APPENDIX A

Portland/Vancouver eFare
System Integrator
Technical Specifications

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APPENDIX A

eFare System Integrator Technical Specifications

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Acronyms & Abbreviations

The following acronyms and abbreviations may appear in this document:

ACH – Automated Clearing House
ADA – Americans with Disabilities Act
ADAAG – ADA Accessibility Guidelines
AMPS – Account Management and Processing System
ANSI – American National Standards Institute
API – Application Programming Interface
AR – Accounts Receivable
CAD – Computer-aided Design
CAD/AVL – Computer-aided Dispatch/Automatic Vehicle Location system
CDMA – Code Division Multiple Access
COTS – Commercial-off-the-Shelf equipment
CRM – Customer Relationship Management System
CSC – Card Security Code
ECR – Engineering Change Request
EDP – Electronic Data Processing
EFT – Electric Funds Transfer
EMI – Electromagnetic Interference
EMV – Europay, MasterCard, Visa
FACI – First Article Configuration Inspection
FAT – First Article Testing
FCSS – Financial Clearing and Settlement System
FDR – Final Design Review
FMI – Field Modification Instructions
FRT – Failure Review Team
GSM – Global System for Mobile communications
HHV – Handheld Validator
IIN – Issuer Identification Number
iOS – Operating System for Apple products
IVR – Interactive Voice Response system
IP – Internet Protocol
ISO – International Standards Organization
LCD – Liquid Crystal Display
LLRC – Lowest Level Replaceable Component
LLRU – Lowest Level Replaceable Unit
MAX – Metropolitan Area Express
MDT – Mobile Data Terminal
MIL-STD – U.S. Military Standard
MMIS – Maintenance Management Information System
NEC – National Electric Code
NFC – Near Field Communication
NTP – Notice to Proceed
OEM – Original Equipment Manufacturer
OHSU – Oregon Health and Science University
PAN – Primary Account Number
PCI-DSS – Payment Card Industry – Data Security Standard
PDR – Preliminary Design Review
PII – Personally Identifiable Information
POS – Point of Sale system
RFI – Radio Frequency Interference
RST – Retail Sales Terminals
SAE – Society of Automotive Engineers
SAM – Secure Access Modules
SAV – Stand-alone Validator
SLA – Service Level Agreement
SQL – Structured Query Language
SSL – Secure Socket Layer
TDEA – Triple Data Encryption Algorithm
TVM – Ticket Vending Machine
UL – Underwriter Laboratories
USB – Universal Serial Bus
VPN – Virtual Private Network
WES – Westside Express Service

Glossary

Account-based system	System where account details are stored at a central server, as opposed to a card-based system, where account information resides on the fare media.
Americans with Disabilities Act (ADA)	Federal law that prohibits discrimination or reduced service based on disability. In a transit application, disabled patrons must have full and unrestricted access to all station features and transportation options, as well as be offered discounted fares under certain guidelines.
Application Programming Interface (API)	A set of protocols that define interaction between software packages. APIs can be proprietary or open source, but are required for data exchange between software systems.
Autoload	Process where value is loaded automatically to a transit account when the account balance reaches a certain threshold, or at a specified time interval.
Bankcard authorization	Step during a credit or debit payment transaction when the card and account is verified by the card issuing bank and payment is committed. Usually is processed by a credit card processor, and often requires real-time communication link.
Base fare	The cash fare paid at a farebox or TVM for a single adult boarding.
Business rules	The rules and guidelines that govern an agreement between parties. In an electronic fare system, the business rules define how the system will enforce the agency fare policies.
Canned reports	Pre-built reports that provide fundamental data in a database-driven operation.
Closed-loop system	A system where data processing is constrained within system.
Commercial-Off-The-Shelf (COTS) equipment	Term for products that are available for purchase in the open marketplace by the general public. COTS goods are generally widely available at lower cost than privately developed products.
Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) system	System that provides vehicle dispatch, scheduling, location, and maintenance services within a centralized dispatch center. CAD/AVL systems typically require operator login, which can be integrated with fare collection equipment.
Contactless bank card	Bank-issued credit or debit card that supports contactless payment through an ISO 14443 communication interface.
Contactless reader	Hardware component that supports a contactless communication protocol such as ISO 14443, and is embedded into contactless fare collection equipment.
C-TRAN	Clark County Public Transportation Benefit Area, a public transit agency serving Clark County, Washington, and surrounding areas including Portland, Oregon.

Customer Relationship Management System (CRM)	Enterprise software system used to manage customer relationships including customer support information, sales data, and IT support. Usually managed through customized software portal developed to the requirements of managing organization.
Data warehouse	Central database used as primary system for reporting and data analysis.
Europay, MasterCard, Visa (EMV)	A global standard for inter-operation of integrated circuit cards ("chip cards") and point-of-sale (POS) terminals and automated teller machines (ATMs), for authenticating credit and debit card transactions
Handheld Validator (HHV)	Handheld device used to validate fare payment by inspectors. Has the capability to read fare media and query transit accounts, and often the capability to transmit inspection data for reporting purposes.
Institutional programs	Special programs administered by transit agencies for institutions outside of the transit-riding public. Can include business, educational, social service, and government entities that have special public transportation needs.
ISO 14443	International standard that defines contactless proximity cards, including physical layer definition and transmission protocols. Used for many identification and transportation purposes.
Issuer Identification Number (IIN)	The first six digits of a credit or debit card number Primary Account Number that identify the institution (e.g., bank) that issued the card to the cardholder.
Interactive Voice Response (IVR) system	An automated telephone system that allows customers to receive information and initiate actions through the use of voice commands or touchtone input.
Internet Protocol (IP)	The communications protocol of the public Internet, many wide area networks (WANs), and most local area networks (LANs). The Internet Protocol (IP) is part of the TCP/IP protocol suite, and the terms "IP network" and "TCP/IP network" are synonymous.
Linked trip	An origin to destination trip on a transit system, inclusive of all transfers.
Metropolitan Area Express (MAX)	Light rail service operated by TriMet, serving the Portland metropolitan area.
MIFARE	Family of contactless chips manufactured by NXP corporation for use in contactless smart cards. Several variants of MIFARE chips are widely used by U.S. transit agencies.

Near Field Communication (NFC)	Wireless communication standard that defines communications between mobile devices such as smartphones, and includes the use of secure memory to store sensitive data on devices. Based on existing communications standards, including ISO 14443 and ISO 18092.
Portland Aerial Tram	Portland Aerial Tram connecting the Oregon Health and Science University (OHSU) to the South Waterfront district in Portland.
Primary Account Number (PAN)	The account number used to access a bank-administered credit or debit account. This number is embossed on the front of the customer's bank card, and is usually the number transmitted when a contactless bank card is used for payment.
Open architecture	A system architecture where data exchange and format is based on published standards allowing for interoperability between equipment from different vendors. Contrary to closed architecture, where the interfaces are proprietary.
Open payments	Payment model where payments are made using industry standard bank cards.
Open source	Software development model that uses publicly available source code in effort to encourage collaboration and interoperability. Use, modification and distribution are usually governed by open source licenses.
Open-loop system	A system that includes interfaces to external systems for data processing based on open standards. In transit, this usually refers to a system that allows the payment of fares using bank-issued credit and debit cards through an interface to an external payment processor.
Original Equipment Manufacturer (OEM)	Manufacturer that produces products sold by another company, usually under that company's brand or model. It is common for the manufacture to provide warranty support for the product.
Paratransit	Transportation service that services disabled patrons or those with special access needs.
Participant	Member of a business partnership or entity governed by an agreement that serves a common goal and set of business rules.
Payment Card Industry-Data Security Standard (PCI-DSS)	Standard that defines security requirements for vendors accepting bank cards for payment.
Payment credential	An instrument that provides proof of qualification to make a payment, usually associated with a credit card company or closed-loop card issuer.
Personally Identifiable Information (PII)	Information that can be used to uniquely identify an individual. Usually subject to stringent security and data transmission rules and regulations.

Point of Sale (POS) system	Manned terminal used for the sale fare media and loading of transit value. Most commonly used at in-person customer service centers.
Portland Streetcar	Streetcar system that serves downtown Portland, Oregon, and is owned and operated by the City of Portland in partnership with TriMet.
Proof-of-payment	Fare collection concept where access to transit service is not restricted, and patrons are required to show valid fare media to authorities when inspected. Failure to present valid fare media usually results in a fine.
Stand-alone Validator (SAV)	Physical device used to accept fare payment. Usually installed at the entrance to the paid area of a transit station.
Ticket Vending Machine (TVM)	Self-service fare media vending device where patrons can purchase, reload, or inspect fare media. Can have many physical forms, but usually designed to operate in outdoor environment.
Tokenization	Process to secure sensitive data elements during processing and transmission by replacing the data with a proxy, or token, and storing the original data, which can be accessed using the proxy, in a secure location.
Transit account	In an account-based electronic fare system, the back office account that stores the value loaded by the customer and used to pay fares.
TriMet	Tri-County Metropolitan Transportation District of Oregon, a public transit agency serving the Portland metropolitan area in three counties. Operates bus, light rail, commuter rail, and paratransit services.
Virtual Private Network (VPN)	The extension of a private network through a public domain using encryption and other security measures. Allows access to private network from remote location or device.
Westside Express Service (WES)	Commuter rail line between Beaverton and Wilsonville, Oregon operated and managed by TriMet.

1 Project Overview & Contract Management

1.1 Project Overview

The scope of work in this technical specification consists of designing, manufacturing, testing and deploying a new electronic fare payment system (eFare) for transit agencies serving the Portland, OR, and Vancouver, WA, region. Following system deployment, the selected system integrator contractor ("Contractor") will also maintain certain eFare operation and maintenance responsibilities under separate maintenance agreements.

The eFare project will revolutionize the way transit customers in the Portland/Vancouver region pay their fares. Currently all transit agencies in the region use non-electronic systems that accept cash and magnetic-stripe credit and debit cards for the purchase of paper fare media. The new eFare system will be designed to incorporate leading edge electronic payment technologies to make travel on transit more convenient for customers, and provide the region's transit agencies with a more efficient and secure fare collection system.

Customers will pay for transit trips by tapping or scanning an accepted form of transit fare media at an eFare contactless validator. Depending on the media used, the correct fare will either be deducted from the customer's transit account (maintained within the eFare system), or charged to the customer's credit or debit card. Customers will have the option to use an eFare-specific contactless smartcard or limited-use ticket, a bank-issued contactless credit or debit card, or an appropriately configured mobile device. Customers will also continue to have the option to pay their fare using cash upon boarding a bus or streetcar.

Customers will have multiple options for loading funds into their eFare transit account, including a subscription autoload feature, the eFare customer website, agency operated transit stores, and a robust network of retail locations.

1.1.1 Background

TriMet began planning for the new electronic transit fare payment system in 2011. In the years leading up to today, TriMet met with a number of peer agencies and industry suppliers to gain an understanding of the state of the industry and garner best practices for system implementation. In 2012, TriMet made a significant commitment toward simplifying their fare structure when they eliminated all fare zones in favor of a flat fare structure that is consistent with the fare structure of the other transit agencies in the region.

Recently, TriMet conducted a peer agency and industry request for information (RFI) to obtain feedback on a set of preliminary eFare project planning documents. This was undertaken in order to further solidify the overall approach and design of the eFare system. Feedback received during the RFI process was considered during the development of these specifications.

1.1.2 Project Goals & Objectives

The goal of the eFare project is to increase agency ridership and revenue, while improving customer convenience, reducing fare leakage, and improving fiscal controls. The eFare project core team has

adopted the following design guidelines to meet this goal in development of the eFare specification, and aid in decision-making:

- Easy and convenient for customers to understand and use
- Easy and convenient for operators and fare inspectors to understand and use
- Reduce the overall cost of fare collection
- Reduce cash handling and maintenance associated with agency-owned devices (i.e., vending machines and fareboxes)
- Operate on all transit modes and systems
- Accommodate seamless transfers between vehicles and agencies serving the Portland/Vancouver region
- Adopt next generation payment technology
- Maintain and improve existing institutional and special fare programs
- Drive adoption of electronic media by providing customers with incentives to transition
- Accommodate the unbanked and under-banked with a broad retail network to acquire and reload electronic fare media
- Collect data for improved transit operations and customer service, while preserving customer privacy

1.1.3 Participating Agencies

The eFare system is being designed as a regional transit fare payment system that will allow customers to use the same fare media for travel on multiple transit service providers in the Portland, OR, and Vancouver, WA, region. Combined, TriMet, C-TRAN, and the City of Portland customers make approximately 114M trips annually. Descriptions of the participating agencies ("the Agencies") are provided below. TriMet is the host agency responsible for procuring the regional eFare system. C-TRAN and the City of Portland participate through the exercise of contract options to purchase the validators, inspection devices, and other front-end equipment necessary for the deployment of eFare onto their transit systems. These options are subject to the conditions described in Section 4B.15 of the RFP.

TriMet

TriMet provides bus, light rail, and commuter rail transit services in a 570-square-mile service area in and around Portland, Oregon. TriMet bus service consists of 609 vehicles operating on more than 75 separate lines, which provided more than 59 million trips in FY2012 throughout Multnomah, Washington and Clackamas counties. The 52-mile Metropolitan Area Express (MAX) light rail system also serves the three counties, including the Portland International Airport, making more than 42 million trips annually. The MAX line has 87 stations, with 11 more to be opened in September 2015. The Westside Express Service (WES) is a 14.7-mile suburban commuter line with five stations serving the heavily traveled I-5/Hwy. 217 corridor, which connects with MAX and buses. WES provided over 418,000 trips in FY2012. TriMet also operates TriMet LIFT, the shared-ride paratransit service for the Portland area.

TriMet uses a flat fare, proof-of-payment fare structure for all its service modes. In addition to cash, TriMet customers may pay for their fare using 2-hour, 1-day, 7-day, 14-day, 30-day, and monthly passes. Bus customers pay their cash fare upon boarding or show one of the accepted passes as proof-of-payment. Day passes may also be purchased onboard buses. MAX and WES customers pay their fares

prior to boarding using Ticket Vending Machines (TVMs) located at each station/platform. The TriMet TVMs issue nearly all of the available fare products, and accept cash and bank cards as forms of payment. TriMet fare products are also available for purchase at various transit and retail outlets. Most TriMet fare products are honored for payment on C-TRAN and Portland Streetcar.

C-TRAN

C-TRAN provides local bus service in Clark County, Washington, and express bus service across the Columbia River to various points in Portland, Oregon, with a fleet of 130 vehicles. C-TRAN buses complete nearly 7 million customer trips annually. C-TRAN also operates C-VAN, a dial-a-ride paratransit service. C-TRAN uses a flat fare, proof-of-payment fare structure. Customers have the option to pay their fares using cash, ticket book, day pass, monthly pass, or annual pass. Cash paying customers purchasing a single-ride or day pass complete their fare transaction upon boarding the bus. Ticket books, day passes and monthly passes are available for purchase at various transit and retail outlets. C-TRAN "All-Zone" and Express fare products are also honored for payment on TriMet.

Portland Streetcar

The Portland Streetcar is owned and operated by the City of Portland in partnership with TriMet. The City's 17 streetcars run on a 14.7-mile system made up of two lines that connect the City's key districts and places of business and entertainment. Portland Streetcar carries over 4 million riders annually. The Streetcar operates under a flat fare, proof-of-payment fare structure. Streetcar customers who wish to pay their fares with cash utilize TVMs located onboard each vehicle. Customers who wish to pay their fares using credit or debit cards utilize credit/debit-only TVMs located at each Streetcar stop. Alternatively, Streetcar customers may use any valid TriMet ticket or pass as fare payment on Streetcar. Streetcar ticket books and annual passes are available for purchase at various retail outlets.

Portland Aerial Tram

The Portland Aerial Tram provides a critical link between Marquam Hill and South Waterfront for 2 million customers annually. It is owned by the City of Portland, which shares operating responsibilities with Oregon Health and Science University (OHSU). The Tram operates under a proof-of-payment fare policy. Customers may purchase their fares from ticket machines that accept cash and bank cards as forms of payment. In addition to Tram-specific tickets, TriMet monthly and annual passes, the C-TRAN monthly Portland Express Pass, and Streetcar annual passes are honored forms of payment.

1.1.4 Scope

The Contractor's scope of work for this project is to design, build, test, and implement a regional fare payment system on TriMet and other participating agency's facilities servicing the Portland, OR/Vancouver, WA, region. Key components of the scope include:

- Provide an account-based, open-architecture contactless payment system that supports closed-loop, open payment, and NFC-based mobile payment forms of fare media
- Implement a centralized back office that performs transaction processing, account management, customer service, device monitoring, maintenance management, data management and reporting, and financial clearing and settlement

- Deploy customer and transit employee facing equipment including payment validators, mobile payment inspection units, and retail point of sale devices
- Integrate with systems and devices provided by others including a TVM network, CAD/AVL system, maintenance management system, retail merchant network, transit store point of sale system, and paratransit reservation system
- Provide websites for customer account management and institutional program management
- Provide a mobile app for mobile ticketing and eFare account management
- Train agency personnel to properly operate and maintain the furnished eFare system
- Provide full-time system operations and maintenance support upon commencement of back office training
- Provide software maintenance services following the warranty expiration

1.1.5 General Requirements

Contractual and other requirements appear in this Request for Proposal (RFP) package. The Contractor is responsible for designing, implementing and integrating the eFare payment system with existing equipment and systems to be provided by others. The specified requirements will be achieved without damage to or degradation of service of existing equipment. The Contractor is responsible for the selection, application, and integration of software, hardware and materials as necessary to conform to contract requirements. Where brand names are mentioned, these will be understood to include "or approved equal," and will not be understood to pre-approve all or part of a design.

The design and production of the fare payment system equipment will be controlled by the Contractor to ensure that a high quality, reliable and accurate system suitable for a minimum of 15 years of service is produced and that the requirements of this document are met.

The system provided under this Contract shall be new. Rebuilt or refurbished equipment is prohibited, New equipment damaged during execution of this Contract may be restored to like-new condition only where approved by TriMet on a case-by-case basis, and such restorations will be performed by the Original Equipment Manufacturer (OEM) or someone designated by the OEM.

TriMet may, at its option, monitor any or all Contractor and sub-contractor activities, review any or all designs, and inspect or test any or all equipment. The Contractor shall not hinder or limit such activities.

1.2 Document Organization

These technical specifications are divided into multiple sections, each addressing a separate aspect of the system and its delivery. Explicit references may appear within sections linking requirements appearing in other sections. Such references will in no way be assumed to limit the applicability of any requirements in this document, whether referenced or not.

1.3 Codes, Regulations & Standards

All equipment will comply with applicable local, state, and federal rules and regulations, codes, and standards cited in this document. Where conflicts exist between standards, the more restrictive, as determined by TriMet, will apply. Application of these codes and standards will be as modified by this Contract.

Deviations from, and substitutions of, specified standards will be made only if previously approved by TriMet. The Contractor shall submit a copy of the alternate standard, a detailed comparison of the alternative criteria, the rationale for the alternative, and whether the proposed code or standard meets or exceeds the existing standard.

Throughout this specification, references to applicable standards are made and frequently the wording states "…will be compliant with the latest or current version of…." This phrase will be understood to mean the version of the referenced standard or code at the time of Contract award.

1.4 Project Management & Schedule

1.4.1 Project Manager & Lead Engineer

The Contractor's Project Manager (PM) shall possess full authority to render project technical and commercial decisions on behalf of the Contractor. The Contractor's Lead Engineer must possess a command of the systems and technologies that will be utilized within the eFare system 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)
1.4.1-1	Contractor shall designate a responsible and experienced individual to serve as the project manager for the entire term of the contract.	Contractor's Proposal
1.4.1-2	The project manager will be fluent in English and possess demonstrable, recent, and extensive (at least 3 years) experience managing electronic payment system projects of similar size that include multiple points of integration with third-party systems and devices.	Contractor's Proposal
1.4.1-3	The lead engineer will be fluent in English and possess demonstrable, recent, and extensive (at least 3 years) experience serving in a lead technical role on electronic payment system projects of similar size and design as the eFare project and that include multiple points of integration with third-party systems and devices.	Contractor's Proposal
1.4.1-4	The lead engineer shall be located in the Portland metropolitan area, preferably near TriMet offices, beginning no later than 30 days following NTP and continuing through final system acceptance.	Contractor's Proposal
1.4.1-5	Removal or replacement of the PM or lead engineer by the Contractor requires prior approval by TriMet. The Contractor's request to remove or replace the PM must be made in writing and include the reason for removal or replacement.	NA

1.4.2 Management Plan

The Contractor will submit a management plan that describes project organization, controls, planning, and schedules.

Req #	Requirement	Assigned CDRL(s)
1.4.2-1	A management plan will be submitted no more than 30 calendar days following notice to proceed (NTP) and will be subject to TriMet's review and approval.	CDRL 1-1
1.4.2-2	The management plan will include but not necessarily be limited to the following: • 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 TriMet approval • Configuration management plan for all submittals and subsequent revisions • Subcontractor management and communications plan outlining the Contractor's methods and procedures for organizing and communicating with subcontractors. This will include an outline of activities to be performed by D/M/W/ESB firms, an identification of the portion of the Contract revenues to be allocated to such firms for these activities, and the means of encouraging, tracking and controlling D/M/W/ESB participation throughout the duration of the Contract • Procedures and processes to be followed for the replacement of any subcontractors throughout the duration of the Contract	CDRL 1-1

1.4.3 Risk Management Plan

The risk management plan will document the process that the Contractor 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)
1.4.3-1	Contractor shall submit a risk management plan to TriMet for approval within 30 calendar days of NTP.	CDRL 1-2
1.4.3-2	Risk management plan will address risk planning, risk identification, risk analysis, and risk control.	CDRL 1-2
1.4.3-3	The risk management plan will identify the process that the Contractor shall follow for mitigating risk from the project, and how identified risk items will be evaluated for severity and reported to TriMet.	CDRL 1-2
1.4.3-4	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 1-2

1.4.4 Schedules & Project Control

Req #	Requirement	Assigned CDRL(s)
1.4.4-1	Contractor shall develop and submit within 30 days of NTP a master program schedule that identifies all program activities and milestones.	CDRL 1-3
1.4.4-2	The master program schedule will be developed using MS Project or equivalent scheduling software approved by TriMet.	CDRL 1-3
1.4.4-3	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 Contractor's delivery of the system.	CDRL 1-3
1.4.4-4	Contractor's submitted master program schedule approved by TriMet will become the baseline schedule, against which subsequent schedule updates will show performance.	CDRL 1-3
1.4.4-5	The Contractor shall update the master program schedule on a monthly or more frequent basis and submit the updated schedules for TriMet review and approval.	CDRL 1-3

1.5 Meetings

The Contractor shall participate in regular project coordination and status meetings throughout the life of the project. Meeting topics may range from general project status/updates to discussion and decision making on specific topics.

Req #	Requirement	Assigned CDRL(s)
1.5-1	Contractor is responsible for taking minutes during all meetings, and submitting those minutes to TriMet within 3 business days after meeting.	CDRL 1-13

1.5.1 Project Kickoff Meeting

The purpose of the 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)
1.5.1-1	Approximately three weeks following NTP, Contractor shall participate in the project kickoff meeting to be held at TriMet's offices.	NA

1.5.1-2	Contractor shall work with TriMet to assemble an agenda for the meeting that at a minimum covers the following topics: • Introductions of key client and Contractor staff/points of contact and review of responsibilities • Review of Contractor's scope of work • Presentation of project baseline schedule	NA

1.5.2 Progress Reviews & Reporting

Req #	Requirement	Assigned CDRL(s)
1.5.2-1	Progress reviews will be held on a monthly basis at either the Contractor's or TriMet's facilities, or via live conference call as appropriate.	CDRL 1-1
1.5.2-2	The Contractor shall prepare and submit to TriMet a monthly progress report that addresses the following topics and serves as the agenda for the progress review meeting: • Review and status of actions from previous meeting(s) • Updated master project schedule showing progress against the baseline schedule • 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 • Updated CDRL list indicating current status of each CDRL	CDRL 1-1 CDRL 1-2 CDRL 1-3
1.5.2-3	The Contractor shall document the minutes of each monthly meeting and submit them for TriMet review within three (3) business days following each meeting.	CDRL 1-13

1.5.3 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. TriMet will work with the Contractor to prepare weekly meeting agendas and will be responsible for preparing meeting minutes. Other ad hoc meetings will also be necessary to facilitate project delivery.

Req #	Requirement	Assigned CDRL(s)
1.5.3-1	Contractor's PM and other designated staff shall participate in weekly project coordination meetings.	NA
1.5.3-2	The Contractor's PM and other designated staff shall participate as required in other ad hoc meetings to facilitate project coordination and decision making.	NA

1.6 Subcontractors & Suppliers

The Contractor shall ensure that any suppliers or subcontractors included in this project are informed of all specified requirements of this Contract and that appropriate engineering and project management tools are utilized to coordinate and provide communication between the Contractor and its subcontractors and suppliers.

If the Contractor is not the OEM of any part of the equipment, all applications of this equipment by the Contractor shall be with the full concurrence of the suppliers that the application is suitable and within the recommended limits of operation for the equipment.

The Contractor shall have all 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, TriMet will have access to all subcontractors and suppliers.

1.7 Waivers

The Contractor is required to provide a system that meets all requirements of the Contract; however, a request to waive a specific Contract requirement may be submitted to TriMet for consideration. A waiver request will be limited to one topic and must include detailed technical and commercial analysis and justification. It is TriMet's sole privilege to grant the waiver or not. An approved waiver request changes the requirements of the contract without going through the change order process.

1.8 Manuals, Documentation & Data

1.8.1 Manuals

The Contractor shall provide documentation for all equipment, devices and software of the eFare system in electronic and hard copy formats. Block diagrams, illustrated parts breakdowns, and schematic drawings will be used to facilitate descriptions of assemblies and the relationships of components, subsystems, and systems. The format of such documentation will be determined as agreed upon by the Contractor and TriMet staff.

Req #	Requirement	Assigned CDRL(s)
1.8.1-1	A schedule for development of the required manuals with time allotted for TriMet review will be submitted 120 days after NTP.	CDRL 1-4
1.8.1-2	All manuals will be submitted in electronic format.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8

1.8.1-3	Electronic files will be able to be deployed individually, or the contents can be hosted on a server to allow multiple users to access the same data. Information will not be encrypted, and will be developed and delivered using standard authoring tools such as Microsoft Word, Excel, Visio and PowerPoint, or Adobe Acrobat. Specifically, documentation provided in electronic file format will be as follows: • Manuals and illustrated parts catalogues will be provided in Portable Document File (PDF) format and in a modifiable electronic format (Microsoft Word) • Electrical Computer-Aided Design (CAD) files will be provided in PDF format • Schematic drawing will be provided in PDF format	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8
1.8.1-4	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 TriMet to operate, maintain, diagnose and repair the eFare system.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8
1.8.1-5	All documentation 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 TriMet.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8
1.8.1-6	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 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8
1.8.1-7	Training documentation will be separate from the operation and maintenance manuals, but may reference those manuals.	CDRL 10-4
1.8.1-8	The Contractor shall furnish the following approved manuals for each eFare device and system, as applicable: • Operation manuals • Repair, maintenance, and installation manuals • Illustrated parts catalogs • Special tools manuals • OEM manuals for all subassemblies	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8
1.8.1-9	One complete set of documents will be provided to TriMet prior to the start of the acceptance testing.	CDRL 1-5 CDRL 1-6 CDRL 1-7
1.8.-10	Information gathered during installation and acceptance testing and during the warranty period will be incorporated into documents for final submittal.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8 CDRL 1-9

1.8.1-11	Revisions to documents will be recorded on a control list in the front of each document. 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 Contractor until the warranty period expires.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8 CDRL 1-9
1.8.1-12	The content of the various manuals will meet the requirements specified in this document.	CDRL 1-5 CDRL 1-6 CDRL 1-7 CDRL 1-8

1.8.1.1 Operation Manuals

The operation manual will contain all information needed to obtain a top level understanding of how to operate the fare collection equipment or system. This manual is intended for use by operations, revenue service, maintenance, and supervisory personnel.

Req #	Requirement	Assigned CDRL(s)
1.8.1.1-1	The operation manual will include the following content at a minimum: • 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 1-5

1.8.1.2 Repair, Maintenance & Installation Manuals

Req #	Requirement	Assigned CDRL(s)
1.8.1.2-1	The repair, maintenance, and installation manual will provide all information needed for troubleshooting service failures, performing equipment replacements and installations and for performing periodic maintenance for each component, including general servicing and inspecting.	CDRL 1-6
1.8.1.2-2	The repair, maintenance, and installation manual 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 1-6

1.8.1.2-3	The repair, maintenance, and installation manual will provide all information needed for trouble diagnosis to the lowest level replaceable unit (LLRU). An LLRU is further defined as any complete assembly as sold by the Contractor or OEM suppliers as spare parts.	CDRL 1-6

1.8.1.3 Electrical, Illustrated Parts Catalog

Req #	Requirement	Assigned CDRL(s)
1.8.1.3-1	The Contractor shall submit an illustrated parts catalog including all installation hardware, wiring assemblies, and LLRU's. The illustrated parts catalog may be a subset of the maintenance materials.	CDRL 1-8
1.8.1.3-2	Each listed part shall be referenced by the Contractor by assigned part number and, where applicable, OEM part number.	CDRL 1-8

After warranty, it is TriMet's intent to have the capability of ordering and purchasing Contractor-delivered equipment down to the component level, (e.g., LCD screens), and not just the ability to swap out entire modules or devices.

1.8.1.4 eFare Back Office System Administrator Operation & Maintenance Manuals

The Contractor shall provide software user manuals containing detailed operating instructions and procedures to be used by TriMet system administrators and IT personnel responsible for operating and maintaining the eFare back office and all of its components.

Req #	Requirement	Assigned CDRL(s)
1.8.1.4-1	The Contractor-provided documents will be presented in terms that are meaningful to users. They will include functional explanations and descriptions of each application program 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 1-7
1.8.1.4-2	Sensitive information that is not to be distributed to all departments will be contained in a separate document marked "Confidential." The nature of this information will be mutually agreed upon between the Contractor and TriMet.	CDRL 1-7
1.8.1.4-3	Operating instructions will describe procedures to be followed as a result of system restarts or failures. The documents will contain sufficient information to enable the user to restart or re-configure the system and take diagnostic data dumps.	CDRL 1-7

1.8.1.4-4	Disaster recover 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 1-7
1.8.1.4-5	Detailed data backup requirements and procedures will be provided.	CDRL 1-7

1.8.2 Software Escrow

Req #	Requirement	Assigned CDRL(s)
1.8.2-1	The Contractor shall submit for TriMet approval an Escrow Management Plan that includes at a minimum the following: • A complete inventory of the items to be deposited into escrow. • Escrow agent name, location, and account ID • Plan for ensuring that the escrow account always contains the most current data and information • Escrow deposit procedures and frequency • Escrow inspection process	CDRL 1-10
1.8.2-2	Within 30 calendar days of system acceptance, and in accordance with the software license conditions and the master escrow agreement between the Contractor and a mutually agreeable software escrow company, the Contractor shall place in escrow firmware and software source code and documentation, in both electronic and hardcopy formats, for all firmware and software delivered by the Contractor for the eFare Account Management and Processing System (AMPS).	CDRL 1-10
1.8.2-3	Firmware and software source code and documentation to be provided will include application firmware and software for AMPS components not provided as open source, as well as any firmware and software developed for embedded microprocessors that are integrated into any AMPS modules.	CDRL 1-10
1.8.2-4	Firmware and software documentation will provide the following: • General description and operation • Architecture and basic program functions • Data flow information • Annotated source code listing, with comments and descriptions pertaining to each module sufficient to allow an experienced programmer to understand the program • Detailed memory map and listing • Input/output port map	CDRL 1-10

1.8.2-5	In addition, the Contractor shall also place in escrow: • Documentation and a licensed copy of all software tools such as debuggers, assemblers, and compilers, needed to convert the supplied source code into executable form used by the target processors and procedures necessary to transfer executable code to operational systems. • Hardware devices, such as EPROM programmers, with their accompanying firmware and software tools, necessary to transfer the executable programs onto the storage device used by any embedded microprocessor.	CDRL 1-10
1.8.2-6	During the contract, the Contractor shall place updated software and related source code in escrow, along with release notes documenting test results.	CDRL 1-10
1.8.2-7	The Contractor shall maintain the materials in escrow for not less than 15 years from the end of the base eFare SMA period. The Contractor shall prepay to provide escrow services for this duration.	CDRL 1-10
1.8.2-8	Escrow contents will immediately be obtainable and usable by TriMet should the material in escrow be released under the terms of the master escrow agreement.	CDRL 1-10
1.8.2-9	During the term of any active SMA, Contractor agrees to ensure that all software documentation is kept current and synchronized with the currently deployed eFare software.	CDRL 1-10

1.8.3 Application Programming Interfaces

Req #	Requirement	Assigned CDRL(s)
1.8.3-1	For each API provided by the contractor under this contract, the contractor shall supply separate documentation in PDF form.	CDRL 1-11
1.8.3-2	The API documentation will specify in detail: • 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 system	CDRL 1-11
1.8.3-3	The Contractor shall meet the detailed API requirements further specified in Section 2 of this document.	CDRL 1-11
1.8.3-4	The Contractor shall agree to provide TriMet with a license to use and as necessary provide others with the APIs in order to facilitate operation, maintenance, replacements and enhancements to the eFare system.	CDRL 1-11

1.8.4 Data

Req #	Requirement	Assigned CDRL(s)
1.8.5-1	TriMet and the Agencies will retain ownership of all eFare system data in perpetuity	NA
1.8.5-2	TriMet and the agencies will own all transaction data generated by usage of the eFare system.	NA
1.8.5-3	TriMet and the agencies will own all maintenance and operations data generated by usage of the eFare system.	NA

1.9 Modifications & Configuration Control

Throughout the Contract, up to and including the warranty period, the Contractor will implement and maintain a configuration control system that encompasses the entire system, Contractor and subcontractor supplied equipment alike. Changes to released and approved documents, drawings, and data will be controlled by the processing of Engineering Change Requests (ECRs). The Contractor's change control system and procedures will be documented in a Change and Configuration Control Plan (CDRL 1-12) and include provision for TriMet review and approval of changes.

In an effort to avoid unproductive "paper pushing" during the design process, the Contractor and TriMet will mutually agree upon a date for design freeze. The date will be chosen to reflect a point when the design of the system is substantially complete. The Contractor and subcontractors are not required to submit every in-process change to TriMet for review and approval prior to the design freeze date. This requirement does not relieve the Contractor and subcontractors from meeting any other submittal requirement in the contract.

Changes requiring approval will be defined as hardware, material, or software changes which affect previously approved documents and drawings, or interchangeability with previously produced components. A different configuration control system may be used to track software changes; see Section 13.

Changes that would modify specification requirements or any other aspects of this Contract shall be processed as change orders.

1.9.1 Engineering Changes

ECRs for all changes requiring approval, complete with documentation describing the reasons for and effects of the change, will be submitted to TriMet for review and approval prior to implementation. The Contractor shall maintain an engineering change status report that lists all changes, their submittal/approval status, implementation status, and completion dates. Implementation of a change will incorporate applicable updates to all components and spare parts.

1.9.2 Field Modifications

Following the factory acceptance testing and equipment installation, ECRs will generate Field Modification Instructions (FMI) that will require TriMet review and approval prior to implementation. The Contractor shall approve subcontractor FMIs before submitting them to TriMet. Each FMI will be

assigned a unique sequential number and the Contractor will maintain a log showing the status of FMI submittal, approval, implementation, affectivity, and completion. The Contractor shall be responsible for all FMIs, including the tracking of FMIs, even if the FMI is not performed directly by the Contractor.

An FMI will include the following:

- Cover sheet
  - Unique and serial FMI number
  - Title of FMI
  - Affectivity including spare parts (quantity, model, serial or car number)
  - Implementation location (combine with affectivity if applicable)
  - Sign off provisions for actual implementation of FMI
- Procedure
  - Step-by-step process
  - Inspection
  - Testing
- Supporting documentations
  - Underlying ECR(s)
  - Affected documents and drawings, including any change to manuals and catalogs

1.9.3 Component Identification & Serial Numbers

The Contractor shall develop and submit for TriMet approval an Equipment Identification and Labeling Plan that identifies how the deployed eFare system will comply with the following requirements.

Req #	Requirement	Assigned CDRL(s)
1.9.3-1	All payment system equipment will be permanently identified with a supplier's name, part number, and serial number.	CDRL 1-14
1.9.3-2	The Contractor shall assign unique serial numbers to equipment enabling tracking of components for maintenance, repair, and warranty and to provide sufficient identification ability to analyze failure data for declaring fleet defects.	CDRL 1-14
1.9.3-3	The serial number format will be submitted for TriMet approval and, where possible, serial numbers for like components will be sequential.	CDRL 1-14
1.9.3-4	Identification will be by engraved metal labels riveted in place or other approved permanent method.	CDRL 1-14
1.9.3-5	All equipment will also be labeled in duplicate with its own unique barcode labels to further facilitate tracking of the equipment. Labels will be placed in areas where they are likely to avoid wear and fading.	CDRL 1-14
1.9.3-6	The visible serial number will match the Electronic Serial Number (ESN) in all instances where an ESN is assigned.	CDRL 1-14
1.9.3-7	Serial numbers of all components will be presented to TriMet in the form of an MS Excel spreadsheet included with the shipment when spare components are received.	CDRL 1-14

1.9.3-8	At a minimum, the following equipment will have serial numbers applied: • Platform validators • Platform validator brackets and mounting hardware • Onboard validators • Onboard validator brackets • Mobile inspection devices • Retail Point of Sale (POS) units • Back office hardware, including redundant system hardware • Test environment hardware and devices	CDRL 1-14

1.10 Required Submittals

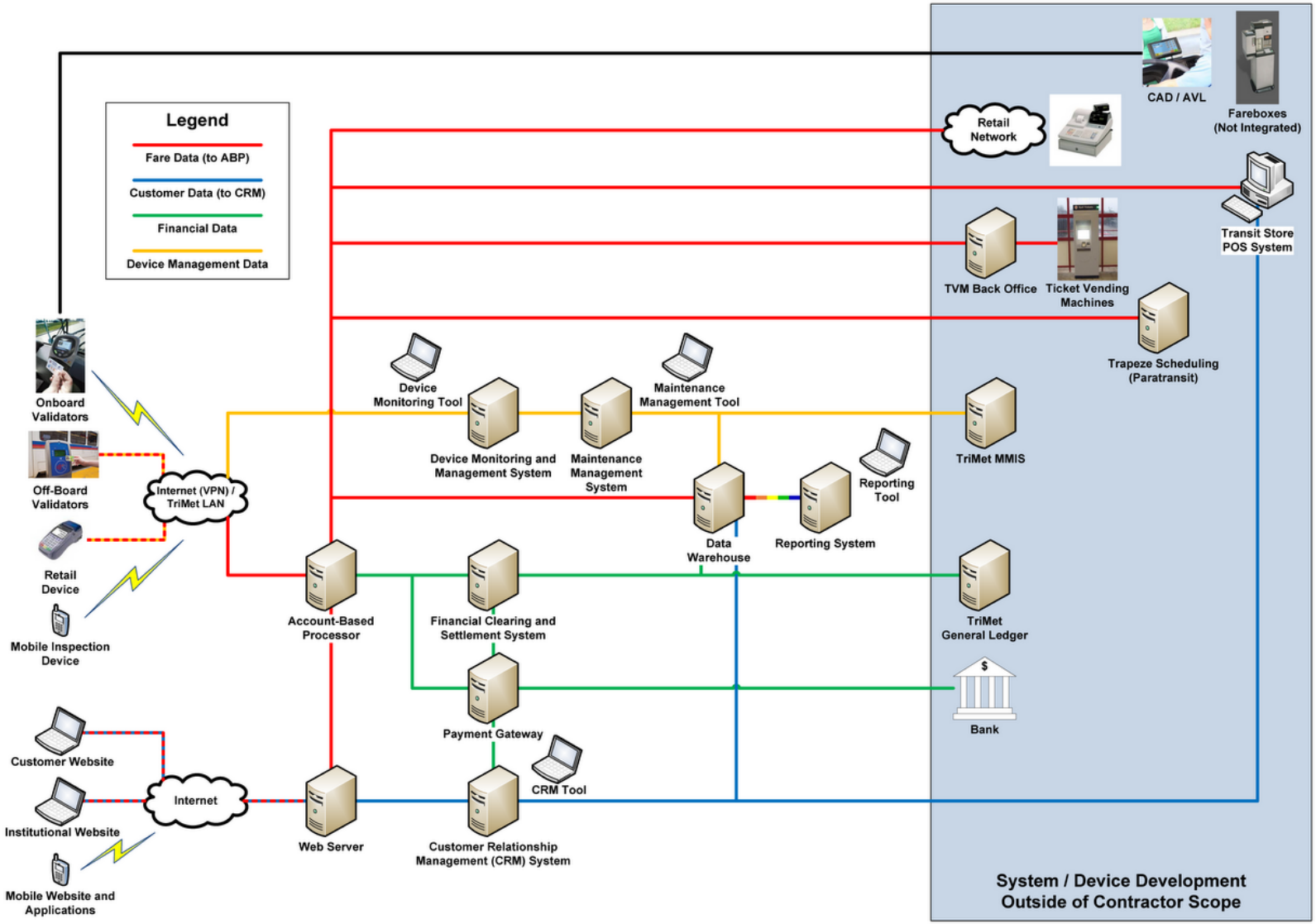
The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 1-1	Management Plan	1.4.2	✓	✓		
CDRL 1-2	Risk Management Plan	1.4.3	✓	✓		
CDRL 1-3	Master Program Schedule	1.4.4	✓	✓	✓	
CDRL 1-4	O&M Manuals Schedule	1.8.1		✓	✓	
CDRL 1-5	Operations Manual	1.8.1.2				Per manuals delivery schedule
CDRL 1-6	Repair, Maintenance and Installation Manuals	1.8.1.3				Per manuals delivery schedule
CDRL 1-7	eFare Back office System Admin and O&M Manual	1.8.1.4				Per manuals delivery schedule
CDRL 1-8	Illustrated Parts Catalog	1.8.1.5				Per manuals delivery schedule
CDRL 1-9	Firmware and Software Documentation	1.8.2				Per approved schedule
CDRL 1-10	Escrow Management Plan	1.8.2			✓	
CDRL 1-11	API Documentation	1.8.3	✓	✓	✓	
CDRL 1-12	Change Control Plan and Procedures	1.9		✓	✓	
CDRL 1-13	Meeting Minutes	1.5-1 1.5.2-3				Per contract requirement
CDRL 1-14	Equipment Identification and Labeling Plan	1.9.3		✓	✓	

2 System Architecture

The eFare system will be built using an account-based, open payment architecture with key system interfaces based on Application Programming Interfaces (APIs) that are published by the Contractor and fully owned or licensed by TriMet. Figure 2-1 provides a diagram of the conceptual system architecture of the eFare system.

Figure 2-1 Conceptual System Diagram



2.1 General Architecture

2.1.1 Account-Based System

The eFare system will be designed using an account-based architecture for the sale and distribution of fare value, as well as for the processing and validation of fare payments.

Req #	Requirement	Assigned CDRL(s)
2.1.1-1	Contractor shall design and implement an account management and fare processing system, known as the Account Management and Processing System (AMPS).	CDRL 6-2 CDRL 6-3 CDRL 6-4
2.1.1-2	AMPS will manage transit accounts, calculate open and closed-loop fare payments (based on established business rules), and perform fare processing and validation at the time of payment and inspection.	CDRL 6-2 CDRL 6-3 CDRL 6-4
2.1.1-3	The loading of fare value and execution of fare payments will be performed using of transit accounts maintained within AMPS.	CDRL 6-2 CDRL 6-3 CDRL 6-4
2.1.1-4	Transit accounts will be accessed using fare media accepted by the eFare system, including agency-issued smartcards, third-party-issued smartcards, limited-use smartcard fare media, bank-issued contactless credit and debit cards, and Near Field Communication (NFC)-equipped devices.	CDRL 2-1 CDRL 2-2 CDRL 6-2
2.1.1-5	The fare media will serve as a token for accessing an AMPS-maintained account, and no data will be written to the media when loading fare value or paying a fare.	CDRL 2-1 CDRL 2-2 CDRL 6-2 CDRL 6-4
2.1.1-6	Both closed-loop and open payments will result in the creation or modification of a transit account within AMPS.	CDRL 2-1 CDRL 6-4
2.1.1-7	For closed-loop payments, all fare value loaded by the customer will be stored in a transit account and reduced as it is used for payment.	CDRL 2-1 CDRL 6-2
2.1.1-8	For open payment transactions, a transit account will maintain a record of payments processed against the card being used, and allow for the conferring of fare discounts and transfers, as defined by agency fare policies.	CDRL 2-1 CDRL 6-2
2.1.1-9	AMPS will manage, batch, and submit open payment transactions to the payment gateway (see Section 6.1.7) as necessary.	CDRL 2-1 CDRL 6-2 CDRL 6-4
2.1.1-10	AMPS will be scaled such that the total number of possible accounts and total concurrent use of accounts will, at a minimum, support 150 percent of regional ridership needs.	CDRL 6-2 CDRL 6-4

2.1.2 Real-Time Communications

Req #	Requirement	Assigned CDRL(s)
2.1.2-1	All fare distribution and payment devices deployed as part of the eFare system will be equipped with real-time communications to AMPS and the device monitoring system.	CDRL 6-2
2.1.2-2	The communication interfaces will support the real-time loading of fare value through all distribution channels; processing of open and closed-loop fare payments onboard vehicles and at train platforms; and fare inspection by agency staff.	CDRL 6-2
2.1.2-3	The device monitoring system will provide real-time status of all devices and systems down to the module level, and of all communication nodes that connect system components (see Section 6.1.3). The devices will also maintain local event and error logs in the event that communications are unavailable.	CDRL 6-5
2.1.2-4	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.	CDRL 6-2
2.1.2-5	The system will support offline operation of all field devices to perform essential functions.	CDRL 6-2

2.2 Open Architecture

2.2.1 General Approach

The eFare system will be designed and implemented using an open architecture approach to provide flexibility as technology and agency needs change. The open architecture will apply to all fare media types, devices, back office interfaces and transaction formats used within the system for the management, distribution, payment, and inspection of fares.

2.2.2 Fare Media Formats

2.2.2.1 General Requirements

Req #	Requirement	Assigned CDRL(s)
2.2.2.1-1	Contractor shall design, develop, test, and provide compliant contactless fare media that will be accepted by the eFare system.	CDRL 2-1 CDRL 8-1
2.2.2.1-2	Fully functional extended-use and limited-use closed-loop fare media will be provided by the Contractor for issuance by the agencies.	CDRL 2-1
2.2.2.1-3	The media will be based on ISO-14443 and ISO 18092 (NFC) compliant formats.	CDRL 2-1
2.2.2.1-4	Additional agency-defined formats may be defined during system design that conform to the design principles in this section.	CDRL 2-1

2.2.2.1-5	All media formats will be account-based, and support the secure storage of a unique token used to access a transit account in AMPS, without the ability to write additional data to the media.	CDRL 2-1 CDRL 2-2
2.2.2.1-6	The transit account token stored on the media will not be the media serial number (i.e., UID) or transit account number used within AMPS, and will not be printed on the media or otherwise accessible using a non-eFare device.	CDRL 2-1 CDRL 2-2
2.2.2.1-7	The format of the transit account token and transit account number used within AMPS will be subject to Agency review and approval as part of design review.	CDRL 2-1 CDRL 2-2
2.2.2.1-8	Test cards will be provided for each version of fare media, including closed-loop extended-use and limited-use media, and open payment cards. For open payment test cards that require pre-payment or other special financial consideration, the Contractor may submit costs for reimbursement.	CDRL 2-1 CDRL 8-1
2.2.2.1-9	Contractor shall publish specifications for all card formats supported within the system, including all information necessary to generate required security keys. The card formats shall be fully owned by TriMet, including the right to distribute specifications to third-parties for media production and to support multi-application smartcard implementations.	CDRL 2-2

2.2.2.2 Extended-Use Fare Media

Req #	Requirement	Assigned CDRL(s)
2.2.2.2-1	The extended-use closed-loop fare media will make use of a licensed open payment application to be selected during design review.	CDRL 2-1 CDRL 2-2
2.2.2.2-2	The card will contain a magnetic stripe and barcode to support the sale and loading of fare value in the retail environment. The format and data content of the magnetic stripe and barcode will be defined by the selected retail vendor during design review.	CDRL 2-1
2.2.2.2-3	The card body will be comprised of a composite PVC/PET material.	CDRL 2-1
2.2.2.2-4	The card dimensions will be compliant with ISO 7810 ID-1.	CDRL 2-1
2.2.2.2-5	The card must be constructed of appropriate durable materials for a minimum useful life of 10 years.	CDRL 2-1
2.2.2.2-6	Test cards will be provided to adequately exercise all aspects of fare media and system performance through system acceptance. A minimum of 500 test cards will be available for ad-hoc testing, with more available upon request.	CDRL 2-1 CDRL 8-1

2.2.2.3 Limited-Use Fare Media

Req #	Requirement	Assigned CDRL(s)
2.2.2.3-1	Limited-use fare media will be provided for the distribution of limited duration passes and/or stored value to infrequent customers.	CDRL 2-1 CDRL 2-2
2.2.2.3-2	The limited-use media will be in the form of a limited-use secure smartcard, such as the MIFARE Ultralight C.	CDRL 2-1 CDRL 2-2
2.2.2.3-3	The eFare system will support the issuance of pre-encoded limited-use media (i.e., account number encoded during media production), and the encoding of the limited-use media upon issuance by an eFare device, using the Contractor-supplied APIs (see Section 2.2.3). An associated transit account will be created within AMPS upon issuance of the media.	CDRL 2-1 CDRL 2-2
2.2.2.3-4	The limited-use ticket body will be comprised of polyester paper laminate, plastic PVC, PET, or composite PVC/PET.	CDRL 2-1
2.2.2.3-5	The card dimensions will be compliant with ISO 7810 ID-1.	CDRL 2-1
2.2.2.3-6	The physical ticket body will be coated with an appropriate durable material for a minimum useful life (in use, not storage) of six (6) months.	CDRL 2-1
2.2.2.3-7	Test cards will be provided to adequately exercise all aspects of fare media and system performance through system acceptance. A minimum of 500 test cards will be available for ad-hoc testing, with more available upon request.	CDRL 2-1 CDRL 8-1

2.2.2.4 MIFARE-Compatible Application

Req #	Requirement	Assigned CDRL(s)
2.2.2.4-1	Contractor shall develop an MIFARE-compatible transit application to support closed-loop fare payments in multi-application smartcard environments. This application may be the same application that is developed for use on the limited-use media.	CDRL 2-1 CDRL 2-2
2.2.2.4-2	The MIFARE application will be compatible with all platforms in the MIFARE family, including but not limited to: MIFARE Classic, MIFARE Plus, MIFARE DESFire, SmartMX, and MIFARE Ultralight and Ultralight C.	CDRL 2-1 CDRL 2-2
2.2.2.4-3	The MIFARE application will allow use on third-party issued media that supports a multi-application MIFARE environment. Compatible third-party media may include, but is not limited to: • Transit employee and contractor ID badges • Corporate employee ID badges • School ID cards • Social service program cards, such as the Oregon Trail card • PIV cards issued as identification to employees of federal, state or local government agencies	CDRL 2-1 CDRL 2-2

2.2.2.4-4	The eFare system will include the necessary key management tools to support the sharing, loading, and management of the transit application in a multi-application environment.	CDRL 2-1 CDRL 2-2
2.2.2.4-5	If the agencies decide to utilize the MIFARE-compatible payment application, it will be supported without any additional development to the Contractor-supplied devices and systems.	CDRL 2-1 CDRL 2-2

2.2.2.5 Alternative Form Factors

Req #	Requirement	Assigned CDRL(s)
2.2.2.5-1	The provided fare media formats will support alternative contactless form factors that can be read by the eFare validators.	CDRL 2-1 CDRL 2-2
2.2.2.5-2	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 2-1 CDRL 2-2

2.2.2.6 Cryptography

Req #	Requirement	Assigned CDRL(s)
2.2.2.6-1	All provided fare media will support strong cryptography, such as TDEA, Advanced Encryption Standard (AES) and RSA, and support offline cryptography as necessary.	CDRL 2-1 CDRL 2-2
2.2.2.6-2	As required, key management services will be provided. Key management in this context includes, but is not limited to: • Key generation – agencies may require derived key generation for each manufactured card. These may consist of a card manager key set, as well as multiple application related key sets. Key sets may consist of encryption and authentication keys. • Key management – agencies may require key management services for the storage and retention of card and application key sets.	CDRL 2-1 CDRL 2-2

2.2.2.7 Fare Media Certifications

Req #	Requirement	Assigned CDRL(s)
2.2.2.7-1	All provided fare media will be certified by all parties involved in the design, manufacture, testing, licensing, and issuance of fare media.	CDRL 2-1 CDRL 2-2
2.2.2.7-2	Certifications may include, but are not limited to, ISO, NEC, MIL, UL, MIFARE, ADA, PCI-DSS, EMV, and any applicable agency certifications related to fare media.	CDRL 2-1 CDRL 2-2
2.2.2.7-3	Media recertification will be provided on an ongoing basis as required as part of the software maintenance agreement.	CDRL 2-1 CDRL 2-2 CDRL 13-3

2.2.2.7-4	Fare media will undergo a comprehensive Quality Assurance (QA) process 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 as a cost to the Contractor.	

2.2.3 Application Programming Interfaces

2.2.3.1 General Requirements

Req #	Requirement	Assigned CDRL(s)
2.2.3.1-1	Contractor shall develop and publish APIs that support core system functions and enable access to these functions for any device or system that requires use of them. Devices or systems may make use of more than one API to support desired functionality.	CDRL 2-3 CDRL 2-4 CDRL 2-5 CDRL 2-6 CDRL 2-7 CDRL 2-8 CDRL 2-9 CDRL 2-10
2.2.3.1-2	Contractor shall publish full API specifications that document the process for sending messages over the interfaces between system components, and all messages that the interfaces support, including message description, format, and timing requirements.	
2.2.3.1-3	Contractor shall be responsible for providing the following APIs: • Fare distribution (device/system to AMPS) • Fare payment (device/system to AMPS) • Fare inspection (device/system to AMPS) • Transit account management (device/system to AMPS) • Customer account management (device/system to CRM system) • Device management (device-specific) • CAD/AVL integration (onboard communications) • Payment (device/system to payment gateway)	
2.2.3.1-4	Contractor shall demonstrate use of APIs as part of system implementation and testing; any resulting changes to the APIs will result in specifications being updated by the Contractor.	
2.2.3.1-5	Following implementation, the APIs will become the property of, or fully licensed to, TriMet with the right to use and distribute the API specifications without further approval, license, or payment.	

2.2.3.2 Fare Distribution API

The fare distribution API will support the sale of all fare media and fare products offered through all fare distribution channels within the eFare system.

Req #	Requirement	Assigned CDRL(s)
2.2.3.2-1	The fare distribution API will support the passing of data between AMPS and distribution devices and systems, such as: TVMs, transit store Point of Sale (POS) systems, retail devices and the retail load network, Customer Relationship Management (CRM) system, eFare websites, and the eFare mobile application.	CDRL 2-3
2.2.3.2-2	The fare distribution API will support the following functionality at a minimum: • Sale of limited-use media and creation of an associated transit account • Sale of extended-use media and creation of an associated transit account • Sale of closed-loop transit value and update of the associated transit account • Sale of institutional fare products and update of the associated transit account	CDRL 2-3
2.2.3.2-3	Unique transit accounts will be generated by AMPS, and the associated account identifiers passed to the devices/systems via the fare distribution API, to support the issuance of new media.	CDRL 2-3
2.2.3.2-4	Products available for sale and the associated pricing will be maintained in AMPS and sent to distribution devices/systems via the fare distribution API.	CDRL 2-3
2.2.3.2-5	The fare distribution API will allow any distribution device/system to initiate a sale of any available fare media or fare product.	CDRL 2-3
2.2.3.2-6	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 AMPS to allow for the full tracking of all sales.	CDRL 2-3
2.2.3.2-7	The fare distribution API will support the return of a confirmation of the actions taken by AMPS to complete the sale if the sale was successful, or a denial (with reason code) if the sale was unsuccessful.	CDRL 2-3

2.2.3.3 Fare Payment API

The fare payment API will enable various payment devices and validators to access AMPS for purposes of processing fare payments.

Req #	Requirement	Assigned CDRL(s)
2.2.3.3-1	The fare payment API will support the payment of fares across all agencies and modes, using all supported fare media and fare products, and will be utilized by devices such as the eFare validators to accept open and closed-loop fare payments.	CDRL 2-4

2.2.3.3-2	The fare payment API will support the following functionality at a minimum: • Acceptance of closed-loop fare payments using all accepted fare media and products • Acceptance of open payments using all supported open payment network-branded cards and NFC-enabled devices	CDRL 2-4
2.2.3.3-3	The fare payment API will support the passing of data between the fare payment devices and AMPS 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 account.	CDRL 2-4
2.2.3.3-4	All fare payment processing will be performed by AMPS, although AMPS may distribute media hotlists and white lists to the payment devices (via the device management APIs), as deemed appropriate for fraud prevention.	CDRL 2-4
2.2.3.3-5	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 account number. Transactions will be processed by AMPS to allow for the full tracking of all fare payments.	CDRL 2-4
2.2.3.3-6	The fare payment API will support confirmation of the action taken by AMPS 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 account or product balance.	CDRL 2-4

2.2.3.4 Fare Inspection API

The fare inspection API will enable fare inspectors to confirm fare payment or non-payment through use of eFare inspection devices.

Req #	Requirement	Assigned CDRL(s)
2.2.3.4-1	The fare inspection API will enable eFare inspection devices to query transit accounts for the validation of fare payments.	CDRL 2-5
2.2.3.4-2	The fare inspection API will support the passing of data between inspection devices and AMPS, and enable the following functionality at a minimum: • Validation of closed-loop fare payments using all accepted media and products • Validation of open payments using all supported payment network-branded cards and NFC-enabled devices	CDRL 2-5
2.2.3.4-3	All fare payment validation will be performed by AMPS, although AMPS may distribute media hotlists and white lists to the inspection devices (via the device management APIs), as deemed appropriate for fraud prevention.	CDRL 2-5

2.2.3.4-4	The fare inspection API will support the generation of transactions containing all required information regarding a fare inspection, including agency, device/system ID, location, date/time, and transit account number. Transactions will be processed by AMPS to allow for the full tracking of all fare inspections.	CDRL 2-5
2.2.3.4-5	The fare inspection API will support the return of payment status and information on the account and last fare payment, including fare category, fare product used, amount paid, and account or product balance.	CDRL 2-5

2.2.3.5 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)
2.2.3.5-1	The transit account management API will be utilized by devices and systems such as the eFare TVMs, transit store POS systems, retail devices and the retail load network, CRM system, eFare websites, and the eFare mobile app to query and modify data maintained in transit accounts.	CDRL 2-6
2.2.3.5-2	The transit account management API will support the passing of data between devices/systems and AMPS to enable the following functionality at a minimum: • Query of sales transaction history • Generation of sales adjustments and refunds • Query of fare payment transaction history • Generation of payment adjustments and refunds	CDRL 2-6
2.2.3.5-3	The transit account management API will allow devices/systems to query a transit account associated with closed-loop or open fare payments, and return the sales and fare payment transactions that were conducted against that account over a specified timeframe.	CDRL 2-6
2.2.3.5-4	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, account number, adjustment type, adjustment value and adjustment reason, and will be processed by AMPS to allow for the full tracking of all actions.	CDRL 2-6

2.2.3.6 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)
2.2.3.6-1	The customer account management API will be utilized by devices and systems such as the transit store POS systems, the CRM system, eFare websites, and the eFare mobile app to create, query and modify customer account data.	CDRL 2-7
2.2.3.6-2	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: • 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 to a customer account)	CDRL 2-7
2.2.3.6-3	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 database.	CDRL 2-7
2.2.3.6-4	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 2-7
2.2.3.6-5	If setting up autoload requires modification to the transit account as well as the customer account, this change will be handled within AMPS via an automated process triggered by the update to the customer account.	CDRL 2-7

2.2.3.7 Device Management APIs

The device management APIs will support hardware and software management of devices deployed within the eFare system.

Req #	Requirement	Assigned CDRL(s)
2.2.3.7-1	A device management API will be used by each type of device deployed in the system to report device errors and events at the module level, and to receive new software and configuration parameters as required.	CDRL 2-8

2.2.3.7-2	Device management APIs will be created to support the following devices at a minimum: • Transit store POS system • Retail device • Fare payment validators • Fare inspection device	CDRL 2-8
2.2.3.7-3	The device management APIs will support the passing of data between the devices and the device management 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 modular level, and support accurate reporting on all device performance requirements.	CDRL 2-8
2.2.3.7-4	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 hotlists and white lists maintained locally at the devices for the purpose of offline fare processing.	CDRL 2-8
2.2.3.7-5	Universal APIs to capture device events and distribute software will be created wherever possible; however, the Contractor shall work collaboratively with device manufactures to develop device-specific APIs as necessary.	CDRL 2-8
2.2.3.7-6	The TVMs, which will be procured separately, will not require a device management API, as they will be managed by the TVM back office.	CDRL 2-8

2.2.3.8 CAD/AVL Integration API

The CAD/AVL integration will be designed specifically to support the integration of the eFare onboard payment validators with CAD/AVL systems from multiple suppliers.

Req #	Requirement	Assigned CDRL(s)
2.2.3.8-1	The CAD/AVL integration API will be utilized by the onboard validators to exchange information with the bus CAD/AVL system to support single sign-on, the capture of geo-location information, and provide fare payment feedback to the bus operator through the CAD/AVL control unit.	CDRL 2-9
2.2.3.8-2	The CAD/AVL integration API will support the transmittal of operator login and route data captured through the CAD/AVL system, including operator ID, pattern, block, route, and direction. The onboard validator will append this information to the fare payment transactions generated by the device.	CDRL 2-9

2.2.3.8-3	The CAD/AVL integration API will support the transmittal of geo-location data captured through the CAD/AVL system, including Bus Stop ID and GPS coordinates. The onboard validator will append this information to the fare payment transactions generated by the device.	CDRL 2-9
2.2.3.8-4	The CAD/AVL integration API will support the display of fare payment information on the CAD/AVL operator control unit, including the fare payment result, fare product used, and the fare category associated with the transit account.	CDRL 2-9
2.2.3.8-5	The CAD/AVL integration API will support initiation of a fare override function through the CAD/AVL operator control unit. The fare override function shall cause the eFare validator 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 (see Section 4.2.1.2).	
2.2.3.8-6	The CAD/AVL integration API will be designed such that it is vendor agnostic; however, the Contractor will work with TriMet's existing CAD/AVL supplier, INIT, to ensure that any system-specific requirements are met.	CDRL 2-9

2.2.3.9 Payment API

The payment API will support the processing of bank card payments through the Contractor-supplied payment gateway (see Section 6.1.7).

Req #	Requirement	Assigned CDRL(s)
2.2.3.9-1	The payment API will be utilized to process open fare payment transactions generated by the eFare validators/AMPS, and bank card sales and adjustments generated by the customer website, institutional website, mobile application, CRM system, and IVR.	CDRL 2-10
2.2.3.9-2	The payment API will support the return of a unique token when a bank card PAN and expiration date is passed to the payment gateway. This unique token will remain associated with the individual bank card so that is can be used for the future tracking and processing of payments.	CDRL 2-10
2.2.3.9-3	The payment API will use bank card standard transaction formats wherever possible.	CDRL 2-10
2.2.3.9-4	The payment API will support the processing of payments through the payment gateway by external systems, should it be deemed necessary in the future.	CDRL 2-10

2.2.4 Transaction Formats

Req #	Requirement	Assigned CDRL(s)
2.2.4-1	Contractor shall publish specifications for the format of all transaction generated and used within the system, which are not already covered by the required APIs. The transaction formats shall be fully owned by TriMet, including the right to distribute the specifications to third-parties.	CDRL 2-13
2.2.4-2	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 Contractor-provided Financial Clearing and Settlement System (see Section 6.1.6).	CDRL 2-13

2.3 Open Payment Architecture

2.3.1 General Requirements

Req #	Requirement	Assigned CDRL(s)
2.3.1-1	The system will be designed to accept open payment media (i.e., contactless bank cards and their mobile wallet equivalents) for the direct payment of transit fares wherever fares are paid. This includes validators installed onboard vehicles, and off-board validators installed at station platforms.	CDRL 2-11
2.3.1-2	The requirements of the system and transaction flow necessary to support open payments include: • 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 communication with a payment processor for the purpose of authorizing open payment transactions • Security protocols required for PCI-DSS compliance associated with the capture, storage, transmittal, and processing of bank card data	CDRL 2-11
2.3.1-3	All open payment fare transactions flowing through the eFare system will be processed by TriMet's payment processor, First Data, via the Contractor-supplied payment gateway (see Section 6.1.7).	CDRL 2-11

2.3.2 Supported Formats

Req #	Requirement	Assigned CDRL(s)
2.3.2-1	Open payments will be accepted based on existing contactless bank card standards and protocols. The system will accept ISO 14443 compliant credit or debit cards, including but not limited to the following association-branded formats: • Visa payWave • Master Card PayPass • American Express ExpressPay • Discover Zip • Third-party issued pre-paid debit cards	CDRL 2-11
2.3.2-2	The devices will support any payment formats that comply with existing open payment standards, such as NFC (ISO 18092)-enabled phones with a mobile wallet application.	CDRL 2-11
2.3.2-3	The system will support payment using any contactless Europay, MasterCard, and Visa (EMV) compliant bank cards. The Contractor shall be responsible for ensuring compliance with all requirements associated with EMV payment acceptance in the United States, as they are defined by the card associations and issuers.	CDRL 2-11
2.3.2-4	One of the open payment association-branded formats will be licensed for use on the closed-loop transit card issued by TriMet (see Section 2.2.2.2). Use of an open payment format will maintain a high level of security, while limiting key management responsibilities and simplifying validator software design.	CDRL 2-11

2.3.3 Open Payment Authorization

Req #	Requirement	Assigned CDRL(s)
2.3.3-1	The eFare payment validators will be equipped with real-time communication to AMPS, which will determine whether to submit the transaction to the payment processor for authorization, or provide authorization within the eFare system.	CDRL 2-11
2.3.3-2	Prior to seeking payment authorization from the payment processor, the system will perform basic validation checks on the card being used for payment, and enforce basic fraud controls. These validation checks will include at a minimum: • MOD 10 check of card PAN • Check of card expiry status • Configurable velocity check (i.e., limit on frequency of use within the system)	CDRL 2-11

2.3.3-3	The card validation checks shall be performed at the device-level wherever possible. No payment authorization request will be sent for cards that fail any of the validation checks.	CDRL 2-11
2.3.3-4	The system will support real-time fare calculation and online authorization of open payments.	CDRL 2-11
2.3.3-5	AMPS will provide payment authorization within 500 milliseconds of the media being presented to the payment validator. If full authorization of an open payment has not been received within the required timeframe, AMPS will issue a limited authorization. The time period for issuing a limited authorization will be configurable.	CDRL 2-11
2.3.3-6	If payment authorization fails after a limited authorization has been issued, the payment will be periodically re-presented to the payment processor for a configurable period of time. If a successful authorization is not received, the payment instrument will be hotlisted, resulting in denial of subsequent use in the eFare system.	CDRL 2-11
2.3.3-7	Failed 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 hotlist if the customer resolves the issue and pays the outstanding balance.	CDRL 2-11
2.3.3-8	The system will accept open payments when the validators cannot communicate with AMPS 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 validator, and transmitted for authorization as soon as the connection is restored.	CDRL 2-11
2.3.3-9	Failed authorizations following acceptance of an offline transaction will be handled in the same way as declined payments following issuance of a limited authorization.	CDRL 2-11
2.3.3-10	In all cases where a full authorization is not available, the system will not provide any feedback to the rider or operator to indicate that a full authorization was not received.	CDRL 2-11

2.3.4 Payment Aggregation

Req #	Requirement	Assigned CDRL(s)
2.3.4-1	Wherever possible, the system will aggregate open payment fare transactions generated using the same payment instrument to reduce payment processing fees.	CDRL 2-12
2.3.4-2	On first use of a payment instrument, the system will process a pre-authorization for a pre-determined, configurable amount and begin transaction aggregation.	CDRL 2-12
2.3.4-3	Transactions will be aggregated over a specified time period and up to a specified value to be defined during design review.	CDRL 2-12

2.3.4-4	The Contractor shall be responsible for ensuring compliance with all payment card association rules, including those regarding the aggregation of payments. The system will accommodate scenarios where the aggregation rules vary by association and issuer by determining the card type using the Issuer Identification Number (IIN).	CDRL 2-12

2.4 Required Submittals

The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 2-1	Fare Media Design	2.1 2.2	✓	✓	✓	
CDRL 2-2	Fare Media Formats	2.2	✓	✓	✓	
CDRL 2-3	Fare Distribution API Specification	2.2.3.2	✓	✓	✓	Final as-built API specifications will be delivered as part of system acceptance and will continue to be maintained as part of the software maintenance agreement
CDRL 2-4	Fare Payment API Specification	2.2.3.3	✓	✓	✓	
CDRL 2-5	Fare Inspection API Specification	2.2.3.4	✓	✓	✓	
CDRL 2-6	Transit Account Management API Specification	2.2.3.5	✓	✓	✓	
CDRL 2-7	Customer Account Management API Specification	2.2.3.6	✓	✓	✓	
CDRL 2-8	Device Management API Specification	2.2.3.7	✓	✓	✓	
CDRL 2-9	CAD/AVL Integration API Specification	2.2.3.8	✓	✓	✓	
CDRL 2-10	Payment API Specification	2.2.3.9	✓	✓	✓	
CDRL 2-11	Open Payment Architecture and Transaction Processing	2.3	✓	✓	✓	
CDRL 2-12	Payment Aggregation Design	2.3.4	✓	✓	✓	
CDRL 2-13	Transaction Formats Specifications	2.2.4	✓	✓	✓	

3 Design Criteria

The Contractor shall employ commonly accepted industrial design principles throughout the design and manufacturing processes. Design calculations, layouts, and other documentation summarizing the human factors and engineering considerations will be submitted during the design review. Topical reviews to address key issues will be held as needed.

3.1 Design Review

3.1.1 General Requirements

Req #	Requirement	Assigned CDRL(s)
3.1.1-1	Formal design reviews will be conducted to evaluate progress and the technical, functional and programmatic adequacy of the design in accordance with the performance requirements of the Contract.	CDRL 3-1
3.1.1-2	In addition to formal design reviews, meetings to address key issues will be held as needed.	NA
3.1.1-3	Contractor will submit a design review packages that includes CDRLs and other required items prior to each design review meeting.	CDRL 3-1
3.1.1-4	Design review packages will be provided at least 14 calendar days before a design review meeting.	CDRL 3-1
3.1.1-5	Design reviews will consist of the following key activities: • Design review packages will be reviewed by TriMet and the Agencies and consultant staff. • A Master Issues List (MIL) will be created as a result of the review and will be provided to the Contractor at least two (2) days prior to the scheduled design review meeting. • The design review meeting, or series of meetings, will be held with the Contractor and TriMet and/or Agency staff, where the Contractor shall explain the design and TriMet and the Agencies will confirm the requirements. Where possible, issues will be resolved during the design review meetings. • All Issues discussed during the meetings will be identified and documented, including status (i.e. Open or Closed). TriMet or the affected Agency will determine the appropriate action to close the issue, giving consideration to where the project is in the overall design review process. This may require resubmission of design review packages. • The submittal will be approved, upon TriMet's and the Agencies' determination that there are no open issues.	CDRL 3-1
3.1.1.6	Contractor may establish suitable confidentiality agreements.	NA

3.1.1-7	Contractor shall conduct three formal design reviews: • Conceptual Design Review (CDR) • Preliminary Design Review (PDR) • Final Design Review (FDR)	CDRL 3-1 CDRL 3-2 CDRL 3-3 CDRL 3-4

3.1.2 Conceptual Design Review (CDR)

The primary objectives of the CDR are to acquaint TriMet with the Contractor's intended design and procurement activities, resolve any open items related to external system interfaces, and provide the basis for proceeding to PDR.

Req #	Requirement	Assigned CDRL(s)
3.1.2-1	At a minimum, the Conceptual Design Review will accomplish the following: • Confirm the structure of the Contractor's management team and the scope of any subcontractors • Provide narrative descriptions of the major systems and subsystems proposed by the Contractor • Provide preliminary specifications for the payment validators, inspection device and retail sales device • Identify all interfaces between the major systems and subsystems, and identify responsibilities and a schedule for completion of the detailed interface definitions • Provide system block diagrams showing the functionality of and interfaces between system components, including external systems that will not be provided by the Contractor but will interface with the eFare system • Provide a software conceptual design, including software block diagrams for key system components • Confirm Contractor's understanding of the intended operations and maintenance environment • Identify key information and decisions required from TriMet and the Agencies	CDRL 3-2
3.1.2-2	Specific submittals will be required as part of CDR in addition to the items listed above (see CDR CDRL list). Each submittal will conform to the requirements specified herein.	CDRL 3-2
3.1.2-3	CDR submittals will be provided at least 14 calendar days prior to the CDR meeting.	CDRL 3-1
3.1.2-4	Each submittal will include documents in electronic format (searchable PDF) and one reproducible hard copy.	CDRL 3-1 CDRL 3-2

3.1.3 Preliminary Design Review (PDR)

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 Contractor is encouraged to categorize the PDR information into logical topics. The PDR may be conducted as a series of meetings in locations relevant

to the topics discussed. Ideally, the formal PDR meetings should be limited to confirmation of previously reviewed, commented on, and approved-in-principle submittals and the resolution of open items.

Req #	Requirement	Assigned CDRL(s)
3.1.3-1	PDR will represent approximately 75 percent completion of the total engineering and organizational design.	CDRL 3-1 CDRL 3-3
3.1.3-2	The PDR will cover the following: • Schedule compliance review and discussion of variances or delays • Power diagrams and functional block diagrams for each Contractor-supplied device • Detailed hardware and software specifications for all Contractor-supplied devices, including mounting arrangements and installation methods • Complete customer and operator user interface specifications, flow charts, and messages for all Contractor-supplied equipment, including accommodations of all boundary and error conditions • Detailed interface and communication specifications for all internal and external system interfaces • List of special tools and diagnostic test equipment needed for maintenance of each device and system • Detailed software flow charts for all back office systems • Detailed specifications for software version and configuration control systems • Detailed specifications for access control systems supporting back office operations • Detailed description of system and data backup and recovery procedures	CDRL 3-3
3.1.2-3	Specific submittals will be required as part of PDR in addition to the items listed above. Each submittal will conform to the requirements specified herein.	CDRL 3-3
3.1.3-4	PDR submittals will be provided at least 2 weeks prior to the PDR meeting.	CDRL 3-3
3.1.3-5	Each submittal will include documents in electronic format (searchable PDF) and one reproducible hard copy.	CDRL 3-1 CDRL 3-3

3.1.4 Final Design Review (FDR)

The objective of the FDR is to determine whether the detailed system design will satisfy all of the design requirements established in the Contract.

Req #	Requirement	Assigned CDRL(s)
3.1.4-1	FDR will be conducted when detailed design is complete and production specifications and drawings are ready for release.	CDRL 3-1 CDRL 3-4

3.1.4-2	Data submitted for the PDR will be updated to a level of detail consistent with the completed design and submitted as part of FDR.	CDRL 3-4
3.1.4-3	FDR will include but not be limited to the following: • Schedule compliance review and discussion of variances or delays • Assembly drawings for all Contractor-supplied devices, down to the lowest replaceable unit level • Electrical schematic drawings for all Contractor-supplied devices • Preliminary "as-built" drawings and prototypes for all device mounting configurations • Final system architecture drawings • Detailed software specifications for all back office systems, consisting of structured data flow diagrams to the lowest level of decomposition with software module descriptions in a structured narrative format • Detailed specifications for all APIs supporting frontend and back office operations • Detailed specifications for all system transaction formats not included in the API specifications • Complete data dictionary and detailed database design documentation for the data warehouse	CDRL 3-4
3.1.4-4	Specific submittals will be required as part of FDR in addition to the items listed above. Each submittal will conform to the requirements specified herein.	CDRL 3-4
3.1.4-5	FDR submittals will be provided at least 2 weeks prior to the FDR meeting.	CDRL 3-4
3.1.4-6	Each submittal will include documents in electronic format (searchable PDF) and one reproducible hard copy.	CDRL 3-1 CDRL 3-4

3.2 General Design Requirements

This section specifies the general requirements of the fare collection equipment to be provided under this Contract.

Req #	Requirement	Assigned CDRL(s)
3.2-1	The fare collection equipment and systems delivered by the Contractor will have a minimum useful life of 15 years.	All Applicable CDRLs
3.2-2	System components will be constructed to prevent theft and unauthorized access, minimize the effects of vandalism, prevent unauthorized removal of components, and facilitate access by authorized personnel.	All Applicable CDRLs
3.2-3	Principals of human factors engineering will be applied throughout the design to facilitate ease of use and safety for passengers, operators, maintainers, and servicers.	CDRL 3-5

3.2-4	The Contractor shall employ expertise and best practices in ergonomics, human factors, and industrial and graphic design to assist in the development of passenger and operator interfaces for all system components.	CDRL 3-5
3.2-5	System components will comply with the Americans with Disabilities Act (ADA) of 1990, as amended through the date of these specifications. The equipment will also meet the requirements of the proposed ADA Accessibility Guidelines (ADAAG), as it stands at contract signing. Descriptions and drawings of the ADA, and proposed ADAAG-compliant automated fare collection equipment will be submitted for review and approval. (CDRL 202, "ADA Compliance Report").	CDRL 3-6
3.2-6	The system will support five languages via the customer website, IVR and mobile application with the capability to support at least four additional languages. Contractor shall deliver English and Spanish with the system, and the Agencies will determine three additional languages to be provided with the delivered system during design review.	CDRL 5-2 CDRL 6-19 CDRL 6-20 CDRL 6-21 CDRL 6-22
3.2-7	The Contractor shall provide TriMet tools necessary for modifying text or audio files for all user interfaces associated with delivered devices and systems. Full instructions on use of the tools will be provided in the software user manuals delivered for review and acceptance during design review.	All Applicable CDRLs
3.2-8	All furnished equipment will be designed to conform to standard wiring practices, including generally accepted color coding used in the United States.	All Applicable CDRLs

3.3 Environmental Factors

System components will meet the following environmental operating requirements.

3.3.1 Environment & Climate Tolerance

Req #	Requirement	Assigned CDRL(s)
3.3.1-1	Platform validators will be: • Designed to be installed in the open environment of the Portland, Oregon region with no shelter provided over the 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 Normal operation of the equipment in this environment will not in any way impair equipment performance or operational life.	CDRL 6-12 CDRL 6-13

3.3.1-2	Fare inspection devices will be designed for installation and use in the operating environment in which the components are expected to operate, including be exposure to salt laden air, direct sunlight, snow, ice and laterally wind-driven rain. Normal operation of the equipment in this environment will not in any way impair equipment performance or operational life.	CDRL 6-14 CDRL 6-15
3.3.1-3	The platform validators and fare inspection devices provided by the Contractor shall be able to operate and not suffer any degradation in performance under the following environmental conditions: • Storage temperature: -25° to +150°F • Operating temperature: -5°F to 120°F ambient • Thermal shock: 1° per minute drop in temperature over a 15° range between 110° and 60°F • Relative humidity: 15-95 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 system components from cleaning floors and walls, industrial cleaning solvents, rain, mud, snow and slush • Fog: salty fog characteristic of the Agencies' service region • 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 Portland area, including salt, volcanic ash, dust and corrosive or base chemicals	CDRL 6-12 CDRL 6-13 CDRL 6-14 CDRL 6-15
3.3.1-4	Onboard validators will be: • Designed, built, and installed for the harsh, high shock and vibration operating environment in which this system component will operate • Available within five (5) seconds of engine on, and operational until a TriMet configurable time after ignition off, subject to normal operating conditions • Protected to prevent degradation from exposure to moisture or dust raised by interior cleaning Normal operation of the fare collection equipment in this environment will not in any way impair equipment performance or operational life.	CDRL 6-12 CDRL 6-13
3.3.1-5	The onboard system components provided by the Contractor shall be able to operate and not suffer any degradation in performance under the following environmental conditions: • Storage temperature: -25° to +150°F • Operating temperature: -5°F to 120°F ambient • Thermal shock: 1° per minute drop in temperature over a 15° range between 110° and 60°F	CDRL 6-12 CDRL 6-13

	• Relative humidity: 15-95 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 system components from cleaning floors and walls, industrial cleaning solvents, rain, mud, snow and slush • Fog: salty fog characteristic of the Agencies' service region	
3.3.1-6	The onboard system components provided by the Contractor shall be tested and certified to operate under the environmental condition specified below: • Standard transit agency specifications which are attached to this document • SAE J1455 and all standards contained therein	CDRL 6-12 CDRL 6-13
3.3.1-7	Retail sales terminals will be designed for installation and use in the operating environments in which the components are expected to operate, including exposure to moisture or dust raised by cleaning. Normal operation of the fare collection equipment in this environment will not in any way impair equipment performance or operational life.	CDRL 6-16 CDRL 6-17
3.3.1-8	The retail sales devices and back office components provided by the Contractor shall be able to operate and not suffer any degradation in performance under the following environmental conditions: • Operating temperature: 50°F to 100°F • Relative humidity: 20-80 percent, non-condensing	All Applicable CDRLs
3.3.1-9	The Contractor shall provide fans, heat sinks, heaters and other devices necessary to control internal temperature and humidity conditions in order to maintain proper operation of the system components.	All Applicable CDRLs
3.3.1-10	Provisions will be installed to maintain an internal operating temperature range between the minimum and maximum operating temperatures of internal components, as specified by the system components manufacturers, and as necessary to ensure system component reliability. Solar load and heat generated by internal components will be added to the operating environment.	All Applicable CDRLs
3.3.1-11	Means will be provided to detect failure of any cooling device and provide for a controlled shutdown of the system components and notification of a maintenance event through the device monitoring system.	All Applicable CDRLs

3.3.2 Shock & Vibration

Req #	Requirement	Assigned CDRL(s)
3.3.2-1	System components will be designed to withstand structure-borne stresses and vibrations caused by the passing of trains or other vehicles as well as emergency braking of fully-loaded trains.	All Applicable CDRLs

3.3.2-2	Fare collection system 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 system components.	All Applicable CDRLs
3.3.2-3	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 resonance.	All Applicable CDRLs
3.3.2-4	Onboard and platform validators will additionally meet the following shock and vibration requirements: • MIL-STD 810D, Method 516-3, procedure I, 20 g(s), 11 ms • MIL-STD 810D, Method 514.3, category 8 modified. 1.0g, 5 Hz-500 Hz; 1.5g (RMS)	CDRL 6-12 CDRL 6-13
3.3.2-5	System components and mounts will be sufficiently constructed to comply with local code regarding stability of structures and contents in earthquakes.	All Applicable CDRLs

3.3.3 Power & Voltage Requirements

Req #	Requirement	Assigned CDRL(s)
3.3.3-1	The Contractor shall design, supply, install, test, and commission all system elements necessary to provide the required electrical power to the Contractor-supplied components.	All Applicable CDRLs
3.3.3-2	Electrical power will be obtained from existing power sources and will be filtered, transformed, converted, battery-stored, and distributed by the Contractor as required, including all necessary connections and terminations.	All Applicable CDRLs
3.3.3-3	Primary power will be provided by the Agencies at primary equipment locations and may not be clean and isolated at the voltage level required by the Contractor-supplied system components. Any necessary conditioning of the primary power or addition of line interface filters or power supplies will be the responsibility of the Contractor, and if required, will be located within the equipment enclosures.	All Applicable CDRLs
3.3.3-4	All fare collection system components will be designed to operate with a plus or minus 10 percent fluctuation in line voltage without any damage or service interruption.	All Applicable CDRLs

3.3.3-5	System components will retain any and all information stored in non-volatile memory under any conditions of the power supply.	All Applicable CDRLs
3.3.3-6	No condition occurring in the power source will cause any degradation to fare media being processed when the power condition occurs.	All Applicable CDRLs
3.3.3-7	Onboard and platform validators will be provided with an external power supply or conditioner that will allow the equipment to meet the following requirements: • Over-voltage protection up to 1000V for up to 10ms • Current-limiting protection (values to be determined by vehicle and device specifications) • Protection against electromagnetic interference (EMI) conditions as follows: o Immunity: EN 50121-4; EN61000-6-2 o Emissions: EN 61000-6-3; FCC part 15 Class B; e marking, electrical/electronic devices • Operation with input voltages between 9Vdc and 42.5Vdc • Nominal operating voltage range between 10V-18V (subject to device specifications)	CDRL 6-12 CDRL 6-13
3.3.3-8	Onboard and platform validators will include a built-in battery for protection against power fluctuations and outages.	CDRL 6-12 CDRL 6-13
3.3.3-9	Onboard and platform validators will meet the following flammability requirements: • UL 94 V-O • UL HB	CDRL 6-12 CDRL 6-13
3.3.3-10	The onboard system components will be designed to operate reliably from a transit coach's direct current power source without malfunction.	CDRL 6-12 CDRL 6-13
3.3.3-11	The onboard system components will be protected against damage, loss or modification of data caused by: • Voltage fluctuations • Reverse polarity of the input voltage • Temporary voltage variations • Over-current draw	CDRL 6-12 CDRL 6-13
3.3.3-12	The onboard system components power supply will include adequate filters and components to regulate the coach-supplied voltage and render it devoid of power spikes and noise. Provisions will include elimination 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 6-12 CDRL 6-13
3.3.3-13	Adequate protection against transient surges on the coach power supply will be incorporated to the extent necessary to prevent damage to electronic components of the onboard system components.	CDRL 6-12 CDRL 6-13

3.3.3-14	Power sensing will be incorporated into onboard system 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 6-12 CDRL 6-13

3.3.4 Electrical Noise Requirements

Req #	Requirement	Assigned CDRL(s)
3.3.4-1	The Contractor shall incorporate an approach to electromagnetic compatibility that will ensure the system components and subsystems will operate without being affected by or causing electromagnetic interference (EMI).	All Applicable CDRLs
3.3.4-2	Protection will be provided against radio frequency interference (RFI) emission sources, as well as internal conductive or inductive emissions.	All Applicable CDRLs
3.3.4-3	Operation of the system components 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.	All Applicable CDRLs
3.3.4-4	Operation of system components will not be adversely affected by station equipment such as lighting and communications equipment within close proximity to eFare system components.	All Applicable CDRLs
3.3.4-5	Onboard system components will be unaffected by interference such as radiation from vehicle equipment, including radio, lights, electronic destination signs, air conditioners, and generators.	CDRL 6-12 CDRL 6-13
3.3.4-6	Onboard system components will not emit measurable EMI or RFI that produces harmful interference with any other onboard electronic device or system.	CDRL 6-12 CDRL 6-13
3.3.4-7	The Contractor shall certify the electromagnetic compatibility of system components to be furnished. The Contractor shall provide results of interaction analysis and testing of each system component with regard to frequency distribution, amplitude, and harmonic content.	All Applicable CDRLs
3.3.4-8	Existing certifications, interaction analysis, and testing will be submitted for review and acceptance during design review.	All Applicable CDRLs

3.3.5 Grounding

Req #	Requirement	Assigned CDRL(s)
3.3.5-1	All equipment 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 supplied system components are connected to a	All Applicable CDRLs

	common ground point.	
3.3.5-2	The Contractor 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.	All Applicable CDRLs
3.3.5-3	The Contractor shall provide certification that the system components furnished have been tested to meet UL applicable criteria. Documentation citing UL certification or acceptable test results will be provided. Prior certification of identical equipment and "UL Field Evaluated Marked" will also be acceptable.	All Applicable CDRLs

3.4 Standards, Codes & Regulations

The eFare collection system provided will be configured to meet or exceed the applicable sections within the following standards and codes. Certification of compliance with codes by the governing organization may be requested depending on the applicability of the code.

- Americans with Disabilities Act (ADA)
- Architectural Barriers of 1968
- American National Standards Institute (ANSI)
- American Public Transit Association (APTA)
- American Society for Quality Control (ASQC)
- American Society of State Highway and Transportation Officials (AASHTO)
- America Society of Mechanical Engineers
- American Wire Gage
- Europay, MasterCard, Visa (EMV)
- Financial Accounting Standards Board (FASB)
- Fire Insurance Association
- Generally Accepted Accounting Principles (GAAP)
- Institute of Electrical and Electronics Engineers
- Instrument Society of America
- Intelligent Transportation System America (ITSA)
- International Standards Organization (ISO)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association
- National Fire Protection Association (NFPA)
- Occupational Safety and Health Act (OSHA)
- Oregon Electrical Specialty Code (OESC)
- Oregon Mechanical Specialty Code (OMSC)
- Oregon Fire Code (OFC)
- Payment Card Industry (PCI)
- Rehabilitation Act of 1973 (Article 504)
- Request for Comments for TCP/IP
- Transit Communications Interface Protocols (TCIP) and Transit Standards Consortium (TSC)
- Underwriters Laboratories (UL)
- Uniform Building Code (UBC)

- Uniform Federal Accessibility Standards (FED-STD-795)
- Uniform Mechanical Code (UMC)
- Uniform Plumbing Code (UPC)
- Vending Equipment Interface Specification
- Washington State Mechanical Code (IMC 2009)
- Washington State Electrical Code (NEC 2006)
- Washington State Fire/Life Safety Code (IFC 2009)
- Washington State Accessibility Code (ADAAG)

In addition, all equipment provided will meet or exceed all applicable federal, state and local laws, codes and regulations.

3.5 Software Requirements

3.5.1 Open Source

TriMet has a preference for the use of open source software in the design and deployment of the eFare system.

Req #	Requirement	Assigned CDRL(s)
3.5.1-1	Any open source software, or Vendor-developed software provided as open source will include an open source license or an equivalent free-use software license.	All Applicable CDRLs

3.5.2 Software Licenses & Ownership

Req #	Requirement	Assigned CDRL(s)
3.5.2-1	Any software not provided under an open source license as described in Section 3.5.1 will be considered "licensed or owned software" for the purposes of these specifications.	All Applicable CDRLs
3.5.2-2	TriMet will be granted ownership or a perpetual, non-exclusive, irrevocable and royalty-free license to use and distribute the licensed software in conjunction with its operation of the eFare system.	All Applicable CDRLs
3.5.2-3	If the Contractor obtains any licensed software from a subcontractor, contractor or other vendor during implementation of this contract, the Contractor shall obtain from them, for the benefit of TriMet and the Agencies, a software license in accordance with the terms of this contract.	All Applicable CDRLs
3.5.2-4	TriMet will own any data generated by the systems and software delivered under this contract, regardless of the license structure. TriMet will be able to freely access and distribute all data free of charge.	All Applicable CDRLs

3.6 Service-Proven Design

Req #	Requirement	Assigned CDRL(s)
3.6-1	The eFare system design will be service proven. TriMet will assess the extent to which it is "service proven" according to the risk associated with the particular design.	All Applicable CDRLs
3.6-2	A service-proven system design will meet all of the following criteria: • Has been successfully implemented at a minimum of one transit agency with an off-board fare environment on rail and a vehicle fleet size of at least 50 vehicle • Has been successfully implemented at a minimum of one transit agency with a bus fare environment and a vehicle fleet size of at least 100 vehicles • Has achieved a level of reliability consistent with the requirements in this specification	All Applicable CDRLs
3.6-3	Proposed validators will be nearly identical in design and components to a model deployed and in revenue service for a public or private agency for at least one (1) year.	CDRL 6-12 CDRL 6-13
3.6-4	Proposed inspection devices will be similar in design and components to a model deployed and in revenue service for a public or private agency for at least one (1) year.	CDRL 6-14 CDRL 6-15
3.6-5	Proposed retail sales devices will be nearly identical in design and components to a model deployed and in revenue service for a public or private agency for at least one (1) year.	CDRL 6-16 CDRL 6-17
3.6-6	To establish a design's service proven history, the Contractor shall submit specific details of the application history, certified by current users of the equipment.	All Applicable CDRLs
3.6-7	The Contractor 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 TriMet requirements. The Contractor shall show, in detail, what has been changed and why such changes will not adversely affect operation in the Portland environment.	All Applicable CDRLs

3.7 Required Submittals

The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 3-1	Design Review Plan	3.1.1	✓	✓	✓	
CDRL 3-2	Conceptual Design Review Package	3.1.2	✓			

CDRL 3-3	Preliminary Design Review Package	3.1.3		✓		
CDRL 3-4	Final Design Review Package	3.1.3			✓	
CDRL 3-5	Human Factors Analysis	3.1.3		✓	✓	
CDRL 3-6	ADA Compliance			✓	✓	

4 Fare Policy

This section describes the fare policies that will be supported by the eFare system.

Req #	Requirement	Assigned CDRL(s)
4-1	The Contractor shall develop and implement all business rules necessary to support enforcement of the eFare fare policies.	CDRL 4-1

4.1 Payment Options

Customers using the eFare system will have two options for paying a fare:

- Closed-loop payment
- Open payment

Closed-loop payment will use agency or third-party issued fare media, linked to a closed-loop transit account, to enable the payment of fares at all Agencies. Alternatively, customers will be able to pay fares directly using bank-issued open payment media. The following table summarizes the fare payment options that will be available to customers.

Table 4-1. eFare Payment Options

Fare Media	Payment Account	Fare Products	Customer Eligibility
Agency or Third-Party Issued Extended-Use Media	Closed-Loop Transit Account	Stored Value	Full Fare Customers Reduced Fare Customers Institutional Customers
		Institutional Products	Institutional Customers Only
Agency Issued Limited-Use Media	Closed-Loop Transit Account	Stored Value	Full Fare Customers Reduced Fare Customers Institutional Customers
		Institutional Products	Institutional Customers Only
Bank-Issued Media	Open Payment Account	N/A	Full Fare Customers Reduced Fare Customers (via fare override)

4.1.1 Fare Media

4.1.1.1 Extended-Use Media

The Agencies will issue common extended-use fare media in the form of a transit card (see Section 2.2.2.2) and an NFC-based mobile ticketing application (see Section 5.1.7).

Req #	Requirement	Assigned CDRL(s)
4.1.1.1-1	The extended-use fare media will be linked to a closed-loop transit account that holds value loaded by the customer and is used for payment when accessing the system.	CDRL 2-1 CDRL 2-2 CDRL 6-3
4.1.1.1-2	The system will be capable of accepting third-party issued extended-use media, such as student ID cards and employee security badges, linked to closed-loop transit accounts (see Section 2.2.2.4). This feature will not be enabled at launch.	CDRL 2-1 CDRL 2-2 CDRL 6-3

4.1.1.2 Limited-Use Media

The Agencies will issue common limited-use fare media in the form of a limited-use smart card (see Section 2.2.2.3).

Req #	Requirement	Assigned CDRL(s)
4.1.1.2-1	The limited-use fare media will be linked to a closed-loop transit account that holds value loaded by the customer and is used for payment when accessing the system.	CDRL 2-1 CDRL 6-2
4.1.1.2-2	Transit accounts associated with limited-use media will not be reloadable.	CDRL 2-1 CDRL 2-2

4.1.1.3 Open Payment Media

The eFare system will accept open payment media in the form of contactless credit and debit cards, and their mobile wallet equivalents, for the payment of fares (see Section 2.3).

Req #	Requirement	Assigned CDRL(s)
4.1.1.3-1	Open payment media will also be able to be used as a token, and linked to a closed-loop transit account. This feature may not be enabled at launch.	CDRL 2-1 CDRL 2-2 CDRL 6-2 CDRL 6-3

4.1.2 Fare Products

4.1.2.1 Stored Value

Stored value will be the only fare product available to members of the general public using the extended-use and limited-use fare media to access the eFare system. Customers will load stored value to a closed-loop transit account and spend that value by tapping the linked fare media at eFare validators prior to or upon boarding a transit vehicle.

Req #	Requirement	Assigned CDRL(s)
4.1.2.1-1	The system will support the loading of stored value to closed-loop transit accounts linked to extended-use and limited-use media.	CDRL 2-1 CDRL 2-2

		CDRL 6-3 CDRL 6-4
4.1.2.1-2	The system will support stored value payment for full fare, reduced fare and institutional customers.	CDRL 4-1 Other applicable CDRLs
4.1.2.1-3	Stored value payment will include fare capping and transfer privileges (see Sections 4.2.3 and 4.2.4).	CDRL 4-1 Other applicable CDRLs
4.1.2.1-4	The system will support the automatic assessment of a monthly dormancy fee against the stored value balance when a transit account has remained inactive (i.e., no loads or use) for a pre-defined period. The dormancy fee and inactivity period will be configurable within AMPS by the Agencies.	CDRL 4-1 Other applicable CDRLs

4.1.2.2 Institutional Fare Products

The Agencies will continue to offer configurable calendar- and ride-based fare products to participants of institutional programs (see Section 4.3).

Req #	Requirement	Assigned CDRL(s)
4.1.2.2-1	Institutional fare products to be offered will be defined during design review.	CDRL 4-1
4.1.2.2-2	Institutional fare products will be distributed using the institutional website (see Section 5.1.2.2) and will not be available to the general public.	CDRL 5-1

4.2 Fare Structure

All fares will be based on a flat fare structure.

Req #	Requirement	Assigned CDRL(s)
4.2-1	Each boarding will be priced at a single fare based on the agency and service being paid for, and the fare category associated with the payment account.	CDRL 4-1
4.2-2	Fare payment using the eFare system will require a single tap of contactless fare media at the time of boarding with no tap-off. Customers will be expected to tap on at all boardings, even if a fare does not need to be paid.	CDRL 4-1 Other applicable CDRLs
4.2-3	The eFare system will be capable of supporting distance-based fares (i.e., tap-on, tap-off), but this feature will not be included as part of the initial implementation.	CDRL 4-1 Other applicable CDRLs

4.2.1 Fare Categories

4.2.1.1 Full Fare

Full fare will be the default category assigned to closed-loop transit accounts, and will be associated with the default pricing charged by the system for the payment of closed-loop and open payment fares.

Req #	Requirement	Assigned CDRL(s)
4.2.1.1-1	Contractor shall design the eFare system to support the designation of closed-loop transit accounts as full fare by default.	CDRL 4-1 Other applicable CDRLs
4.2.1.1-2	Full fare customers will be able to pay fares using stored value and open payment media.	CDRL 4-1 Other applicable CDRLs

4.2.1.2 Reduced Fare

The reduced fare category will be assigned to closed-loop transit accounts linked fare media that are issued to customers who qualify to pay reduced fares by virtue of age, disability, or income.

Customers who qualify for reduced fares by virtue of age will purchase specially-marked fare media that are linked to closed-loop transit accounts designated as reduced fare. No pre-registration of age-based reduced fare transit accounts will be required.

Customers who qualify for reduced fares by virtue of a disability or income must go through the Agencies' approval process before being issued personalized extended-use media linked to a closed-loop transit account designated as reduced fare. Personalized media will be issued at the transit stores operated by the Agencies.

Req #	Requirement	Assigned CDRL(s)
4.2.1.2-1	Contractor shall design the eFare system to support the designation of closed-loop transit accounts as reduced fare for customers who qualify by virtue of age or disability.	CDRL 4-1
4.2.1.2-2	A minimum of five reduced fare designations shall be supported to enable the tracking of usage by different types of reduced fare customers, and unique fare options and pricing should they be required in the future.	CDRL 4-1 Other applicable CDRLs
4.2.1.2-3	Reduced fare customers will be able to pay fares using stored value.	CDRL 4-1 Other applicable CDRLs

4.2.1.2-4	The system will support the issuance of extended-use and limited-use fare media that is linked to a reduced fare transit account, and the addition or removal of a reduced fare designation for existing transit accounts.	CDRL 4-1 Other applicable CDRLs
4.2.1.2-5	The Agencies shall be able to configure and modify a validity period for a reduced fare designation, such that expiry results in automatic removal of the designation from the account (i.e., migration to a full fare account), or the blocking of the account and associated media.	CDRL 4-1 Other applicable CDRLs
4.2.1.2-6	When paying a fare using a transit account designated as reduced fare, a reduced fare (as defined by the Agencies' fare policies) will automatically be charged.	CDRL 4-1 Other applicable CDRLs
4.2.1.2-7	The Contractor-provided CAD/AVL Integration API (see Section 2.2.3.8) shall provide the ability for bus operators to perform a fare override via the CAD/AVL operator control unit that results in charging a reduced fare when a full fare transit account or open payment media is being used to pay a fare.	CDRL 2-9 CDRL 6-12

4.2.2 Fare Pricing

With few exceptions, services will be priced at a common base fare for each fare category.

Req #	Requirement	Assigned CDRL(s)
4.2.2-1	Fare pricing for each agency, service type, and fare category will be defined during design review, and will be configurable within AMPS by the Agencies.	CDRL 4-1 Other applicable CDRLs
4.2.2-2	The system will support fare pricing based on the service type, including "premium service" (e.g., C-TRAN express routes) that is priced higher than the base fare and "local service" (e.g., Streetcar service) that is priced lower than the base fare.	CDRL 4-1 Other applicable CDRLs
4.2.2-3	The system will support differential fare pricing based on the type of fare media or product used for payment (e.g., a fare paid using extended-use fare media may be discounted over the open payment or limited-use fare).	CDRL 4-1 Other applicable CDRLs
4.2.2-4	The eFare system will support configurable time-based fare pricing for closed-loop and open payment fares. The system will support peak/off-peak pricing, weekday/weekend pricing, and free-ride days and hours (e.g., free after 7 p.m. on Dec. 31 only) by service type.	CDRL 4-1 Other applicable CDRLs

4.2.3 Fare Capping

With the introduction of the eFare system, calendar pass and multi-trip fare products that are currently offered to the general public will be eliminated and replaced with stored value fare capping.

Req #	Requirement	Assigned CDRL(s)
4.2.3-1	Fare capping will be supported for customers that pay fares using stored value in a closed-loop transit account, or using open payment media.	CDRL 4-1 Other applicable CDRLs
4.2.3-2	Fare capping will establish a maximum fare value that a customer will be charged within a defined calendar period (e.g., day, week, month, or year).	CDRL 4-1 Other applicable CDRLs
4.2.3-3	Initially two capping periods will be supported by the eFare system, calendar-day and calendar-month (reset at end of service day), but the fare system will be configurable to support other capping periods, such as a week or year.	CDRL 4-1 Other applicable CDRLs
4.2.3-4	The fare capping algorithm will support configurable accumulators and threshold values based on the payment type, customer fare category, and the agency and/or service type (e.g., local service, express service, paratransit service) being accessed.	CDRL 4-1 Other applicable CDRLs
4.2.3-5	A regional fare accumulator with a common threshold value for all agencies and service types will be supported.	CDRL 4-1 Other applicable CDRLs
4.2.3-6	The system will allow the configuration of a maximum number of allowed rides within a capping period. When the maximum number of rides is reached the media will be blocked from further use during the capping period.	CDRL 4-1 Other applicable CDRLs
4.2.3-7	The fare capping algorithm and threshold values will be defined during design review, and will be configurable within AMPS by the Agencies.	All applicable CDRLs

4.2.4 Transfers

Transfers will be managed electronically by the eFare system.

Req #	Requirement	Assigned CDRL(s)
4.2.4-1	Transfers will be supported for customers that pay fares using stored value in a closed-loop transit account, or using open payment media.	CDRL 4-1 Other applicable CDRLs
4.2.4-2	The eFare system will support transfer credits for boardings that occur within a configurable timeframe of tapping at a fare validator.	CDRL 4-1 Other applicable CDRLs

4.2.4-3	Transfers will be free for customers transferring between routes or services with the same fares. For customers transferring to routes or services with higher fares, the system will support charging an upgrade fare equal to the difference between the applicable fares.	CDRL 4-1 Other applicable CDRLs
4.2.4-4	The initial transfer periods (i.e., time period during which a boarding is considered a transfer) and rules regarding allowable transfers will be defined during design review, and will be configurable within AMPS by the Agencies.	CDRL 4-1 Other applicable CDRLs

4.2.5 Fare Reciprocity

The splitting of fare revenue between the Agencies will be based on fare reciprocity agreements.

Req #	Requirement	Assigned CDRL(s)
4.2.5-1	The eFare system will perform fare reciprocity calculations that determine the allocation of fare revenue among all agencies.	All applicable CDRLs
4.2.5-2	Fares for single boarding journeys will be allocated based on the agency that provided the service. Multi-agency journeys involving transfers, institutional fare products, or an account where a fare cap has been reached will result in a formula-based allocation based on the type of service accessed, the number of boardings on each agency, and the value of the rides on each agency.	All applicable CDRLs
4.2.5-3	Revenue allocation will occur on a weekly basis with a monthly reconciliation (i.e., true-up) based on the final fare reciprocity calculations.	All applicable CDRLs
4.2.5-4	The allocated fare revenue will automatically be settled to the Agencies by the Financial Clearing and Settlement System (see Section 6.1.6).	All applicable CDRLs
4.2.5-5	The allocation formulas will be defined during design review, and will be configurable by the Agencies.	All applicable CDRLs

4.3 Institutional Programs

The eFare system will support the transition of existing institutional programs to the eFare system.

Req #	Requirement	Assigned CDRL(s)
4.3-1	The eFare system will support the group sale of fare media and value to employers, elementary and high schools, colleges and universities, event and convention organizers, and social service organizations.	CDRL 4-1 Other applicable CDRLs

4.3-2	Participating organizations will manage closed-loop transit accounts assigned to their participants using the institutional website (see Section 5.1.2.2), including adding value to accounts and updating account information as participants enter and leave the program.	CDRL 4-1 Other applicable CDRLs
4.3-3	Fare products available to institutional customers will include stored value that is available to the general public, as well as institutional fare products (see Section 4.3.1).	CDRL 4-1 Other applicable CDRLs
4.3-4	When paying fares using stored value loaded through the institutional programs, full fare pricing will apply, unless an institutional account is specifically designated as reduced fare.	CDRL 4-1 Other applicable CDRLs
4.3-5	The eFare system will support both pre-bill and post-bill payment for institutional programs (see Section 4.3.2).	All applicable CDRLs
4.3-6	The eFare system will support transit benefit sales under the institutional programs, including order management, invoicing, payment processing, and the bulk distribution of value.	All applicable CDRLs
4.3-7	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 4-1 Other applicable CDRLs

See Table 4-2 for descriptions of the existing programs and their expected treatment under the eFare system.

Table 4-2. Institutional Programs

	Programs		eFare Scheme		
Category	**Name**	**Description**	**Media**	**Fare Product[1]**	**Billing / Payment[2]**
Employer / Transit Benefits	Universal Annual Pass	100% employee participation required; priced based on ridership	Extended-use	Non-valued (post-bill) unlimited-ride annual pass	Post-bill; quarterly payment option
	Transit Benefits	Employees purchase value on opt-in basis at retail price	Extended-use	Annual Pass; Monthly Pass; Stored Value	Pre-bill; monthly, quarterly and split payment options
College	Universal Term Pass	100% student participation required; ridership-based pricing	Extended-use	Non-valued (post-bill) unlimited-ride pass	Post-bill
	Term Pass	Students purchase term passes on opt-in basis at retail price	Extended-use	Term pass (3-4 mo.)	Pre-bill
Student	Student Pass	PPS High School students (or subset based on eligibility criteria) ride free	Extended-use	Non-valued unlimited-ride pass	Pre-bill or post-bill
	Field Trips	Allows payment for groups of up to 35 students; one pass valid for entire group	Extended-use or limited-use	Configurable multi-fare, single-use pass	Pre-bill
Medical	Medical Transportation Program	Provides passes for customers using transit to travel to and from medical appointments	Extended-use and limited-use	Monthly Pass; Day Pass	Pre-bill or post-bill
Social Service	Social Service Bulk Sales	Agencies purchase passes and tickets for their clients	Extended-use and limited-use	Monthly Pass; Stored Value	Pre-bill; monthly
Special Event	Convention Pass	Qualifying conventions receive multi-day passes for their participants	Extended-use or limited-use	Configurable multi-day pass	Pre-bill
	Portland Timbers Pass	Timbers soccer club distributes game day passes for season ticket holders; valid day of event only	Extended-use or limited-use	Configurable multi-day pass	Pre-bill
	Event Pass	Events that distribute tickets in advance through ticket outlets can include a pass for every attendee	Limited-use	Day Pass	Pre-bill
Honored Citizen	Honored Citizen Downtown Pass	Honored Citizens ride free in the old downtown fare-less area; photo ID costs $10	Extended-use	Non-valued unlimited-ride pass	No bill

[1] Revenue for non-value products is expected to be collected outside of the eFare system

[2] While in most cases TriMet will choose to pre-bill customers, the system will be configured to accommodate invoicing arrangements for all institutional sales

4.3.1 Fare Media and Products

The eFare system will enable use of specific fare media and products to support the institutional programs.

Req #	Requirement	Assigned CDRL(s)
4.3.1-1	The fare media distributed as part of the institutional programs will be agency-issued extended-use and limited-use fare media.	CDRL 4-1 Other applicable CDRLs
4.3.1-2	The system will be capable of accepting media issued by participating institutions and social service organizations as tokens to access closed-loop transit accounts (see Section 2.2.2.4). This feature will not be enabled at launch.	CDRL 4-1 Other applicable CDRLs
4.3.1-3	The system will include calendar-based institutional fare products, including annual, monthly, day, and term-based passes.	CDRL 4-1 Other applicable CDRLs
4.3.1-4	The system will include date-specific institutional fare products that can be configured to allow access during both consecutive and non-consecutive days.	CDRL 4-1 Other applicable CDRLs
4.3.1-5	The system will include institutional group fare products that can be configured to record the payment of multiple fares in a single use.	CDRL 4-1 Other applicable CDRLs
4.3.1-6	The system will support unlimited-ride institutional fare products that track system access and allow the Agencies to bill an institution based on a participant's actual transit use.	CDRL 4-1 Other applicable CDRLs
4.3.1-7	The fare media and products available under each institutional program will be defined during design review.	CDRL 4-1 Other applicable CDRLs

4.3.2 Billing/Payment Terms

The eFare system will support a variety of payment arrangements for institutional programs.

Req #	Requirement	Assigned CDRL(s)
4.3.2-1	The eFare system will support both pre-bill and post-bill payment institutional programs: • Pre-bill – the system will generate sale transactions and require payment in advance of the fare media or value	CDRL 4-1 Other applicable CDRLs

	distribution • Post-bill – the system 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	
4.3.2-2	The eFare system will support multiple payment types for institutional sales, including single payments, periodic payments (i.e., monthly or quarterly), and payments spilt between an institution and a participant's personal funding source	CDRL 4-1 Other applicable CDRLs
4.3.2-3	The designation of billing and payment terms for institutional programs will be configurable by Agency staff.	All applicable CDRLs

4.4 Non-Transit Payment

4.4.1 Paratransit

The eFare system will interface with the paratransit trip scheduling systems operated by TriMet (LIFT) and C-TRAN (C-VAN) for the payment of paratransit fares. All LIFT and C-VAN trips are scheduled through Trapeze scheduling systems.

Req #	Requirement	Assigned CDRL(s)
4.4.1-1	The Contractor shall be responsible for integration with the Trapeze paratransit reservation systems for processing paratransit fare payments: • TriMet LIFT currently uses Trapeze-PASS Workstation version 8.0.48.0. TriMet plans to upgrade to Version 13 in the 1st quarter of 2014. Contractor shall integrate to version and build number provided by TriMet during design review. • C-TRAN's C-VAN currently uses Trapeze-PASS Workstation Version 10.0.14. Contractor shall integrate to version and build number provided by C-TRAN during design review.	All applicable CDRLs
4.4.1-2	LIFT and C-VAN customers will be able to establish closed-loop transit accounts that may or may not be linked to eFare media. Customers who ride LIFT and/or C-VAN exclusively will not need eFare media. Paratransit customers who ride both fixed route and paratransit services, will be required to obtain personalized reduced fare media (see Section 4.2.1.2)	CDRL 4-1 Other applicable CDRLs
4.4.1-3	The integration of eFare and the paratransit trip scheduling systems will result in the paratransit customer's eFare closed-loop transit account being automatically charged the correct fare when the reservation is entered into the Trapeze system(s).	CDRL 4-1 Other applicable CDRLs
4.4.1-4	Transfers will be supported between LIFT and C-VAN paratransit services and fixed route services.	CDRL 4-1 Other applicable CDRLs

4.4.1-5	Fare capping will be supported for customers who only ride paratransit service, and for customers that ride both paratransit and fixed route services.	CDRL 4-1 Other applicable CDRLs

4.4.2 Parking & Bicycle Sharing/Lockers

The eFare system will support the payment of parking fees at some park-and-ride facilities, and bike sharing and storage fees at various facilities.

Req #	Requirement	Assigned CDRL(s)
4.4.2-1	The Contractor-supplied fare payment API (see Section 2.2.3.3) will support integration with parking gates, bike lockers and similar equipment to enable the payment of parking and bike sharing fees using a closed-loop transit account.	CDRL 4-1 Other applicable CDRLs
4.4.2-2	The eFare system will support configurable parking- and bike sharing-specific business rules, including flat fees paid at entry, and time-based fees calculated between entry and exit taps.	CDRL 4-1 Other applicable CDRLs
4.4.2-3	The system will support the loading of pre-tax parking funds, which will be segregated within a closed-loop transit account and used only for the payment of parking fees.	CDRL 4-1 Other applicable CDRLs
4.4.2-4	Contractor shall design the eFare system to report and settle parking- and bicycle-related payments separate from transit fares.	All applicable CDRLs

4.5 Required Submittals

The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 4-1	eFare Business Rules	Section 4 – Fare Policy	✓	✓	✓	

5 Fare Distribution

The distribution of eFare media and value will occur through multiple channels. Given the high cost of operation and maintenance, reliance on TVMs will be minimized. Key to the eFare distribution strategy will be deployment of a robust retail network (services to be procured separately), support for the automatic reloading of value (i.e., autoload), and high-quality customer and institutional websites, as well as a mobile account management and ticketing application. The Agencies will also continue to operate transit stores that will support media and value sales, and the qualification of reduced fare customers. Fareboxes will continue to be used to accept cash fare payments on buses, but will not be an integrated component of the eFare system.

Req #	Requirement	Assigned CDRL(s)
5-1	The Contractor shall develop an eFare system that supports the all fare distribution options detailed in this section.	CDRL 5-1
5-2	The eFare back office will serve as the system of record and reporting for all fare media and value sales.	CDRL 5-1 CDRL 6-2

5.1 Distribution Channels

5.1.1 Retail

Retail locations will serve as the primary distribution channel for agency-issued full fare and reduced fare media (see Section 4.2.1), and the loading of value to closed-loop transit accounts. As part of the eFare system implementation, there will be a significant expansion of the retail network currently used to distribute fare media. Retail network deployment and distribution services will be procured separately, and wherever possible, will leverage the infrastructure used to sell, activate, and load closed-loop gift cards or pre-paid debit cards through the retailers' existing POS systems.

Req #	Requirement	Assigned CDRL(s)
5.1.1-1	Contractor shall work with the providers or owners of the retail distribution network to enable integration with the eFare back office.	NA
5.1.1-2	Contractor shall furnish a fare distribution API (see Section 2.2.3.2) that enables the retail network provider to format data generated through the retail network to be received and processed by the eFare back office for the sale of eFare media and loading of value to closed-loop transit accounts.	CDRL 2-3 CDRL 5-1
5.1.1-3	Contractor shall deliver a stand-alone retail sales terminal that connects directly to the eFare back office to enable the sale of eFare media and value at retail locations not affiliated with the retail network provider.	CDRL 5-1 CDRL 6-16 CDRL 6-17

5.1.2 Web

The web is a key component of the eFare distribution strategy. The Agencies place 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 Agencies will be actively involved in the website design.

5.1.2.1 Customer Website

Req #	Requirement	Assigned CDRL(s)
5.1.2.1-1	Contractor shall employ professionals in website design and e-commerce to design, develop, and deploy a customer-facing website that is PCI-DSS compliant, and serves as a convenient and comprehensive online portal for the purchase of eFare value and management of closed-loop transit accounts.	CDRL 5-1 CDRL 6-18 CDRL 6-19

5.1.2.2 Institutional Websites

Req #	Requirement	Assigned CDRL(s)
5.1.2.2-1	Contractor shall employ professionals in website design and e-commerce to design, develop, and deploy a customer-facing website that is PCI-DSS compliant, and serves as a convenient and comprehensive online portal for employers, schools, social service agencies, and other institutions to administer transit accounts on behalf of participants in institutional programs.	CDRL 5-1 CDRL 6-18 CDRL 6-20

5.1.3 Autoload

The eFare system will include the ability to automatically reload value to closed loop transit accounts (i.e., autoload) when the account balance falls below a certain threshold, or at a defined period.

Req #	Requirement	Assigned CDRL(s)
5.1.3-1	The Contractor-furnished eFare system 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 5-1
5.1.3-2	The autoload feature will support both threshold-based autoloads (reloading of value when a customer's account balance falls below an established minimum), and calendar-based autoloads (reloading of value on a customer- or system-designated date every month).	CDRL 5-1

5.1.3-3	Autoload will be able to be enabled using the customer and institutional website, through the customer call center (including the IVR), and at in-person customer service centers.	CDRL 5-1
5.1.3-4	Autoload funding source information will be stored within the CRM system in a tokenized form.	CDRL 5-1
5.1.3-5	A customer will be able to have two funding sources associated with their account, a primary funding source and a secondary funding source. The system will support splitting of an autoload payment between the two funding sources.	CDRL 5-1
5.1.3-6	Once a funding source has been established, customers will be able to be enable autoload using the customer and institutional websites, through the customer call center (including the IVR), and at agency transit stores	CDRL 5-1
5.1.3-7	The parameters governing threshold and calendar-based autoloads will be fully configurable and established during design review.	CDRL 5-1
5.1.3-8	The account-based nature of the eFare system will allow for autoload payment authorization prior to the loading of any value, and immediate use of the value once the load occurs.	CDRL 5-1

5.1.4 Call Center

The eFare system will support a call center to be operated by the Agencies or a third-party under a separate contract.

Req #	Requirement	Assigned CDRL(s)
5.1.4-1	The Contractor shall furnish an eFare system that enables fare media sales and value loads, as well as account management and general customer support via a customer call center **that is not part of this procurement**.	CDRL 5-1
5.1.4-2	The Contractor will furnish a Customer Relationship Management (CRM) system that allows call center staff to perform all necessary customer service functions.	CDRL 5-1 CDRL 6-22
5.1.4-3	The Contractor shall provide a robust Interactive Voice Response (IVR) system that serves to manage call volume and provides customers with a mechanism for obtaining answers to questions and performing account management functions without having to speak to a call center representative.	CDRL 5-1 CDRL 6-22

5.1.5 Transit Stores

The Agencies will continue to operate existing in-person customer service centers, or transit stores (TriMet has one; C-TRAN has two), which will serve as locations for customers to make transit inquiries, purchase new fare media and load value, set up autoload, register transit accounts, and register for reduced fare classifications. Access to the eFare system to perform these functions will be via the web-

based CRM tool (see Section 6.1.5), or in the case of TriMet, direct integration of their existing transit store point of sale (POS) system.

Req #	Requirement	Assigned CDRL(s)
5.1.5-1	The Contractor-provided CRM system (see Section 6.1.5) will support user access controls that enable functions specific to operation of the agency transit stores.	CDRL 5-1
5.1.5-2	The Contractor shall provide APIs to support the integration of the TriMet POS system with the eFare back office (see Section 2.2.2).	CDRL 5-1 Other applicable CDRLs
5.1.5-3	The Contractor shall provide technical support for TriMet's integration of the existing POS system as part of the eFare implementation.	CDRL 5-1
5.1.5-4	The transit store locations will accept a wide variety of payments, including pre-tax transit vouchers, which may not be accepted through other channels. Payments accepted through the TriMet POS system will be recorded by the eFare back office.	CDRL 5-1

5.1.6 Ticket Vending Machines

A TVM network to be procured separately will issue limited-use fare media (see Section 4.1.1.2). The TVMs will connect to a stand-alone TVM back office (procured along with the TVMs), which will enable device monitoring for maintenance and revenue servicing, as well as the tracking of cash received by the devices. Transaction data resulting from fare media sales at the TVMs will be captured by the eFare back office for the creation of a transit account within AMPS. The TVMs will not serve as a reload station for closed-loop transit accounts.

Req #	Requirement	Assigned CDRL(s)
5.1.6-1	Contractor shall work with the TVM system supplier to enable integration between the TVM back office and eFare back office.	NA
5.1.6-2	The interface of the eFare back office to the TVM back office will support real-time processing of eFare media sales.	CDRL 5-1 CDRL 6-2
5.1.6-3	Contractor shall furnish APIs that enable the TVM network supplier to format sales data generated by the TVMs so that it can be received and processed by the eFare back office (see Section 2.2.2).	CDRL 2-3 CDRL 5-1
5.1.6-4	The eFare back office will serve as the system of record and reporting for all fare media sales, and will maintain the closed-loop transit accounts for all limited-use media.	CDRL 5-1 CDRL 6-2
5.1.6-5	Contractor shall design the limited-use media to be vended by the TVMs and work with the TVM network supplier to enable its deployment as a part of the eFare program (see Section 2.2.2.3).	CDRL 2-2 CDRL 5-1

5.1.7 Mobile Application

TriMet and local software development firm GlobeSherpa recently deployed a barcode-based mobile ticketing application known as TransitSherpa. The TransitSherpa application allows customers to purchase virtual single-ride tickets and passes using their mobile device, and display proof-of-payment onboard vehicles. The Contractor shall propose to partner with GlobeSherpa for the design and deployment of a mobile account management and contactless ticketing application to support the eFare system. The Contractor may also propose a mobile application that is not built in partnership with GlobeSherpa.

Req #	Requirement	Assigned CDRL(s)
5.1.7-1	Contractor shall propose to contract with GlobeSherpa to provide an account management and contactless ticketing mobile application to support fare distribution and payment under the eFare system. Contractor may propose a mobile application that is not developed in partnership with GlobeSherpa as an option (see Section 6.7).	CDRL 5-1

5.2 Required Submittals

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 5-1	Fare and Media Distribution Design	5.1	✓	✓	✓	

6 System Components

6.1 Back Office

6.1.1 General Requirements

The Contractor shall develop and deploy a fully integrated eFare back office. The back office will support all system functions described in the following sections.

Req #	Requirement	Assigned CDRL(s)
6.1.1-1	The Contractor shall develop and submit for Agency approval a back office hardware design document that provides a detailed description of all of the hardware components that will comprise the eFare back office and the purpose, functions, interdependencies, and power and communication requirements for each component.	CDRL 6-1
6.1.1-2	The Contractor shall develop and submit for Agency approval a back office architecture design document that provides both graphical and narrative descriptions of each software component of the back office. The back office architecture design document will include at a minimum the following: • Each software component including functional description, purpose, OEM, and version • Interfaces and communication flows between components	CDRL 6-2 CDRL 6-3
6.1.1-3	User access to all elements of the eFare back office, including all systems described in Sections 6.1.2 through 6.1.9, as well as the configuration interfaces for the websites (Section 6.5), IVR (Section 6.6), Backup and Disaster Recovery Systems (Section 12), and the hosting platforms (Section 13.5), will be controlled using profiles maintained in Contractor-provided user management software. The eFare system will also support use of the Agencies' existing user access control platforms where they exist.	CDRL 11-3

6.1.2 Account Management & Processing System

The primary component of the eFare back office will be the Account Management and Processing System (AMPS), which will maintain all closed-loop transit accounts, and perform fare calculation and validation for both open and closed-loop payments.

Req #	Requirement	Assigned CDRL(s)
6.1.2-1	AMPS will enable the following system functions: • Issuance of closed-loop fare media (i.e., creation of a new transit account) • Loading of value to closed-loop transit accounts (with	CDRL 6-4

	immediate availability) • Maintenance of closed-loop transit account balances and transaction history • Inquiry of closed-loop transit account balances and transaction history • Fare calculation for both open and closed-loop fare payments • Determination of which transactions require bank authorization • Fare payment validation for both open and closed-loop fare payments	
6.1.2-2	The eFare systems and devices will access these functions using the Contractor-provided APIs, and through a direct, real-time connection with AMPS.	CDRL 6-4
6.1.2-3	AMPS will support the processing of both closed-loop and open fare payments.	CDRL 6-4
6.1.2-4	For closed-loop fare payments, AMPS will maintain a transit account storing all closed-loop value loaded by the customer, and deduct value from the account as it is used for payment.	CDRL 6-4
6.1.2-5	When accepting open payments, AMPS will create a transit account that allows for the tracking of payments, payment aggregation, and the conferring of discounts as permitted by the Agencies' fare policies.	CDRL 6-4
6.1.2-6	Fare processing will occur in real-time for all payment types. Processing timing requirements are specified in Section 6.2.2.	CDRL 6-4
6.1.2-7	AMPS will query or create the associated transit account, perform fare pricing, and submit the payment for authorization or update the account balance prior to providing an authorization or decline response to the fare payment device.	CDRL 6-4
6.1.2-8	For closed-loop payments, the authorization transaction generated by AMPS will include the customer fare category associated with the account, as well as with fare product used for payment and remaining balance where applicable.	CDRL 6-4
6.1.2-9	AMPS will support the real-time loading of closed-loop fare value through all fare distribution channels.	CDRL 6-4
6.1.2-10	The loading of fare value will require a connection to AMPS at all times. No loading of value to a transit account will be permitted without an active connection to AMPS.	CDRL 6-4
6.1.2-11	Payments will be authorized prior to the loading of any value. Following payment authorization, AMPS will update the account in real-time to allow for immediate use of the value by the customer.	CDRL 6-4

6.1.2-12	User interface access to all elements of AMPS will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1. Individual users or user groups will have access configured to allow for standard business operations.	CDRL 6-4

6.1.3 System Monitoring & Management Application

Req #	Requirement	Assigned CDRL(s)
6.1.3-1	The Contractor shall develop and implement a system monitoring and management application that allows for real-time remote monitoring and control of all eFare devices and systems.	CDRL 6-5
6.1.3-2	Device monitoring and management features will be accessible down to the component-level to support system operations.	CDRL 6-5
6.1.3-3	The system monitoring and management platform will be accessible in real-time through desktop and mobile client software, or via an internet web browser. Web access may have limited functionality for security purposes.	CDRL 6-5
6.1.3-4	User interface access to all elements of the system monitoring and management application will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1. All accounts will be password protected, and the displayed information and allowed functions will be restricted based on centrally defined user-access privileges.	CDRL 6-5
6.1.3-5	The device monitoring and management application will provide real-time status, events, alarms, and error codes for each fare collection device and system in both text and graphical format using the Contractor-provided device management APIs (see Section 2.2.3.7).	CDRL 6-5
6.1.3-6	Text and graphical formats will be used to provide overall system status with drill-down capabilities, including but not limited to location, device type, service status, and error type. Critical status information will be highlighted.	CDRL 6-5
6.1.3-7	The monitoring system graphical view will display a system map that can be drilled-down by location or group of locations. The system map will be configurable and allow editing of locations and location names as system expansion occurs.	CDRL 6-5
6.1.3-8	The monitoring system graphical view will allow each participating agency to define vehicle groups as one location with drill-down to distinct vehicles.	CDRL 6-5

6.1.3-9	The following component status information will be provided (as applicable) for the retail sales terminals: display screen, processing unit/board, contactless media reader, alphanumeric keypad, receipt printer, credit/debit card reader, power supply, audio subsystem, memory/storage subsystem, communications interfaces, security/alarm status, and all other hardware components that impact revenue operation.	CDRL 6-5
6.1.3-10	The following component status information will be provided (as applicable) for payment validators: display screen, processing unit/board, contactless media reader, power supply, microprocessor, audio subsystems, memory/storage subsystems, communications interfaces, security/alarm status, and all other hardware components that impact revenue operation.	CDRL 6-5
6.1.3-11	The following component status information will be provided (as applicable) for fare inspection devices: display screen, contactless media reader, battery, audio subsystems, memory/storage subsystems, communications interfaces, location/security status, and all other hardware components that impact revenue operation.	CDRL 6-5
6.1.3-12	The following status information will be provided (as applicable) for the back office system: AMPS services (fare calculation engine, fare validation engine, and account manager), CRM system services, FCSS services, payment gateway services, data warehouse services, reporting system services, customer and institutional website services, IVR services, and all other system services that impact daily operation.	CDRL 6-5
6.1.3-13	The following status information will be provided (as applicable) for the network infrastructure and each network node: physical network status, wireless network status, real-time network traffic, firewall/security configuration status, network device (hubs/switches/routers) status, and server disk/memory utilization.	CDRL 6-5
6.1.3-14	The system management platform will issue commands through an appropriate command protocol. The protocol chosen will be supported by all eFare devices and systems, and take into account the expected network traffic associated with an account-based fare collection system.	CDRL 6-5
6.1.3-15	The system management application will allow the real-time issuance of device commands using the Contractor-provided device management APIs (see Section 2.2.3.7).	CDRL 6-5
6.1.3-16	Retail sales terminal commands will include reset device, out of service, shut down, power up, update software, resend transaction data, clear memory, maintenance mode, and reset for individual hardware components.	CDRL 6-5

6.1.3-17	Payment validator commands will include reset device, out of service, shut down, power up, update software, resend transaction data, clear memory, maintenance mode, and reset for individual hardware components.	CDRL 6-5
6.1.3-18	Inspection device commands will include lock device, shut down, power up, resend transaction data, and clear memory.	CDRL 6-5
6.1.3-19	Back office system commands will include restart AMPS services (fare calculation engine, fare validation engine, and account manager), restart CRM system services, restart FCSS services, restart payment gateway services, restart data warehouse services, restart reporting system services, restart web server services, restart IVR services, and management of all other system services that impact daily operation..	CDRL 6-5
6.1.3-20	Network infrastructure commands will include enable/disable network nodes, set firewall/security configuration, and reset/block network devices (hubs/switches/routers).	CDRL 6-5
6.1.3-21	The system monitoring and management application will provide access, either directly or through an interface with other systems, to a centrally managed system configuration tool. The tool shall enable configuration by the Agencies of all settable parameters within the system, including but not limited to, those identified in these specifications.	CDRL 6-5
6.1.3-22	The monitoring and management system interface and functionality will be subject to Agency review and approval during design review.	CDRL 6-5

6.1.4 Maintenance & Inventory Management System

Req #	Requirement	Assigned CDRL(s)
6.1.4-1	The Contractor shall deploy a Maintenance and Inventory Management System (MIMS) that provides central management and tracking of all eFare maintenance activities, and inventory control for all eFare devices and media.	CDRL 6-6
6.1.4-2	The MIMS will interface with TriMet's and C-TRAN's existing Maintenance Management Information Systems (MMIS) to provide a comprehensive system inventory, monitoring, and performance platform. The combined systems will track all system maintenance issues from identification through resolution, and will provide analytics to improve maintenance performance through the life of the program.	CDRL 6-6

6.1.4-3	The Contractor shall develop a two-way data feed between the MIMS and the Agency's MMIS systems to transmit maintenance incidents and inventory updates to the appropriate agency system. The Agency MMIS systems will continue to be used for agency-level inventory and maintenance ticket management. The Contractor-provided MIMS system will be used for system-level performance monitoring and inventory management.	CDRL 6-6
6.1.4-4	Maintenance incidents will be able to be created manually within the MIMS system, and through the Agency MMIS systems, by designated personnel, as well as automatically generated based on device events and alarms received through the system monitoring and management application (see Section 6.1.3).	CDRL 6-6
6.1.4-5	The MIMS will have the capability to automatically generate emails or text messages when maintenance incidents are created or change status.	CDRL 6-6
6.1.4-6	The MIMS will provide central inventory management for all eFare devices and maintain device location status to support device monitoring, system reporting, and agency maintenance activities.	CDRL 6-6
6.1.4-7	All Contractor-supplied devices shall be capable of self-reporting their location, including bus, platform, garage, or retail location, upon installation or swap-out. Device locations in MIMS shall be updated automatically based on the device-reported location, or through manual entry into the MIMS or Agency MMIS systems by authorized personnel.	
6.1.4-8	The MIMS will provide central inventory management for eFare media distributed through all distribution channels. The MIMS will interface with the CRM system (see Section 6.1.5) to support order management, and track inventory as it is sent to distribution locations for issuance to customers.	CDRL 6-6
6.1.4-9	User accounts will be password protected. The allowed maintenance functions will be restricted based on centrally defined user-access privileges. User interface access to all elements of the MIMS will be will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1.	CDRL 6-6
6.1.4-10	The maintenance management system interface and functionality will be subject to Agency review and approval during design review.	CDRL 6-6

6.1.5 Customer Relationship Management System

Req #	Requirement	Assigned CDRL(s)
6.1.5-1	The Contractor shall deploy a Customer Relationship Management (CRM) system that allows for the central management of all customer data, customer service operations, order management, and the cradle-to-grave tracking of customer service incidents.	
6.1.5-2	The CRM system will be supported by an isolated customer database, which will be fully PCI-compliant and compliant with agency, local, and state policies for the handling of customer PII.	CDRL 6-7
6.1.5-3	The CRM system will store all customer personal and payment information for registered transit accounts and accounts set up for the automatic reloading of value (i.e., autoload).	CDRL 6-7
6.1.5-4	The CRM system will serve as the repository for information on all customers applying for a reduced fare classification, including applications and supporting documentation, eligibility parameters, and card personalization information, such as a customer photograph.	CDRL 6-7
6.1.5-5	A CRM tool will support call center and transit store operations and provide the primary interface for customer service staff to access the CRM database and supporting systems.	CDRL 6-7
6.1.5-6	The CRM tool will allow customer service staff to create, view, and modify customer accounts, including: • Creation of a new customer account (i.e., registration of an associated transit account) • Association of transit accounts to an existing customer account • Modification of customer account registration data • Addition and modification of payment data associated with a customer account	CDRL 6-7
6.1.5-7	The CRM tool will connect to AMPS through the using the Contractor-provided APIs (see Section 2.2.3), and provide a fully integrated interface for customer service staff to view and update transit accounts.	CDRL 6-7
6.1.5-8	The CRM tool will enable customer service staff to create, view, and modify closed-loop transit accounts, including: • Creation of a new transit account (i.e., issuance of eFare media) • Loading of eFare value • Viewing of transaction history and fare calculation for open and closed-loop payments • Modification of transit account balances through generation of an account adjustment or refund	CDRL 6-7

6.1.5-9	All actions resulting in a change to a customer or transit account will be recorded in the CRM system.	CDRL 6-7
6.1.5-10	The CRM system will support the association of multiple transit accounts with a single customer account for account management and the loading of value.	CDRL 6-7
6.1.5-11	The CRM system will support the management of institutional programs (see Section 4.3), which will allow customers and the associated transit accounts to be linked to an institution for account management and the loading of value.	CDRL 6-7
6.1.5-12	The CRM system will provide central order management for the distribution of eFare media and value through all distribution channels, including intuitional programs. The CRM system will interface with the MIMS (see Section 6.1.4) to maintain proper inventory controls.	CDRL 6-7
6.1.5-13	The customer service tool will allow the viewing and creation of customer service incidents recorded within the CRM system.	CDRL 6-7
6.1.5-14	Customer service staff will be able to manually create incidents when responding to customer service issues over the web or phone.	CDRL 6-7
6.1.5-15	Customer service incidents will be created automatically based on customer-initiated actions performed through the website, mobile application, or IVR system.	CDRL 6-7
6.1.5-16	Customer service incidents will be linked to a specific customer account when the account is registered.	CDRL 6-7
6.1.5-17	Access to the CRM system and tool 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 will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1.	CDRL 6-7

6.1.6 Financial Clearing & Settlement System

Req #	Requirement	Assigned CDRL(s)
6.1.6-1	The Contractor shall deploy an enterprise-level Financial Clearing and Settlement System (FCSS) that maintains a general ledger of all financial activity within the eFare system, and supports the settlement of funds between the Agencies.	CDRL 6-8
6.1.6-2	The FCSS will be built using commercial-off-the-shelf (COTS) financial management software.	CDRL 6-8
6.1.6-3	The general ledger maintained within the FCSS will include accounts to track fare revenue, deferred revenue, accounts receivable, expenses, and other revenue offsets.	CDRL 6-8

6.1.6-4	The FCSS will allow for the full auditing of all eFare activity, including reconciliation of all eFare accounts, and end-to-end tracking of eFare revenue as it is generated and recognized by the participating agencies.	CDRL 6-8
6.1.6-5	The FCSS will produce reports, either directly or via the data warehouse, which accurately capture deferred and recognized revenue, in both summary and detail formats.	CDRL 6-8
6.1.6-6	The settlement of revenue between the agencies will be based on fare reciprocity formulas to be defined during design review (see Section 4.2.5). The FCSS will perform the necessary revenue distribution calculations to enable the settlement of funds.	CDRL 6-8
6.1.6-7	The FCSS will be capable of initiating the transfer of funds between agency bank accounts.	CDRL 6-8
6.1.6-8	The FCSS will include an Accounts Receivable (AR) module that supports the creation and management of accounts receivable within the general ledger.	CDRL 6-8
6.1.6-9	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 6-8
6.1.6-10	The AR module will create receivables for pre-bill and post-bill fare media and value sales, such as those generated as part of institutional and transit benefit programs. The AR system will support the issuance of refunds for media sales as needed.	CDRL 6-8
6.1.6-11	Receivables against individual customers will be supported in instances of funding source failures or negative account balances due to an offline payment authorization.	CDRL 6-8
6.1.6-12	The AR Module will support the application of payments (full and partial), credit memos, and adjustments against customer accounts. The process will support batch entry of receipts and lockbox functionality.	CDRL 6-8
6.1.6-13	The FCSS will support the setting of configurable credit limits for institutional and individual customers, and the automated generation of a credit hold and blocking of associated fare media when the credit limit is reached.	CDRL 6-8
6.1.6-14	The AR Module will support the automatic generation of interest charges on customer accounts that are past due, and generate dunning (collection) letters for overdue receivables when accounts become delinquent.	CDRL 6-8
6.1.6-15	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 6-8
6.1.6-16	The AR Module will support the automatic generation of monthly statements detailing customer account activity, including consolidation of multiple accounts receivable on to a single customer statement.	CDRL 6-8

6.1.6-17	The AR Module will provide standard AR reports, , either directly or via the data warehouse, including but not limited to aged trial balance (with "as-of date" functionality), customer transaction, cash on account, and customer listing reports.	CDRL 6-8
6.1.6-18	The AR Module will provide the ability to perform online queries of account activity (i.e., billing, collection, and adjustment) by customer and receivable.	CDRL 6-8
6.1.6-19	The FCSS will support integration with existing agency systems, both directly and through the data warehouse, for the automated generation of accounting entries.	CDRL 6-8
6.1.6-20	User interface access to all elements of the FCSS will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1. Individual users or user groups will have access configured to allow for standard business operations. Examples include ability to execute particular types of actions, etc.	CDRL 6-8

6.1.7 Payment Gateway

Req #	Requirement	Assigned CDRL(s)
6.1.7-1	The Contractor shall deploy a payment gateway that supports the secure processing of credit and debit payment transactions generated within the eFare system. Bank card payments generated by external systems, including the TVMs, TriMet POS systems, and retail network will not be processed by the payment gateway, but may be integrated in the future using the Contractor-supplied payment API (see Section 2.2.3.9).	
6.1.7-2	The payment gateway will connect directly to TriMet's payment processor, First Data, for the secure processing of payments.	CDRL 6-9
6.1.7-3	Contractor shall be responsible any system testing and certifications required to process payments through First Data.	CDRL 6-9
6.1.7-4	Contractor shall be responsible for demonstrating that the payment gateway is PCI-DSS compliant, and for providing the necessary PCI-DSS testing and certification.	CDRL 6-9
6.1.7-5	The payment gateway will use the Contractor-supplied payment API to capture payment transactions from all eFare devices and systems.	CDRL 6-9

6.1.7-6	The payment gateway will be used to process bank card payments generated by the following eFare devices/systems: • Payment validators/AMPS (open payment of fares) • Customer website (fare media and value sales) • Institutional website (fare media and value sales) • Mobile application (fare value sales) • CRM system (fare media and value sales, adjustments, and refunds) • IVR (fare media and value sales, adjustments, and refunds)	CDRL 6-9
6.1.7-7	With the payment gateway, the Contractor shall deliver an in-system tokenization solution, which will tokenize all open payment card information that it is accepted, processed and stored by the system, including during fare payment, fare media and value sales, autoload processing, and customer service inquiries.	CDRL 6-9
6.1.7-8	Any communications between the eFare system and payment processor will not use the full card number after the first transaction has been authorized, and eFare system will not use the full card number for the internal processing and storing transactions.	CDRL 6-9
6.1.7-9	The payment gateway will maintain records to support the auditing of payments processed, and to support dispute and chargeback resolution.	CDRL 6-9
6.1.7-10	The tokenization solution provided by Contractor shall allow for refunds and tracking of chargebacks without having to store the bank card number.	CDRL 6-9

6.1.8 Data Warehouse

Req #	Requirement	Assigned CDRL(s)
6.1.8-1	All data generated by the eFare system will be stored in a central data warehouse.	CDRL 6-10
6.1.8-2	The database engine will be the most current version of Oracle or approved equal accepted by the Agencies.	CDRL 6-10
6.1.8-3	The data warehouse will collect data from AMPS, system monitoring and management application, MIMS, CRM system, and FCSS to provide a central source for agency reporting.	CDRL 6-10

6.1.8-4	Data captured in the warehouse will include at a minimum: • Open and closed-loop fare payment transactions (including Geographic Information System data) • Closed-loop transit account sales transactions • Device events and alarms captured by the system monitoring and management application • Device location and inventory data • Maintenance incidents created within MIMS • Customer service incidents created within the CRM system • Actions within the CRM system affecting account value or status (e.g., credits, refunds, and adjustments) • Fare media and value orders created through the CRM system, including those associated with institutional programs • Accounting entries generated by the FCSS • Analytics data to support fraud detection and prevention	CDRL 6-10
6.1.8-5	The data warehouse will be fully compliant with agency policies for the handling of customer PII, but may not contain all customer information.	CDRL 6-10
6.1.8-6	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 card data, but still allow for the querying of transactions generated using a particular payment instrument.	CDRL 6-10
6.1.8-7	Data received from the various systems and maintained in the data warehouse will be maintained in an individual event, record or transactional format, and if aggregated, consolidated, or combined within the database, will be organized in such a way as to allow standard SQL query tools to extract events and transactions discretely. Normalization for purposes of improving database efficiency will be acceptable.	CDRL 6-10
6.1.8-8	The data warehouse will provide online access to detailed transaction information for analysis for no less than 18 months following the date that a transaction is generated. Summary data will be available online for four years.	CDRL 6-10
6.1.8-9	A user function will be available that allows cleanup and removal of old or unwanted data. This will be an administrative function that would permanently delete data from a specified date backwards.	CDRL 6-10
6.1.8-10	As part of implementation, the Contractor shall deliver a full and complete data dictionary and schema for the data warehouse.	CDRL 6-10
6.1.8-11	Data will be accessible by standard Structured Query Language (SQL) query tools. All data stored in the data warehouse will be retrievable as standard ASCII data using a standard SQL query.	CDRL 6-10

6.1.8-12	An interface to the data warehouse will provide the ability to query the database directly, export data in a variety of formats, and establish a connection to a third-party reporting tool for use in custom reporting.	CDRL 6-10
6.1.8-13	Access to the data warehouse will be password-controlled with the viewable data and allowed functions restricted based on centrally defined user-access privileges over a secure connection. User interface access to all elements of the data warehouse will be controlled through a centrally-managed user authentication and access control platform as required in Section 6.1.1.	CDRL 6-10
6.1.8-14	The Contractor shall provide a complete and detailed preliminary design for the data warehouse. This will include: • 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 data system • Communications protocols • Test procedures to ensure that all capabilities specified are indeed present • Data warehouse operating procedures • Specific means of transmitting data to other applications • Format of the data for transmission to other applications • This information will be submitted in draft at the preliminary design review. After review by TriMet and discussion with the Contractor, the final data warehouse description will be submitted at the final design review.	CDRL 6-10
6.1.8-15	This data warehouse design will be submitted in draft form at preliminary design review. The final data warehouse design will be submitted at the final design review.	CDRL 6-10

6.1.9 Reporting System

Req #	Requirement	Assigned CDRL(s)
6.1.9-1	The Contractor shall deploy a reporting system that interfaces with the data warehouse for the generation of canned and customized reports. A reporting tool will allow the viewing, running, and scheduling of predefined reports, with a querying interface to define and save custom reports.	CDRL 6-11
6.1.9-2	The reporting system shall support the querying and generation of reports using large datasets.	CDRL 6-11

6.1.9-3	Canned reports will include, but are not limited to: • Ridership reports • Sales reports • Revenue reports • Deferred revenue reports • Financial settlement reports • Maintenance reports • Device and system performance reports • Customer service reports • Exception reports • Device errors and alerts • Service planning reports • System and device availability reports	CDRL 6-11
6.1.9-4	The reporting system will have capability to define custom reports. These reports will be able to be shared across user types and accessed by all users of the reporting system.	CDRL 6-11
6.1.9-5	Reports will be able to be run through a web interface, and exported in several forms including but not limited to: Adobe Acrobat (PDF), Microsoft Excel (XLS), Microsoft Word (DOC), and comma separate value (CSV). All file formats will include the same data and general layout where possible. Data files (XLS and CSV) will be generated such that data can be extracted without formatting or graphic elements, and can be imported into other third-party reporting without manipulation.	CDRL 6-11
6.1.9-6	All report types will be able to be scheduled and automatically delivered to one or multiple email addresses through the web interface. Delivery to emails will be able to be scheduled on a daily, weekly, or monthly basis and in any of the available file types.	CDRL 6-11
6.1.9-7	Access to the reporting tool 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 as required in Section 6.1.1.	CDRL 6-11
6.1.9-8	Contractor shall be responsible for delivering the canned reports and up to 15 custom reports to be defined and developed with TriMet and the Agencies during design review and throughout system implementation.	CDRL 6-11

6.2 eFare Payment Validators

Payment validators are the customer facing devices that will be located onboard transit vehicles and at rail station platforms and will be used to pay transit fares. Unless otherwise stated, the following requirements apply to both onboard and platform validator configurations.

6.2.1 General Requirements

Req #	Requirement	Assigned CDRL(s)
6.2.1-1	Contractor shall provide payment validators in two primary configurations: • Onboard validator - intended for installation on a bus or streetcar • Platform validator - intended for outdoor, permanent installation at rail platforms	CDRL 6-12 CDRL 6-13
6.2.1-2	If validators are purchased from a third-party, the Contractor shall deliver the latest generation device manufactured by the OEM. If a newer generation device is released following design review, but prior to device procurement, the Agencies shall have the option to upgrade to the newer device.	CDRL 6-12 CDRL 6-13
6.2.1-3	Validators will support all common ISO-14443 (Type A and B), ISO 18092 (NFC), EMV, and closed-loop (e.g., the entire MIFARE product line) media formats, and provide expansion for the acceptance of user-defined formats.	CDRL 6-12 CDRL 6-13
6.2.1-4	Validators will be PCI-certified for the acceptance of bank-issued contactless credit and debit cards using all common formats (including but not limited to MasterCard PayPass, Visa PayWave, American Express ExpressPay, Discover Zip, and future EMV-compliant formats), and for the secure capture, transmission, and storage of bankcard data.	CDRL 6-12 CDRL 6-13
6.2.1-5	Validators will support a minimum of four (4) Secure Access Modules (SAMs) to facilitate acceptance of a variety of fare media formats with unique security keys.	CDRL 6-12 CDRL 6-13
6.2.1-6	Validators will accept the following fare media at a minimum: • Agency-issued extended-use media (see Section 2.2.2.2) • Agency-issued limited-use media (see Section 2.2.2.3 • Third-party-issued media (see Section 2.2.2.4) • Bank-issued contactless credit and debit cards and their mobile wallet equivalents • NFC-enabled mobile devices with an eFare payment application (see Section 6.7)	CDRL 6-12 CDRL 6-13
6.2.1-7	Validator software design will allow for accepted media formats, including user-defined formats, to be enabled and disabled via configurable parameters.	CDRL 6-13

6.2.1-8	Validators will be remotely configurable and managed through the system monitoring and management application (see Section 6.1.3). Validator software and configuration, including all white lists and hotlists will be managed through this system.	CDRL 6-12

6.2.2 Communications

Req #	Requirement	Assigned CDRL(s)
6.2.2-1	Onboard validators will be designed with an Ethernet port that enables connection to existing mobile data routers installed on TriMet and C-TRAN buses. Where available, the mobile data routers will serve as primary means of off-board communication with the eFare back office.	CDRL 6-12 CDRL 6-13
6.2.2-2	Platform validators will be designed with an Ethernet port that enables direct connection to the eFare back office.	CDRL 6-12 CDRL 6-13
6.2.2.-3	All validators will include an embedded cellular communications interface that supports third generation (3G GSM/CDMA) and fourth generation (4G) Long-Term Evolution (LTE) data networks on all major U.S. carriers. The embedded cellular communications will be used in instances where a mobile data router or Ethernet connection is not available.	CDRL 6-12 CDRL 6-13
6.2.2-4	All validators will include Wi-Fi (802.11a/b/g/n/ac) communications to enable integration with other systems, exchange of non-critical data at designated locations, and sharing of data connections on vehicles and at rail platforms.	CDRL 6-12 CDRL 6-13
6.2.2-5	Validators will be designed with a spare USB port to support the future connection of an ancillary device, such as a barcode reader.	CDRL 6-12

6.2.3 CAD/AVL Integration

Req #	Requirement	Assigned CDRL(s)
6.2.3-1	Contractor shall be responsible for integration of the onboard payment validator with the INIT CAD/AVL system installed on TriMet and C-TRAN vehicles. The integration will use the Contractor-supplied CAD/AVL Integration API (see Section 2.2.3.8) and the embedded communication interfaces.	CDRL 6-12 CDRL 6-13
6.2.3-2	Integration with the CAD/AVL systems will support single sign-on, the capture of geo-location data, and provide an auxiliary display and input device for the eFare system through the CAD/AVL operator control unit.	CDRL 6-13

6.2.3-3	Single sign-on will enable the CAD/AVL login and routing data, including operator ID, pattern, block, route, and direction, to be captured by the eFare validator. The login and routing data will be appended to every fare transaction generated by the eFare validator.	CDRL 6-13
6.2.3-4	The eFare validator will capture geo-location data generated by the CAD/AVL system, including Bus Stop ID and GPS coordinates. The geo-location data will be appended to every fare transaction generated by the eFare validator. Validators will also include an embedded global positioning system (GPS) receiver, and append local GPS coordinate information to each eFare transaction, in addition to and geo-location data provided by the CAD/AVL system.	CDRL 6-13
6.2.3-5	The CAD/AVL operator control unit will display fare payment results transmitted from the eFare validator, including fare payment approval or denial, and the case of approval, fare product and fare category associated with the transit account (e.g., adult, youth, or honored citizen) used for payment.	CDRL 6-13
6.2.3-6	The CAD/AVL operator control unit will be able to initiate a fare override function that will cause eFare validator 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 to support both open and closed-loop payments.	CDRL 6-13

6.2.4 Transaction Processing

Req #	Requirement	Assigned CDRL(s)
6.2.4-1	The eFare validators will automatically and continuously poll for all supported media formats.	CDRL 6-13
6.2.4-2	The eFare validators will be equipped with real-time communication to AMPS for the processing of fare payments using the Contractor-supplied fare payment API (see Section 2.2.3.3).	CDRL 6-12 CDRL 6-13
6.2.4-3	Prior to transmitting a fare payment transaction to AMPS, the validators will perform local fare media validity checks, including checks against any locally maintained white lists and hotlists, as deemed necessary for security and the efficient processing of transactions.	CDRL 6-13
6.2.4-4	Validators will provide a payment result within 500 milliseconds of valid fare media being presented for all fare payment types.	CDRL 6-12 CDRL 6-13
6.2.4-5	Validators will display fare payment results, including approval or denial, fare paid, fare product used for payment, remaining account balance, time remaining on transfers, and fare capping status, for all fare payments.	CDRL 6-13

6.2.4-6	Validators will be able to accept fare payments in an offline mode, and accommodate scenarios where a full authorization cannot be received within the required timeframe. In these scenarios, risk mitigation strategies will be employed to limit exposure for declined payments.	CDRL 6-12 CDRL 6-13
6.2.4-7	Validators will provide no indication to the customer or operator when they are operating in offline mode.	CDRL 6-12 CDRL 6-13
6.2.4-8	Validators will maintain a whitelist of all media linked to reduced fare accounts to enable indication of a reduced fare payment via the CAD/AVL operator control unit, even when the validator is operating in offline mode.	CDRL 6-12 CDRL 6-13
6.2.4-9	All transactions generated in an offline mode will be sent to AMPS immediately upon restoration of communications.	CDRL 6-12 CDRL 6-13
6.2.4-10	Validators will support an anti-collision algorithm to ensure that payment is only accepted from a single piece of media when multiple valid pieces of media are presented.	CDRL 6-13
6.2.4-11	The transaction processing algorithm will be subject to agency review and approval during design review.	CDRL 6-12 CDRL 6-13

6.2.5 User Interface

Req #	Requirement	Assigned CDRL(s)
6.2.5-1	Validators will include a full color displays that supports adjustable brightness and contrast, and can be easily read under any combination of ambient lighting, including direct sunlight and night-time operation.	CDRL 6-11
6.2.5-2	Validators will include at least three (3) multicolor LED indicator lights that can be configured to provide feedback on payment and device status.	CDRL 6-11
6.2.5-3	Validators will include an audio interface and speakers for customizable audio feedback, including varying tones and full speech.	CDRL 6-11
6.2.5-4	Platform validators will include a 3.5mm headphone jack capable of providing customizable audio feedback.	CDRL 6-11
6.2.5-5	The visual and audio interfaces will provide visual and audible feedback on fare payment and device status that meets all ADA requirements.	CDRL 6-11 CDRL 6-12
6.2.5-6	Voice annunciation of the fare charged and remaining account balance will be separately configurable as follows: • Annunciation through the validator speaker • Annunciation through the validator headphone jack	CDRL 6-11 CDRL 6-12
6.2.5-7	All validator visual and audio output will be fully configurable and subject to agency review and approval during design review	CDRL 6-11 CDRL 6-12

6.2.6 Electronic Storage

Req #	Requirement	Assigned CDRL(s)
6.2.6-1	Validators will include sufficient embedded storage to hold thirty (30) days of fare payment transactions, and a hotlist or whitelist equivalent to 75% of total media issuance, at the anticipated maximum usage of the system.	CDRL 6-11 CDRL 6-12
6.2.6-2	Validators will support expandable storage in a common, commercially available format (e.g., compact flash, secure digital, etc.) that can be easily swapped or expanded without modification to the rest of the device components.	CDRL 6-11 CDRL 6-12
6.2.6-3	Validators will generate an alarm through the system monitoring and management application (see Section 6.1.3) and provide a visual indication if a failure of either the primary or backup data storage occurs.	CDRL 6-12
6.2.6-4	An alternate means of removing data from the validator device will provided for instances where the there is a failure of the wired or wireless communication or power supply.	CDRL 6-11 CDRL 6-12
6.2.6-5	Where it is necessary to store sensitive data, including all transaction data, white lists and hotlists, validators will do so in a PCI-compliant manner.	CDRL 6-11 CDRL 6-12

6.2.7 Finish/Mounting

Req #	Requirement	Assigned CDRL(s)
6.2.7-1	Validators will be rugged and function under environmental conditions including: direct sunlight, dust/grit/sand, humidity, electrical storms, exposure to urban environment, and the range of elevations and altitudes in the operation region (see Section 3.3).	CDRL 6-11
6.2.7-2	Validator housing will be resistant to corrosion, abrasion, scratching, impacts, and vandalism.	CDRL 6-11
6.2.7-3	Validator housing color and finish will be such that it minimizes reflection and is highly resistant to fading, cracking, and peeling.	CDRL 6-11
6.2.7-4	All validator corners will be rounded, and there will be no exposed bolt heads, nuts, sharp edges, or cracks on outside surfaces.	CDRL 6-11
6.2.7-5	Validator displays will be flush mounted in the housing.	CDRL 6-11
6.2.7-6	Covers on the 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 6-11

6.2.7-7	A metal identification label inscribed with the validator serial number will be permanently attached to the outside of each housing.	CDRL 6-11
6.2.7-8	All required mounting hardware and brackets will be provided by the Contractor.	CDRL 6-11
6.2.7-9	Validator design and mounting will meet all applicable ADA requirements.	CDRL 6-11
6.2.7-10	A sample of each validator configuration and its mounting will be demonstrated for each vehicle and platform type as part of final design review.	CDRL 6-11
6.2.7-11	Validator design, appearance and styling, and mounting will be subject to Agency review and approval as part of design review.	CDRL 6-11

6.3 Inspection Devices

Req #	Requirement	Assigned CDRL(s)
6.3-1	Contractor shall provide handheld fare inspection devices that enable fare enforcement personnel to inspect all media accepted within the eFare system and verify payment with an associated account using the Contractor-supplied fare inspection API (see 2.2.3.4).	CDRL 6-14 CDRL 6-15
6.3-2	The inspection devices will be designed for mobile use and support real-time communications with AMPS for payment validation.	CDRL 6-14 CDRL 6-15
6.3-3	The devices will be commercial-available NFC-enabled mobile phones running a Contractor-supplied fare inspection application. Device choice will be driven by form factor, ruggedness, cost, battery life, and potential for future upgrades, and subject to Agency approval.	CDRL 6-14 CDRL 6-15

6.3.1 Inspection Devices General Requirements

Req #	Requirement	Assigned CDRL(s)
6.3.1-1	Inspection devices will be low-cost to procure, commercially available, and use a common mobile platform. Mobile platforms with NFC capability include Android, Windows Phone, Blackberry, and iOS, via a third-party cradle or adaptor.	CDRL 6-14 CDRL 6-15
6.3.1-2	The handheld inspection device will be portable and not unreasonably hinder an 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.	CDRL 6-14 CDRL 6-15

6.3.1-3	Inspection devices will be rugged and function under environmental conditions including: direct sunlight, dust/grit/sand, humidity, electrical storms, exposure to urban environment, and the range of elevations and altitudes in the operation region (see Section 3.3).	CDRL 6-14
6.3.1-4	Inspection devices will include short- and long-range wireless communications, including NFC, cellular (3G GSM/CDMA and 4G LTE), Wi-Fi (802.11 a/b/g/n/ac), and Bluetooth (v3.0).	CDRL 6-14 CDRL 6-15
6.3.1-5	Inspection devices will include wired communications via Universal Serial Bus (USB), or other serial communications protocol.	CDRL 6-14 CDRL 6-15
6.3.1-6	Inspection devices will include an embedded global positioning system (GPS) receiver.	CDRL 6-14 CDRL 6-15
6.3.1-7	Battery life will last at least one day of full inspection use. Standby times will last considerably longer, but at least two (2) full days without regular inspection activity.	CDRL 6-14 CDRL 6-15
6.3.1-8	Potable power chargers for inspection devices will be provided, and enable charging via standard 110V AC power outlets and 12V DC car chargers.	CDRL 6-14 CDRL 6-15
6.3.1-9	Inspection devices will be remotely configurable and managed through the system monitoring and management application (see Section 6.1.3). Inspection device software and configuration, including all eFare enforcement rules will be managed through this system.	CDRL 6-14 CDRL 6-15

6.3.2 Inspection Devices Transaction Processing

Req #	Requirement	Assigned CDRL(s)
6.3.2-1	The inspection devices will support enforcement of both closed-loop and open fare payments based on the transaction history maintained within AMPS.	CDRL 6-14 CDRL 6-15
6.3.2-2	Fare inspection devices will communicate with AMPS via a cellular or Wi-Fi network to validate that fare payment has occurred. When media is inspected, AMPS will query the associated account in real-time and respond to the inspection device with fare payment status.	CDRL 6-14 CDRL 6-15
6.3.2-3	The fare payment status reported by the inspection device will include the result (i.e., valid or no valid fare payment), and if a valid payment has been found, the time and date of payment, location, fare product used, product validity, amount paid, and fare category associated with the account.	CDRL 6-15
6.3.2-4	All inspections will generate inspection transactions for audit and traceability purposes.	CDRL 6-15
6.3.2-5	Fare inspector login data, inspection route/location, and GPS coordinates will be appended to all fare inspection transactions.	CDRL 6-15

6.3.2-6	The upload frequency of inspection transactions will be configurable to occur in time increments, or each time an inspection occurs.	CDRL 6-15
6.3.2-7	AMPS will support the distribution of white lists to all fare inspection devices to speed up the inspection process and allow for inspection when communications are temporary unavailable.	CDRL 6-14 CDRL 6-15
6.3.2-8	The inspection device will notify the fare inspector when it is operating in an offline mode.	CDRL 6-15

6.3.3 User Interface

Req #	Requirement	Assigned CDRL(s)
6.3.3-1	The inspection device user interface will be based on industry accepted human interface design standards and best practices, and will consider ergonomics, human factors, and graphic design in development of the layout and interaction.	CDRL 6-14 CDRL 6-15
6.3.3-2	The inspection device will require login by the fare inspector via manually entry, or by reading a contactless employee badge, if available. The login will be validated against a list of valid IDs. Repeated login rejections will lock the device until unlocked by centrally administered application.	CDRL 6-14 CDRL 6-15
6.3.3-3	Upon login, the inspection application will require the fare inspector to enter the route or location where inspection is occurring. The inspector will be able to modify the route or location without logging out of the application.	CDRL 6-14 CDRL 6-15
6.3.3-4	The fare inspection results will be clearly presented on the inspection device to minimize confusion by inspectors and customers.	CDRL 6-15
6.3.3-5	The fare inspector will not have the ability to exit the fare inspector application, or access any non-inspector functions of the mobile device.	CDRL 6-14 CDRL 6-15
6.3.3-6	The inspection device user interface will be subject to Agency review and approval during design review.	CDRL 6-14 CDRL 6-15

6.4 Retail Sales Terminal

The retail sales terminal is a counter-top sales device that will enable the sale of eFare media and value at retail merchants that are not affiliated with the primary retail distribution contract (see Section 5.1.1).

Req #	Requirement	Assigned CDRL(s)
6.4-1	Contractor shall deliver a retail sales terminal that enables the sale of closed-loop eFare media and value using the Contractor-supplied fare distribution API (see Section 2.2.3.2).	CDRL 6-16

6.4-2	The retail sales terminal will include the following hardware components: • Telephone or calculator-type keyboard with separate "ENTER" and "CANCEL" keys • Color LCD display • Audio interface and speakers • ISO-14443 compliant contactless card reader • Magnetic stripe card reader • Thermal receipt printer (min 2¼ in. wide)	CDRL 6-16
6.4-3	The retail sales terminal will be compact in size so as to not hinder normal retail sales activities when placed on a sales counter at retail locations.	CDRL 6-16
6.4-4	The ISO-14443 compliant contactless reader and magnetic stripe reader will enable the reading of all closed-loop media supported within the eFare system.	CDRL 6-16 CDRL 6-17
6.4-5	The retail sales terminal will be powered by a standard 110 VAC power source.	CDRL 6-16
6.4-6	The retail sales terminal will include Ethernet, cellular (3G GSM/CDMA and 4G LTE), and Wi-Fi (802.11 a/b/g/n/ac) communication interfaces.	CDRL 6-16
6.4-7	The retail sales terminal will support the following functionality: • Secure login/logoff • Closed-loop fare media sales and activation • Closed-loop stored value sales and loading • Transit account inquiry • Transaction reversal and cancellation • Local sales reporting (i.e., shift report) • Remote configuration via the system monitoring and management application (see Section 6.1.3)	CDRL 6-16 CDRL 6-17
6.4-8	The retail sales terminal will be certified PCI-DSS compliant.	CDRL 6-16 CDRL 6-17
6.4-9	The Contractor shall provide a complete description of the functionality of the retail sales terminal for Agency review and approval at design review.	CDRL 6-16 CDRL 6-17

6.4.1 Transaction Processing

Req #	Requirement	Assigned CDRL(s)
6.4.1-1	The retail sales terminal will support the sale of new eFare media, resulting in the creation or activation of an associated closed-loop transit account, and the loading of value to existing accounts.	CDRL 6-16 CDRL 6-17
6.4.1-2	All retail transactions will require an active connection to the eFare back office.	CDRL 6-16 CDRL 6-17

6.4.1-3	Upon initiation of a transaction, AMPS will provide the retail sales terminal with the available options based on the media presented and associated transit account.	CDRL 6-17
6.4.1-4	For the sale of new media and value, the retail sales terminal will generate a sales transaction that is processed in real-time by AMPS. Upon completion, AMPS will provide a sales confirmation to the retail sales terminal, and the associated media or value will be immediately usable by the customer.	CDRL 6-17
6.4.1-5	The retail sales terminal will allow retailers to cancel the last sales transaction that was completed. Cancelation will result in a reversal of the sale and removal of any value loaded to a closed-loop transit account as part of the sale. All cancelation transactions will be recorded within AMPS.	CDRL 6-17
6.4.1-6	For inquiry transactions, AMPS will return transit account information, including the stored value balance, fare products, product validity periods, and fare category associated with the account.	CDRL 6-17
6.4.1-7	AMPS will serve as the system of record and reporting for all retail actions, and will capture all data necessary to support the collection of funds from the retailers. Retailer login information will be appended to all transactions generated by the retail sales device.	CDRL 6-17
6.4.1-8	All actions performed on the retail sales terminal will generate a detailed receipt, either automatically or upon request. Sales receipts will include a barcode that can be scanned by the retailer to record the sale in their point-of-sale system.	CDRL 6-17
6.4.1-9	All payments in the retail environment will be processed by the retailer through their existing point-of-sale system.	NA

6.4.2 User Interface

Req #	Requirement	Assigned CDRL(s)
6.4.2-1	The retail sales terminal user interface will be easy to use and require minimal training.	CDRL 6-16 CDRL 6-17
6.4.2-2	All actions performed on the retail sales terminal will result in a visual and/or audio response that prompts the user for the next action to be performed.	CDRL 6-16 CDRL 6-17
6.4.2-3	Use of the retail sales terminal will require the retailer to login to the device. The login will be validated against a list of valid IDs. Repeated login rejections will lock the device until unlocked by an administrator.	CDRL 6-16 CDRL 6-17
6.4.2-4	The retailer will be required to logoff the retail sales device at the end of each shift. Device logoff will result in the printing of a detailed shift report at the device, and a sales summary audit transaction being transmitted to the eFare back office.	CDRL 6-16 CDRL 6-17

6.5 Websites

6.5.1 Customer Website

The system provided by the Contractor shall include a website to be used by the general public for the purchase of value and the management of closed-loop transit accounts.

Req #	Requirement	Assigned CDRL(s)
6.5.1-1	Contractor shall deliver a customer website and provide all hardware necessary to support website operations, including servers and interfaces to internal and external systems needed to perform the required functions and process payments.	CDRL 6-18 CDRL 6-19
6.5.1-2	The customer website will allow customers to perform the following functions: • Purchase eFare extended-use media (optional) • Register a closed-loop transit account • Load stored value to a closed-loop transit account • Enable autoload • View transaction history • Initiate a customer service request	CDRL 6-19
6.5.1-3	The customer website will allow ordering of eFare extended-use media to be delivered by mail. Ordering of media via the website will require registration of the associated transit account at the time the order is placed. Online media sales will be a configurable option that the Agencies may elect to disable.	CDRL 6-19
6.5.1-4	The website will allow registration of a transit account associated with previously issued media, which will create an associated customer account in the CRM system (see Section 6.1.5).	CDRL 6-19
6.5.1-5	During registration the website will capture all necessary customer information and create a web account that requires the setting of a username (or e-mail address), password, and Personal Identification Number (PIN) that will be used to access account management features via the IVR (see Section 6.6).	CDRL 6-19
6.5.1-6	The website will support the linking multiple transit accounts to a single web account. Registered customers will be able to register new transit accounts under an existing web account, and add a single funding source to support the loading of value to all associated transit accounts.	CDRL 6-19
6.5.1-7	Registered customers will be required to login using their username and password to access account management and loading features of the website.	CDRL 6-19

6.5.1-8	Registered customers will be able to initiate a one-time load of stored value to their transit account using a credit or debit card. The website will support the selection of pre-defined values, as well as the entry of a custom value (subject to configurable minimum and maximum limits).	CDRL 6-19
6.5.1-9	Registered customers will be able to enable and disable autoload of stored value (see Section 5.1.3). As part of the autoload setup process, the customer will select the amount of the autoload (pre-defined and custom values), type of autoload (threshold or periodic), and if periodic, the date on which the monthly autoload should occur.	CDRL 6-19
6.5.1-10	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 database in a tokenized form (see Section 6.1.5).	CDRL 6-19
6.5.1-11	For one-time and autoload sales, the website will provide customers an option to split the payment between two funding sources.	CDRL 6-19
6.5.1-12	All payments initiated via the website will be accepted using e-commerce best practices and processed through the payment gateway (see Section 6.1.7) in a PCI-DSS compliant manner.	CDRL 6-19
6.5.1-13	All credit card data will be encrypted for transmission employing the Triple Data Encryption Algorithm (TDEA) and Secure Socket Layer (SSL), at a minimum. All portions of the website that transmit or receive personal customer data will be SSL-encrypted.	CDRL 6-19
6.5.1-14	The website will support Address Verification System (AVS) in a configurable manner that allows the AVS feature to be turned on or off by the Agencies.	CDRL 6-19
6.5.1-15	The website will prompt customers 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 gateway.	CDRL 6-19
6.5.1-16	If a payment authorization is not completed within a configurable time period, or is interrupted, the website will cancel the transaction and notify the customer. Any canceled transactions will be recorded in system monitoring logs.	CDRL 6-19
6.5.1-17	Customers will be e-mailed a receipt for all successfully completed sales, including the fulfillment of an autoload. Customers will have the option of opting-out of e-mail notifications.	CDRL 6-19
6.5.1-18	Registered customers will be able to view up to twelve (12) months or prior transaction history. The transaction history will be viewable and sortable on the website, and able to be exported in PDF and Excel formats.	CDRL 6-19

6.5.1-19	Registered customers will have the option of initiating a customer service request. The request will generate and incident within the CRM system (see Section 6.1.5) and assign the incident to the appropriate customer service staff.	CDRL 6-19
6.5.1-20	The website will allow registered customers to report a card lost or stolen. Initiating this action will immediately result in the associated fare media being blocked from further use.	CDRL 6-19
6.5.1-21	The website will include general information on use of the eFare system, including an FAQ section, information on where to acquire media, how to pay, the cardholder agreement, and general program information and updates.	CDRL 6-19
6.5.1-22	The website will include links to all participating agency websites with schedules, fares and other general transit information.	CDRL 6-19
6.5.1-23	The website will be compliant with all applicable ADA regulations.	CDRL 6-19
6.5.1-24	The website will be provided in multiple languages, including English, Spanish, and up to four other languages to be identified prior to the completion of FDR.	CDRL 6-19
6.5.1-25	Contractor shall provide a mobile-friendly version of the customer website that supports all the functionality described in this section. Customers will automatically be redirected to the mobile version when accessing the website using a mobile device.	CDRL 6-19
6.5.1-26	The website will be built using current web design and e-commerce best practices. The development tools and design for the website will be subject to review and approval during design review. The Contractor shall work closely with the Agencies' IT and web services teams to develop an approved user interface design. The agencies will continue to play a critical role in the website design and testing throughout the implementation.	CDRL 6-19

6.5.2 Institutional Website

Req #	Requirement	Assigned CDRL(s)
6.5.2-1	Contractor shall deliver an institutional website and provide all hardware necessary to support website operations, including servers and interfaces to internal and external systems needed to perform the required functions and process payments.	CDRL 6-18 CDRL 6-20
6.5.2-2	The institutional website will provide a portal for the Agencies, employers, schools, social service agencies, and other institutions to administer transit accounts on behalf of participants in institutional programs (see Section 4.3).	CDRL 6-20

6.5.2-3	The institutional website will provide the following functions: • Register a new institution • Add participants to an intuitional account • Delete participants from an intuitional account • Initiate value loads to participants' transit accounts • Initiate bulk order of limited-use media • View invoicing and payment status	CDRL 6-20
6.5.2-4	Prior to using the institutional website, institutions will need to be approved by the Agencies and setup within the institutional website. The Agencies will use the website to add new institutions and configure what products are available to them (see Section 4.3.1) and payment terms.	CDRL 6-20
6.5.2-5	Following approval, the program administrator for an institutional will be able login to the institutional website to perform all program administration.	CDRL 6-20
6.5.2-6	Institutional program administrators will be able to add participants under their institutional account individually, or through a bulk upload process.	CDRL 6-20
6.5.2-7	New customers and existing customers (with a registered transit account) will be able to be added as a participant to an intuitional account. All new customers will be registered as part of the process.	CDRL 6-20
6.5.2-8	Institutional program administrators will be able to delete participants under their institutional account, individually or through a bulk process.	CDRL 6-20
6.5.2-9	Institutional program administrators will be able initiate the loading of value to participants' transit accounts, individually or through a bulk upload process.	CDRL 6-20
6.5.2-10	When adding value to participant accounts, institutional program administrators will be able to select from the fare products configured for their institution, 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 6-20
6.5.2-11	As part of placing an order for a participant, the intuitional program administrator will be able to configure the amount of the purchase price to be paid by the institution. If the amount set by the administrator is less than the total purchase price, the remaining amount will be charged to the funding source attached to the participant's personal account. If no funding source is available, or the payment is declined, the entire load will be rejected.	CDRL 6-20

6.5.2-12	If configured to be able to do so, institutional program administrators will be able to place bulk orders for extended-use and limited-use eFare media to be delivered by mail. Online media sales will be a configurable option that the Agencies may elect to disable.	CDRL 6-20
6.5.2-13	Payment terms for institutional customers will be configured as part of the intuitional account setup. The Agencies will be able to configure institutions such that payment is required at the time an order is placed (and processed through the institutional website), or so that the institution is invoiced for orders based on configured payment terms.	CDRL 6-20
6.5.2-14	Institutions for which 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 6-20
6.5.2-15	All payments initiated via the institutional website will be accepted using e-commerce best practices and processed through the payment gateway (see Section 6.1.7) in a PCI-DSS compliant manner.	CDRL 6-20
6.5.2-16	All credit card data will be encrypted for transmission employing the Triple Data Encryption Algorithm (TDEA) and Secure Socket Layer (SSL), at a minimum. All portions of the website that transmit or receive personal customer data will be SSL-encrypted.	CDRL 6-20
6.5.2-17	The website will support Address Verification System (AVS) in a configurable manner that allows the AVS feature to be turned on or off by the Agencies.	CDRL 6-20
6.5.2-18	The website will prompt administrators 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 gateway.	CDRL 6-20
6.5.2-19	If a payment authorization is not completed within a configurable time period, or is interrupted, the institutional website will cancel the order and notify the administrator. Any canceled transactions will be recorded in system monitoring logs.	CDRL 6-20
6.5.2-20	Institutional program administrators will be e-mailed a receipt for all successfully completed sales.	CDRL 6-20
6.5.2-21	For institutional orders where an invoicing is configured, an invoice will automatically be generated by the FCSS (see Section 6.1.6), and sent electronically or via mail to the institution.	CDRL 6-20
6.5.2-22	The Agencies will be able to configure the placing of automatic holds on institutional accounts, and the loading of value to participant accounts, based on the status of outstanding receivables.	CDRL 6-20

6.5.2-23	Institutional program administrators will be able to view at least twelve (12) months of invoice and payment history via the institutional website. The history will be viewable and sortable on the website, and able to be exported in PDF and Excel formats.	CDRL 6-20
6.5.2-24	The institutional website will support the administration of transit benefit programs. Institutions configured as transit benefit providers will 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 6-20
6.5.2-25	The Agencies will be able to use the institutional websites to serve as administrators for their own programs as necessary.	CDRL 6-20
6.5.2-26	All data associated with intuitional accounts will be stored securely in the CRM database (see Section 6.1.5). Funding source information will be stored in a tokenized form.	CDRL 6-20
6.5.2-27	The website will be built using current web design and e-commerce best practices. The development tools and design for the website will be subject to review and approval during design review. The Contractor shall work closely with the Agencies' IT and web services teams to develop an approved user interface design. The agencies will continue to play a critical role in the website design and testing throughout the implementation.	CDRL 6-20

6.6 Interactive Voice Response (IVR)

To manage call center staffing resources, an Interactive Voice Response (IVR) system will be delivered to provide customers with an automated interface to obtain up-to-date account information and access account management features through the phone.

Req #	Requirement	Assigned CDRL(s)
6.6-1	The Contractor shall provide an IVR system that integrates with and will be hosted in the same location as the customer call center phone system. The customer call center phone system will be hosted by either TriMet or a third-party vendor to be selected as part of a separate procurement (see Section 5.1.4).	CDRL 6-21
6.6-2	The IVR system will support touch tone entry and voice recognition to access all IVR functions.	CDRL 6-21
6.6-3	The IVR system design will allow for the use of a teletype writing (TTY) device for the hearing impaired.	CDRL 6-21
6.6-4	The IVR system will provide answers to common user questions.	CDRL 6-21
6.6-5	The IVR system will support the transfer of customers to and from Agency phone systems used for general customer support.	CDRL 6-21

6.6-6	The IVR system will provide an option to reach a live representative at any time.	CDRL 6-21
6.6-7	The IVR system will provide customers with an interface to obtain up-to-date transit and customer account information, and perform account management functions.	CDRL 6-21
6.6-8	Access to account information 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 6-21
6.6-9	Following entry of the required security information, the IVR system 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 6-21
6.6-10	The IVR system will allow a customer who has already associated a payment source with their account (via the customer website or customer call center) to initiate and immediate load of value, or enable autoload, using the associated funding source.	CDRL 6-21
6.6-11	To update account or funding source information, the customer will be required to use the website or contact customer service.	CDRL 6-21
6.6-12	The IVR system will allow a customer to close a transit account, and report a card lost or stolen.	CDRL 6-21
6.6-13	The IVR will be fully configurable by the Agencies, including the IVR script, functions available to customers, and handoffs to and from external phone systems.	CDRL 6-21 CDRL 6-22
6.6-14	The IVR will be subject to Agency review and approval at design review.	CDRL 6-21 CDRL 6-22

6.7 Mobile Application

Req #	Requirement	Assigned CDRL(s)
6.7-1	Contractor shall deliver a native mobile application for iOS and Android platforms (at a minimum) supported by the Contractor-supplied APIs.	CDRL 6-23
6.7-2	Contractor shall propose to contract with GlobeSherpa for development of the mobile application. Contractor may also propose a mobile application that is not developed in partnership with GlobeSherpa as an option.	CDRL 6-23

6.7-3	The mobile application will support eFare transit account management and sales, including but not limited to: • Transit account registration • Stored-value sales • Management of autoload settings • Checking of account balance • Viewing of transaction history • Initiating a customer service request	CDRL 6-23
6.7-4	For compatible handsets, the mobile application will support mobile ticketing and contactless payment using NFC technology, including: • Provisioning of a mobile payment credential linked to a unique closed-loop transit account • Purchase of virtual limited-use media • Fare payment and inspection at all eFare devices	CDRL 6-23
6.7-5	The mobile application will be PCI-DSS compliant and support a strong security for the storage of credentials and the processing of payments.	CDRL 6-23
6.7-6	The mobile application will include configurable instructions on use, including frequently asked questions, and a mechanism for users to provide feedback.	CDRL 6-23
6.7-7	The mobile application will configurable in-app messaging, and the ability for the customer to opt-in or opt-out of the messaging.	CDRL 6-23
6.7-8	The mobile application will provide links to TriMet's mobile website for Trip Tools, such as real-time arrivals, Planning a Trip, Service Alerts, Stops, Schedules and Maps.	CDRL 6-23
6.7-9	The mobile application will be developed using a collaborative design approach and incorporate platform characteristics and human interface principles into the user interface design, as well as industry and e-commerce best practices for the secure processing of payments.	CDRL 6-23

6.8 Required Submittals

The required submittals specified in this section are summarized below. They are further described at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 6-1	Back Office Hardware Design	6.1.1	✓	✓	✓	
CDRL 6-2	Back Office System Architecture	6.1	✓	✓	✓	

CDRL 6-3	Back Office Software Design and Interfaces	6.1	✓	✓	✓	
CDRL 6-4	AMP System Design and Interface	6.1.2	✓	✓	✓	
CDRL 6-5	Device Monitoring & Management System Design and Interface	6.1.3	✓	✓	✓	
CDRL 6-6	Maintenance Management System Design and Interface	6.1.4	✓	✓	✓	
CDRL 6-7	Customer Relationship Management System Design and Interface	6.1.5	✓	✓	✓	
CDRL 6-8	Financial Clearing and Settlement System Design and Interface	6.1.6	✓	✓	✓	
CDRL 6-9	Payment Gateway Design and Interface	6.1.7	✓	✓	✓	
CDRL 6-10	Data Warehouse Design and Interface	6.1.8	✓	✓	✓	
CDRL 6-11	Reporting System Design and Interface	6.1.9	✓	✓	✓	
CDRL 6-12	Payment Validators Hardware Design	6.2	✓	✓	✓	
CDRL 6-13	Payment Validators Software Design	6.2	✓	✓	✓	
CDRL 6-14	Inspection Device Hardware Design	6.3	✓	✓	✓	
CDRL 6-15	Inspection Device Software Design	6.3	✓	✓	✓	
CDRL 6-16	Retail Sales Terminal Hardware Design	6.4	✓	✓	✓	
CDRL 6-17	Retail Sales Terminal Software Design	6.4	✓	✓	✓	
CDRL 6-18	Website Hardware Design	6.5	✓	✓	✓	
CDRL 6-19	Customer Website Software Design	6.5.1	✓	✓	✓	
CDRL 6-20	Institution Website Software Design	6.5.2	✓	✓	✓	
CDRL 6-21	IVR System Design and Interface	6.6	✓	✓	✓	
CDRL 6-22	IVR Voice Scripts and Prompts	6.6		✓	✓	
CDRL 6-23	Mobile Ticketing Application	5.2	✓	✓	✓	

7 Installation

Req #	Requirement	Assigned CDRL(s)
7-1	Contractor shall be responsible for delivery and installation of all fare collection system components in accordance with these specifications.	CDRL 7-1
7-2	Contractor shall be responsible for all required testing and corrective actions demonstrating that installation and equipment operation are in compliance with the specifications.	CDRL 7-1
7-3	Each installation will be inspected and tested in accordance with the requirements specified in Section 8 and will be subject to TriMet and agency acceptance.	CDRL 7-1
7-4	Contractor shall submit an Installation and Interface Plan for the Agencies' review and approval no later than three months prior to the first delivery of equipment. The installation and interface plan will outline the processes and procedures, schedule, post installation testing details, and resources to be used for installation of the equipment.	CDRL 7-1

7.1 Installation Requirements

7.1.1 Contractor Responsibilities

Req #	Requirement	Assigned CDRL(s)
7.1.1-1	The Contractor shall install all onboard validators on TriMet and C-Tran buses and Portland Streetcar vehicles. The Contractor shall provide all required wiring and service loops, cabling, and hardware necessary to properly install and secure the equipment in its planned location.	CDRL 7-1 CDRL 7-3
7.1.1-2	The Contractor shall connect TriMet and C-Tran eFare equipment with the existing CAD/AVL systems enabling consolidated login and capture of GIS data.	CDRL 7-1 CDRL 7-3
7.1.1-3	The Contractor shall install and test all off-board validators for MAX light rail, WES commuter rail, and Aerial Tram systems.	CDRL 7-1 CDRL 7-3
7.1.1-4	The Contractor shall install and test all fare inspection devices at locations specified by the Agencies.	CDRL 7-1 CDRL 7-3
7.1.1-5	The Contractor shall install and test all retail sales devices at locations specified in the retail sales network CDRL.	CDRL 7-1 CDRL 7-3
7.1.1-6	The Contractor shall install and test the back office system, including all components at the location designated by TriMet. The back office will be installed in an environmentally controlled area provided by TriMet.	CDRL 7-1 CDRL 7-3

7.1.1-7	The Contractor shall install and test the back office redundant system including all components at the location designated by TriMet.	CDRL 7-1 CDRL 7-3
7.1.1-8	The Contractor shall install and test the test environment system including all components at the location designated by TriMet.	CDRL 7-1 CDRL 7-3
7.1.1-9	Contractor shall comply with and be responsible for all regulatory requirements applicable to design, installation and construction, and testing, including applicable permits.	CDRL 7-1 CDRL 7-3
7.1.1-10	Any Contractor expenses for personnel travel associated with the delivery and installation of system components will be included in system component installation costs.	NA
7.1.1-11	All Contractor's and subcontractor's 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. Agencies will provide required information and/or briefing to these individuals before that person is allowed to work on site.	CDRL 7-1 CDRL 7-3
7.1.1-12	The Contractor shall document each onboard validator installation in the form of as-built drawings. The as-built documentation shall identify equipment location information, wiring traces and details, and all additional information needed to maintain the newly installed infrastructure.	CDRL 7-5
7.1.1-13	Any holes that must be created in the vehicle that extend into bus flooring or through vehicle exterior will be sealed using wiring grommets to the satisfaction of TriMet.	CDRL 7-3
7.1.1-14	The mounting of the onboard 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 TriMet.	CDRL 7-3

7.1.2 Platform & Facility Site Preparation

The Agencies will be responsible for providing electrical and communication wiring and conduit necessary for the installation of platform validators, fare inspection devices, and retail sales devices installed in transit ticket offices. Retail merchant shall be responsible for providing electrical and communication service necessary for the installation of retail sales terminals at third-party merchant locations.

Req #	Requirement	Assigned CDRL(s)
7.1.2-1	Contractor shall survey rail stations to identify any existing provisions that may be used to support platform validators.	CDRL 7-2
7.1.2-2	The Contractor rail station survey will be completed as a part of the design process and submitted to TriMet for acceptance.	CDRL 7-2
7.1.2-3	Use of existing provisions to support platform validators will be subject to advance approval by the Agencies.	CDRL 7-2

7.1.2-4	Contractor shall provide and install all platform validator support structures such as pedestals and mounting brackets, as needed.	CDRL 7-1 CDRL 7-2
7.1.2-5	Contractor shall identify any modifications needed, including installation provisions necessary for installation of eFare equipment and all related system components.	CDRL 7-2
7.1.2-6	Contractor shall provide as part of FDR the installation details including mounting bolt patterns and specifications for all equipment installation types.	CDRL 7-1 CDRL 7-2
7.1.2-7	Contractor shall be responsible for installation of all needed provisions, including wiring, mounting brackets and special hardware, for all onboard validators.	CDRL 7-1 CDRL 7-2

7.2 Installation Procedures

The Agencies will provide applicable installation rules and requirements as part of the design review process.

Req #	Requirement	Assigned CDRL(s)
7.2-1	Contractor installation procedures will be in accordance with approved installation plan and Agency rules and guidelines.	CDRL 7-3

7.3 Installation Sequence & Schedule

Req #	Requirement	Assigned CDRL(s)
7.3-1	Contractor shall provide a proposed methodology and schedule for the back office and eFare equipment installations.	CDRL 7-4
7.3-2	Contractor's proposed installation methodology will seek to maximize the efficiency with which the installation is performed while minimizing the impact on transit operations.	CDRL 7-4

7.4 Required Submittals

The required submittals specified in this section are summarized below.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 7-1	eFare Equipment Installation & Interface Plan	7.1 7.3	✓	✓	✓	
CDRL 7-2	eFare Site Preparation Plan	7.1.2	✓	✓	✓	
CDRL 7-3	Installation Procedures	7.2	✓	✓	✓	
CDRL 7-4	Installation Schedule	7.3	✓	✓	✓	
CDRL 7-5	As-built documentation	7.1				No later than 30 days following each equipment install.

8 Quality Assurance, Inspection and Testing

8.1 Quality Assurance (QA) & Quality Control (QC)

This section describes the Quality Assurance (QA), inspection, and testing requirements for all system components.

8.1.1 Contractor's QA & QC Program Plan

Req #	Requirement	Assigned CDRL(s)
8.1.1-1	Contractor shall set forth quality assurance (QA) and control procedures in a quality assurance and control plan.	CDRL 8-1
8.1.1-2	Contractor shall submit the quality assurance and control plan to TriMet for approval.	All applicable CDRLs
8.1.1-3	Contractor shall not commence performance of any design, manufacturing or construction work until the quality assurance and control plan has been approved by TriMet.	All applicable CDRLs
8.1.1-4	The quality assurance and control plan will include written descriptions of quality assurance and control policies, procedures, methods, and instructions, including the process and procedures that the Contractor will follow to ensure that control and detailed documentation is maintained throughout software development and configuration changes.	CDRL 8-1
8.1.1-5	The quality assurance and control plan will describe the overall quality processes and responsibilities that will ensure the quality of work performed for each phase of work under the Contract.	CDRL 8-1
8.1.1-6	The quality assurance and control plan will address all participating subcontractors and their relationship to the Contractor.	CDRL 8-1
8.1.1-7	TriMet will, at its own discretion, perform QA monitoring of work done under these specifications, including monitoring of the Contractor's or subcontractor's QA activities.	All applicable CDRLs
8.1.1-8	Contractor's QA records will be made available to TriMet for inspection upon request.	All applicable CDRLs
8.1.1-9	Such QA activities performed (or not performed) by TriMet will not reduce nor alter the Contractor's QA responsibilities or its obligation to meet the requirements of this document.	All applicable CDRLs
8.1.1-10	At any time during the manufacturing process, subject to a minimum of five (5) days prior notice, TriMet or the Agencies' representatives may choose to schedule a visit to the Contractor's facility or a subcontractor's facility during normal working hours to audit the manufacturing and QA processes.	All applicable CDRLs
8.1.1-11	Contractor shall include the quality function as an integral part of its design development and review process.	All applicable CDRLs

8.1.1-12	Contractor shall identify design variances from Contract requirements and document and report variances to TriMet before procurement, fabrication or installation.	CDRL 8-1
8.1.1-13	Contractor shall bear all costs incurred in correcting rejected items or work.	All applicable CDRLs
8.1.1-14	Contractor shall remove rejected items from the worksite unless in-place correction is reviewed and accepted by TriMet or affected Agency.	All applicable CDRLs

If damage, defect, error, or inaccuracy is found in any specified item or work, TriMet or the affected Agency has the right to reject or to require correction to bring the item or work into conformance with Contract requirements.

If the Contractor fails to remove, replace or correct rejected items or work, TriMet or the affected Agency may replace or correct rejected items or work and charge the Contractor actual costs incurred plus cost necessary to terminate the Contractor for default.

8.1.2 Inspection & Testing Plan

Req #	Requirement	Assigned CDRL(s)
8.1.2-1	Contractor shall submit an inspection and testing plan for TriMet's review and acceptance, to be used in connection with all inspections and tests as described in Section 8 of this document.	CDRL 8-2
8.1.2-2	No inspections or tests will be performed before the Contractor has received TriMet acceptance of the inspection and testing plan.	All applicable CDRLs
8.1.2-3	Inspection and testing plan will cover all Contractor, supplier and subcontractor inspections and tests to be performed, including those performed under the Contractor's QA plan.	CDRL 8-2
8.1.2-4	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.	CDRL 8-2
8.1.2-5	The inspection and testing plan will include a description of the Contractor's system for control of the test equipment throughout the entire program, including parts lists, drawings, software versions, inspection and test records, networks and maintenance records.	CDRL 8-2
8.1.2-6	All system components and sub-systems will be tested individually and in an integrated environment to ensure that they meet all technical and functional requirements.	CDRL 8-2
8.1.2-7	Testing will incorporate all requisite integration with Agency systems as specified in the specification.	CDRL 8-2

8.1.2-8	Contractor's proposal will include all labor, materials (including but not limited to closed-loop, limited use, and open payment media), and support services required to completely inspect and test all hardware and software being supplied.	All applicable CDRLs
8.1.2-9	Testing will be conducted at device, systems, and field integration levels as further specified in Section 8.	CDRL 8-2
8.1.2-10	All tests and inspections will be monitored and signed-off by TriMet or its representative, and documented by the Contractor.	All applicable CDRLs
8.1.2-11	Inspection and testing plan will identify those requirements the Contractor intends to meet by means other than testing.	CDRL 8-2
8.1.2-12	Any and all hardware or software not passing inspection or test will be replaced, or otherwise corrected by the Contractor and rescheduled for inspection and testing.	All applicable CDRLs
8.1.2-13	Contractor shall establish the Client Test Facility as specified in Section 6.8 no later than the commencement of Systems Integration Lab Testing, specified in Section 8.4	All applicable CDRLs
8.1.2-14	Contractor shall update the Client Test Facility throughout Quality Assurance, Inspection and Testing period to maintain a duplicate instance of Contractor Test Facility, as necessary.	All applicable CDRLs
8.1.2-15	The Inspection and Testing Plan shall include plans for each type of testing defined in this section, including: 1. First Article Configuration Inspection (FACI) 2. First Article Testing (FAT) 3. Production Inspection & Testing 4. Systems Integration Lab Testing 5. Systems Integration Field Testing 6. Acceptance Testing	CDRL 8-2

8.1.3 Inspection & Test Procedures

Req #	Requirement	Assigned CDRL(s)
8.1.3-1	Contractor shall prepare and submit to TriMet a detailed test procedure for each test to be performed.	CDRL 8-3
8.1.3-2	Detailed test procedures will be submitted to TriMet for review and acceptance a minimum of 30 days prior to the corresponding test performance, unless otherwise specified herein. Detailed test procedures shall include mapping or references to the design documents or functional requirement related to the test.	All applicable CDRLs
8.1.3-3	No test will be conducted until acceptance of the corresponding detailed test procedure has been given by TriMet.	All applicable CDRLs
8.1.3-4	Detailed test procedures will include the procedure to be followed, as well as a description of the resolution of test problems and failure recurrence.	CDRL 8-3

8.1.3-5	A re-test will be performed for all system components affected by adjustments resulting from testing, up to and including the entire eFare system if TriMet determines such is needed.	All applicable CDRLs
8.1.3-6	The Inspection and Testing Procedures shall include procedures for each type of testing defined in this section, including: 1. FACI 2. FAT 3. Production Inspection & Testing 4. Systems Integration Lab Testing 5. Systems Integration Field Testing 6. Acceptance Testing	CDRL 8-3

With TriMet's prior acceptance, the Contractor shall submit existing procedures that differ from this format. TriMet will accept test procedures only if they are inclusive and thoroughly test each system component, both independently and collectively.

TriMet reserves the right to develop additional test procedures to be performed by the Contractor or other designated organizations.

8.1.4 Inspection & Test Reports

Req #	Requirement	Assigned CDRL(s)
8.1.4-1	Contractor shall submit a written report for each inspection and test, including copies of all inspection/test data for TriMet acceptance.	CDRL 8-4
8.1.4-2	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, system component or system tested.	CDRL 8-4
8.1.4-3	Reports will be submitted to TriMet for review and acceptance within 30 days of the completion of any test.	All applicable CDRLs
8.1.4-4	The Inspection and Test Reports shall include reports for each type of testing defined in this section, including: 1. FACI 2. FAT 3. Production Inspection & Testing 4. Systems Integration Lab Testing 5. Systems Integration Field Testing 6. Acceptance Testing	CDRL 8-4

8.1.5 Quality Assurance& Control, Inspection & Testing Overview

Req #	Requirement	Assigned CDRL(s)
8.1.5-1	Inspections, first article tests and production inspections and tests will be used to establish the integrity of the design and manufacturing of the system and all system components.	All applicable CDRLs
8.1.5-2	The major inspections and tests to be conducted will be as follows: • FACI • FAT • Production inspection and testing • Systems Integration Testing (lab and field) • Acceptance Testing Minimum requirements for each inspection/test are subsequently provided.	All applicable CDRLs

Testing procedures and sequence are summarized in the table below:

Section	Test Description	Component Tests	Duration	Notes
8.2	System Components Inspection and Testing	First Article Configuration Inspection (FACI)		
		First Article Testing (FAT)		Prerequisite: Completion of FACI
		Production Inspection & Testing		Prerequisite: Completion of FAT
8.3	Systems Integration Lab Testing			Prerequisite: Completion of System Components Inspection and Testing
8.4	Systems Integration Field Testing	Installation and verification of all system and subsystem components		Prerequisite: Completion of Systems Integration Testing
		REVENUE SERVICE MAY COMMENCE		
		Settling period and ad hoc testing	90 days	Prerequisite: Completion of Integrated Field Inspection and Testing
8.5	Acceptance Testing	Back Office	90 days	Prerequisite: Completion of Integrated Field Inspection and Testing Test durations are concurrent
		Website		
		Validator		
		Inspection Device		
		Retail Sales Unit		

8.2 System Components Inspection & Testing

This section describes the requirements for comprehensive inspection and testing of the system components as specified herein.

8.2.1 First Article Configuration Inspection

Req #	Requirement	Assigned CDRL(s)
8.2.1-1	FACI will take place at the point of assembly after completion of the first several production runs for each of the system components: onboard validators, platform validators, inspection devices, retail sales terminals and the back office system, including all subsystems.	All applicable CDRLs
8.2.1-2	TriMet will have the right to inspect any or all of the units produced to date.	All applicable CDRLs
8.2.1-3	Quality of workmanship for the production of subsequent system components will be established at the FACI.	CDRL 8-2
8.2.1-4	TriMet will be notified not less than 21 working days before the FACI; subsequently, the Contractor will be advised regarding TriMet's attendance.	All applicable CDRLs
8.2.1-5	FACI will verify that production system components comply with the specifications, including design configuration and drawings as accepted during the final design review, or the latest revision thereof.	CDRL 8-2 CDRL 8-3
8.2.1-6	Documentation of quality inspections performed at subcontractor facilities or of the Prime Contractor's quality inspections of components manufactured by others will be available for TriMet's review at the FACI.	CDRL 8-2 CDRL 8-3 CDRL 8-4
8.2.1-7	Contractor shall deliver data that include the latest drawings, design test procedures, specifications, and quality documentation required for adequate checkout of the First Article system components under inspection a minimum of 30 days prior to FACI.	CDRL 8-2 CDRL 8-3
8.2.1-8	The list of drawings will be identified by revision and be complete to the lowest-level replaceable unit.	All applicable CDRLs

8.2.2 First Article Testing

The purpose of FAT will be to demonstrate that all system components to be furnished meet all requirements contained in this specification.

Req #	Requirement	Assigned CDRL(s)
8.2.2-1	FAT will be conducted upon successful completion of the FACI.	All applicable CDRLs
8.2.2-2	Contractor shall prepare and submit FAT procedures within 21 days of the completion of the FACI for review and acceptance by TriMet.	CDRL 8-3
8.2.2-3	System components to be tested in the FAT will be from the first run of production units and may be chosen by TriMet. Once chosen, the units may not be modified without the express consent of TriMet.	CDRL 8-2
8.2.2-4	FAT will be conducted by the Contractor at the Contractor's facility.	All applicable CDRLs
8.2.2-5	TriMet may, at its discretion, assign staff to witness and/or periodically audit FAT progress.	All applicable CDRLs
8.2.2-6	All FAT reports will be subject to TriMet's acceptance.	CDRL 8-4
8.2.2-7	FAT Functional and cycling tests will demonstrate all base functions of the system components; cycling testing will be comprised of 60,000 validator, 60,000 inspection device and 10,000 retail sales unit transactions.	CDRL 8-2 CDRL 8-3
8.2.2-8	Human factors test will demonstrate device compliance with the general design requirements in Section 3.2 and component requirements identified in Section 6 .3.3.	CDRL 8-2 CDRL 8-3
8.2.2-9	Environmental test will demonstrate compliance with the environmental requirements contained in Section 3.3.	CDRL 8-2 CDRL 8-3
8.2.2-10	Maintainability test will demonstrate compliance with the maintainability requirements set forth in Section 9.1.	CDRL 8-2 CDRL 8-3
8.2.2-11	First article system components will be representative of the final production item.	All applicable CDRLs

In the event the Contractor has already conducted substantially similar tests to those described herein, TriMet may be willing, but is not obligated, to accept the results of those tests as satisfying the requirements of this section. Proposers who anticipate requesting such a waiver based on testing already performed are strongly advised to submit information indicating their justification for requesting the waiver, testing already performed and similarity with proposed system components, as part of proposals.

Req #	Requirement	Assigned CDRL(s)
8.2.2-12	If Contractor has already conducted substantially similar tests to those described herein the Contractor shall submit procedures and results of those tests to TriMet for consideration.	CDRL 8-4

8.2.2-13	Test procedures and results will be submitted to TriMet for review at least 60 days prior to scheduled conduct of the FAT.	CDRL 8-3 CDRL 8-4
8.2.2-14	Contractor shall be responsible to maintain a complete log of all FATs conducted under this section, showing each test conducted and results.	CDRL 8-4
8.2.2-15	The log will be submitted to TriMet at conclusion of the FAT for review and acceptance.	All applicable CDRLs
8.2.2-16	Contractor shall certify the accuracy of all submitted test results.	CDRL 8-4
8.2.2-17	Results not meeting specification requirements will be fully documented and explained by the Contractor, and a plan for corrective action will be submitted.	CDRL 8-4
8.2.2-18	TriMet may delay delivery of any system components until FAT procedures are successfully completed and documented.	All applicable CDRLs
8.2.2-19	First article system components will be connected to the back office for data transfer in a manner simulating the installed system throughout functional and cycling tests.	CDRL 8-2
8.2.2-20	Device interface with the back office will be tested as an integral part of the FAT.	CDRL 8-2
8.2.2-21	Contactless smart cards (CSC) to be used in the FAT will be those provided for testing purposes by the Contractor as specified in CDRL 2-2.	CDRL 2-2
8.2.2-22	Smart cards will be the same or similar to those planned for revenue service.	CDRL 8-2
8.2.2-23	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 8-2
8.2.2-24	Open payment contactless payment cards to be used in FAT will be those provide for testing purposes by the Contractor as specified in CDRL 2-2.	CDRL 2-2
8.2.2-25	Req. # 8.2.3-10.2 and 8.2.3-10.3 will apply to contactless payment cards procured for testing.	All applicable CDRLs
8.2.2-26	If at any time after the FAT results have been accepted a design change is made, the performance of the modified system components will be demonstrated as conforming to the specifications and the re-test results will be submitted to TriMet for acceptance.	All applicable CDRLs
8.2.2-27	Successful completion of FAT will be a prerequisite for manufacturing of production system components.	All applicable CDRLs
8.2.2-28	Contractor shall provide all necessary supplies for the FAT.	All applicable CDRLs

8.2.3 Production Inspection & Testing

Req #	Requirement	Assigned CDRL(s)
8.2.3-1	Contractor and subcontractors shall perform production inspections and tests on each system component that is produced as an integral part of their quality assurance program.	CDRL 8-2
8.2.3-2	Inspections and tests will verify, and Contractor shall certify, that all system components contain the correct materials, is assembled properly, and functions all in accordance with specifications.	CDRL 8-2 CDRL 8-3 CDRL 8-4
8.2.3-3	TriMet may choose to observe, participate in, conduct, or repeat testing on any item to confirm the validity of the Contractor's test procedures and results.	All applicable CDRLs
8.2.3-4	Contractor shall perform production inspections and tests at the point of manufacture on all system components and on each completed device prior to each shipment.	CDRL 8-2 CDRL 8-3
8.2.3-5	Inspections and tests will verify that each unit is produced to at least the same quality level as the unit presented for the FACI and FAT.	CDRL 8-2 CDRL 8-3 CDRL 8-4
8.2.3-6	At a minimum and as applicable, these tests will include: • Performance tests of onboard validators, platform validators, inspection devices and retail sales terminals, which test operation in all modes • Data reporting and transfer • Alarms and alarms communication • Control keypad functions • Displays	CDRL 8-2 CDRL 8-3
8.2.3-7	Contractor shall update production inspection and testing sheets and procedures based upon experience gained from subsequent testing or system component operation.	All applicable CDRLs
8.2.3-8	Test procedures will be expanded to focus on areas that prove to be, or have historically been, troublesome.	All applicable CDRLs
8.2.3-9	Contractor may submit requests in writing for test simplification in areas where a high degree of confidence is developed.	All applicable CDRLs
8.2.3-10	Test simplification requests will be subject to TriMet approval.	All applicable CDRLs
8.2.3-11	Contractor shall keep complete records of all production inspections and tests that are performed.	CDRL 8-4
8.2.3-12	Contractor shall note any failures and subsequent corrective measures.	CDRL 8-4
8.2.3-13	Contractor shall submit all production inspection and testing records to TriMet upon completion.	CDRL 8-4

8.2.3-14	Successful completion of the production inspections and tests on all onboard validators, platform validators, inspection devices and retail sales terminals will be a prerequisite for installation of the system components on Agency properties.	All applicable CDRLs

8.3 Systems Integration Lab Testing

Successful completion of system components Inspection and Testing is a prerequisite for commencement of systems integration testing. The purpose is to demonstrate the control and data monitoring and reporting functions as specified herein, with full integration of the back office subsystems, TriMet and the Agencies' networks, and/or an outside third-party network, and data transmission system with all system components.

Req #	Requirement	Assigned CDRL(s)
8.3-1	Contractor shall submit the systems integration test plan to TriMet for review and approval no later than 30 days prior to commencement of the systems integration testing.	CDRL 8-2
8.3-2	Contractor shall perform the systems integration test upon successful completion of the FAT.	All applicable CDRLs
8.3-3	The back office system will be connected to the TriMet and Agencies' networks, and/or an outside third-party network, and software will be installed as a mockup of the ultimate configuration.	CDRL 8-2
8.3-4	Contractor shall assemble a test bed that fully integrates all system components, including the back office, any work stations associated with back office subsystem operations, and any Agency system integrations required in the specification.	CDRL 8-2
8.3-5	Contractor's test facility will be connected directly to the payment processor, First Data, to fully test the processing of open payments.	CDRL 8-2
8.3-6	The system will be provided with test data simulating TriMet and the Agencies' databases for purposes of this test.	CDRL 8-2
8.3-7	At a minimum, the systems integration test will include: • Three (3) days of continuous testing of all system components, during which all system components will be operational 24 hours a day; • Fifty (50) transactions per day per onboard validator, platform validator, inspection device and retail sales terminals to be completed; and, • All alarm and boundary conditions to be tested five (5) times each.	CDRL 8-2 CDRL 8-3

8.3-8	Systems integration testing will occur in two parts: test bed integration testing as outlined in Section 8.3 and field integration testing that will occur as a part of integrated field inspection and testing outlined in Section 8.4.	CDRL 8-2 CDRL 8-3
8.3-9	Integrated field inspection and testing will not take place until Contractor obtains TriMet and the Agencies' approval of test bed systems integration testing.	All applicable CDRLs

8.4 Systems Integration Field Testing

This section describes the inspection and testing requirements associated with system installation and acceptance.

Req #	Requirement	Assigned CDRL(s)
8.4-1	Installation of the system components at TriMet and the Agencies' properties will commence upon TriMet and Agency acceptance of test reports of the systems integration lab testing.	All applicable CDRLs
8.4-2	Contractor shall provide detailed inspection sheets and test procedures for installation inspection and testing.	CDRL 8-2 CDRL 8-3
8.4-3	Detailed inspection sheets and test procedures will include installation checklists, identifying the system 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 8-2 CDRL 8-3
8.4-4	Procedures will also identify and describe all necessary tests to verify proper interfacing and installation of the system components with other system facilities.	CDRL 8-2 CDRL 8-3
8.4-5	Contractor shall submit pre-and post-installation checklists and test procedures to TriMet or the Agencies a minimum of 60 days prior to scheduled installation and will be subject to the acceptance of TriMet or the Agencies.	CDRL 8-2 CDRL 8-3
8.4-6	Contractor shall perform a complete installation operational test and systems integration field test upon verification of proper installation of the system components.	CDRL 8-2 CDRL 8-3
8.4-7	All functional characteristics of the installed system components at each location will be tested to ensure operation of all the system components as specified, including those involving interfaces with the back office and integrating with Agency systems.	CDRL 8-2 CDRL 8-3
8.4-8	The systems integrated field test must be witnessed by TriMet, and TriMet approval given of the results, before TriMet will approve that installation is successfully completed.	CDRL 8-2 CDRL 8-3 CDRL 8-4

8.4-9	TriMet and Agency participation will be required for the successful completion of field inspection and testing.	All applicable CDRLs
8.4-10	Contractor shall notify TriMet and the Agencies a minimum of 21 days prior to the scheduling of any inspection or test.	All applicable CDRLs
8.4-11	TriMet reserves the right to specify and/or perform installation inspections and tests in addition to those identified by the Contractor in the inspection and testing plan.	All applicable CDRLs
8.4-12	Contractor shall submit all inspection and testing reports to TriMet and the Agencies for approval.	CDRL 8-4
8.4-13	Contractor shall complete all installation testing prior to revenue service.	All applicable CDRLs
8.4-14	In the event a particular problem has not been resolved, TriMet or the Agencies, at their option, may proceed with revenue service under whatever temporary arrangements have been mutually agreed between TriMet/Agencies and the Contractor.	All applicable CDRLs
8.4-15	A 90-day settling period will commence upon completion of integrated field testing.	CDRL 8-4
8.4-16	The settling period will not begin until all components and subsystems are completely functional, operational, on-line, and in service, and until TriMet authorization is provided.	CDRL 8-4
8.4-17	TriMet and the Agencies may, at their sole discretion, conduct additional ad hoc testing during the 90-day settling period.	All applicable CDRLs
8.4-18	Ad hoc testing may, at TriMet and the Agencies' sole discretion, include limited public testing. This may include a controlled friendly user test conducted by TriMet.	All applicable CDRLs

8.5 System Acceptance

Prior to achieving system acceptance, the system must meet the performance requirements contained in this section. Achievement of the system acceptance milestone is subject to TriMet approval, in consultation with the Agencies.

8.5.1 Acceptance Testing

Req #	Requirement	Assigned CDRL(s)
8.5.1-1	Acceptance testing period will commence upon successful completion of the integrated field testing 90-day settling period.	All applicable CDRLs
8.5.1-2	Acceptance testing will be performed with all components, subsystems, and third-party networks completely functional, operational, on-line, and in service.	CDRL 8-5

8.5.1-3	Acceptance testing will be comprised of a 90 consecutive day period in which all system components meet or exceed the performance requirements defined in this section.	CDRL 8-5
8.5.1-4	Any system component or system failures or conditions not meeting these requirements, or not reported by the Contractor, will subject the acceptance testing period for any such system component to be restarted.	CDRL 8-5
8.5.1-5	Contractor shall identify and implement remedial action at no cost to TriMet or the affected Agency in the event that a system component does not meet the performance requirements during the acceptance testing.	CDRL 8-5
8.5.1-6	Contractor shall submit an acceptance test plan to TriMet for acceptance at least 30 calendar days prior to the commencement of the 90-day integrated field testing settling period.	CDRL 8-5
8.5.1-7	Commencement of revenue service will not begin until TriMet approval of the acceptance test plan has been achieved.	All applicable CDRLs
8.5.1-8	Within 10 business days following the completion of acceptance testing, the Contractor shall provide all testing data, documentation, reports, and all other related testing information to TriMet for approval.	CDRL 8-4

8.5.2 Performance Measurement Methodology

8.5.2.1 Failure Review Team

Req #	Requirement	Assigned CDRL(s)
8.5.2.1-1	A Failure Review Team (FRT) will be established to evaluate which failures are chargeable against the Contractor's performance requirements.	CDRL 8-2
8.5.2.1-2	Acceptance test plan will include an FRT performance review process for the purposes of evaluating system performance.	CDRL 8-2
8.5.2.1-3	FRT will be comprised of, at a minimum, one member from the Agencies or an Agency representative and one member from the Contractor's staff.	All applicable CDRLs
8.5.2.1-4	Responsible parties within the FRT will initially attempt to settle any disputes in accordance with these specifications.	All applicable CDRLs
8.5.2.1-5	TriMet program director will make the final and binding decision on any disputes that remain unsettled by the FRT after a period of 10 days.	All applicable CDRLs
8.5.2.1-6	Under mutual agreement, the FRT will define additional chargeable and non-chargeable failures as required.	All applicable CDRLs

8.5.2.2 Non-Chargeable Failure

A non-chargeable failure is a malfunction caused by a condition external to the system component under consideration, which is neither a functional, environmental, nor a test requirement in this specification and is not expected to be encountered during normal and correct operation of the system components in revenue service, and exceeds the requirements as described in the specification.

Req #	Requirement	Assigned CDRL(s)
8.5.2.2-1	Non-chargeable failures will not affect the acceptance testing reliability, accuracy or availability calculations.	CDRL 8-2
8.5.2.2-2	Non-chargeable failures will include the following, at a minimum: • Accident or mishandling of validator, inspection device, retail sales terminal or back office system components • Failure of test facility or test instrumentation, except where test facility or instrumentation is under the control of the Contractor • Any failures caused by externally applied stress conditions outside normal operating conditions in excess of the accepted specification requirements contained herein • 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 Contractor (failures resulting from any maintenance or repair by the Contractor shall be chargeable) • Failure caused by vandalism • Failures caused by out-of-specification fare payment media • Communications failures beyond the control of the Contractor • Third party equipment and services not required to be provided by the Contractor or subcontractor under these specifications • Downtime due to scheduled maintenance	CDRL 8-2
8.5.2.2-3	All other failures will be considered relevant and chargeable unless determined to be non-chargeable by the failure review process.	CDRL 8-2
8.5.2.2-4	Failure review process will be applied as needed during acceptance testing.	CDRL 8-2

8.5.2.3 Chargeable Failure

Req #	Requirement	Assigned CDRL(s)
8.5.2.3-1	A chargeable failure includes but is not limited to any of the	CDRL 8-2

	following: • A malfunction which prevents the eFare collection system component from performing its designated function, or meeting its performance criteria, when used and operated under the environmental and operational conditions stated in these specifications • A malfunction that might cause a threat to the system components, passengers, employees or others • A random occurrence that does not cause the system 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 system • Planned software updates or fixes that adversely affect operation or performance of the system • Scheduled maintenance or repair activities that adversely affect operation or performance of the system	
8.5.2.3-2	Any failure not listed in section 8.5.2.2 will be considered chargeable.	CDRL 8-2
8.5.2.3-3	The following specific conditions, at minimum, will be considered chargeable failures in any system components or systems delivered under this specification: • 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 this 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 a card • Failure of mounting or mounting hardware • Failure to properly register and report any transaction • Undesired shutdown of the system	CDRL 8-2

8.5.2.4 Performance Requirements

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

8.5.2.4.1 Back Office, Web & Software

Back office, web service, and software performance requirements are presented below:

Req #	Type	Description	Require-ment	Assigned CDRL(s)
8.5.2.4.1-1	Back Office Availability OVERALL	Availability is: [total operating hours] - [out-of-service hours] / [scheduled operating hours] per month	99.5%	CDRL 8-2
8.5.2.4.1-2	Back Office Availability SERVICE HOURS	Availability is: [call center operating hours] - [out-of-service hours (during call center op. hours)] / [call center operating hours] per month	99.9%	CDRL 8-2
8.5.2.4.1-3	Web Availability	Availability is: [actual uptime] / [scheduled uptime] per month	99.5%	CDRL 8-2
8.5.2.4.1-4	Transaction Processing	Transactions are processed correctly within 24 hours from receipt at the back office for posting. 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.	99.95%	CDRL 8-2
8.5.2.4.1-5	File Transfer	Timely and accurate assembly and transmission, or receipt and processing, of all file transfers. Timely performance will be in accordance within system specification and design parameters for file assembly and transmission and will be determined by TriMet. Accuracy will be assessed as file transmission fidelity such that the contents of files assembled and transmitted match the contents of files that are received and processed.	99.95%	CDRL 8-2

8.5.2.4.1-6	Software	Software updates, patches and configuration data updates, including routine, scheduled and ad hoc deployments, will not adversely impact successful operation of system components and subsystems. Successful operations will be in accordance with system specification and design parameters for back office, web and software components and will be determined by TriMet.	99.95%	CDRL 8-2

8.5.2.4.2 Validator, Inspection Device & Retail Sales Unit Reliability

Reliability is defined as the failure rate for each device type (e.g., fare payment, fare distribution, and fare inspection) measured over each calendar month. The failure rate is the ratio of the number of chargeable failures recorded in that period to the number of active devices.

Req #	Type	Description	Require-ment	Assigned CDRL(s)
8.5.2.4.2-1	Aggregate Requirement	Validator, Inspection Device and Retail Sales Unit Reliability is calculated monthly as: [chargeable failures] / [population of devices]	95%	CDRL 8-2
8.5.2.4.2-2	Individual Requirement	Any single validator, inspection device or retail sales terminal that fails more than two (2) times in any 30-day period during acceptance testing will be replaced with a new or repaired unit.	NA	CDRL 8-2
8.5.2.4.2-3	Individual Requirement	If the new/repaired unit experiences the same failure rate, the Contractor shall identify and implement remedial action subject to TriMet approval.	NA	CDRL 8-2
8.5.2.4.2-4	Individual Requirement	If a single validator, inspection device or retail sales terminal experiences an average failure rate greater than 1.5 failures per month during the 90-day acceptance testing period, the Contractor shall identify and implement remedial action subject to TriMet approval.	NA	CDRL 8-2

8.5.2.4.2-5	Barcode Read Requirement	Any device equipped with a bar code read-function will be designed and manufactured so that the reader will be able to process 500,000 documents before requiring replacement. Failure of the reader will contribute to the calculation of failure rate for the entire device.	NA	CDRL 8-2
8.5.2.4.2-6	Remedial Action	Remedial action will; include, at no additional cost to TriMet or the affected Agency, an investigation to determine the cause, modification of the system components and on-site services of an engineer or competent service technician.	NA	CDRL 8-2
8.5.2.4.2-7	Tracking	Tracking and reporting of failures will be performed by the device monitoring and management system and maintenance management system. Failure rate calculation will be based on comparison of device monitoring and management MMS and failures reported by TriMet, Agency and Contractor staffs and the public.	99.5%	CDRL 8-2
8.5.2.4.2-8	Reporting	Devices that return to service will self-report incidents via device logs per the system component specifications in Section 6. Calculation will be determined by comparison of device failure reporting by TriMet, Agency and Contractor staffs and device logs of those devices that return to service.	99.5%	CDRL 8-2

8.5.2.4.3 Validator, Inspection Device & Retail Sales Unit Availability

Availability is defined as the probability that a system component is operating in accordance with the specifications.

Req #	Type	Description	Require-ment	Assigned CDRL(s)
8.5.2.4.3-1	Aggregate Requirement	Validator, Inspection Device and Retail Sales Unit Availability is: [total operating hours] – [out-of-service hours] / [scheduled operating hours]	99.7%	CDRL 8-2

8.5.2.4.3-2	Service Hours	Out-of-service hours attributable to non-chargeable failures, as defined in Section 8.5.1.2, will be excluded.	NA	CDRL 8-2
8.5.2.4.3-3	In-Service Devices	Only fare collection system components in revenue service will be taken into consideration.	NA	CDRL 8-2
8.5.2.4.3-4	Reporting Requirement	Devices subject to failure that return to service will self-report down-time via device logs per the system component specifications in Section 6.	NA	CDRL 8-2

8.5.2.4.4 Validator, Inspection Device & Retail Sales Unit Accuracy

Accuracy requirements for validators, Inspection Devices and Retail Sales Units are presented below:

Req #	Type	Description	Require-ment	Assigned CDRL(s)
8.5.2.4.4-1	Aggregate Requirement	Validator, Inspection Device and Retail Sales Unit Valid fare media will be accurately read upon proper tap, assuming the fare media is not damaged sufficient to destroy the ability of the reader to correctly read the coded data. Data for calculating performance against this requirement may encompass reports by TriMet and other agency staff, Contractor staff and customers.	1st tap: 99% 2nd tap: 99.9%	CDRL 8-2
8.5.2.4.4-2	Aggregate Requirement	Validator and Retail Sales Unit Accuracy is: the ratio of the transactions (value and volume) processed by the transaction processor to those recorded by the devices, as evidenced by the transactional data recorded in the device audit registers.	99.95%	CDRL 8-2
8.5.2.4.4-3	Aggregate Requirement	Inspection Devices Accuracy is: accurate validation of fare media usage and status as evidenced by fare media usage records, data recorded in the device, and usage reporting from authorized personnel.	99.95%	CDRL 8-2

8.5.3 Final System Acceptance

System acceptance is based upon successful completion of inspection and testing. TriMet will issue a certificate of final system acceptance upon approval of Contractor's request for system acceptance.

Req #	Requirement	Assigned CDRL(s)
8.5.3-1	Contractor will submit a request for system acceptance upon verification of final system inspection and testing and determination that all work has been completed including all documentation delivered, and software glitches fixed in accordance with specifications and requirements.	CDRL 8-4

8.6 Waiver of Testing

Req #	Requirement	Assigned CDRL(s)
8.6-1	If the component or subsystem in question is considered by TriMet to be substantially identical in design to equipment previously deployed in other transit applications, specific tests on that system component may not be necessary. To obtain this waiver, the Contractor must provide a formal request for a testing waiver for each applicable component or subsystem.	CDRL 8-5
8.6-2	If Contractor desires waiver of testing Contractor will submit required information for each applicable component or subsystem 60 days prior to the date of planned testing.	All applicable CDRLs
8.6-3	Required information for waiver of testing will include the following: • List of the locations and quantities of current equipment installations, including duration of revenue service • Description of all relevant differences among the other installations and the requirements of this specification • Description of all differences between the currently installed equipment and the system components intended for these 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 contract for the waiver	CDRL 8-5
8.6-4	Based on submitted data, TriMet will determine if the requirements for testing will be waived.	NA
8.6-5	Specific requirements for each system component will be considered individually, and waivers will be issued on an individual basis; it is possible TriMet may grant a waiver for certain tests while others will still be required.	CDRL 8-5

8.6-6	Component waiver will not satisfy integrated testing of components.	CDRL 8-5

8.7 Client Test Facility

Req #	Requirement	Assigned CDRL(s)
8.7-1	Contractor shall furnish a client test facility on TriMet property for TriMet use.	CDRL 8-7 CDRL 8-8
8.7-2	Scope and functionality of the client test facility will be a duplicate of that found at Contractor's test facility.	CDRL 8-7 CDRL 8-8
8.7-3	Client test facility environment will include at a minimum: functional back office (all components), platform validator, on-board validator, CAD/AVL control unit, inspection device, retail sales unit, IVR, website.	CDRL 8-7 CDRL 8-8
8.7-4	The client test facility will have the ability to connect directly to the payment processor, First Data, to fully test the processing of open payments.	CDRL 8-7 CDRL 8-8

8.8 Required Submittals

The required submittals specified in this section are summarized below. They are further described at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 8-1	Quality Assurance and Control Program Plan	8.1.1	✓	✓	✓	
CDRL 8-2	Inspection and Testing Plan	8.1.2 8.2 8.3 8.4 8.5		✓	✓	
CDRL 8-3	Inspection and Testing Procedures and Scripts	8.1.3 8.2 8.3 8.4 8.5			✓	At least 10 business days prior to the start of each test.
CDRL 8-4	Inspection and Testing Reports	8.1.4 8.2 8.3 8.4 8.5				Within 10 business days of completion of each successful test/inspection

CDRL 8-5	Acceptance Test Plan	8.5.1				At least 60 calendar days prior to the start of acceptance testing
CDRL 8-6	Waiver of Testing	8.6				At least 60 days prior to the start of planned testing
CDRL 8-7	Client Test Facility Hardware Design	8.7	✓	✓	✓	
CDRL 8-8	Client Test Facility Software Design	8.7	✓	✓	✓	

9 Maintenance

The Contractor will give primary consideration to maintenance, troubleshooting, component removal, repair, replacement, and inspection in the design of all system components. The primary objective of the maintainability program is to minimize maintenance labor, material costs, and fare collection system downtime.

9.1 Maintainability Requirements

Req #	Requirement	Assigned CDRL(s)
9.1-1	Contractor is responsible for any and all system maintenance and support prior to system acceptance.	CDRL 9-1
9.1-2	Use of COTS components will be considered as much as possible to leverage lower costs and quicker procurement turnaround.	All Applicable CDRLs
9.1-3	System components will utilize standard, commercially available hardware and components that maximize interchangeability, and allow for handling of most maintenance problems with minimal time and use of tools in the field.	All Applicable CDRLs
9.1-4	All assemblies of a given type will be identical, interchangeable and removable, designed to allow quick replacement of identical modules.	All Applicable CDRLs
9.1-5	Automatic diagnostic test routines of major system components will be included to aid technicians in troubleshooting. These routines will guide technicians through test procedures to isolate defects to the lowest level replaceable unit.	All Applicable CDRLs
9.1-6	Failure indicators will be provided and identified on major system components.	All Applicable CDRLs
9.1-7	All system components subject to field usage will have a durable, weather resistant barcode attached to allow for easy identification and tracking. Placement of the barcode will be in an easily accessible location.	All Applicable CDRLs

9.2 Maintenance Plan

Req #	Requirement	Assigned CDRL(s)
9.2-1	The Contractor shall provide a maintenance plan sufficiently detailed to permit TriMet to allocate manpower and resources to the maintenance and servicing of the eFare collection system, and will be scaled as necessary to reflect varied requirements over the anticipated service life of the system.	CDRL 9-1

9.2-2	The maintenance plan will provide reference to the appropriate preventative maintenance requirement and service reliability performance standard.	CDRL 9-1
9.2-3	Preventive maintenance activities will not require more than 5 mins/device (excluding back office components) to perform and will not be required more often than once every 30 days or a set number of minimum transactions, whichever occurs first. Preventive maintenance activities will include but are not limited to: • inspection of indicators • tightening of fasteners • housing maintenance • surface cleaning • replacement of consumables • Prompting self-diagnostic programs	CDRL 9-1
9.2-4	Upon completion of service actions, each component or device will automatically perform a self-diagnostic check and ensure that all components are properly operating before returning to operational status.	CDRL 9-1
9.2-5	The device or component will perform the same diagnostic testing (at minimum) at reset or power-up as after completion of service actions.	CDRL 9-1
9.2-6	Device reset will not be required for routine maintenance or required for normal revenue servicing.	CDRL 9-1
9.2-7	The maintenance management system will include a record and schedule of all planned and performed maintenance activities.	CDRL 9-1
9.2-8	Maintainers in the field will have remote access to the maintenance management system, and be able to update and review maintenance plans in real time.	CDRL 9-1

9.2.1 Spares & Itemized Price List

Req #	Requirement	Assigned CDRL(s)
9.2.1-1	The Contractor shall prepare and submit to TriMet a recommended list of spare modules and parts to support the installed field equipment.	CDRL 9-2
9.2.1-2	This list will: • Be grouped by equipment, each module, part, and plug-in PC card assembly • Provide complete ordering and procurement information for each item, or reference a catalog for this information • Contain at least the following information for each item: o Item name o description o rating (if applicable)	CDRL 9-2

	o current price o original manufacturer's name o part number o revision number o drawing reference number o country of origin	
9.2.1-3	Items that are common to more than one equipment, module, or subassembly will be suitably cross referenced.	CDRL 9-2
9.2.1-4	Recommended quantities will be provided based on expected usage or based on a percentage not to exceed 10 percent of the installed base.	CDRL 9-2
9.2.1-5	TriMet will purchase spare parts at the end of warranty based on the Contractor's recommendation and price.	CDRL 9-2
9.2.1-6	During warranty TriMet will monitor actual usage against the Contractor's recommendations. Should actual usage in revenue service differ from the Contractor's recommendations by greater than 50 percent, the Contractor shall provide justification for the difference. Contractor agrees to allow TriMet to procure parts at prices listed in CDRL 9-2 for a minimum of one (1) year from completion of warranty.	CDRL 9-2
9.2.1-7	The Contractor shall list separately those spare parts that the Contractor plans to utilize for warranty and maintenance support of field equipment.	CDRL 9-2
9.2.1-8	During the Contractor warranty and maintenance support, the Contractor shall return the same serial number module/component/part, or new item, back to TriMet, even when using TriMet's spare parts.	CDRL 9-1 CDRL 9-2
9.2.1-9	All TriMet-owned spares used by Contractor shall be made whole and brought back to 100 percent successful operation within one (1) week of Contractor access.	CDRL 9-1 CDRL 9-2
9.2.1-10	The Contractor shall maintain an adequate inventory of spare parts for all the equipment furnished for the eFare system for 10 years after final acceptance. In the event the Contractor fails to furnish these parts within 60 days after receipt of order, the Contractor shall notify TriMet to arrange suitable replacements. Exceptions to the nominal delivery time will be stated in the Spare Parts List. This arrangement will include providing sufficient information to allow TriMet to procure the parts affected.	CDRL 9-1 CDRL 9-2

9.3 Required Submittals

The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 9-1	Maintenance Plan	9.2	✓	✓	✓	
CDRL 9-2	Spares and Itemized Price List	9.3		✓	✓	

10 Training

The Contractor shall provide a comprehensive program to educate, train, and teach personnel in all details of the eFare payment system enabling personnel to properly operate, service, and maintain the system and each of its components throughout its useful life.

Req #	Requirement	Assigned CDRL(s)
10-1	Course sizes will be designed to assure all trainees have one-on-one training with equipment and software.	CDRL 10-1
10-2	The Contractor's training program will include classroom training provided by the Contractor's staff.	CDRL 10-1
10-3	When appropriate, training will occur in the field or location of service. The Contractor shall allow TriMet staff to shadow Contractor staff during warranty activities in order to gain a better understanding of how properly operate and maintain the eFare system.	CDRL 10-1
10-4	The Contractor shall supplement training, as appropriate by providing OEM representatives to train the Agencies' staff on their subassemblies and devices.	CDRL 10-1
10-5	The Contractor's training program will include formal and informal instruction, working equipment, manuals, and diagrams as instructional tools.	CDRL 10-1
10-6	All materials used in the programs, such as training jigs, fare media, manuals, simulators, and drawings, will be of durable construction and will become the property of TriMet upon completion of the training.	CDRL 10-1
10-7	Training materials will be updated as required during the course of instruction.	CDRL 10-1
10-8	The Contractor shall assume that TriMet staff does not have knowledge of any eFare system features. However, the Contractor may assume that maintenance personnel have the basic skills pertinent to their crafts.	CDRL 10-1
10-9	Courses will be limited to a maximum of eight (8) hours per day.	CDRL 10-1
10-10	During warranty and any active software maintenance agreement, the Contractor shall provide update course instruction and materials of any type as needed.	CDRL 10-1
10-11	TriMet will furnish the following training-related items upon Contractor request at least two (2) weeks prior to the scheduled classes. • Space for classroom lectures and practical training on equipment. Location and class times will be set by TriMet. • Projectors, screens, white boards, and similar equipment. • Shop space as needed. • Bus and/or streetcars with installed eFare equipment	CDRL 10-1

10-12	The Contractor 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 Contractor shall be responsible for ensuring that such parts are not damaged or modified in any way. In addition, these parts must pass re-inspection and acceptance tests after return to TriMet.	CDRL 10-1

10.1 Training Program Plan

Req #	Requirement	Assigned CDRL(s)
10.1-1	The Contractor shall submit a training program plan in accordance with the criteria outlined below.	CDRL 10-1
10.1-2	The Contractor shall develop and submit for TriMet approval a narrative description that documents the design for training TriMet and agency personnel.	CDRL 10-1
10.1-3	TriMet staff to be trained includes IT and finance professionals, supervisors, maintenance and repair personnel, auditors, planners, field operations and command center personnel, paratransit and LIFT personnel, customer service and transit store personnel, managers and trainers.	CDRL 10-1
10.1-4	In addition to general training plan information the training program plan will include at a minimum the following for each course: • Identification and summary descriptions of all training courses including course lengths • 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.	CDRL 10-1
10.1-5	The training program plan will also address the Contractor's approach for training TriMet trainers to deliver training subsequent to the Contractor's involvement. It will describe the Contractor's approach, resources and hours required, and any training aids that might be included.	CDRL 10-1

10.1.1 Training Delivery Schedule

Req #	Requirement	Assigned CDRL(s)
10.1.1-1	A training schedule will be included in the Contractor'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 10-2

10.2 Training Courses

Req #	Requirement	Assigned CDRL(s)
10.2-1	The Contractor shall propose the actual courses to be delivered to TriMet and agency staff. The course curriculum will include instruction of TriMet and agency personal in at least the following categories: • Back office System Administration, Configuration, Operations and Maintenance, Backup, and Disaster Recovery • Financial Reporting and Reconciliation • Onboard Validator Operations and Maintenance • Platform Validator Operations and Maintenance • Fare Inspection Device Operations and Maintenance • Retail Sales Device Operations and Maintenance • Train-the-Trainer – Onboard Validator Operations and Maintenance • Train-the-Trainer – Platform Validator Operations and Maintenance	CDRL 10-1
10.2-2	The Contractor shall develop and deliver Train-the-Trainer courses that provide TriMet and agency training instructors with the necessary instruction to deliver the eFare training without the need for Contractor instructors. Train-the-trainer instruction will be provided for the following course categories: • Onboard and platform validator operations and maintenance • Fare inspection device operations and maintenance	CDRL 10-1

10.3 Training Materials & Equipment

Req #	Requirement	Assigned CDRL(s)
10.3-1	The Contractor shall provide all necessary training materials for delivery of each course discussed in the training program plan. The Contractor shall reflect all changes and revisions to the installed eFare system in all training materials, whether supplied	CDRL 10-3

Req #	Requirement	Assigned CDRL(s)
	to TriMet personnel, or used in Contractor-conducted training courses. Contractor is required to provide any hard-copies used for training purposes for all expected attendees, plus 5 spare copies. At a minimum the following training materials will be provided for each course in sufficient quantities: • 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 eFare equipment • Computer-based presentations	
10.3-2	Draft training materials will be submitted at FDR. Final training materials will be submitted to TriMet at least 30 days before classes are scheduled to begin. All documentation and training material shall be submitted in an electronic form as specified by TriMet. 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 10-3
10.3-3	TriMet reserves the right to reproduce portions or all of the training materials for internal use. If the Contractor produces an update or new training aids (e.g., video recordings, manuals, etc.) within two (2) years following the completion of equipment installation, TriMet will receive copies of the updated material for its sole use in TriMet training programs, at no cost to TriMet.	CDRL 10-1 CDRL 10-3
10.3-4	The Contractor shall provide onboard and platform validator training jigs that enable students to receive hands- on equipment operation and maintenance instruction while in a classroom setting. The training jigs shall be powered by a standard 110v AC power source.	CDRL 10-1 CDRL 10-3

10.4 Required Submittals

The required submittals specified in this section are summarized below. They are further described at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 10-1	Training Program Plan	10.1 10.2 10.3	✓	✓	✓	
CDRL 10-2	Training Schedule	10.1			✓	Training schedule updates shall occur weekly beginning 1 month prior to the commencement of training
CDRL 10-3	Training Materials and Equipment	10.1 10.2 10.3	✓	✓	✓	All materials and equipment shall be identified in the Training Program Plan. All necessary materials and equipment must be available for use at the time of training instruction.

11 Security

11.1 Data Security

Req #	Requirement	Assigned CDRL(s)
11.1-1	All PII data transmissions will be encrypted.	CDRL 11-1
11.1-2	VPN will be used for all communication where practicable.	CDRL 6-2 CDRL 11-1
11.1-3	Firewalls will be established around all system-specific servers.	CDRL 6-2 CDRL 11-1
11.1-4	Any communications through firewalls will be established from inside the firewall.	CDRL 11-1
11.1-5	Security-sensitive information will be submitted separately according to a procedure to be jointly developed between the Contractor and the TriMet PM. Security-sensitive information will include: • Information that would allow an individual to duplicate, skim or counterfeit fare media • 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 system, without such diversion becoming evident to TriMet or the Agencies through normal reporting by the system	TBD
11.1.6	Any eFare equipment provided or purchased by Contractor that will capture, store, transmit, or process payment card data will be PCI-certified, either by Contractor or by the OEM. Contractor shall be responsible for demonstrating that all hardware and software delivered is Payment Card Industry-Data Security Standard (PCI-DSS) compliant.	CDRL 11-1
11.1.7	Contractor shall be responsible for providing a PCI compliance plan as part of design review and supporting certification for the entire system. Contractor shall be responsible conducting all testing required to achieve certification prior to system acceptance.	CDRL 11-1
11.1.8	The approach to PCI-DSS compliance will include avoiding the storage of personally identifiable information (PII) and bank card data on field devices whenever possible, and only storing or transmitting this data in an encrypted or tokenized form.	CDRL 11-1

11.1.9	Any eFare equipment or systems that will capture, store, transmit or process PII will comply with the Oregon Consumer Identity Theft Protection Act, ORS 646A.600 to 646A.628, and any implementing rules or regulations.	CDRL 11-1
11.1.10	The connection between the validators and AMPS will be over an Internet Protocol (IP) network. The connection between AMPS and payment processor may be over an IP network or the internet.	CDRL 6-2 CDRL 6-4 CDRL 11-1
11.1.11	All payment data will be encrypted from the point when it is captured from the card to when it is received by the payment processor. When communications are over public networks, Virtual Private Networks (VPNs) will be used to increase security.	CDRL 11-1
11.1.12	User interface access to all elements of the eFare back office systems, including all systems described in sections 6.1.2 through 6.1.8, as well as configuration interfaces for the websites (6.5), IVR (6.6), Backup and Disaster Recovery Systems (12), and Hosting platforms (13.5), will be managed using either a vendor-provided user management system or the Agencies' existing user authentication and access control platform.	CDRL 11-3

11.2 Physical Security

Req #	Requirement	Assigned CDRL(s)
11.2-1	Physical protection will be established for any agency-hosted servers.	CDRL 11-2
11.2-2	Physical and virtual access to back office systems will be restricted.	CDRL 11-2
11.2-3	Physical security will be sufficient for compliance with the PCI-DSS.	CDRL 11-2

11.3 Required Submittals

The required submittals specified in this section are summarized below. They are described in detail at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 11-1	Data Security Design	11.1	✓	✓	✓	
CDRL 11-2	Physical Security Design	11.2		✓	✓	
CDRL 11-3	Secure System Access Design	11.3	✓	✓	✓	

12 Backup & Recovery

The eFare system will have a disaster recovery plan that allows for the efficient recovery of critical systems in the event of an outage. The system will also support offline operation of the field devices to perform specific functions, as deemed reasonable by the agencies.

Req #	Requirement	Assigned CDRL(s)
12-1	The Contractor shall be responsible for installing and testing a disaster recovery system as part of the eFare implementation.	CDRL 6-2 CDRL 12-1
12-2	The Contractor shall document and train TriMet staff in the procedures to properly restore eFare system operations following a catastrophic event.	CDRL 10-1 CDRL 12-1
12-3	User interface access to all elements of the backup and disaster recovery systems will be managed using TriMet's existing one of two user authentication and access control platforms as required in Section 6.1.1. Individual users or user groups will have access configured to allow for standard business operations.	CDRL 11-3 CDRL 12-1

12.1 Redundancy & Backup

Req #	Requirement	Assigned CDRL(s)
12.1-1	At a minimum, the system will be deployed on two identical and independent systems that are geographically separated.	CDRL 6-2 CDRL 12-1 CDRL 12-2
12.1-2	The Contractor shall provide and implement a hot backup architecture and fail-over-to-back-up servers, eliminating a single point of failure.	CDRL 6-2 CDRL 12-1 CDRL 12-2
12.1-3	All value-based data will be 100 percent protected against loss. Each identical and independent system will be equipped with appropriate systems and procedures (e.g., RAID) to assure this requirement, subject to acceptance by the TriMet.	CDRL 6-2 CDRL 12-1 CDRL 12-2
12.1-4	The Contractor shall provide a means for regularly schedule backups using a backup system and backup media sufficient to archive four (4) years of data.	CDRL 6-2 CDRL 12-2
12.1-5	Data generated and contained in any system component (such as validators, inspection devices, etc.) will not be deleted until it has been confirmed received and recorded by the back office.	CDRL 6-2 CDRL 11-1 CDRL 12-2

12.1-6	The design of the system and all of its components will provide for a mechanism to recover transaction or other usage data stored on faulty equipment that has not been transmitted and captured by the eFare central system.	CDRL 6-2 CDRL 12-1

12.2 Disaster Recovery

Req #	Requirement	Assigned CDRL(s)
12.2-1	The Contractor shall provide a data system that offers protection against data loss and system failure.	CDRL 6-2 CDRL 12-1
12.2-2	Means will be provided in data system design to ensure complete recovery from loss of system components or data at any point.	CDRL 6-2 CDRL 12-1
12.2-3	The Contractor will provide an evaluation of the types of disasters which may impact the system's operations and detail the steps to be taken to survive and recover from such disaster.	CDRL 12-1
12.2-4	The Contractor shall develop and submit for TriMet approval a disaster recovery plan and procedures that ensure that no data is loss in the event of a catastrophic event.	CDRL 12-1
12.2-5	The disaster recovery plan will include provisions to ensure that all settlement information continues to be accessible by system participants.	CDRL 12-1
12.2-6	The Contractor shall identify the resources (i.e., people, systems, communication lines, etc.) that must be committed to implement the disaster recovery plan.	CDRL 12-1

12.3 Required Submittals

The required submittals specified in this section are summarized below. They are further described at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 12-1	Disaster Recovery Plan	12.2		✓	✓	An updated disaster recovery plan will be delivered at the start of eFare back office training
CDRL 12-2	System Backup and Redundancy	12.1	✓	✓	✓	

13 Ongoing Support

13.1 System Operations

Following Contractor-delivered training and system acceptance TriMet will assume responsibility for operation and maintenance of the eFare back office, excluding Contractor responsibilities as specified in the software maintenance agreement (Section 13.3) and warranty (Section 13.2). To help facilitate a smooth transition of system operations responsibility, the Contractor's lead system's engineer will continue to provide onsite technical and operational support to TriMet following training, through the settling period and up until full system acceptance is achieved.

Req #	Requirement	Assigned CDRL(s)
13.1-1	The Contractor's lead system's engineer will provide fulltime onsite support to TriMet including eFare system administration and operational support and responding to and resolving installation and system performance issues.	CDRL 1-1 CDRL 13-1
13.1-2	The full-time systems engineer must have a commanding understanding of the operation of all Contractor-furnished components of the eFare system and have the authority to engage any Contractor resources necessary to ensure the successful operation of the eFare system.	Contractor's Proposal

13.2 Warranty

The Contractor shall develop a warranty plan outlining the processes and procedures to be implemented in order to meet all specified requirements.

Req #	Requirement	Assigned CDRL(s)
13.2-1	A draft of the warranty plan will be submitted at the FDR and a revised final version will be provided a minimum of 90 days prior to the start of any warranty period.	CDRL 13-2
13.2-2	The Contractor shall warrant to TriMet that all of the equipment, computer systems and software, including firmware as warranted by third-party suppliers, provided for the eFare system will be free from defects in material and workmanship under normal operating use and service. Remedial work to correct deficiencies will include the repair or replacement, at the Contractor's option, of equipment, components, devices and/or materials including all applicable software and/or firmware as warranted by third-party suppliers.	CDRL 13-2
13.2-3	The Contractor warranty will encompass all work associated with Software Maintenance Agreement Req. # 13.3-8 for the correction of errors and bugs in the system software.	CDRL 13-2

13.2-4	The Contractor shall provide a two (2) year warranty that begins upon completion of Integrated Field Testing and commencement of the 90-day settling period. Any system component repaired or replaced under terms of warranty will be warranted for at least 6-months, or the remaining duration of warranty for the failed device or component, whichever is longer.	CDRL 13-2
13.2-5	After two years, should there be warranty work to complete, the warranty will be staggered to provide equal coverage for each piece of equipment.	CDRL 13-2
13.2-6	During the warranty period, the Contractor shall provide 24-hour response for servicing of any and all defects or malfunctions of the eFare system equipment and software.	CDRL 13-2
13.2-7	The 24-hour response also means that a fully-qualified service representative will be onsite within 24 hours after being contacted by TriMet if a physical presence is needed to resolve the identified issue. The 24-hour servicing will include all parts and labor necessary to repair the eFare equipment onsite and in place.	CDRL 13-2
13.2-8	During the warranty period and prior to System Acceptance, the Contractor shall allow TriMet to shadow its maintenance personnel (e.g., attend maintenance operations) so that TriMet staff can achieve on-the-job training following their formal training.	CDRL 13-2
13.2-9	Formal training must precede the period of shadowing. If the Contractor has not reasonably attempted to provide formal training in sufficient time to allow for TriMet staff to conduct the shadowing activities, the Contractor's on-call warranty period will extend to allow for a full six months of shadowing activities.	CDRL 13-2
13.2-10	The Contractor shall provide TriMet with all contractual spare parts and unused consumable items prior to the achievement of System Acceptance.	CDRL 13-2
13.2-11	Prior to achievement of System Acceptance, Contractor shall be responsible for all operations and maintenance activities, including the swapping of faulty on-board and off-board validators.	CDRL 13-2
13.2-12	TriMet will operate and maintain the equipment and software in accordance with the Contractor's specific instructions in order to maintain this warranty. However, TriMet will be held blameless if the Contractor has not provided adequate or correct training, and/or complete operating manuals, maintenance manuals, electrical and electronic schematics, mechanical diagrams and complete software documentation.	All Applicable CDRLs

13.2-13	If during the warranty period the rate of failure of any part or component exceeds 10 percent of the mean quantity of such item installed in revenue service, then the entire quantity of such item will be considered to have failed, and will be repaired, corrected, or replaced. Any item repaired or replaced under these terms shall be warranted for at least one (1) year after repair or replacement. Contractor shall undertake and complete a work program reasonably designed to prevent the occurrence of the same defect in all other equipment purchased under this Contract. The work program will include inspection and correction of the defective or potentially defective module in all of the equipment.	CDRL 13-2
13.2-14	Spare modules will be replaced in a maximum of 14 calendar days. The Contractor shall maintain sufficient staff, spare sub-assemblies, modules and component piece parts to meet the eFare system availability requirements through the conclusion of the warranty period.	CDRL 13-2
13.2-15	In the event the Contractor fails to comply promptly with warranty requirements, TriMet will upon written notice to the Contractor, have the right to deduct the cost of TriMet's then prevailing labor and materials from any compensation due or becoming due to the Contractor. In the event the Contractor has been paid in-full, the Contractor agrees to compensate TriMet for the costs incurred, or potentially suffer consequences of contract default.	CDRL 13-2
13.2-16	The warranty will not apply to any equipment that has been damaged by any person other than Contractor or Contractor's assignee. Environmental conditions described in these technical specifications will be considered normal operating conditions for this system and shall not qualify for exclusion.	CDRL 13-2
13.2-17	The Contractor shall follow proper TriMet security procedures for gaining access to field equipment and locations and shall not undertake such procedures without having received TriMet-provided training. The Contractor shall not modify or repair any equipment in revenue service without the approval of TriMet's project manager or a TriMet authorized representative.	CDRL 13-2
13.2-18	The Contractor shall be responsible for all costs associated with the repair or replacement of components and/or subsystems, and the shipping charges to and from the Contractor's repair facilities.	CDRL 13-2
13.2-19	The Contractor shall provide TriMet with a new component/subsystem if that particular component/subsystem was repaired or replaced three (3) times, for the same failure.	CDRL 13-2

13.2-20	During the entire warranty period, any and all repairs and/or adjustments of equipment by the Contractor shall be documented by the Contractor on a TriMet approved form (i.e. MMIS work ticket), at the completion of every day. A repair report summary shall be weekly via email to a TriMet specified distribution list.	CDRL 13-2
13.2-21	Should there be overlap during the System Acceptance period between provisions of the warranty and the System Acceptance requirements specified in Section 8.6, the stricter of the two requirements shall apply.	NA

13.3 Software Maintenance Agreement

During the warranty and maintenance periods specified and during any optional maintenance period elected by TriMet, the Contractor shall provide software maintenance services described in this section. Maintenance of software will consist of the following work:

Req #	Requirement	Assigned CDRL(s)
13.3-1	The terms of the Software Maintenance Agreement shall commence upon completion of Integrated Field Testing and commencement of the 90-day settling period.	CDRL 13-3
13.3-2	Contractor shall provide all preventive and corrective maintenance to support operations with no degradation in performance standards set forth in this specification.	CDRL 13-3
13.3-3	Contractor shall provide software maintenance for seven (7) years plus applicable extensions following system acceptance.	CDRL 13-3
13.3-4	Software to be maintained under this specification will be inclusive of all APIs provided by the Contractor.	CDRL 13-3
13.3-5	Performance of maintenance activities will be completed in a manner that does not disrupt or degrade eFare system operations, to the fullest extent possible.	CDRL 13-3
13.3-6	Advance notification and concurrence of TriMet will be obtained for maintenance activity requiring interruption of service or operations.	CDRL 13-3
13.3-7	Software and firmware updates will be clearly documented in advance of deployment for TriMet review and approval.	CDRL 13-3
13.3-8	Software and firmware update deployment will be scheduled and planned with TriMet.	CDRL 13-3
13.3-9	Maintenance of software will consist of the following: • correction of errors and bugs in the eFare system software including those identified by Contractor, TriMet, and other Contractor customers • Provide updated, and accurate, documentation • Contractor's support to detect software failures • Contractor's support to create temporary work-around for	CDRL 13-3

	any failure, until fix is deployed • Conversion of any TriMet data that is required to support new software	
13.3-10	Maintenance of software will encompass the following work: • Changes, enhancements and other modifications to and new releases for the software • Contractor's support to assist TriMet in the development and efficient use of applications of the software	CDRL 13-3
13.3-11	Software maintenance will include all system components, including those not being maintained by the Contractor.	CDRL 13-3
13.3-12	If the condition requiring correction affects the operation of other system components, then the Contractor shall provide the repair or replacement for other system components that fails due to this condition, regardless of whether the warranty period has expired for those other system components.	CDRL 13-3
13.3-13	The Contractor shall submit a Software Maintenance Plan for review and approval identifying the approach to meeting the requirements of the software maintenance agreement.	CDRL 13-3
13.3-14	All changes to any delivered and/or installed part of the eFare system must comply the mutually agreed upon change request and software deployment procedures.	CDRL 13-3
13.3-15	Contractor shall maintain a change log of all changes that become available, regardless of whether the change was implemented by TriMet, and provide this change log to TriMet on a frequent mutually agreed upon schedule. The change log must be sufficiently detailed to allow TriMet to determine when any feature was added or modified, and the scope of the change to that feature.	CDRL 13-3
13.3-16	During the period when the software maintenance agreement is in effect, the Contractor shall provide update course instruction and materials of any type as needed.	CDRL 10-1 CDRL 13-3

13.3.1 Software Maintenance Requirements

Software maintenance will include back office system administration, database updates and upgrades, operating system updates, antivirus updates, firmware updates, license renewal, and any other activities needed to maintain the performance standards set forth in this specification.

Req #	Requirement	Assigned CDRL(s)
13.3.1-1	Third-party software will be maintained at the most current or one-back version throughout the term of the Contract at no additional charge.	CDRL 13-3

13.3.1-2	Without releasing the Contractor from its obligations for warranty, support and maintenance of the software, TriMet will have the right to maintain versions of the software that are one or more levels behind the most current version of such software, and to refuse to install any such enhancements if, in TriMet's discretion, installation of such enhancements would interfere with TriMet's operations.	CDRL 13-3
13.3.1-3	Contractor and TriMet shall agree on an appropriate course of action if a third-party software provider goes out of business or if maintenance updates of third-party software degrades performance of the Contractor's software.	CDRL 13-3
13.3.1-4	The Contractor shall make corrections and modifications to the system immediately upon discovery of issues and in coordination with TriMet staff, in accordance with Req. # 13.3.2-3 through 13.3.2-5. Serious errors (e.g., any error which causes system reliability or availability to fall below stated requirements) will be updated immediately.	CDRL 13-3
13.3.1-5	Contractor shall notify TriMet whenever corrections, modifications or revisions of system software are available and in advance of deployment.	CDRL 13-3
13.3.1-6	The Contractor shall keep all software instances (training, test, development, pre-production, and production) at the same configuration and patch level.	CDRL 13-3
13.3.1-7	As standard practice when repairing deficiencies and releasing device or back office system fixes or upgrades, the Contractor shall prepare and run regression testing scripts to test each build that is delivered to the test environment to ensure that no regression problems have surfaced. Any regression issues will be documented as deficiencies and resolved accordingly.	CDRL 13-3
13.3.1-8	Contractor shall update the Client Test Facility throughout the warranty and software maintenance periods of the agreement to maintain a duplicate instance of Contractor Test Facility, as necessary.	CDRL 13-3

13.3.2 Communication, Response & Resolution Requirements

Req #	Requirement	Assigned CDRL(s)
13.3.2-1	Contractor shall provide technical support to TriMet for the use and operation of the software via telephone consultation, which will be provided by the Contractor during normal business hours (8 a.m. to 5 p.m., Pacific time, Monday through Friday, excluding holidays), and on evenings, weekends and holidays on an as-needed basis.	CDRL 13-3

13.3.2-2	The Contractor shall establish and provide a 24 hour-per-day phone number for the reporting of systemic software and system outages and problems.	CDRL 13-3
13.3.2-3	Contractor shall respond to systemic software and system outages, either on-site or via remote access, within fifteen (15) minutes of notification, 24 hours a day, seven (7) days per week.	CDRL 13-3
13.3.2-4	Contractor shall make every attempt to fix software problems within three (3) hours of being reported.	CDRL 13-3
13.3.2-5	If the software problem potentially impacts revenue collection but repair will take longer than (3) hours, the Contractor shall report to TriMet the status of problems as soon as the situation becomes evident and provide status reports at least every four (4) hours thereafter, until the problem is corrected or a work around is established.	CDRL 13-3
13.3.2-6	Contractor shall submit to TriMet no less than once every three (3) months a newsletter setting forth errors in and modifications and updates to the software, upgrade schedules, vendor changes to systems worldwide, a matrix of key dates for system changes (e.g., PCI upgrade) for the following quarter and beyond, and information setting forth details regarding deployed software versions.	CDRL 13-6
13.3.2-7	Newsletter information will be sufficiently detailed and clear to enable TriMet to make corrections, modifications and updates, without assistance from the Contractor.	CDRL 13-6
13.3.2-8	Where the Contractor generally provides such information on a data processing medium or by telephone in a manner that permits the software to be changed directly, such service will be provided to TriMet in accordance with Contractor's standard maintenance schedule and procedures.	CDRL 13-6
13.3.2-9	TriMet may reproduce for internal use all hard copy and computer medium information.	All Applicable CDRLs

13.3.3 Software Maintenance Management

Contractor shall support the following software maintenance management processes.

Req #	Requirement	Assigned CDRL(s)
13.3.3-1	Contractor shall support regularly scheduled maintenance management meetings throughout the term of the agreement, either in person or via phone.	CDRL 13-3
13.3.3-2	Maintenance management meetings will occur at least monthly.	CDRL 13-3
13.3.3-3	Contractor shall measure and submit monthly reports detailing system performance against contract requirements for review.	CDRL 13-3

13.3.3-4	Contractor shall track and maintain a list of maintenance issues and open items. Contractor shall distribute the list to TriMet at least monthly.	CDRL 13-3
13.3.3-5	Contractor shall report out chargeable and non-chargeable failures during maintenance management meetings.	CDRL 13-3
13.3.3-6	The TriMet program director will make the final and binding decision regarding disputes for chargeable and non-chargeable failures.	CDRL 13-3
13.3.3-7	When updates become available, the Contractor shall provide all work, training and support required to install such updates and to convert and reformat any of TriMet's data, if necessary.	CDRL 13-3
13.3.3-8	All such work will be available at Contractor's labor rates as specified in the price schedule.	CDRL 13-3
13.3.3-9	Without releasing the Contractor from its obligations for warranty, support and maintenance of the software, TriMet has the right to refuse to install any such updates, at its sole discretion.	CDRL 13-3

13.3.4 Software Enhancements

Req #	Requirement	Assigned CDRL(s)
13.3.4-1	Contractor shall provide timely response to requests for enhancements (customization) by TriMet.	CDRL 13-3
13.3.4-2	Enhancements will include all modifications to the software that increase its speed, efficiency or ease of operation, or that add capabilities and improve or change its functions	CDRL 13-3
13.3.4-3	Contractor warrants that such enhancements will not adversely affect the performance criteria set forth in the Contract.	CDRL 13-3
13.3.4-4	Contractor shall provide to TriMet all work and support required to install such enhancements and to convert and reformat any data, if necessary, at the Contractor's labor rates specified in the price schedule.	CDRL 13-3

13.4 Performance Requirements

The 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)
13.4-1	Section 13.4 Performance Requirements will be applicable upon completion of Acceptance Testing and will be in effect throughout the term of the Software Maintenance Agreement.	CDRL 13-4

13.4.1 Key Performance Indicators (KPI)

Contractor shall be subject to the following at-risk damages throughout the software maintenance term.

Req #	Requirement	Assigned CDRL(s)
13.4.1-1	KPI point assessment for non-compliance with performance requirements specified in Section 13.4.1, 13.4.2 and 13.4.3 will result in deductions from Contractor's monthly Software Maintenance Agreement fee payment.	CDRL 13-4
13.4.1-2	Monthly KPI point assessments will correspond to the following deductions from the monthly Software Maintenance Agreement fee: • 0 – 50 points 0.00% • 51 – 100 points 1.25% • 101 – 150 points 2.50% • 151 – 200 points 3.75% • 201 – 250 points 5.00% • Each additional 100 points Additional 1%	CDRL 13-4
13.4.1-3	Deductions for performance requirement non-compliance in any given month will not be in excess of the total Software Maintenance Agreement fee payment for that month.	CDRL 13-4
13.4.1-4	In the event that non-compliance points are assessed more than once in a 12-month period for any individual requirement the number of KPI non-compliance points that are assigned will be multiplied by the number of non-compliance periods during the preceding 12 months. For example, if a requirement is not in compliance for the months of May, July and September the number of non-compliance points assigned for July would be multiplied by two and the points assigned for September would be multiplied by three.	CDRL 13-4
13.4.1-5	Contractor shall calculate and provide reports on KPI performance monthly.	CDRL 13-4
13.4.1-6	Contractor shall incorporate KPI non-compliance Software Maintenance Agreement fee deductions into monthly invoicing, as appropriate.	CDRL 13-4

13.4.2 Back Office, Web & Software

Back office, web service, and software performance requirements are presented below.

Req #	Type	Key Performance Indicator	Require-ment	Penalty	Assigned CDRL(s)
13.4.2-1	Transaction Processing	Transactions are processed correctly within 24 hours from receipt at the back office for posting. 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.	99.95%	50 points for failure to meet req. 20 points each % below 99	CDRL 13-4
13.4.2-2	File Transfer	Timely and accurate assembly and transmission, or receipt and processing, of all file transfers. Timely performance will be in accordance within system specification and design parameters for file assembly and transmission and will be determined by TriMet. Accuracy will be assessed as file transmission fidelity such that the contents of files assembled and transmitted match the contents of files that are received and processed.	99.95%	50 points for failure to meet req. 20 points each % below 99	CDRL 13-4
13.4.2-3	Software	Software updates, patches and configuration data updates, including routine, scheduled and ad hoc deployments, will not adversely impact successful operation and availability of system components and subsystems. Successful operations will be in accordance with system specification and design parameters for back office, web and software components and will be determined by TriMet. Availability is: ([total operating hours] – [out-of-service hours]) / [scheduled operating hours]	99.95%	50 points for failure to meet req. 20 points each % below 99	CDRL 13-4

13.4.2-4	Reporting	Devices that return to service will self-report incidents via device logs per the system component specifications in Section 6. Calculation will be determined by comparison of device failure reporting by TriMet, Agency and Contractor staffs and device logs of those devices that return to service.	99.5%	25 points for failure to meet req. 10 points each % below 99	CDRL 13-4
13.4.2-5	Tracking	Tracking and reporting of failures will be performed by the device monitoring and management system and MMS. Failure rate calculation will be based on comparison of device monitoring and management MMS and failures reported by TriMet, Agency and Contractor staffs and the public.	99.5%	25 points for failure to meet req. 10 points each % below 99	CDRL 13-4

13.4.3 Validator, Inspection Device & Retail Sales Unit Reliability

Reliability is defined as the failure rate for each device type (e.g., fare payment, fare distribution, and fare inspection) measured over each calendar month. The failure rate is the ratio of the number of chargeable failures recorded in that period to the number of active devices.

Req #	Type	Key Performance Indicator	Require-ment	Penalty	Assigned CDRL(s)
13.4.3-1	Aggregate Requirement	*Validator, Inspection Device and Retail Sales Unit* Reliability is calculated monthly as: [chargeable failures] / [population of devices]	95%	50 points for failure to meet req. 20 points each % below 94	CDRL 13-4
13.4.3-2	Barcode Read Requirement	Any device equipped with a bar code read-function will be designed and manufactured so that the reader will be able to process 500,000 documents before requiring replacement. Failure of the reader will contribute to the calculation of failure rate for the entire device group per Req. # 13.4.3-1.			CDRL 13-4

13.4.4 Validator, Inspection Device & Retail Sales Unit Accuracy

Accuracy requirements for validators, inspection devices and retail sales units are presented below:

Req #	Type	Key Performance Indicator	Require-ment	Penalty	Assigned CDRL(s)
13.4.4-1	Aggregate Requirement	*Validator, Inspection Device and Retail Sales Unit* Valid fare media will be accurately read upon proper tag, assuming the fare media is not damaged sufficient to destroy the ability of the reader to correctly read the coded data Data for calculating performance against this requirement may encompass reports by TriMet and other agency staff, Contractor staff and customers.	1st tag: 99% 2nd tag: 99.9%	25 points for failure to meet 1st tag req. Additional 15 points for failure to meet 2nd tag req.	CDRL 13-4
13.4.4-2	Aggregate Requirement	*Validator and Retail Sales Unit* Accuracy is: the ratio of the transactions (value and volume) processed by the transaction processor to those recorded by the devices, as evidenced by the transactional data recorded in the device audit registers	99.95%	50 points for failure to meet req. 20 points each % below 99	CDRL 13-4
13.4.4-3	Aggregate Requirement	*Inspection Devices* Accuracy is: accurate validation of fare media usage and status as evidenced by fare media usage records, data recorded in the device, and usage reporting from authorized personnel	99.95%	25 points for failure to meet req. 10 points each % below 99	CDRL 13-4

13.4.5 Chargeable Failures

Req #	Requirement	Assigned CDRL(s)
13.4.5-1	A chargeable failure includes but is not limited to any of the following: • A software malfunction which prevents the eFare collection system component from performing its designated function, or meeting its performance criteria, when used and operated under the environmental and operational conditions stated in	CDRL 13-4

	these specifications • A software malfunction that might cause a threat to the system components, passengers, employees or others • A random occurrence that does not cause the system component to be inoperable, but would normally require some form of maintenance attention to restore normal function • Any occurrence where data are not successfully transmitted between elements of the system • Planned software updates or fixes that adversely affect the operation of the system • Scheduled software maintenance or repair activities that adversely affect the operation of the system	
13.4.5-2	The following specific conditions, at minimum, will be considered chargeable failures in any system components or systems delivered under this specification: • Software anomalies and bugs (every incident of a software anomaly or bug causing a malfunction will be considered a failure) • Data storage failures, including those due to the disk space provided • Data storage and/or alarm transmission failure • Data download/upload failure • Failure to accurately read and/or process a card • Failure to properly register and report any transaction • Undesired shutdown of the system	CDRL 13-4
13.4.5-3	Any failure not listed in 13.4.5 will be considered chargeable.	CDRL 13-4

13.4.6 Non-Chargeable Failures

A non-chargeable failure is a malfunction caused by a condition external to the system component under consideration, which is neither a functional, environmental, nor a test requirement in this specification and is not expected to be encountered during normal and correct operation of the system components in revenue service, and exceeds the requirements as described in the specification.

Req #	Requirement	Assigned CDRL(s)
13.4.6-1	Non-chargeable failures will not affect the reliability, accuracy or availability calculations, and will include the following, at a minimum: • Accident or mishandling of validator, inspection device, retail sales terminal or back office system components • Failure of test facility or test instrumentation, except where test facility or instrumentation is under the control of the Contractor • Any failures caused by externally applied stress conditions	CDRL 13-4

	outside normal operating conditions in excess of the accepted specification requirements contained herein • 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 Contractor (failures resulting from any maintenance or repair by the Contractor shall be chargeable) • Failure caused by vandalism • Failures caused by out-of-specification fare payment media • Communications failures beyond the control of the Contractor • Third party equipment and services not required to be provided by the Contractor or subcontractor under these specifications • Downtime due to scheduled maintenance	
13.4.6-2	All other failures will be considered relevant and chargeable unless determined to be non-chargeable by the failure review process as specified in Section 8.6.2. The failure review process will be applied as needed throughout the term of the agreement.	CDRL 13-4

13.5 Hosting (Option)

13.5.1 Data Center Functions

Req #	Requirement	Assigned CDRL(s)
13.5.1-1	The Contractor or approved subcontractor shall provide (as a separate cost option) system hosting services that provide a secure and reliable facility where eFare back office hardware may be housed and operated.	CDRL 13-5
13.5.1-2	The proposed hosting system must be securely hosted and accessed in a data center that minimally meets Uptime Institute Tier 3 standards (www.uptimeinstitute.com); Tier 4 standards are preferred.	CDRL 13-5
13.5.1-3	The data center may be at the Contractor's site(s) or subcontracted and must meet all PCI/DSS security requirements.	CDRL 13-5
13.5.1-4	The Contractor must use generally accepted industry standards to implement and operate the system environment and must meet the requirements and performance standards for the indicated tier. This will include the use of auditable procedures for system operations, change control, capacity planning, performance management, physical security and problem management.	CDRL 13-5
13.5.1-5	The systems environment must be scalable to accommodate future systems expansion.	CDRL 13-5

13.5.1-6	The hosting systems must reside in the continental U.S. and the facility must be accessible to designated TriMet personnel for inspection and other activities.	CDRL 13-5
13.5.1-7	Hosting services will include: provisioned computer rack space, conditioned electrical power and multiple access paths to the Internet.	CDRL 13-5
13.5.1-8	Hosting services will include: Ability for the Agency or the Vendor to establish a VPN connection in to the environment for management purposes via the Internet.	CDRL 13-5
13.5.1-8	Hosting services will include: The resources to power cycle the physical systems on demand.	CDRL 13-5
13.5.1-10	Hosting services will not include the following after final system acceptance. These elements will become the responsibility of the Agencies: • Monitoring and management of system uptime • Monitoring and management of system response time. • Configuration and updates to the system • Performance of backups or system level Disaster Recovery	CDRL 13-5
13.5.1-10	User interface access to all elements of hosting services will be managed using one of two user authentication and access control platforms as required in Section 6.1.1. Individual users or user groups will have access configured to allow for standard business operations.	CDRL 13-5

13.5.2 Service Level Requirements

The service levels that the Contractor or approved subcontractor shall meet are set forth below. The following terms will be used in defining and measuring compliance with service levels:

- "Availability" means the total time in a calendar month when the data system is accessible via an Internet connection and performing its intended functions as specified in this document. The hosted environment will be unavailable during certain scheduled downtime periods for the purpose of conducting maintenance and upgrades to the data system.
- "Uptime" means the percentage of total time in a calendar month that the hosted environment is either available or in scheduled downtime. Uptime is calculated as the sum of available time plus scheduled downtime divided by total time, expressed as a percentage.
- "Response Time" means the amount of time elapsed between the point at which an http/https request reaches the hosting site and the beginning of the transmission of a response back to the originating station. The Contractor or its approved subcontractor will continually monitor the performance of the hosted environment and will use commercially reasonable efforts to anticipate how the hosted environment appears to users, including Internet latency, and will take all reasonable and prudent steps to maintain the agreed upon response times. The response time is a metric exclusive to the Contractor's hosting site.

<table>
<tr><th>Req #</th><th>Requirement</th><th>Assigned CDRL(s)</th></tr>
<tr><td>13.5.2-1</td><td>The Contractor guarantees that the data system will have an uptime of 99.9 percent each calendar month. If the Contractor fails to meet this guarantee, the Contractor shall provide a credit to TriMet at the applicable credit percentage set forth in the table below, limited to a maximum of a 25 percent credit across all penalties.
System Downtime Credit Schedule
<table>
<tr><th>System Uptime</th><th>Credit %</th><th>Approximate Monthly Unscheduled Downtime (Minutes)</th></tr>
<tr><td>≥ 99.9 %</td><td>0%</td><td><45 minutes</td></tr>
<tr><td>99.8-99.9%</td><td>8%</td><td>45 – 120 minutes</td></tr>
<tr><td>99.6-99.8%</td><td>12%</td><td>121 – 240 minutes</td></tr>
<tr><td><99.6%</td><td>15%</td><td>≥ 241 minutes</td></tr>
</table></td><td>CDRL 13-5</td></tr>
<tr><td>13.5.2-2</td><td>The Contractor guarantees that the data system response time for reporting and data queries will be within three (3) seconds. The response percentage is calculated as the number of requests serviced within the stipulated response time, divided by the total number of requests. If the Contractor fails to meet this guarantee, the Contractor shall provide a credit to TriMet at the applicable credit percentage set forth in table below. If the system is not responding due to the lack of availability, only the credits related to system availability apply.
Response Time Credit Schedule
<table>
<tr><th>Response Percentage</th><th>Credit Percentage</th></tr>
<tr><td>≥ 99.00 %</td><td>0%</td></tr>
<tr><td>95.00 – 99.00 %</td><td>10%</td></tr>
<tr><td>< 95.00 %</td><td>20%</td></tr>
</table></td><td>CDRL 13-5</td></tr>
</table>

13.5.3 Outage Management

Req #	Requirement	Assigned CDRL(s)
13.5.3-1	The Contractor shall provide on TriMet's reasonable request (such as once a month), a service level report in a form to be agreed upon between Contractor and TriMet, that measures the following: • 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 • Bank authorization statistics (e.g., percentage of approvals and	CDRL 13-5

	percentage of denials by reason type) • Transit account authorization statistics (e.g., percentage of approvals and percentage of denials by reason type)	

13.6 As-needed Support Services

During the course of the design-build, implementation, and post implementation phases of the eFare project, TriMet may wish to retain the Contractor for technical or management services that are outside the scope of any existing agreement. Requests for these types of services will be initiated through the contract change process. To the extent that the as-needed services include a labor component, the Contractor shall utilize the category labor rates contained in the Pricing Form 5.7 – As-needed Support Services.

13.7 Required Submittals

The required submittals specified in this section are summarized below. They are further described at the referenced location.

Submittal No.	Description	Reference	Due Date			
			CDR	PDR	FDR	Other
CDRL 13-1	System Operations Plan				✓	Also 60 days prior to the start of Contractor delivered training
CDRL 13-2	Warranty Plan			✓	✓	
CDRL 13-3	Software Maintenance Plan				✓	Also 60 days prior to the start of the 90-day settling period
CDRL 13-4	System Operations Performance Requirements				✓	Also 60 days prior to the start of the 90-day settling period
CDR 13-5	System Hosting Plan					Per agreed upon schedule if option is exercised
CDRL 13-6	Quarterly Newsletter				✓	Format to be submitted at FDR. Quarterly newsletters beginning with the start to the software maintenance agreement