Section 24.2 (Web Hosting) for a period of five (5) years (plus an additional five-year option) commencing upon the MTA's exercising of the applicable Option.	CDRL 35-2
35.2-2	Upon conclusion of the Website Hosting Services (including any optional extensions), the SI shall migrate the NFPS Websites (including all NFPS Data) to MTA-designated production and disaster recovery servers.	CDRL 35-2
35.2-3	Upon migration of the NFPS Websites, the SI shall in the following order: (i) activate the migrated NFPS Websites in the MTA-designated production and disaster recovery servers; (ii) demonstrate that the migrated NFPS Websites are functioning in the same manner as before the migration and as otherwise required herein; and (iii) upon notice from the MTA that the migrated NFPS Websites are functioning as intended, discontinue all functioning of the previously-hosted NFPS Websites.	CDRL 35-2

35.2.1 Extended Web Portal Hosting Services Required Submittals

The required submittals specified in this Technical Specifications Section 35.2 (Extended Web Portal Hosting Services) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-2	Web Portal Hosting Migration Plan	Section 35.2				Upon notification of termination of hosting services

35.3 Retail Point of Sale Network

As part of NFPS deployment, the MTA requires an extensive and convenient network of Retail Merchants where customers can purchase and reload Extended Use NFPS Agency-Issued Account-Based Media. This Retail POS Network will leverage, as much as possible, existing retail merchant POS systems for the sale and reloading of Media and pre-paid gift cards. Retail network managers may not exclusively partner with the SI.

The MTA shall have an option to have the SI develop and execute a plan that offers customers an off-property network that, at a minimum, achieves the current coverage and convenience of the MetroCard's merchant network. Appendix C contains a full list of current MetroCard Retail Merchant Locations, including the products offered at each location, for use by the SI in developing a plan for the NFPS Retail POS Network. Retailer Merchants shall include check cashers, chain stores (drug stores, convenience stores and grocery stores) and bodegas.

35.3.1 General Requirements

The following requirements determine the minimum of service levels at all Retail Merchant Locations. These requirements can be enhanced by use of additional online or NFPS Mobile Applications steps, or additional equipment or specifications for acceptance of Open Payment cards and/or NFPS Mobile Applications for reload transactions.

Req. #	Requirement	Assigned CDRL(s)
35.3.1-1	Retail Merchant Locations will offer sales of NFPS Agency-Issued Media and reload of Closed-Loop Transit Accounts linked to NFPS Agency-Issued Media, either individually or in combination, through direct interaction with sales or customer service personnel or through automated machines that are for self-directed use by customers.	CDRL 35-3
35.3.1-2	All Retail Merchant Locations shall process transactions in real-time.	CDRL 35-3
35.3.1-3	All self-funded customer sales and reloads of NFPS Agency-Issued Media will be completed such that: <ul style="list-style-type: none">• Newly purchased NFPS Agency-Issued Media loaded with any Fare Product can be used immediately for fare payments on NFPS Agency and Linked NFPS Entity systems;• Any reload of Fare Products for customers who already have NFPS Agency-Issued Media can be immediately used for fare payments on NFPS Agency and Linked NFPS Entity services.	CDRL 35-3
35.3.1-4	All Retail Merchant Locations will support, at a minimum, loading of stored-value and time-based Fare Products to NFPS Agency-Issued Media for regular and reduced fare customers. Special Programs will be administered through the B2B Portal and may not require Retail Merchant support for reloading or issuing Media.	CDRL 35-3
35.3.1-5	If existing automated equipment is leveraged for self-directed NFPS sales and reloads, other payment applications may be hosted on the same equipment according to NFPS Agency-defined parameters, with such parameters defined on an NFPS Agency-specific basis.	CDRL 35-3
35.3.1-6	These services will be provided for a period of five (5) years plus two separate and individual, additional five-year options commencing upon the MTA's exercising of the applicable Option.	CDRL 35-3

35.3.2 Retail Network Locations

The Retail Network Provider shall identify and include in Retail Merchant Locations that are suitable, known and convenient locations for customers to purchase Media and reload Transit Accounts. All Retail Network Locations will be safe, secure and encourage use of the Retail POS Network by their customers.

Req. #	Requirement	Assigned CDRL(s)
35.3.2-1	The NFPS will have, at a minimum, 2,000 off-property, physical Retail Merchant Locations that support the sale of NFPS Agency-Issued Media and reloading of Closed-Loop Transit Accounts.	CDRL 35-3
35.3.2-2	<p>Physical Retail Merchant Locations will, at a minimum, provide the following coverage in relation to NYCT, MTA Bus Company, and SIRTQA subway stations and bus stops:</p> <ul style="list-style-type: none"> • 90% of subway stations will have a Retail Merchant Location within a quarter mile • 75% of bus stops will have a Retail Merchant Location within a quarter mile • A single Retail Merchant Location may serve multiple bus stops or stations, provided that the distance criteria is met for all served stations and stops <p>Appendix D provides geolocation data for all applicable subway stations and bus stops and a map of current Retail Merchant Locations in relation to stations and stops. Where possible, these Retail Merchant Locations will be offered participation in the program, however, there is a strong desire to expand beyond the current partners to larger retailers and chains to enable full retail integration and provide maximum flexibility for MTA Group customers.</p>	CDRL 35-3
35.3.2-3	Exceptions of up to one-half mile from the distance criteria set forth in req. # 35.3.2-3 for Retail Merchant Locations will be allowed based on documented low density or ridership activities.	CDRL 35-3
35.3.2-4	The Retail Network Provider shall work at the direction of the MTA to recruit Retail Merchants as needed throughout deployment and operation of the NFPS to provide coverage in underserved or targeted areas. Targeted locations include, but are not limited to, routes with high cash use on bus service and neighborhoods with lower levels of financial inclusion (e.g., lower levels of banking relationships).	CDRL 35-3
35.3.2-5	At its discretion, the NFPS Agencies may change the location of bus stops in their service areas. The Retail Network Provider shall modify the Retail POS Network to maintain the coverage requirements set forth in req. # 35.3.2-3 at the direction of the MTA.	CDRL 35-3
35.3.2-6	The Retail Network Provider shall submit an annual review of Retail Merchant Locations to the MTA to allow the MTA to monitor and verify compliance with the required coverage.	CDRL 35-3

Req. #	Requirement	Assigned CDRL(s)
35.3.2-7	All Retail Merchant Locations will provide customers the ability to purchase and reload Media during all hours of the Retail Merchant Locations' normal business operations.	CDRL 35-3
35.3.2-8	The Retail Network Provider shall include Retail Merchant Locations that offer 24/7 availability for purchase and reloading – whether staffed or unstaffed. For unstaffed locations, the Retail Network Provider shall enlist Retail Network Locations that provide the maximum degree of safety and security possible (including sufficient lighting and surveillance).	CDRL 35-3
35.3.2-9	All staffed Retail Merchant Locations will provide a consistent customer service experience, messaging and marketing materials for the NFPS.	CDRL 35-3

35.3.3 Retailer Participation and Performance

The MTA reserves the right to monitor and evaluate the performance of Retail Merchant Locations. The Retail Network Provider will manage the services, logistics and relationships with Retail Merchants as necessary and supply the required materials for their participation.

Req. #	Requirement	Assigned CDRL(s)
35.3.3-1	The Retail Network Provider shall identify, recruit, manage, contract with and compensate Retail Merchants (via commissions) for participation in the Retail POS Network.	CDRL 35-3
35.3.3-2	The Retail Network Provider shall manage merchant invoicing, reconciliation and cash flow.	CDRL 35-3
35.3.3-3	The Retail Network Provider shall develop written Customer Service Policies as described in this Technical Specifications Section 35 (Options) that will be contractually binding for all Retail Merchants that participate in the Retail POS Network. Appendix E includes the current Merchant Manual for MetroCard.	CDRL 35-3
35.3.3-4	Customer Service Policies shall be developed in conjunction with, and approved by, the MTA during design review.	CDRL 35-3
35.3.3-5	The Retail Network Provider shall provide all Retail Merchant Locations with approved marketing and information materials for the NFPS, including signage that identifies the location as a Retail Merchant for NFPS sales and reloading of Media.	CDRL 35-3
35.3.3-6	The Retail Network Provider shall ensure that all Retail Merchant Locations consistently have marketing and information materials available for customers.	CDRL 35-3

Req. #	Requirement	Assigned CDRL(s)
35.3.3-7	The Retail Network Provider shall ensure that owners and operators are familiar with the NFPS, NFPS Agency Fare Products, and customer service options in use of the NFPS.	CDRL 35-3
35.3.3-8	The Retail Network Provider shall submit a performance measurement and monitoring plan for the Retail POS Network to the MTA as part of design review, including ongoing reporting and data requirements.	CDRL 35-3

35.3.4 Retail Network Media

Req. #	Requirement	Assigned CDRL(s)
35.3.4-1	All Retail Merchant Locations will make available NFPS Agency-Issued Media (Extended Use, Account-Based) in sufficient supply to meet customer demand.	CDRL 35-3
35.3.4-2	The SI shall provide the NFPS Agency-Issued Media to the Retail Network Provider for delivery to Retail Merchant Locations.	CDRL 35-3
35.3.4-3	The Retail Network Provider shall provide specifications necessary for the SI to design NFPS Agency-Issued Media that can interface with integrated POS devices (i.e., barcode and/or magnetic stripe requirements).	CDRL 35-3
35.3.4-4	The retail network provider shall package the NFPS Agency-Issued Media as necessary for prominent placement of the NFPS Agency-Issued Media at Retail Merchant Locations, such that customers can easily locate and identify the NFPS Agency-Issued Media. Packaging is subject to the MTA's approval.	CDRL 35-3
35.3.4-5	Packaging of NFPS Agency-Issued Media will comply with all applicable federal, state and local laws and regulations.	CDRL 35-3
35.3.4-6	The Retail Network Provider shall manage the distribution of NFPS Agency-Issued Media as required and retailer inventory of NFPS Agency-Issued Media as needed.	CDRL 35-3
35.3.4-7	The NFPS will track the current and historical status of all NFPS Agency-Issued Media in Retail POS Network inventory; whenever NFPS Agency-Issued Media is purchased, upon receipt of the transaction record, the NFPS will update all inventory records accordingly, with such records updated on an NFPS Agency-specific basis.	CDRL 35-3

35.3.5 Transaction Processing and Financial Settlement

Req. #	Requirement	Assigned CDRL(s)
35.3.5-1	The Retail Network Provider shall process transactions for the Retail POS Network utilizing the Retail Merchant's integrated POS. NFPS sales and reloading transactions will be processed by the NFPS via the Retail Merchant's integrated or non-integrated solutions, but credit and debit payments for those transactions will be processed by the Merchant Retailers using their existing merchant services.	CDRL 35-3
35.3.5-2	All financial settlement of the Retail Merchant Network will occur through the NFPS Backend.	CDRL 35-3
35.3.5-3	The MTA requires settlement in three (3) days of all funds due from purchase of Fare Products at Retail Network Locations.	CDRL 35-3
35.3.5-4	The Retail Network Provider shall interface with the NFPS Backend using the APIs provided by the SI and described in Technical Specifications Section 6.4 (Application Programming Interfaces).	CDRL 35-3
35.3.5-5	The Retail Network Provider shall provide transaction records to the NFPS Backend with all required information, including device/merchant ID, location, date/time, account number, Fare Product type/value, which will be processed by the NFPS to allow for the full tracking of all actions.	CDRL 35-3

35.3.6 Retail Point of Sale Network Required Submittals

The required submittals specified in this Technical Specifications Section 35.3 (Retail Point of Sale Network) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-3	Retail POS Network Plan	Section 35.3	✓	✓	✓	30 days after NTP for the Retail Network Provider

35.4 Additional NFPS Equipment, Integration Services, and Media

The SI shall provide pricing for integration services with MetroCard Affiliates as described in Technical Specifications Section 4.4.2 (Linked NFPS Entities), and fixed volume pricing for additional NFPS Equipment and Media purchases to be made by the MTA (either for itself, or on behalf of other NFPS Agencies, Ancillary MTA Group Entities, or Linked NFPS Entities) for twelve (12) years after NTP as follows (see Price Proposal Forms):

Req. #	Requirement	Assigned CDRL(s)
35.4-1	The SI shall provide unit pricing and installation costs for additional CVMs and components based on quantities of 1-25; 25-100; 101-250; 251-1,000; 1,001+.	N/A
35.4-2	The SI shall provide unit pricing and installation costs for additional BVs, SVs and WVMs based on quantities of 1-25; 25-100; 101-250; 251-1,000; 1,001+.	N/A
35.4-3	The SI shall provide individual unit pricing and installation costs for additional CS POS Terminals based on quantities of 1-25; 25-100; 101-250; 251-1,000; 1,001+.	N/A
35.4-4	The SI shall provide individual unit pricing and installation costs for additional TOMs based on quantities of 1-25; 25-100; 101-250; 251-1000; 1,001+.	N/A
35.4-5	The SI shall provide individual unit pricing for additional Paper Media for MNR and LIRR based on quantities of 500,000-1M; 1M-10M; 10M-50M; 50M+.	N/A
35.4-6	The SI shall provide individual unit pricing for additional LU-R Media for MNR and LIRR based on quantities of 500,000-1M; 1M-10M; 10M-50M; 50M+.	N/A
35.4-7	The SI shall provide individual unit pricing for additional LU-S Media for MNR and LIRR based on quantities of 500,000-1M; 1M-10M; 10M-50M; 50M+.	N/A
35.4-8	The SI shall provide individual unit pricing for additional EU Media for NYCT based on quantities of 500,000-1M; 1M-10M; 10M-50M; 50M+.	N/A
35.4-9	The SI shall provide pricing for the Option-Specific Integration Services as further set out in Technical Specifications Section 4.4.2 (Linked NFPS Entities).	N/A

35.4.1 Hardware Warranty for Additional NFPS Equipment Quantities; Additional Obligations

By way of clarification, all NFPS Equipment obtained pursuant to this Option shall be considered NFPS Equipment for all purposes, including the SI's obligation to provide the Hardware Warranties and other obligations set out in the Contract Documents with respect to NFPS Hardware.

35.5 Validator Optical Barcode Readers

The NFPS will be designed to accept payments using Contactless Smart Devices, using a Near Field Communication (NFC) technology, that provide the performance and security that are required in a system of comparable size and complexity to the NFPS. In the event that the MTA determines that barcodes or other optical-encoding standards provide a viable solution to the NFPS in terms of performance and security, the SI shall provide optical barcode scanning capabilities in addition to the Contactless Readers prior to the start of NFPS Validator production. Barcode readers will ideally be housed in the same enclosure as the Contactless Reader and provide a seamless and intuitive option for

the customer. If this Option is exercised, requirements such as those detailed in Technical Specifications Section 5.2 (Prior Service Performance) and others may be revised as appropriate by the MTA.

Req. #	Requirement	Assigned CDRL(s)
35.5-1	In the event that barcodes (1D, 2D, Aztec, and/or other format) will be used to validate Media, optical scanning capability will be provided by the SI at every NFPS Validator. These NFPS Validators will be COTS, and may be installed by the SI or NFPS Agency staff. The SI shall provide optical scanner, Software integration and installation pricing for all NFPS Validators.	CDRL 35-4
35.5-2	The optical barcode Reader will be integrated with or co-located in the same enclosure as the existing Contactless Reader, and provide an intuitive experience to the end-user without adversely impacting the performance of other NFPS Equipment.	CDRL 35-4
35.5-3	The optical barcode Reader will be designed to withstand the general environmental and performance requirements in these Technical Specifications, with special consideration for vandalism and defacing of the optical Reader's face.	CDRL 35-4
35.5-4	The optical barcode Reader will be able to accommodate Third Party Software installed by the SI with prior approval by the MTA.	CDRL 35-4
35.5-5	The optical barcode Reader will be subject to the same testing requirements and procedures as other NFPS devices described in Technical Specifications Sections 27 (Factory Testing and Inspection) and 30 (Post-Installation Testing and System Acceptance).	CDRL 35-5, CDRL 35-6

35.5.1 Optical Barcode Readers Required Submittals

The required submittals specified in this Technical Specifications Section 35.5 (Optical Barcode Readers) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-4	Optical Scanner Installation Plan	Section 35.5	✓	✓	✓	
CDRL 35-5	Optical Scanner Testing Plan	Section 35.5	✓	✓	✓	At least 90 days prior to the start of any planned testing
CDRL 35-6	Optical Scanner Test Records	Section 35.5				10 days after testing is performed

35.6 Extended Technical and Software Support Services

The MTA may choose to continue to have all technical and Software services administered externally. These Options may be exercised by notice in writing as outlined in the Contract Documents.

35.6.1 Extended Support Services

The SI shall provide a range of services as part of Technical and Software Support extended under this Option (“**Extended Technical and Software Support**”):

Req. #	Requirement	Assigned CDRL(s)
35.6.1-1	The MTA shall have the Option to extend Technical and Software Support Services, as defined in Technical Specifications Section 31 (Technical and Software Support Services) for a period of five (5) years plus an additional five-year option, commencing upon the MTA's exercising of the applicable Option.	CDRL 35-7
35.6.1-2	The Extended Technical and Software Support services shall include, if requested by the MTA, migration of the Hosted System from the existing hosting locations to new locations designated by the MTA.	CDRL 35-7

35.6.2 Service Request Procedures

The MTA shall provide the SI with written Documentation of those individuals authorized to call for on-site technical support, and those individuals authorized to initiate Service Requests.

Req. #	Requirement	Assigned CDRL(s)
35.6.2-1	At the MTA's discretion, the SI shall be directed to provide the following services as part of a Service Request: <ul style="list-style-type: none">• Onsite technical support• Software development	CDRL 35-8
35.6.2-2	At the MTA's request, the SI shall supply Extended Technical and Software Support onsite at any MTA Group office or maintenance facility, or where any SI-supplied NFPS Hardware is installed. Qualified SI staff shall be available to provide onsite support within five business days of the authorization of the service request.	CDRL 35-8
35.6.2-3	Upon acceptance of a service request requiring modification of SI-Developed Software, the SI shall commence development of the requested modification. The SI shall test the completed modification, and shall assist the MTA as directed in the installation of the modification to the SI-Developed Software. All Software development work performed under a service request under the Contract Documents will be warranted by the SI against defects for a period of one year after installation of the modification to the SI-Developed Software.	CDRL 35-8

Req. #	Requirement	Assigned CDRL(s)
35.6.2-4	Formal Service Requests will be provided by the MTA by email or other written correspondence. Upon receipt of the formal Service Request, the SI shall provide a good faith estimate of the number of labor hours required to satisfy the Service Request, the proposed start date/time for the effort, the individuals assigned to the task, and other relevant task information in writing to the requesting individual at the MTA. At the direction of the Engineer, the SI shall submit these proposed Service Request procedures for review by the Engineer prior to exercise of this Option.	CDRL 35-8
35.6.2-5	Upon the MTA's acceptance of the written Service Request estimate, the SI shall commence work, notify the MTA upon successful conclusion of the task, and report the number of hours worked to reach such successful conclusion. The SI shall not expend or invoice for labor hours in excess of the approved written Service Request estimate without written approval from the MTA. No additional Work shall be performed without prior approval by the MTA.	CDRL 35-8

35.6.3 Labor Bank

Req. #	Requirement	Assigned CDRL(s)
35.6.3-1	During the initial five-year period of Extended Technical and Software Support services, the SI shall make available fare collection system Software development, system administration, database administration and other technical staff as necessary for a total of 2,000 hours of labor. This Labor Bank, as described in this Technical Specifications Section 35.6.3 (Labor Bank), will be usable by the NFPS Agencies on a service request basis. If tasks performed by the SI exhaust the 2,000-hour Labor Bank prior to the conclusion of the five-year service period, the NFPS Agencies may request additional hours, at contractually-approved rates as necessary.	CDRL 35-7
35.6.3-2	If the MTA exercises the second five-year option for additional Extended Technical and Software Support, all terms and conditions will remain in effect. For each Option exercised: <ul style="list-style-type: none"> The Extended Technical and Software Support shall extend by 60 months 2,000 hours will be added to the Labor Bank 	CDRL 35-7

Req. #	Requirement	Assigned CDRL(s)
35.6.3-3	Approved Service Request Work completed against hours in the Labor Bank shall be invoiced separately from regular monthly charges for the Extended Technical and Software Support at agreed-upon labor rates.	CDRL 35-9
35.6.3-4	Each monthly invoice shall provide Documentation detailing the number of hours remaining in the Labor Bank, and provide an accounting by Service Request of the hours consumed, including information such as the date, time of the Work and the name of the individual who authorized the Work.	CDRL 35-9

35.6.4 Extended Technical and Software Support Services Required Submittals

The required submittals specified in this Technical Specifications Section 35.6 (Extended Technical and Software Support Services) are summarized below. They are further described in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-7	Extended Support Services Plan	Sections 35.6.1, 35.6.3				10 days after exercising of this Option
CDRL 35-8	Service Request Procedures	Section 35.6.2				At the Engineer's request, or 10 days after exercising of this Option
CDRL 35-9	Labor Bank Status Reports	Section 35.6.3				Monthly and upon the MTA's request

35.7 Extended Customer Service Support

During the Customer Call Center Support Period, the SI shall provide Customer Call Center staff and phone lines during transition to support NYCT patrons. The MTA shall have an option to expand that support to cover all NFPS-related Customer Call Center Services for NYCT, including dedicated connections into the NFPS IVR and Customer Call Center, for five (5) years plus two additional five-year option periods, as well as the option to expand the Call Center Services to MNR and LIRR, as further set out below. The MTA may exercise this Option by providing notice pursuant to the Contract Documents. The SI-provided Customer Call Center would then provide all account enrollment and account management functions, except Tier 2 customer claims which require NYCT investigation. Inbound calls received by the NYCT IVR or the NYCT Customer Call Center would be pushed to the SI-provided IVR for NFPS-specific issues.

The Customer Call Center Services shall be designed so that they may be expanded to support LIRR and MNR in the future if requested by the MTA, and such a request shall not result in additional cost to the MTA Group other than increases in the Monthly Customer Interaction Fee based on additional call volumes (if any). By way of clarification, and not limitation, if the MTA exercises its right to expand the

Call Center Services to MNR and LIRR, then all associated requirements that are currently limited to other NFPS Agencies (for example, NYCT) shall be expanded so that they apply to both MNR and LIRR, unless otherwise directed by the MTA.

If this Option is exercised, the SI would also provide Media order fulfillment, including issuing and mailing of Media, from the Customer Call Center/IVR, NFPS Websites, and NFPS Mobile Applications. Processing of reduced fare applications and verification of eligibility would remain the responsibility of NYCT as part of order fulfillment.

Req. #	Requirement	Assigned CDRL(s)
35.7-1	The SI shall provide a dedicated connections into the SI-provided IVR and Customer Call Center for NFPS-related customer service support. Customers will connect to the SI-provided IVR through (handoff from) the MTA's existing 511 IVR.	CDRL 35-10
35.7-2	The SI shall staff a local Customer Call Center to the level required to meet the KPIs detailed in Technical Specifications Section 5.14 (Performance Requirements) for the duration of the Contract Documents, measured monthly. The Customer Call Center will be staffed 24/7 during the transition to the NFPS, and during current NYCT customer service business hours thereafter.	CDRL 35-10
35.7-3	<p>The SI shall provide customer service support via the Customer Call Center for the following, as per applicable Business Rules:</p> <ul style="list-style-type: none"> • Set up Transit Accounts • Transfer customer to IVR to enter Transit Account payment method and details (bank card, ACH, etc.) – if customer enrolls • Register a personal Contactless Bank Card or mobile device as the Media for a Closed-Loop Transit Account • Take NFPS Agency-Issued Media orders • Process Fare Product load and reload • Set up Autoload • Respond to fare program questions • Resolve Tier 1 customer purchase and usage problems • Report lost/stolen Media • Update personal bank card/mobile device information • Process refunds or make account adjustments – for Tier 1 issues only and as per the rules agreed by the SI and the MTA 	CDRL 35-10
35.7-4	The SI shall fulfill NFPS Agency-Issued card orders made via CRM System, IVR, NFPS Websites or NFPS Mobile Applications, including mailing of non-personalized cards. Verification of reduced fare and paratransit eligibility and issuance of associated cards will remain the responsibility of the applicable NFPS Agency.	CDRL 35-10
35.7-5	Card fulfillment will be measured by responsiveness within 48 hours on a monthly basis. This will be calculated by the total of all mailing times/total number of card orders placed for delivery	CDRL 35-10

	by mail. "Mailing time" is defined as the time required from the instant that a card order is received via the NFPS Websites, NFPS Mobile Applications or IVR to the instant the card is placed in the mail.	
35.7-6	Customer Call Center contacts received and responded to will be recorded in detail to support monthly reporting and invoicing by the SI, as well as audit by the MTA as deemed necessary, all in compliance with the requirements set out in the Contract Documents, including Agreement Section 11 (Call Center Services)).	CDRL 35-9
35.7-7	The Customer Call Center shall follow quality assurance/quality control industry best practices and record and monitor customer calls in compliance with all Applicable Laws. The MTA shall be provided access to the recordings upon request, and the SI shall ensure that it has secured sufficient rights to provide the same.	CDRL 35-9

35.7.1 Extended Customer Service Support Required Submittals

The required submittals specified in this Technical Specifications Section 35.7 (Extended Customer Service Support) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-10	Customer Service Support Plan - Extension	Section 35.7	✓	✓	✓	

35.8 Bus Antenna

In the event that the existing antenna onboard the buses is deemed by the MTA to be insufficient to support current and planned bus systems, the MTA shall have an option for the SI to replace the current bus antenna to be exercised by notice pursuant to the Contract Documents.

Req. #	Requirement	Assigned CDRL(s)
35.8-1	The SI shall provide a COTS antenna sufficient to support the NFPS as well as current and planned bus systems as defined by the MTA for the entire bus fleet, or as directed by the MTA.	CDRL 35-11
35.8-2	The SI shall replace the current antenna with the approved replacement using current physical conditions of each bus and without modification to the bus body.	CDRL 35-11
35.8-3	All design and installation procedures will be subject to the MTA's review and approval.	CDRL 35-11

35.8.1 Bus Antenna Required Submittals

The required submittals specified in this Technical Specifications Section 35.8 (Bus Antenna) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-11	Bus Antenna Design	Section 35.8	✓	✓	✓	

35.9 Driver Control Unit (DCU)

The MTA shall have an option to be exercised by notice in writing pursuant to the Contract Documents to require the SI to provide a DCU which will function to provide all necessary NFPS input and displays to fully support the operation of the NFPS onboard fare collection equipment. The DCU will be an independent unit providing driver control and operation of the NFPS BV and associated components. The DCU will also support communications interfaces with other onboard bus systems as defined below and in design review for the purpose of single sign-on, driver control and monitoring at the DCU.

35.9.1 Driver Control Unit (DCU) Description

Req. #	Requirement	Assigned CDRL(s)
35.9.1-1	The DCU design, including operating functionality, dimensions and DCU/BV mounting options as a combination for all bus types, will be provided by the SI for the MTA's review and approval.	CDRL 35-12
35.9.1-2	The DCU will display fare payment results transmitted from the BV, including fare payment approval or denial, and in the case of approval, the Fare Product and fare category associated with the Transit Account (e.g., standard, reduced-fare, student, employee, etc.) used for payment.	CDRL 35-12
35.9.1-3	The DCU will provide programmable touchscreen functions that are configurable by the NFPS Backend. All such touchscreen presses will provide perceptible feedback when pressed.	CDRL 35-12
35.9.1-4	The DCU will be programmable, if possible, so that custom screens can be part of new custom applications. The DCU will include a programmable/extensible graphical display, so that an outside source (such as a new custom application) can drive the display.	CDRL 35-12

Req. #	Requirement	Assigned CDRL(s)
35.9.1-5	<p>The DCU shall expose, through one or more defined Interfaces, all operational information input by the operator. This will include, at minimum:</p> <ul style="list-style-type: none"> • Run • Route • Pass#/id • Destination sign code • Custom Fields (extensibility) <p>The list described above should be extensible, so that other/new user-entered fields can be defined. This DCU should support exposing information input through or generated by custom applications developed for and residing on the DCU. Each custom application shall be responsible for identifying the data to expose, and implementing the Interface.</p>	CDRL 35-12
35.9.1-6	<p>Single sign-on will enable the Bus Operator to log into all relevant bus onboard systems from the DCU. Similarly, the DCU will be able to accept a logon from other bus systems when they become available. These other systems are to include, but are not limited to:</p> <ul style="list-style-type: none"> • Bus stop annunciators • Automatic passenger counters, if applicable • Bus Radio Systems, if applicable • CAD/AVL Systems, if applicable • Automatic vehicle monitoring • MTA Bus Time System • IFU • Destination signs 	CDRL 35-12
35.9.1-7	<p>The communication interfaces used for the DCUs will be in conformance with Open Standards and will be free of non-standard, proprietary technology. At a minimum, the following recognized standards will be supported:</p> <ul style="list-style-type: none"> • EIA-232/422 • RS-435 • J1708/1587 • 10/100 Base-T wired Ethernet • Bluetooth • USB <p>The number of ports will be determined during design review and will ensure adequate support of single sign-on capabilities.</p>	CDRL 35-13
35.9.1-8	<p>The DCU will be able to initiate a fare override function that will cause the BV to flag a fare transaction so that it is priced at a reduced fare, even if a full fare account is being used for payment. The fare override function will be configurable and will support both Open- and Closed-Loop Payments.</p>	CDRL 35-12
35.9.1-9	<p>Communications utilized in the exchange of data between the DCU, the BV and other onboard systems will be fully detailed in Documentation and</p>	CDRL 35-12

Req. #	Requirement	Assigned CDRL(s)
	licensed to the MTA Group pursuant to the Contract Documents. By way of clarification, and not limitation, such rights include the MTA Group's right to sublicense its rights in such Documentation to equipment suppliers for the purpose of effecting interface to the various onboard systems, including NFPS components.	

35.9.2 DCU Enclosure

Req. #	Requirement	Assigned CDRL(s)
35.9.2-1	The DCU enclosure and components shall be made of material suitable to the service under the full range of the specified bus environmental and operating conditions (see Technical Specifications Section 5.6 (Environmental Conditions)).	CDRL 35-12
35.9.2-2	The DCU will be as compact as possible while still providing the required functionality. It will be a modular unit with quick disconnects and captive mounting Hardware for ease of maintenance.	CDRL 35-14
35.9.2-3	The DCU enclosure will be made of high-impact materials and will be corrosion resistant. Additionally the DCU will: <ul style="list-style-type: none"> • Have no paint or other coatings that may wear off or scratch • Be sealed against moisture entry • Be latched or secured in such a way that it can be opened only when properly removed from its mounting bracket • Have no sharp edges or corners • Be resistant to vandalism 	CDRL 35-12
35.9.2-4	All physical and electrical connections required to install and complete the DCU functions will be contained within the enclosure.	CDRL 35-12

35.9.3 DCU Mounting

Req. #	Requirement	Assigned CDRL(s)
35.9.3-1	The SI shall provide all necessary and appropriate Hardware for mounting the DCU on the bus, as required and determined by the configuration of each bus type. This mounting location will conform to all ADA and safety requirements as determined by the MTA during design review.	CDRL 35-12
35.9.3-2	The DCU will be installed in a position to allow bus operators to observe fare transactions without interfering with other bus controls or indicators. The DCU will in no way obstruct the bus operator's view.	CDRL 35-12
35.9.3-3	Mounting will allow easy access to the DCU touch screen without straining and without interfering with other bus controls or displays.	CDRL 35-12
35.9.3-4	The DCU will be designed and mounted so that it can be quickly adjusted by the bus operator for optimal operating angle and viewing. After adjusting, the mounting Hardware will not allow the DCU to shake or become loose as a result of shock and vibration encountered during normal bus operation.	CDRL 35-12

35.9.4 Operator Input Controls

Req. #	Requirement	Assigned CDRL(s)
35.9.4-1	The DCU will contain touchscreen presses which will provide bus operator entry of appropriate control parameters for the BV.	CDRL 35-12
35.9.4-2	The DCU will allow input of bus operator ID for purposes of logging into the NFPS components and for single sign-on to other bus systems that require logon information.	CDRL 35-12
35.9.4-3	The DCU will allow automatic and manual input of service, fare level, route, run, trip and block Data for transaction cataloging.	CDRL 35-12
35.9.4-4	Touchscreen presses will be accompanied by suitable visual and audio feedback to confirm each press of a button.	CDRL 35-12

35.9.5 Onboard Systems Integration

Req. #	Requirement	Assigned CDRL(s)
35.9.5-1	Single sign-on will enable the logon/logoff and other data, including operator ID, block, route, trip, service, fare level and direction to be captured by the other onboard bus systems as required and stored for use in NFPS transactions, using the standard interfaces stipulated above in Technical Specifications Section 35.9.1 (Driver Control Unit (DCU) Description).	CDRL 35-12
35.9.5-2	The DCU will be able to accept appropriate logon/logoff data using the standard interfaces stipulated above in Technical Specifications Section 35.9.1 (Driver Control Unit (DCU) Description).	CDRL 35-12
35.9.5-3	The SI shall provide an interface control Documentation detailing message formats and contents, procedures, interfaces and transport protocols used for the onboard systems integration effort.	CDRL 35-12

35.9.6 Driver Control Unit (DCU) Required Submittals

The required submittals specified in this Technical Specifications Section 35.9 (Driver Control Unit (DCU)) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-12	DCU Design and Interface Control Document	Section 35.9	✓	✓	✓	
CDRL 35-13	DCU Hardware, Software and Communications Design	Section 35.9	✓	✓	✓	
CDRL 35-14	DCU Maintenance Procedures	Section 35.9	✓	✓	✓	

35.10 NFPS Onboard Systems Router

The MTA shall have an option to require the furnishing and installation of a separate mobile router and switch to be connected to the cellular network for use by the BV and other appropriate onboard

systems that are not accessing the cellular network, as designated by the MTA, to be exercised by notice in writing pursuant to the Contract Documents.

Req. #	Requirement	Assigned CDRL(s)
35.10-1	The SI shall provide a COTS external 4G cellular router that will be utilized by all onboard bus systems requiring cellular communications. The router Hardware, configuration and installation will be approved for installations on all bus types by the MTA.	CDRL 35-15
35.10-2	The SI shall provide all necessary and appropriate Hardware for mounting the router on the bus, as required and determined by the configuration of each bus type. This mounting location will be submitted for the MTA's review and approval.	CDRL 35-15
35.10-3	All design and installation procedures will be subject to the MTA's review and approval.	CDRL 35-15

35.10.1 NFPS Onboard Systems Router Required Submittals

The required submittals specified in this Technical Specifications Section 35.10 (NFPS Onboard Systems Router) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-15	Cellular Router Installation and Configuration Procedures	Section 35.10		✓	✓	

35.11 SBS Pilot

The MTA Select Bus Service is an effective means of realizing dwell time savings and providing faster service, and plans to expand this service extend through the projected implementation of the NFPS. The MTA would like to explore possible innovative technological approaches to onboard fare collection and validation that will largely preserve or increase the benefits provided by this service but may reduce the need for infrastructure at all wayside locations. In current Bus Rapid Transit (BRT) deployments, some agencies have chosen to deploy all-door boarding with onboard Validators and/or hand-held units for validation, payment and automated citations. However, advancements in technology may offer additional functions or alternatives that may better suit the MTA Group's needs. The MTA shall have an option to have the SI develop and execute technology and processes to (i) support onboard payment and/or validation for SBS, and (ii) to provide and support Software and equipment to support the pilot on approximately 175 SBS buses, as determined by the MTA. This Option may be exercised by notice in writing pursuant to the Contract Documents. The SBS Pilot shall occur between the SI's receipt of the Beneficial Use Certificate for Beneficial Use #1 and the SI's receipt of the Beneficial Use Certificate for Beneficial Use #5, as directed by the MTA.

35.11.1 General Pilot Requirements

Req. #	Requirement	Assigned CDRL(s)
35.11.1-1	<p>The SI shall provide a proposed pilot that demonstrates alternative payment and/or validation functions, which may include but are not limited to:</p> <ul style="list-style-type: none"> • Accept payment onboard SBS buses • Read NFPS Media accepted within the NFPS (see Technical Specifications Section 8 (Media Types)) and verify payment was made through an associated account within some configurable amount of time. • Automate issuance of citations for fare evasion and track repeat offenders <p>The proposal shall be subject to the MTA's review and approval.</p>	CDRL 35-16
35.11.1-2	<p>Upon approval of the proposal, the SI will provide the pilot design with a detailed schedule and project budget. This design will be subject to the MTA's review and approval. The proposal shall include high level projected cost, dwell time impacts and other service implications of the designated SBS line based on MTA-provided data.</p>	CDRL 35-17

35.11.2 Pilot Technology Requirements

Req. #	Requirement	Assigned CDRL(s)
35.11.2-1	<p>Any hand held technology to be used by NFPS Agency employees or enforcement agents as part of the pilot will be low-cost to procure, commercially available, and use a common and current mobile platform (e.g., Android, iOS, etc.) if applicable.</p>	CDRL 35-17
35.11.2-2	<p>Any hand held technology will be portable and not unreasonably hinder an employee or enforcement agent's ability to perform inspection and other possible security duties. The size and weight will be comparable to a standard touch screen mobile phone or handheld reader used in other commercial applications.</p>	CDRL 35-17
35.11.2-3	<p>The SI shall provide all necessary Hardware and Software to ensure a successful integration into the NFPS, including:</p> <ul style="list-style-type: none"> • Devices • Cables and connections • System enhancements • Software • Fare tables <p>The pilot will support all applicable Business Rules and fare policies.</p>	CDRL 35-17

Req. #	Requirement	Assigned CDRL(s)
35.11.2-4	The pilot technology will support real-time or near real-time communications with the NFPS Backend for payment verification. Technology will also function in offline mode with no loss of Data.	CDRL 35-17
35.11.2-5	All pilot transactions shall generate audit and reporting information identical to that generated for transactions processed in the non-pilot NFPS.	CDRL 35-17
35.11.2-6	Any patron or user interface design will be subject to the MTA's review and approval.	CDRL 35-17
35.11.2-7	On a monthly basis and within 30 days of completion of the pilot, the SI shall provide actual measured results against projections with respect to time, cost and other impacts to service.	CDRL 35-18

35.11.3 SBS Pilot Required Submittals

The required submittals specified in this Technical Specifications Section 35.11 (SBS Pilot) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-16	SBS Pilot Proposal	Section 35.11	✓			
CDRL 35-17	SBS Pilot Design and Budget	Section 35.11	✓	✓	✓	
CDRL 35-18	SBS Pilot Results	Section 35.11				Monthly, and within 30 days of pilot completion

35.12 MNR and LIRR NFPS Equipment

35.12.1 NFPS Equipment Quantities and Locations

In addition to the MTA's rights set out in Technical Specifications Section 35.4 (Additional NFPS Equipment, Integration Services, and Media), the MTA shall have an option to have the SI supply and install, for MNR and LIRR, the NFPS Equipment as shown in Table 35.1 (MNR and LIRR NFPS Equipment Quantities), including additional test and spare NFPS Equipment. Hardware quantities for the Test Facilities will be sourced from the spares.

Table 35.1: MNR and LIRR NFPS Equipment Quantities

NFPS Equipment	Technical Specifications Section	Base Quantity	Spare NFPS Equipment
Configurable Vending Machines (CVMs)	16 (Configurable Vending Machines)	580	14
Ticket Office Machines (TOMs)	17.2 (Ticket Office Machines)	134	11
Revenue Facility (RF) Workstations	28.3 (Revenue Facility (RF) Workstation)	12	4
Smart Card Certification Workstations	28.2 (Smart Card Certification Workstations)	4	0

All MNR and LIRR equipment installations will be performed by the SI pursuant to the requirements set out in Technical Specifications Section 29 (Deployment and Installation Services). All CVM and TOM installations will be a one-to-one replacement of Legacy Equipment (TVMs and TOMs), and will include removal and disposal of the Legacy Equipment by the SI.

If this Option is exercised, then the SI shall also provide the following spare parts for any such additional NFPS Equipment purchased:

- 15% spares for NFPS Equipment moving parts
- 7.5% spares for NFPS Equipment solid-state parts
- 150% spares for bill vaults for CVMs
- 50% spares for coin vaults for CVMs
- 200% spares for other revenue components for CVMs (Coin Hoppers (2 per CVM), Limited Use Media Cassettes)

35.12.2 Hardware Warranty; Additional Obligations

By way of clarification, all NFPS Equipment obtained pursuant to this Option shall be considered NFPS Equipment for all purposes, including the SI's obligation to provide the Hardware Warranties and other obligations set out in the Contract Documents with respect to NFPS Hardware.

35.13 MNR and LIRR Media

The MTA shall have an option to have the SI supply, for MNR and LIRR, MNR and LIRR Media as shown in the table set out in this Section 35.13 (MNR and LIRR Media). Details of Media for MNR and LIRR are described in these Contract Documents, including in Technical Specifications Section 8 (Media Types), Technical Specifications Section 18 (Media), and the requirements set out below.

The current Standard Operating Procedure (SOP) for onboard fare processing teams is to punch holes in tickets as they are inspected and validated. The SI shall ensure that its solution to be used for MNR and LIRR allows for strategic hole-punching of Limited Use and Paper Media, if required, so as not to cause damage to the antennae and electronic structure of the NFPS Media for MNR and LIRR.

For estimating purposes, the SI shall provide Media pricing based on the quantities listed below as well as for different volumes for all Media types. It should be noted that these quantities are based on current Media types and usage but future design and policy may change the quantities required; the

MTA reserves the right to order different amounts of Media (on behalf of MNR and LIRR) as needed.

Media	Quantity
LU-S Media	500,000
LU-R Media	500,000
Paper Media	500,000
Receipt Paper Rolls	15,281

35.14 MNR and LIRR NFPS Equipment Spare Parts and Modules Service and Repair

The MTA shall have an option, on behalf of MNR or LIRR, to require the SI to provide Third-Call Maintenance for those CVMs and TOMs used by MNR and LIRR, and the SI's provision of such Third-Call Maintenance shall otherwise comply with the SI's Third-Call Maintenance obligations set out herein, including in Agreement Section 15 (NFPS Hardware Warranties) and this Technical Specifications Section 35.14 (MNR and LIRR NFPS Equipment Spare Parts and Modules Service and Repair). The Option set out in this Technical Specifications Section 35.14 (MNR and LIRR NFPS Equipment Spare Parts and Modules Service and Repair) shall commence, if exercised, starting at the end of the applicable Hardware Warranty Period and continuing for a term of five (5) years, with two (2) additional five (5) year options following the initial option term (the "**Optional Spares Term**"). The list of all parts and modules covered by this Option will be proposed by the SI during Design Review and will be subject to MNR and LIRR review and approval.

Req. #	Requirement	Assigned CDRL(s)
35.14-1	If the MTA exercises the Option for Spare Parts Service and Repair on behalf of MNR and LIRR, then the SI shall perform all Third-Call Maintenance for all MNR and LIRR CVMs and TOMs throughout the applicable Optional Spares Term, with such Third-Call Maintenance performed in the SI's backshop.	CDRL 35-19
35.14-2	At least ninety (90) days prior to the commencement of the Optional Spares Term, the SI shall prepare, and submit to the MTA for review and approval, a Spare Parts and Modules Service and Repair Plan that describes the parts and modules covered and the various timeframes and methods the SI will use to ensure timely replacement and repairs.	CDRL 35-19
35.14-3	MNR and LIRR will be able to enter and track modules and parts sent for repair or service, on an agency-specific basis, using an SI-provided tracking system. Such tracking system will be used by the SI to log and track, at a minimum, the following information: <ul style="list-style-type: none"> • Applicable agency • Module or Part Number • Serial Number 	CDRL 35-20

Req. #	Requirement	Assigned CDRL(s)
	<ul style="list-style-type: none"> • Date of Error • Error description • Date picked up by the SI <p>This information will be able to be printed on barcoded tags.</p>	
35.14-4	The SI will maintain a database of all spare parts it maintains for MNR and LIRR and also list all spare parts that it has received for repair and the dates of when such repairs were completed. The SI shall provide the MTA, MNR, and LIRR with weekly inventory reports generated by said database, and such inventory reports containing the information designated by the MTA. At a minimum, if replacement parts are used, then they should be designated in the inventory reports to the MTA, MNR, and LIRR.	CDRL 35-20
35.14-5	<p>SI personnel shall pick up failed or faulty modules or parts and return repaired or replacement modules or parts on a weekly basis at two (2) designated locations for MNR and one (1) designated location for LIRR, as provided below.</p> <p>MNR Location 1: Metro-North Facility 525 North Broadway White Plains, NY 10603</p> <p>MNR Location 2: TVM Facility -Lower Level Grand Central Terminal 89 East 42nd Street New York, NY 10017</p> <p>LIRR Location: LIRR Hillside Maintenance Facility Building #2 93-59 183rd Street Hollis NY 11423</p>	CDRL 35-19
35.14-6	In addition to the SI's obligations pursuant to req. # 35.14-5, the SI shall maintain their own spares in a quantity sufficient to immediately replace all failed or faulty modules or parts and upon pickup from either MNR or LIRR.	CDRL 35-19
35.14-7	If the failed or faulty module or part is not repairable, then the SI will replace the module or part with a new (i.e., not refurbished or used) module or part.	CDRL 35-19
35.14-8	For all repairs to modules and parts, the SI will prepare a service report of the corrective action to repair and timeframes along with any other required information as defined by MNR and LIRR, on an agency-specific basis. The full history of all repairs and reports by module or part will be available upon request in both paper and	CDRL 35-20

Req. #	Requirement	Assigned CDRL(s)
	electronic format, and will also be provided by the SI to the MTA, MNR, and LIRR on a weekly basis.	
35.14-9	The SI shall maintain records of all maintenance or replacement activities for MNR and LIRR in each agency's MMS or EAMS, as applicable. These records shall be entered and updated at least daily.	CDRL 35-20

35.14.1 MNR and LIRR NFPS Equipment Spare Parts and Modules Service and Repair Required Submittals

The required submittals specified in this Technical Specifications Section 35.14 (MNR and LIRR NFPS Equipment Spare Parts and Modules Service and Repair) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-19	Spare Parts and Modules Service and Repair Plan	Section 35.14				At least 90 days prior to the commencement of the Optional Spares Term
CDRL 35-20	Parts and Modules Service and Repair Database	Section 35.14				At least 90 days prior to the commencement of the Optional Spares Term

35.15 MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services

The MTA shall have the option, on behalf of MNR or LIRR, to outsource field preventative, remedial, lifecycle maintenance, and Second-Call Maintenance (with such Second-Call Maintenance performed in accordance with the SI's obligations set out herein, including in Agreement Section 15 (NFPS Hardware Warranties)) as further described herein (collectively, the "**Field Preventative, Remedial, and Lifecycle Maintenance Services**") for all of those CVMs and TOMs used by MNR and LIRR. The SI's obligation to provide such Field Preventative, Remedial, and Lifecycle Maintenance Services shall start, if the Option is exercised by the MTA, at the end of the applicable Hardware Warranty Period and continuing for a period of five (5) years with two (2) additional five (5) year options following the initial option term (the "**Optional Maintenance Term**"). All parts and modules for the applicable CVMs and TOMs will be covered by this Option.

Req. #	Requirement	Assigned CDRL(s)
35.15-1	If the MTA exercises this Option, then the SI shall be responsible for all Field Preventative, Remedial, and Lifecycle Maintenance Services for MNR and LIRR CVMs and TOMs as described in these Technical Specifications Section 35.15 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services), starting at the end of the Hardware Warranty Period.	CDRL 35-21
35.15-2	At least ninety (90) days prior to the commencement of the Optional Maintenance Term, the SI shall prepare, and submit to the MTA for review and approval, a Service Work Plan that includes a technical description of the approach to be utilized in the performance of all Field Preventative, Remedial, and Lifecycle Maintenance Services for applicable CVMs and TOMs. This document shall be based on documents provided during the Preliminary Design Review described in Technical Specifications Section 5.13 (Maintainability and Serviceability), and subject to MNR and LIRR review and approval.	CDRL 35-21
35.15-3	At least ninety (90) days prior to the commencement of the Optional Maintenance Term, the SI shall prepare, and submit to the MTA for review and approval, an Administrative Work Plan that describes the various means, methods, and procedures used to ensure the availability of the applicable CVMs and TOMs.	CDRL 35-21
35.15-4	During the Optional Maintenance Term, the SI shall continue to be responsible for the provision of revised manuals, all in compliance with the requirements set out in Technical Specifications Section 32 (Manuals). Revisions to manuals will be recorded on a control list in the front of each manual. The list will be issued with each revision and will show the date of each revision and the page reference. Updated lists and revisions will be maintained in the documents by the SI until the exercised Optional Maintenance Term expires. The MTA will review and comment on each manual submission as required.	CDRL 32-1

35.15.1 Field Remedial Maintenance

Req. #	Requirement	Assigned CDRL(s)
35.15.1-1	During the Optional Maintenance Term, MNR and LIRR will monitor the DMS for CVM and TOM maintenance issues 24 hours a day, seven (7) days a week through automated alerts. First-Call Maintenance activities will be performed by MNR and LIRR staff. If MNR or LIRR staff determines that an issue cannot be resolved through its provision of First-Call Maintenance, then the applicable agency will call an SI-provided phone number. This number will provide access to live support, 24 hours a day, seven (7) days a	CDRL 35-21

Req. #	Requirement	Assigned CDRL(s)
	week. The SI shall be responsible for provision of all Second-Call Maintenance to correct Failures that MNR or LIRR determines cannot be corrected with First-Call Maintenance.	
35.15.1-2	The SI shall respond to each maintenance request or notice with a fully-qualified technician onsite at the applicable location of the CVM or TOM within four (4) hours of such request or notice, unless the underlying issue is fully satisfied remotely within the four (4) hour window. In no event shall the failure of the SI's ability to resolve an underlying issue remotely provide any relief to the SI with respect to its failure to meet the four (4) hour window set out herein.	CDRL 35-22
35.15.1-3	The affected CVM or TOM must be returned to full service within four (4) hours of arrival by the onsite technician. If the affected NFPS Equipment cannot be returned to full service within four (4) hours, then the SI shall provide to MNR or LIRR (as applicable) a plan and timeframe for remediation acceptable by MNR or LIRR, within six (6) hours of arrival by the onsite technician (i.e., no more than two (2) hours following the allotted four (4) hours for returning the applicable CVM or TOM to full service).	CDRL 35-22
35.15.1-4	The SI shall be responsible for all personnel, labor, tools, materials (including replacement parts and modules), consumables, shipping charges, and other costs associated with the repair or replacement of applicable CVMs and TOMs throughout the Optional Maintenance Term.	CDRL 35-21
35.15.1-5	During the Optional Maintenance Term, all repairs, adjustments, or replacements of MNR and LIRR CVMs and TOMs by the SI shall be documented by each agency's MMS or EAMS, as applicable, at the conclusion of each day.	CDRL 35-22
35.15.1-6	Throughout Optional Maintenance Term, the SI will meet the associated device and maintenance performance requirements (e.g., device availability and response time) specified in Technical Specifications Section 5 (General Design Requirements) in addition to those set out in Technical Specifications Section 35.15.4 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Key Performance Indicators).	CDRL 35-21
35.15.1-7	In addition to the other rights set out herein, MNR and LIRR shall have the right, at any time during the Term, to direct the SI to perform additional services that are not contemplated herein, including: <ul style="list-style-type: none"> (1) Relocation of a CVM and/or TOM to a new location as requested by either MNR or LIRR, on an agency-specific basis. This task could include the removing, transporting, 	CDRL 35-21

Req. #	Requirement	Assigned CDRL(s)
	<p>and installing such CVM or TOM.</p> <p>(2) Additional training courses requested by either MNR or LIRR for the NFPS beyond what is included in the Contract Documents.</p> <p>(3) Additional PM tasks beyond the MTA-approved PM tasks and task schedule, provided that (i) such additional tasks are caused by unusual or temporary site conditions, and (ii) the initial MTA-approved tasks and schedule are sufficient to ensure that the performance requirements set out in Technical Specifications Section 35.15.4 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Key Performance Indicators) are met. By way of clarifying example, if the MTA determines during the Term that the SI-proposed and the (previously) MTA-approved PM tasks and schedule are not sufficient to ensure that the performance requirements set out in Technical Specifications Section 35.15.4 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Key Performance Indicators) are met, then the PM tasks and schedule shall be revised to ensure their sufficiency and the SI shall perform the same without any additional compensation or other consideration for such revised PM tasks and schedule, including instances in which the revised PM task schedule requires more frequent maintenance.</p> <p>(4) Repair or replacement of parts/components that were damaged by misuse or mishandling by personnel other than the SI staff.</p> <p>(5) Repairs to CVMs and TOMs damaged by fire, flood, and vandalism; provided, however, that such damage due to fire, flood, or vandalism is not attributable to the actions or inactions of the SI (or its staff).</p> <p>Except as otherwise set out in No. (3) above, the SI's provision of additional services pursuant to this req. # 35.15.1-7 shall be treated as Extra Work pursuant to Agreement Section 32 (Changes in Work; Change Orders).</p>	
35.15.1-8	Notwithstanding anything to the contrary, the SI shall repair and maintain all MNR and LIRR CVMs and TOMs, regardless of whether such NFPS Equipment failure is due to a Hardware component or Software fault, or is user-induced.	CDRL 35-21

35.15.2 Field Preventative and Lifecycle Maintenance

Req. #	Requirement	Assigned CDRL(s)
35.15.2-1	The SI shall develop a schedule of Preventative Maintenance (PM) tasks according to OEM-recommended frequencies and procedures as described in applicable manuals. This schedule will be designed to avoid impacts to Revenue Service, and will be subject to MNR and LIRR review and approval. At a minimum, PM tasks will not be performed during MNR's and LIRR's rush hours. PM task schedules will be adjusted to account for higher volume CVMs and TOMs use where necessary. To the extent that OEM-recommended frequencies and procedures are not provided, then such tasks shall be provided in accordance with Good Industry Practice.	CDRL 35-21
35.15.2-2	All PM and Lifecycle Maintenance tasks performed by the SI on MNR or LIRR property will only be performed when the SI is accompanied by a representative designated by MNR or LIRR, on an agency-specific basis.	CDRL 35-22
35.15.2-3	The SI technician performing the PM tasks will document the Work to be completed, including a numbered multi-part checklist on the work order as appropriate. Completed work orders will be approved and signed by the technician and an MNR or LIRR representative present during the PM task.	CDRL 35-22
35.15.2-4	The work order checklist will contain the part and serial numbers of the major components in the machine being serviced.	CDRL 35-22
35.15.2-5	Work orders will document the time spent as well as parts and supplies used for each PM task.	CDRL 35-22
35.15.2-6	PM tasks that are not completed during a scheduled visit must be identified on the work order along with an explanation for the non-completion of the task. Work not completed must be scheduled and completed at a date determined by MNR or LIRR, respectively.	CDRL 35-22
35.15.2-7	PM tasks performed by the SI on applicable CVMs and TOMs will include maintenance of all electrical, mechanical, and electronic internal machine components and computer Hardware within the applicable CVM or TOM. The SI shall provide and be responsible for all personnel, labor, tools, materials (including replacement parts and modules), consumables, shipping charges, supplies, and other costs necessary to perform the necessary tasks to maintain the applicable CVMs and TOMs throughout the Optional Maintenance Term.	CDRL 35-22
35.15.2-8	At least ninety (90) days prior to the commencement of the Optional Maintenance Term, the SI shall prepare, and submit to the MTA for review and approval, a plan and schedule of LCM tasks, which are defined as the scheduled retrofit or replacement of aging or obsolete CVMs and TOMs components, based on part availability, regulatory compliance, and Good Industry Practice. This	CDRL 35-21

Req. #	Requirement	Assigned CDRL(s)
	schedule will be designed to avoid impacts to Revenue Service, and will be subject to MNR and LIRR review and approval.	
35.15.2-9	MNR and LIRR will approve the list of CVMs and TOMs components specified by the SI to be included in the LCM plan. The SI shall include in the LCM plan all spare parts owned by MNR and LIRR whether on MNR's or LIRR's properties or an SI facility.	CDRL 35-21
35.15.2-10	Any CVM or TOM component or part replacement that is scheduled as part of the LCM will be thoroughly tested at the SI's facility before the LCM task is scheduled and performed on applicable CVM or TOM. Test scripts and results must be provided at least thirty (30) days prior to scheduling any LCM task, and will be subject to MNR- and LIRR-approval, on an agency-specific basis. MNR and LIRR may elect to observe any testing that is performed on a replacement component or part at the SI's facility, as well as conduct testing at each of the MNR's and LIRR's Test Facility, prior to approval.	CDRL 35-22
35.15.2-11	All LCM tasks performed will be tracked on a numbered multi-part work order which clearly identifies the tasks to be performed for the LCM. This work order will be completed and approved/signed by the technician and MNR or LIRR representative present during the LCM.	CDRL 35-22
35.15.2-12	If MNR or LIRR determines, in its reasonable judgment, that a workstation PC (e.g., in an RF Workstation or Smart Card Certification Workstation) referenced herein becomes obsolete during the Optional Maintenance Term, then the workstation will be substituted with PCs provided by the SI and approved by MTA/IT. The PCs will be updated by the SI with appropriate Software, Firmware, and/or Hardware as required to provision the PC to good working order, restoring the PC to its full functionality within the context of the NFPS.	CDRL 35-21
35.15.2-13	If any NFPS Hardware component used or interfaced with a workstation PC (e.g., in an RF Workstation or Smart Card Certification Workstation) becomes obsolete or otherwise no longer available during the Optional Maintenance Term, then the SI will provide Hardware and associated Software to replace the NFPS Hardware component and restore the PC to full functionality with the context of the NFPS at no cost to the MTA Group.	CDRL 35-21
35.15.2-14	The SI shall maintain records of all PM and LCM schedules and tasks for MNR and LIRR in each agency's MMS or EAMS, as applicable. These records shall be entered and updated at least daily.	CDRL 35-22

35.15.3 Maintenance Support Required Service Levels

The SI shall meet the service levels required in this Technical Specifications Section 35.15.3 (Maintenance Support Required Service Levels) with respect to Field Preventative, Remedial, and Lifecycle Maintenance Services, and the SI shall be subject to the following at-risk damages throughout the Optional Maintenance Term. Addressing the issue and restoring an affected unit to full service shall include the furnishing and installing of components, parts or Software changes required to replace malfunctioning elements. Service level measurement methodology, including data sources, and reporting will be further defined during design review and documented in CDRL 35-23.

Req. #	Requirement	Assigned CDRL(s)												
35.15.3-1	Point assessment for non-compliance with maintenance performance requirements specified herein shall result in point-based percentage Service Credit deductions against Field Preventative, Remedial, and Lifecycle Maintenance Services Fees (called the Credit Base).	CDRL 35-23												
35.15.3-2	<p>Service Credits shall be calculated on the basis of “points” as set out below, and monthly Service Credit point assessments shall correspond to the following deductions from the Credit Base:</p> <table><tr><td>1 – 50 points</td><td>no deduction</td></tr><tr><td>51 – 100 points</td><td>2.50%</td></tr><tr><td>101 – 150 points</td><td>3.75%</td></tr><tr><td>151 – 200 points</td><td>5.00%</td></tr><tr><td>201 – 250 points</td><td>6.25%</td></tr><tr><td>Each additional 50 points</td><td>Additional 1.25%</td></tr></table>	1 – 50 points	no deduction	51 – 100 points	2.50%	101 – 150 points	3.75%	151 – 200 points	5.00%	201 – 250 points	6.25%	Each additional 50 points	Additional 1.25%	CDRL 35-23
1 – 50 points	no deduction													
51 – 100 points	2.50%													
101 – 150 points	3.75%													
151 – 200 points	5.00%													
201 – 250 points	6.25%													
Each additional 50 points	Additional 1.25%													
35.15.3-3	<p>Subject to Agreement Section 26.5 (Service Credits), if there is a Credit Overage, the MTA shall have the right to roll-over the Credit Overage to the following month, and to apply it to the Credit Base for that month.</p> <p>Every twelve (12) months there shall be a true-up of Service Credits. If a Credit Overage exists as of the end of such 12 month period, the MTA shall be entitled to apply the Credit Overage against any other available Credit Bases, the Ongoing Services Letter of Credit and any other amounts identified in the Contract Documents.</p>	CDRL 35-23												
35.15.3-4	A failure to meet the same service level for two or more months during the preceding 12 months shall be considered a recurring Failure, and the number of Service Credits for that service level shall be multiplied by the number of months in which the SI has failed to meet it (e.g., if a service level is not met for 2 months in a 12 month period, then the Service Credits associated shall be doubled in the second month; if a service level is not met for 3 months in a 12 month period, the Service Credits shall be tripled in the third month).	CDRL 35-23												
35.15.3-5	The SI shall calculate performance against these service levels and provide reports monthly to the MTA, including all backup details.	CDRL 35-23												

Req. #	Requirement	Assigned CDRL(s)
35.15.3-6	The SI shall incorporate and apply Service Credits into monthly invoicing with respect to the applicable Credit Base, as appropriate. The SI shall itemize such Service Credits, and identify their application against the specified Credit Base.	CDRL 35-23

35.15.4 MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Key Performance Indicators

The SI shall meet all requirements for performance contained herein, including those Key Performance Indicators (KPIs) set out in this Technical Specifications Section 35.15.4 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Key Performance Indicators) throughout the entire Optional Maintenance Term. The Credit Base for these KPIs shall be: Field Preventative, Remedial, and Lifecycle Maintenance Services Fees.

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit
Preventative Maintenance	PM Schedule Compliance	The SI shall complete all approved Preventative Maintenance tasks on schedule, including complete documentation of all tasks.	100% of PM tasks completed within the scheduled time	Per month	50 points for each late task
Lifecycle Maintenance	LCM Schedule Compliance	The SI shall complete all approved Lifecycle Maintenance tasks on schedule, including complete documentation of all tasks.	100% of LCM tasks completed within the scheduled time	Per week	50 points for each late task
Remedial Maintenance	Support Availability	The SI shall provide telephone support twenty-four (24) hours per day, seven (7) days a week.	99.0% of all calls answered	Per month	50 points for each failure to meet the requirement
Remedial Maintenance	Remote Support Response Time	Remote support will be provided for all CVMs and TOMs within the first thirty (30) minutes from receipt of the request.	99.0% of issues supported remotely within 30 minutes; 100% within 1 hour.	Per month	100 points for each failure to meet the requirement

	KPI	Definition and Measurement	Requirement	Measurement Period	Service Credit	
Aggregate Requirement	Defect Resolution Time	All CVMs and TOMs shall be restored to full service within the designated timeframes identified in the associated Service Credit.		Per incident	Hours	Points
					8-12	100
					12-18	150
					18-24	200
					24-48	250
					> 48	400
Remedial Maintenance	Onsite Support Response Time	Calculation will be: Ratio of the number of service calls completed within the stipulated 4 hour timeframe to the total number of service requests requiring a response. NOTE: the required 4 hour timeframe includes any time spent providing remote support.	99%	Per month	50 points for each failure to meet the requirement	

35.15.5 MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services Required Submittals

The required submittals specified in this Technical Specifications Section 35.15 (MNR and LIRR Field Preventative, Remedial, and Lifecycle Maintenance Services) are summarized below. They are described in detail in the referenced Technical Specifications Section.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 35-21	Service Work Plan	Sections 35.15, 35.15.1, 35.15.2				At least 90 days prior to the commencement of the Optional Maintenance Term
CDRL 35-22	Administrative Work Plan	Sections 35.15, 35.15.1, 35.15.2				At least 90 days prior to the commencement of the Optional Maintenance Term

Submittal No.	Description	Reference	Due Date			
CDRL 35-23	Service Level Measurements and Methodology	Section 35.15.3				At least 90 days prior to the commencement of the Optional Maintenance Term

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