

**Caguas Light Rail Line
Fare Collection System
30% Design Specification**

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**Developed by
The Transport Group, LLC and
Washington Group International**

Table of Contents

1	System Description	5
1.1	Overview of Caguas Rail Line	5
1.2	Anticipated Ridership	5
1.3	Fare Structure	5
1.4	Physical Fare Media	6
2	Requirements and Scope of Work	7
2.1	Work to be Performed by Contractor	7
2.2	Standard NextFare 4 Platform	7
2.3	Equipment Overview	7
2.4	Equipment Quantities	8
2.5	Smartcard Capabilities	9
2.6	Interoperability with Tren Urbano	10
3	Acronyms and Standards	11
3.1	Acronyms	11
3.2	Standards	11
4	Fare Collection Equipment	12
4.1	General Equipment Requirements	12
4.1.1	ADA Compliance	12
4.1.2	Environmental Requirements	12
4.2	Ticket Vending Machines	12
4.2.1	Hardware installed at Tren Urbano	12
4.2.2	TVM Operation	12
4.2.3	TVM Modes of Operation	13
4.2.4	TVM Front Panel	14
4.2.5	TVM Components	14
4.2.6	TVM Security and Access	15
4.2.7	TVM Decals and Graphics	15
4.2.8	TVM Transaction Record	15
4.2.9	TVM Configuration	16
4.3	Gates	16
4.3.1	Hardware installed at Tren Urbano	16
4.3.2	Gate Operation	16
4.3.3	Gate and Aisle Types	17
4.3.4	Gate Modes of Operation	18
4.3.5	Gate Components	18
4.3.6	Gate Access	19
4.4	Station Operator Console	19
4.4.1	SOC Control	19
4.4.2	SOC Operation	19
4.4.3	SOC Data Display	19
4.4.4	SOC Data Exchange	20
4.5	Revenue Collection Carts	20
4.6	Performance and Reliability	20
5	Infrastructure, Reporting and Control	22
5.1	Central Computer (CC) System	22
5.2	Network and Infrastructure	22
5.3	Configuration	22
5.4	Data Collection	22
5.4.1	Sales Event Data	22

5.4.2	Fare Equipment Data.....	22
5.4.3	Equipment Access Data.....	23
5.4.4	Ridership Data.....	23
5.4.5	Data Security.....	23
5.4.6	Data Retention and Retrieval.....	23
5.5	Reporting.....	24
5.5.1	Standard Reports Suite.....	24
5.5.2	Ad-Hoc Reports.....	24
5.5.3	Reporting Access.....	24
6	Supporting Equipment.....	25
6.1	Spare Parts.....	25
6.2	Test Equipment.....	25
6.3	Test Lab.....	25
6.4	Disaster Recovery Site.....	25
7	Program Management.....	26
7.1	Project Administration.....	26
7.1.1	Program Manager.....	26
7.1.2	Technical Support.....	26
7.2	Schedules.....	26
7.3	Progress Meetings.....	26
7.4	Design Reviews.....	26
7.4.1	Preliminary Design.....	26
7.4.2	Final Design.....	26
7.5	Documentation.....	27
7.6	Submittals.....	27
7.7	Quality Assurance.....	27
7.8	Configuration Management.....	27
7.9	Site Requirements.....	28
7.9.1	Working Hours and Schedule.....	28
7.9.2	Damage to Facilities.....	28
8	Testing.....	29
8.1	Test Program.....	29
8.2	Test Support.....	29
8.2.1	Test Management.....	29
8.2.2	Test Personnel.....	29
8.2.3	Authority Witnesses.....	29
8.2.4	Test Equipment and Instruments.....	29
8.3	Test Documentation.....	29
8.3.1	Program Plan.....	29
8.3.2	Schedule.....	30
8.3.3	Procedures.....	30
8.3.4	Reports.....	31
8.4	Tests.....	31
8.4.1	First Article Inspection Tests (FAIT).....	31
8.4.2	Acceptance Tests.....	31
8.4.3	System Reliability Test.....	31
8.4.4	Testing Exemption.....	32
8.5	Testing Performance.....	32
8.5.1	Failure Review Board.....	32
8.5.2	Chargeable Failures.....	32
8.5.3	Non-Chargeable Failures.....	33
8.5.4	Test Approval.....	33

8.5.5	Deficiencies	33
9	Installation	34
9.1.1	Installation Plan and Schedule	34
9.1.2	Responsibilities of others	34
10	Training	35
10.1	Training Requirements	35
10.2	Training Schedule	35
10.3	Training Plan	36
10.4	Training Location	36
10.5	Training Materials	36
10.5.1	Instructor Guides	37
10.5.2	Student Guides	37
10.6	Training Equipment	37
11	Warranty	38
11.1	Warranty Period	38
11.2	Warranty Scope	38
11.3	Defects	38
12	Options	39
12.1	Alternative Fare Collection Solution	39
12.2	Removal of smartcard hardware from equipment	39
12.3	Bi-parting leaf gates	39
12.4	Computer Workstations for Reporting	39
12.5	Multi-function Point of Sale (MPOS)	39
12.6	Ticket Encoders	39
12.7	Additional Training	40
12.8	Uninterruptible Power Supply (UPS)	40
12.9	Software Maintenance Agreement	40
12.10	Extended Warranty Agreement	40
13	Contract Deliverables Requirements List (CDRL)	41
	APPENDIX A – Representative Equipment	42
	APPENDIX B – Proposed Station Layout	44

1 System Description

1.1 Overview of Caguas Rail Line

A new 12.3 mile light rail system is being designed to help alleviate road congestion and provide an efficient transportation option for commuting from the City of Caguas to San Juan, Puerto Rico. Three elevated stations are planned initially, with the expectation that additional stations can be added if necessary in the future.

Two stations will be built in the City of Caguas, including Caguas Norte and Las Catalinas. The line will terminate in San Juan at the Cupey station, which is designed to allow passengers to exit the Caguas system and enter the Tren Urbano rail system. The new system is targeted to open in 2008.

1.2 Anticipated Ridership

It is anticipated that the new Caguas rail system will be used primarily for passengers commuting to and from their places of employment in San Juan. Therefore, majority of the morning passenger boardings will take place at the two stations in Caguas, Caguas Norte and Las Catalinas, with the majority of the evening boardings occurring at Cupey station.

Projected volume by the year 2015 is 15,000 boardings per day, or 7,500 boardings each direction, inbound towards San Juan and outbound towards Caguas. Morning and evening rush period is anticipated to last approximately 1.5 hours, with 60% of the total daily boardings occurring during the rush period, equaling 4500 boardings each for morning and evening rush or 3000 boardings per hour. Assuming that morning boarding is divided approximately 60%/40% between Caguas Norte and Las Catalinas, these two stations anticipate peak boardings of 1800 and 1200 passengers per hour respectively, and Cupey anticipates peak boarding of 3000 passengers per hour.

1.3 Fare Structure

The anticipated fare structure of the Caguas light rail system shall be flat fare initially with fare media being processed on entry into as well as exit from the system. The fare collection equipment shall be capable of implementing zone, distance, and time-based fare structures in addition to flat fare, through configuration of the software, without requiring any software or hardware changes.

The full fare product configurability of the Nextfare 4 software system shall be provided, to include capability of creating fare products with the following attributes:

- Stored value, stored ride, and period passes, as well as timed transfers
- Product is specific to a rider class (regular, senior, disabled, etc.)
- Variable validity period
- Variable start date (calendar start and start on first use)
- Acceptance rules based on day of week, time of day, and holidays
- Sale rules based on device group, day of week, date of month
- Fares differing based on time of day and day or week

1.4 *Physical Fare Media*

The system, as delivered, shall implement both paper and plastic magnetic stripe fare media, and shall be capable of implementing contactless smartcard fare media as described herein. Magnetic cards shall be high oerstead magnetics, which use a publically available encoding format that will enable the Authority to purchase pre-encoded magnetic cards from multiple third party manufacturers. Magnetic cards shall be able to be encoded with expiration dates that are software configurable in monthly increments between 1 and 60 months. Smartcards shall be able to be encoded with expiration dates that are software configurable to a single date at least 20 years from the date of card initialization.

Requirements and Scope of Work

2.1 Work to be Performed by Contractor

The Contractor shall be responsible for all work and expenses relating to the design, manufacture, storage, delivery, installation, testing, and commissioning of all Automatic Fare Collection (AFC) System hardware, software, infrastructure and interfaces. In addition, the Contractor shall be responsible for all interface work required to accommodate the new system. Site preparation will not include physical construction of stations. Conduit, power and communications cabling will be provided by Authority from equipment location to SOC, and from the SOC to Central Computer location. Contractor to provide information on installation pre-requirements, including but not limited to locations of power and communications terminations for all fare collection equipment, connections in the station for physically installing equipment, and type of communication network required between equipment and SOC, and SOC to Central Computer.

The Contractor shall provide, at all times during installation, qualified staff who shall be responsible for the installation and adjustments of equipment to meet these specifications. The Contractor shall provide a suitable facility for storing the new equipment prior to its installation, and shall provide personnel and material handling equipment to transport all equipment between storage locations and installation sites.

All equipment and software provided shall be of the latest engineering change level, including modifications for all known operational problems, as applicable to deliver the functionality approved during the design process. During the testing and warranty period, the Contractor shall retrofit all new modifications and engineering changes into the equipment already installed, following Authority approval of the change. The Authority shall be able to maintain full operations at all times during Contractor upgrades without interference from the Contractor. All Contractor activities shall be planned ahead and approved by the Authority prior to the start of the activity.

2.2 Standard NextFare 4 Platform

The fare collection system software delivered by the Contractor shall be the standard NextFare 4 Platform. Contractor to deliver the core modules and custom modules as required to meet this specification. Both included and excluded core NF4 modules shall be detailed in the design review process. All software upgrades to fare collection equipment shall be downloaded to the equipment from the central computer.

2.3 Equipment Overview

The AFC System to be provided by the Contractor shall include the following elements:

- **Ticket Vending Machines (TVMs)** - TVMs shall be installed in the free area of each rail station to facilitate fare media purchases and reload transactions, and to respond to inquiries for media remaining value.
- **Gates** - Patrons pass between the free and paid areas of stations via secure tri-pod turnstyle gate arrays that accept all valid fare media. The gate aisles shall be equipped with the smartcard Tri-Reader processor and magnetic card Read/Write processor. A variable message patron display shall be included to display

transaction information to the patron and indicate direction of the gate to facilitate passenger flow through the aisles.

- **Accessible Gates** – Each gate array shall contain a passenger-operated Accessible swing gate for use by mobility-impaired patrons, or other passengers requiring additional space to enter the system with luggage, packages, or children in strollers. Accessible gates shall be equipped with the smartcard Tri-reader processor and magnetic card Read/Write processor. Styling and supporting modules in the Accessible gates shall be compatible with the Entry/Exit gates, and interchangeable when possible.
- **Station Operator Consoles (SOC)** - Each rail station control area shall be equipped with a SOC for the monitoring and optional local control, based on Authority configuration, of all fare collection equipment at the station. The SOC shall be a PC-based processor connected to the local station equipment via the station LAN, provided by the Authority, and connected to the Central Computer via communication network, provided by the Authority. The SOC shall transmit transaction and performance data, credit/debit card payment authorization requests, system alarms, and device status information to the Central Computer. The SOC may also transmit device operating commands sent from the Central Computer or entered locally by the station attendant. The SOC shall provide the ability for the station attendant to analyze smart card or magnetic fare media for patrons experiencing difficulty entering the system.
- **Central Computer (CC) System** – The Central Computer System shall serve as the single point of control for the fare collection system, including consolidation and storage of transactions, configuration of equipment, control of fare gates, ticket vending machines, and station operator consoles in conjunction with local control, configuration of sale and acceptance of fare media, transaction reporting, and interface with financial institutions for payment processing.
- **Revenue Collection Equipment**- Revenue Collection Carts shall be provided to facilitate secure revenue collection and transportation, and restocking of ticket vending machines and faregates.
- **Supporting Infrastructure** – The gates and TVMS shall be connected to the SOC via an Ethernet LAN.
- **Other elements required for complete AFC System Functionality** – Contractor shall supply all other components and elements required to provide a fully operational fare collection system.

2.4 Equipment Quantities

Equipment shall be delivered in the following quantities:

Equipment Type	General	Station: Caguas Norte	Station: Las Catalinas	Station: Cupey	Test/ Training Lab	Spares	TOTAL
Ticket Vending Machines	0	4	4	5	0	2	15
Reversible Gate	0	3	3	5	1	2	14
End Gate	0	0	0	0	0	0	0
Accessible End Gate	0	1	1	1	1	1	5
Accessible Barrier Gate	0	1	1	1	1	1	5
Station Operator Consoles	0	1	1	1	1	1	5
Central Computer System	1	0	0	0	1	0	2
Revenue Collection Carts	2	0	0	0	0	1	3
Computer Workstations for GUI access and reporting (Optional)							
Multi-function Point of Sale Machines (Optional)							
Ticket Encoders (Optional)							

2.5 Smartcard Capabilities

The system as delivered shall be fully capable of accepting and processing ISO 14443 compatible contactless smartcards as detailed in this specification.

As an Option, Contractor shall provide line item pricing to deliver equipment without the hardware necessary to process smartcards.

2.6 Interoperability with Tren Urbano

The fare media and fare products implemented on the new Caguas light rail system shall be fully interoperable with the fare media processed on the Tren Urbano rail system. The equipment as delivered to Caguas shall be capable of processing all fare media and fare products currently in use on Tren Urbano, as well as all fare media that can be configured and implemented in the future, based on the Tren Urbano fare collection system software and hardware capabilities in place at the time of installation of the Caguas fare collection equipment. All fare media and fare products that can be configured on Caguas shall be operational on Tren Urbano to the fullest extent possible. Contractor shall fully describe, at the time of proposal, any limitations that exist with use of Caguas fare media or products on Tren Urbano, as well as the upgrades that would be necessary on either Caguas or Tren Urbano to reach full interoperability.

Full fare media and fare product interoperability shall be demonstrated as part of System Integration Testing.

3 Acronyms and Standards

3.1 Acronyms

Acronym	Meaning
ADA	Americans with Disabilities Act
AFC	Automatic Fare Collection
ANSI	American National Standards Institute
CC	Central Computer
CHF	Cash Handling Facility
CDRL	Contract Data Requirements List
DES	Data Encryption System
GUI	Graphical User Interface
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standardization
MAC	Message Authentication Code
MBA	Metropolitan Bus Authority
MCBF	Mean Cycles Between Failures
MCP	Magnetic Card Processor
MTBF	Mean Time Between Failures
MTTR	Mean Time To Restore to Service
NIST	National Institute of Standards and Technology
RTCE	Revenue Transfer & Collection Equipment
SIT	System Integration Test
TVM	Ticket Vending Machine

3.2 Standards

The following standards are applicable to the system delivered under this specification:
To be detailed during specification development.

4 Fare Collection Equipment

4.1 *General Equipment Requirements*

Fare gates shall be installed in the three stations in arrays containing a series of Entry/Exit and Accessible gates. Each station shall have physically freestanding TVMs and a single Station Operator Console. All equipment shall be connected via a station Ethernet LAN to facilitate monitoring and control by the Station Operator Console. Station Operator Console shall communicate with the Central Computer to obtain software upgrades and configuration changes for the fare collection equipment at the stations, and provide status messages and transaction information to the Central Computer from the station equipment.

4.1.1 **ADA Compliance**

Ticket Vending Machines and Accessible Gates must be readily accessible and useable by patrons with disabilities, including but not limited to patrons with impaired vision or those restricted to wheelchairs. The fare collection equipment delivered by Contractor must be fully compliant with the Americans with Disabilities Act (ADA) in effect at time of installation of the equipment.

4.1.2 **Environmental Requirements**

The fare collection equipment installed in the rail stations shall be protected from the environment, however, All fare collection equipment to be installed in the Caguas rail stations shall be capable of withstanding the environmental conditions as follows:

- Air Temperature
- Relative Humidity
- Airborne Dust
- Precipitation
- Wind
- Electrical Interference
- Sunlight

4.2 *Ticket Vending Machines*

4.2.1 **Hardware installed at Tren Urbano**

Contractor shall install Ticket Vending Machines that are substantially similar in style and functionality to the Ticket Vending Machines supplied to Tren Urbano. The TVMs delivered for Caguas shall include all upgrades and modifications that have been incorporated by Cubic as a result of the extensive operating experience over the past several years of revenue service in San Juan, New York City, and Baltimore..

4.2.2 **TVM Operation**

TVM shall allow purchase of stored value and fare products (single trip, period pass, stored value, multiple ride, etc.) on paper and plastic magnetic ticket stock which shall be dispensed from the TVM, and reloading of stored value and fare products on smartcards. The addition of modification of fare products shall be software configurable without any intervention from the Contractor.

TVM shall accept payment methods of coins, bills, previously issued magnetic cards/tickets (trade-in), credit/debit cards, and smartcards, as selected by the patron. A new magnetic card shall be issued when payment is received for an appropriate fare product. Trade-in magnetic cards shall be captured. TVM shall be configurable as to whether it may accept off-line credit card payments, and the maximum value of off-line payments.

A minimum of 5 US Coin denominations shall be accepted (nickel, dime, quarter, Susan B Anthony dollar, and Sacagawea dollar coins) and a minimum of four US bill denominations shall be accepted (\$1, \$5, \$10, and \$20).

Change and receipts shall be deposited into a lighted tray for patron to retrieve. Receipts shall be available for all transactions if requested by patron.

TVM shall have a configurable transaction timeout period, which will cancel the transaction after a period of inactivity and return banked money.

TVM shall be capable of storing a negative list, to prevent the use of a previously issued magnetic or smartcard/ticket that has been reported stolen or lost. Such a card, when recognized, shall be invalidated and rejected by the TVM, returned to the patron, and a message displayed on the Patron display indicating an invalid card.

All data, such as sales, maintenance and all events occurring at the TVM, shall be recorded and transmitted to the Station Operator Console. Data shall additionally be stored by the TVM for seven days in the event of data or communications loss by the SOC and/or Central Computer system. Existing stored data is overwritten, beginning with the oldest data, as new data is collected.

4.2.3 TVM Modes of Operation

- **In Service** – TVM shall offer a full range of transaction choices while operating “in service” mode, based on equipment configuration, including language selection for display and audio, payment method, purchase of magnetic tickets, reloading of magnetic tickets or contactless smartcards, checking value, and trade-in of magnetic tickets.
- **Degraded Mode In Service** – TVM shall automatically switch to degraded mode of operation in the event of a malfunction of one of the TVM subsystems such as bill handling, smartcard target, etc., or in the event of loss of communications which would eliminate the device’s ability to process credit/debit payments. The TVM shall alert the patron of the current operations of the TVM via the patron display or annunciator display,
- **Maintenance and Revenue Service** – TVM shall automatically enter maintenance mode when an employee logs into the equipment using an employee card, either magnetic or smartcard, and a maintenance PIN. Depending on the type of employee logged in, the TVM shall be set for either Maintenance or Revenue Service mode.
- **On-line Mode** – TVM shall operate in on-line mode when it is connected to the Central Computer, and shall be capable of transmitting status messages to the Central and receiving control commands.

- **Off-line Mode** – Should communications between the Central Computer and the station be lost, the TVM shall be capable of operating in a standalone mode and shall store a minimum of 7 days of transactions on its internal hard drive. Transactions shall be forwarded to the Central Computer when communications are restored.

4.2.4 TVM Front Panel

The front of the TVM shall include a patron display, annunciator display, audio activation button, credit/debit card dip insertion slot, 12-key PIN pad for entry of secure PIN number with bank card use in compliance with banking requirements, coin insertion slot, bill handling unit, coin change return and receipt slot, contactless smartcard interface, and ticket handling system.

4.2.5 TVM Components

- **Modular Design** – All TVM components shall be modular in design such that they are interchangeable among all TVMs, and modules can be removed and replaced in the field.
- **Patron Display** - TVM shall include a 12 inch color patron display which provides touch-screen interface with menus that may be configured by the Authority to easily direct the patron through each step of operation. All options and decisions shall be displayed and entered at the touch screen. Patron Display shall be vandal resistant through use of a front cover panel that is easily replaceable. The Patron Display shall be capable of displaying up to 5 languages, as selected by the patron. Language selection shall be available from the initial screen by audio and visual means prior to beginning a transaction. Display shall return to a default language, as configured by the Authority, after each transaction is completed through normal termination or cancellation. Capability to add or modify alternate language screens shall be provided as part of the software configurability.
- **Annunciator Display** – TVM shall include a configurable dot matrix scrolling annunciator display. This display provides patrons with information on the status of the TVM, such as operation in degraded mode. When not providing status information, this display can be used to display promotional, safety, or advertising messages downloaded from the CC.
- **Voice Annunciation System** – TVM shall include a speaker to provide an interface for the visually impaired. Audio messages shall be available for all on-screen instructions, and shall be synthesized from downloaded text strings in Spanish or English and played when the Audio function is selected.
- **Credit/Debit Module** – A dip card reader shall be provided, which is compliant with US Banking standards.
- **Coin Handling System** – TVM shall accept and process nickels, dimes, quarters, SBAs, and Sacagawea dollar coins, and shall reject foreign coins and other objects, including Dominican quarters. The coin acceptor shall be capable of being programmed by the manufacturer to accept other coin types in the future. Change shall be dispensed from recirculating coin tubes of at least 50 coin capacity for each type of coin accepted and at least two bulk change hoppers containing nickels, quarters or dollar coins. Each coin hopper shall contain only one denomination of coins, and shall weigh a maximum of 25 pounds when full. Hoppers shall be

refillable in the field. All coins deposited in the TVM shall be held in escrow until the entire fare due for the media selected has been paid or until the transaction has been cancelled, in which case all deposited coins shall be returned to the patron. The maximum amount of change shall be configurable via software at the CC from \$4.25 to \$19.25 in \$0.05 increments. Coins shall be dispensed at a rate of 3 coins per second.

- **Bill Handling System** – The TVM shall include a bill handling system that is capable of accurately accepting US currency and rejecting counterfeits and foreign currency. Bills inserted for a transaction, up to 15 total bills, shall be held in escrow until the end of the transaction. If the transaction is cancelled, the bills shall be returned to the patron. If the transaction is completed, the bills shall be deposited into the cashbox. The bill handling system shall be programmed to accept both old and new version of the following US currency: \$1, \$2, \$5, \$10, and \$20, and shall have the capacity to be programmed to accept at least 12 bill denominations and/or versions. After a bill denomination is programmed into the system, its acceptance shall be configurable from the Central System. Acceptance of bills in any of the four orientations shall be possible.
- **Contactless Smartcard Interface** – The TVM shall include a Tri-Reader contactless smartcard interface, which is configurable to allow the use of ISO 14443 Type A, Type B or GO CARD smartcards. The system as delivered shall process GO CARDS.
- **Ticket Handling System** – The TVM Ticket Handling System shall dispense paper and plastic magnetic stripe farecards. TVM shall be capable of storing four magazines of ticket stock. The TVM shall select the appropriate magnetic ticket stock for each purchase.
- **External Lighting** – External light shall be provided to illuminate the front panel of the TVM.

4.2.6 TVM Security and Access

TVM shall restrict access to only authorized personnel via a specially encoded magnetic card or smart card coupled with a personal identification number (PIN) using a high security physical key. As an additional security feature, the TVM shall require the technician to insert the card into the reader or touch the smart card to the target, and enter a PIN via the maintenance keyboard within a programmable period of time. If these actions are not executed in time, an audible intrusion alarm shall be sounded and an intrusion message shall be recoded by the TVM and sent to the Central Computer.

4.2.7 TVM Decals and Graphics

Contractor shall provide and install graphics and decals for the TVMs and Gates, including front panel and smartcard targets if applicable. Contractor shall detail information in proposal as to the types, locations and sizes of graphics and decals to be supplied. Contents of decals shall be developed in conjunction with Authority, and shall require Authority approval prior to printing.

4.2.8 TVM Transaction Record

TVM shall record all transaction information, including but not limited to transaction type, transaction number, agency ID, product number, media serial number, quantity of

product purchased, cost of purchase, payment method, device ID, date and time. In the event of communication loss, TVM shall have the capability to store, in its memory, transaction data for a minimum of seven days to eliminate the possibility of data loss.

At a minimum, the TVM shall encode, on the fare media purchased through the TVM, data including device ID, date and time, product number, type of fare media, cost of purchase, payment method, product expiration date.

The printed receipt shall include all information required to comply with the version of the "Electronic Funds Transfer Act" that is in effect at time of final design review. At a minimum, printed information on the receipt shall include date and time of purchase, device ID, device location, transaction type, total amount of transaction, transaction authorization number and reference number for electronic payments, fare product number, fare product expiration date, fare media serial number, fare media type vended, last 4 digits of bank card number for electronic payment, bank card expiration date for electronic payments, an indication that debit transaction is from primary account if applicable. Receipt text shall be software configurable and easily changed without intervention from the Contractor.

4.2.9 TVM Configuration

Contractor shall deliver the TVM configured for operation as defined by the Authority. Contractor shall outline the information that is required from Authority in order to configure TVM, and shall work collaboratively with Authority to define equipment initial operation, such as screen layout, display text, audio prompts, fare media to be sold, and other required operational parameters. Configuration plan shall be approved by Authority prior to beginning configuration activities. Authority shall be notified by Contractor a minimum of 14 days in advance of when Contractor begins to configure equipment, so that Authority personnel may participate in the configuration process.

4.3 Gates

4.3.1 Hardware installed at Tren Urbano

Contractor shall install Gates that are substantially similar in style and functionality to the Gates supplied to Tren Urbano. The Gates delivered for Caguas shall include all upgrades and modifications that have been incorporated by Cubic as a result of the extensive operating experience over the past several years of revenue service in San Juan, New York City and other cities.

4.3.2 Gate Operation

The fare gate arrays separate the free areas in a station from the paid areas, and shall control entry and exit from the system. A standard fare gate shall consist of a free standing console with tripod turnstile barrier, an adjacent console, and the passageway between them. An accessible fare gate shall consist of a passenger-operated swing gate to allow customers with impaired mobility to easily enter the system. The term "fare gates" shall apply to both standard and accessible fare gates unless otherwise specified. Fare gates shall be microprocessor controlled, and shall be networked in real time to the Station Operator Console.

Fare gates shall be fitted with a magnetic card read/write unit, contactless smart card read/write unit, a variable message patron display, user/maintenance messages, and approach/ directional signage. They shall be high security units that discourage patrons

from climbing over or under the barrier. Fare barriers shall be designed to discourage multiple patrons from moving through the barrier on a single fare. When processed by a fare barrier, fare media shall be read and re-encoded at the barrier and the appropriate fare shall be deducted from stored value media.

The fare gates shall process fare media in both the entry and the exit direction, and the system shall provide the flexibility, via configuration at the central system, to determine whether fares shall be deducted from the fare media upon entry into or exit from the system when operating in a flat fare mode. Gates shall also be configurable to lock on entry and freewheel on exit.

Fare gates shall be capable of automatically administering passback rules, applying different fares based on rider classifications encoded on smartcards or magnetic tickets and adjusting fares based on peak, off-peak and holiday periods, as configured at the central computer. The patron display shall indicate which type of fare is in effect for each customer.

Fare gates shall be provided with a local free entry/exit control, operated by the Station Operator Console, that shall open the barrier for unlimited passage without requiring use of valid fare media.

In the event of a loss of power or other event requiring unrestricted access, a manual bypass to permit local free entry/exit control shall also be available for the fare gates, allow Authority personnel to activate and deactivate the entry by using a manual key or other device.

4.3.3 Gate and Aisle Types

Four gate types shall be implemented in the Caguas system:

- **Reversible Gate** - Reversible or Bi-Directional Gates allow entry and exit from the subway system and are typically located between the American with Disabilities Act (ADA) gate aisle on the right and an End Gate on the left. Reversible gate operation can be set remotely from the Central Computer, set locally via the Station Operator Console, set by the time of day (AM or PM peak) based on configuration tables, or determined by patron use by responding to the first patron in the aisle either entering or exiting the system.
- **End Exit Gate** – As required based on station configuration, there shall be a single End Exit Gate for each array, containing a contactless smartcard reader, magnetic read/write, and patron display to be used for patrons exiting the system.
- **Accessible End Gate** – The Accessible End Gate is the side of the ADA compliant gate pair that contains the latching mechanism on this cabinet as well as the contactless smartcard reader, magnetic read/write, and patron display for patrons entering the system.
- **Accessible Barrier Gate** – The Accessible Barrier Gate is the half of the ADA gate pair where the swing gate is hinged and also houses the turnstile for the adjacent aisle.

Gates are combined to create two types of aisles:

- **Standard Aisle** – The majority of the aisles in each gate array are standard aisles, which are bi-directional and accept smartcards and magnetic fare media. Reversible gates can be configured as described above. Width of each standard aisle shall be 22 inches.
- **Accessible Aisle** – The Accessible or ADA aisle is intended for system entry/exit by disabled patrons, or passengers with luggage or strollers. The accessible aisle processes smartcards and magnetic tickets. The primary difference is the wide aisle spacing and swing gate. A valid ticket or smartcard shall cause the swing door to unlatch and the patron to proceed with minimal resistance of less than 5 pounds of force. The door shall gently close and latch once the passenger has passed beyond the door. In the event of a power loss or if commanded by the Station Operator Console, the swing door is unlatched. Accessible aisle width shall be in compliance with ADA requirements.

4.3.4 Gate Modes of Operation

- **In-service Operation** – Gates in service shall allow patrons with valid fare media to enter or exit the system. Gates may operate On-line, connected to the SOC, or Stand-alone, when there are problems with communication. The gate shall have sufficient memory to store 7 days of transactions in Stand-alone mode.
- **Out of Service** – Gate shall go into out-of-service mode if it cannot read or write smartcards or magnetic tickets, store data in memory, control the turnstile, or has exceeded its data storage capacity of 7 days. Gates shall remain in-service in a degraded mode if it retains limited functionality. Degraded mode of operation shall be displayed on the patron display.
- **Emergency Exit** – Gates may be placed into emergency exit mode to freewheel and allow patrons into or out of the system without valid fare media.
- **Maintenance** – Gates may be placed into maintenance mode by personnel using authorized magnetic passes or smartcards to access the equipment. Once in maintenance mode, the technician has access to diagnostics and troubleshooting to assist in identifying and correcting problems.

4.3.5 Gate Components

- **Modular Design** – all Gate components shall be modular in design such that they are interchangeable among gates and can be easily removed and replaced in the field.
- **Cabinet** - The gate cabinet shall be a freestanding, sturdy, stainless steel structure that provides support for the turnstile tripod and encloses the electrical and mechanical hardware. The same modular cabinet shall be used for all gate types.
- **Turnstyle Barrier** – The tripod barrier mechanism shall consist of three stainless steel arms mounted to a hub, to create a single module for ease of removal and replacement. An Override function shall the tripod arms to rotate freely in the Entry and Exit directions in the event of an emergency.

- **Patron Display** – the Patron display shall provide information to the patron regarding the value remaining on fare media and expiration date, aisle status, fare media status, maintenance mode, out of service, and emergency exit.
- **Smartcard Processor** – Tri-reader hardware and functionality identical to the smartcard processor in the TVM shall be installed in the gates.

4.3.6 Gate Access

Gates can be placed into maintenance mode by properly authorized personnel. Once the equipment has been opened, the technician must input a PIN number on a keyboard within the gate within a programmable length of time, otherwise an intrusion message shall be sent to the CC via the SOC.

4.4 Station Operator Console

Station Operator Console shall store and forward data from the fare collection devices to the central computer, receive and forward data from the Central Computer to the fare collection devices, and provide the station attendant a means to evaluate magnetic and smart card fare media when a patron has a problem.

The Station Operator Console will be located in a protected area, normally accessible only by Authority personnel, though the SOC shall require proper login by authorized personnel to be placed into service. Heating / cooling, power, electrical, and other site requirements shall be specified by the Contractor in the Infrastructure Requirements Plan, and shall be provided by Authority.

4.4.1 SOC Control

SOC shall be capable of connecting to up to 128 fare collection devices. It shall be responsible for polling fare collection equipment, maintaining communications with the central computer, synchronizing date and time for all connected equipment, and downloading software at the appropriate time for all equipment.

In the event of a communications failure, the SOC shall be capable of operating in a standalone mode for 14 days. In this case, data shall be able to be transferred from SOC to Central Computer via CD ROM.

4.4.2 SOC Operation

SOC shall have the ability to control the station equipment, including permitting patron entry or exit at a gate, opening and closing barriers, blocking a station to prevent card acceptance, disabling passback protection, and rebooting station equipment.

4.4.3 SOC Data Display

SOC shall display data on the attached devices, including date, time, location, intrusion alarms, operational status, fare media analysis, fare gate status, number of stored value cards accepted, current transaction and previous fare media information, and status of communications and software for individual devices. The system shall also be configurable for visual and audible alarms, that alert the station attendant in the event of specific events configured by the Authority, such as use of a hotlisted card and use of student/senior fare media (for fraud prevention).

SOC shall also display data for a magnetic card or smartcard presented to the SOC magnetic reader or smartcard target, including fare product type, start and end date of a product, serial number of fare media, agency ID, remaining value, date and time of last 12 card events, and point of entry.

Using the SOC, a station attendant shall be able to view the above information for any fare media product presented by a patron. A history of transactions in order to respond effectively to customer queries shall also be available from the stored information on the fare media. The attendant shall have the ability to duplicate or override a payment to enable a trip or stored value to be deducted as needed.

The SOC shall be capable of accepting fare cards/tickets from both before and after entry/exit, so that patrons in either the paid or free areas of the station can be assisted.

4.4.4 SOC Data Exchange

SOC is responsible for consolidating data from end devices and sending data to the Central Computer, including transaction, trip, revenue, performance, status, and alarm data, hotlisted card information, and bank card authorization requests.

SOC receives data from the Central computer and forwards data to the end devices, including requests for retransmission of data, transaction data acknowledgement, operating commands and configuration information, fare tables, encoding format parameters, screen layouts, and bankcard authorization responses.

4.5 Revenue Collection Carts

The Contractor shall provide Revenue Collection Carts, designed to transport the money and fare media containers supplied with the Contractor's Fare Collection System. Revenue Carts shall be subject to Authority.

Revenue Collection Carts easily moveable by personnel in the Cash Handling Facility and on the Caguas rail system, and shall be designed to minimize manual handling efforts, pushing or pulling by personnel. Carts shall be designed to minimize forward bending and repetitious lifting by personnel when loading or unloading. Such design may include front or side loading rather than top loading features. Carts shall be constructed of the lightest material available that meets durability, strength and security requirements. Carts shall have height adjustable handles, padded handle grips, easily maneuverable wheels and casters of adequate durability, and easily operated hand and foot brakes. Alternatives to the "dead man" hand brake should be considered. Carts shall be designed for compatibility and ease of fit with coin counting workstations to facilitate loading and unloading.

Revenue Carts shall be transportable by truck, and shall be designed to allow loading on and off of a revenue servicing truck. Contractor shall specify any required lifting equipment for a revenue servicing truck to enable the safe and easy movement of revenue collection cards, both empty and fully loaded.

4.6 Performance and Reliability

Final acceptance of equipment shall be based on the following performance requirements being met.

Equipment Type	Reliability (MCBF)	MTTR (minutes)	Transaction Time	Accuracy (%)
TVM	10000	30	NA	99.70
Fare Gate	100000	20	NA	99.70
Accessible Fare Gate	50000	20	NA	99.70
Central Computer	30,000 hours (MTBF)	60	NA	99.70
Coin Processing System	100000	20		99.90
Bill Processing System	100000	20		99.90
Ticket Encoder	500000	30		99.70

MTBF = Mean Time Between Failures
MCBF = Mean Cycles Between Failure
MTTR = Mean Time to Restore to Service

TVM Transaction Times		
Type of Ticket	Fare Payment	Maximum Transaction Time (Seconds)**
Stored Value Card	Cash	5
Smartcard load	Cash	5
All	Credit	15
All	Debit	15

**The maximum time for the transaction is measured from the time that the last keystroke is pressed to the time that the TVM issues a card, change, and receipt, if required

5 Infrastructure, Reporting and Control

5.1 Central Computer (CC) System

The Central Computer System shall be the primary processing mechanism for all transactions of the fare collection system. Use transactions, sales transactions, configuration data, security, monitoring and reporting shall be facilitated via the Central Computer.

5.2 Network and Infrastructure

The fare collection system will require the appropriate physical infrastructure to support the network and hardware requirements of the system. This physical infrastructure includes accessibility to electrical power, conduits for carrying power cables and telecommunication cables and appropriate construction where required to support the installation of faregates, TVMs and SOC. The Central Computer may require cooled computer storage facility, physical security, access control systems, electrical requirements, emergency power supplies, alternative and redundant telecommunications equipment, and other preparations

The Authority will provide network connectivity and physical site preparations for installation of equipment, based on an Infrastructure Requirements Plan that Contractor shall submit with the proposal, which details Contractor's requirements. Any site preparation, power and communications requirements, or other infrastructure elements that are not fully described in the Contractors Infrastructure Requirements Plan and approved by the Authority as being provided by Authority shall be the responsibility of the Contractor.

5.3 Configuration

Configuration data shall include at minimum, fare table information, action list data, hotlist data, device configuration parameters, event data, key data and software. All configuration of device and system operation shall be done through the Central Computer, and access to configuration capability shall be limited to properly authorized personnel through the login process for the configuration tool.

5.4 Data Collection

The following data shall be recorded for both magnetic tickets and smartcards, and for all device types, as applicable. Data model shall be provided at time of Design Review.

5.4.1 Sales Event Data

Sales Event Data is defined as all data relevant to the sales of fare products onto a card, including but not limited to passes, stored value, ride books/tickets, and other products. The fare collection equipment shall capture, store, and forward all sales event data to the central computer.

5.4.2 Fare Equipment Data

Fare Equipment Data can be segregated into two categories, including transactional data resulting from interaction with a magnetic striped card or smart card, and configuration data, such as fare table information, rider class information, and action list data.

Transactional data shall be captured by each device during card, and device interaction. For each transaction, appropriate card data, such as time, day, event, transaction, transaction type, location, gate device ID, product ID, value, will be processed and retained by the equipment. The equipment and the card shall also utilize a message authentication code on the transactional record as a digital signature to ensure integrity. Once captured and consolidated for a period of time, configurable by the Authority, this data shall be transmitted electronically to the SOC and then forwarded to the Central System for processing.

Configuration data shall be delivered from the Central Computer to each device periodically, in a time frame determined by the Authority. Configuration Data shall also be digitally signed to ensure integrity by the recipient device.

5.4.3 Equipment Access Data

Equipment Access Data is defined as any data associated to the maintenance and/or event by a device. Maintenance activities shall include all activities for each and every sub-component of the fare collection equipment, (e.g., smart card reader, magnetic stripe transport, processing board, etc.). Event data shall include all physical and electronic events detected by the device (e.g., out of service, jammed transport, smart card reader not responding, etc.).

5.4.4 Ridership Data

Ridership Data is defined as all data relevant to each and every boarding regardless of fare payment type, including but not limited to passes, stored value payments, transfers, and free transfers. Ridership data shall be retained in a data model to be proposed by Contractor, that is most conducive to assisting Authority in service planning, load planning, product planning and other business operational and strategic needs as required.

5.4.5 Data Security

Data Security is essential to ensure the privacy of patrons. As such, all patron information, including but not limited to name, address, phone number, credit card information, magnetic card serial number, smart card serial number, and driver's license shall be encrypted and MAC'd to ensure data integrity. Triple DES as based upon NIST standards shall be required for encryption and MACing functions.

5.4.6 Data Retention and Retrieval

All data defined in this specification shall be retained for ten (10) years and be retrievable online via a Structured Query Language (SQL) reporting tool and/or interface such as Crystal Reports® or Hummingbird®. The proposed tool must be approved by Authority during Design Review. Data older than ten years shall be archived via a data archiving tool to be proposed during Design Review by the Contractor.

Contractor shall also provide a real-time data backup process to duplicate data to the Central Computer at the Test Lab, for protection against disaster, accident and malicious activity.

5.5 Reporting

5.5.1 Standard Reports Suite

As part of the standard reports suite, the following report types shall be provided:

- Ridership, including Daily (by time of day), Weekly, Monthly, Peak Periods and Off Peak Periods
- Transaction Usage Volumes, including Daily, Weekly, Monthly, Peak Periods, Off Peak Periods, Lines, Stations, Products Utilized
- Transaction Sales Volumes, including Daily, Weekly, Monthly, Peak Periods, Off Peak Periods, Product Types
- Revenue Collection
- Maintenance and Equipment Access

These are general categories, with specific details of each report area to be further defined during the Design Review stage.

5.5.2 Ad-Hoc Reports

Ad-Hoc reporting functionality shall be made available to Authority via a Structured Query Language mechanism and/or a reporting tool such as Crystal Reports® or Hummingbird®. Detailed Entity/Relationship diagrams, representing the full proposed data model shall be accessible online, along with a pertinent web driven data dictionary.

5.5.3 Reporting Access

The Reporting function shall be available to Authority via direct network connections and remote network access via the web, allowing a minimum of 10 concurrent users. Access to the reporting function shall require both a network authentication as well as an application logon.

Supporting Equipment

6.1 Spare Parts

The Contractor shall provide to Authority a one-year supply of spare parts for all elements of the AFC System, based on estimated ridership. A listing of each spare part proposed by system element, proposed quantity, manufacturer ID, part number, and unit price, and recommended quantities for each part, shall be provided by the Contractor (CDRL) for Authority review. Contractor must identify items considered to be "consumables" for review and approval by the Authority.

Spare parts for each type of equipment shall be delivered 2 weeks prior to start of installation of each type of equipment.

6.2 Test Equipment

Contractor shall provide all test equipment required to maintain the fare collection system. A list of such equipment shall be provided by Contractor at design review. (CDRL)

6.3 Test Lab

Contractor shall provide all equipment and supporting infrastructure, and shall establish a fare collection Test Lab in a location to be provided by Authority. The Test Lab shall include the equipment quantities identified above, as well as any other components required to create a fully operational fare collection system capable of fully testing all system and application software.

6.4 Disaster Recovery Site

Authority intends to utilize the Test Lab as a Disaster Recovery Site in the event of a system failure. Contractor shall provide all hardware, software, and communications and shall configure the test lab equipment to enable fail-over from the revenue system to the Disaster Recovery Site.

Contractor shall provide a detailed plan for Disaster Recovery, outlining the impacts of loss of communications and/or power for each major component of the fare system (e.g. TVMs, Fare Gates, Station Operator Consoles, Central Computer). The plan shall include processes for converting the Test Lab to a Disaster Recovery Site when needed, as well as for restoring the entire system to normal operation. Plan shall detail any differences in fail-over, operations or recovery for short-term and long-term disasters.

Program Management

7.1 *Project Administration*

7.1.1 *Program Manager*

Contractor shall designate a Program Manager to serve as the primary contact between Authority and Contractor. The Program Manager shall be responsible for the overall project management, including budget, schedule, and technical issues to ensure the timely delivery of the system to Authority. The Program Manager shall be identified in the Contractor's proposal.

7.1.2 *Technical Support*

Contractor shall provide technical resources as required throughout the project to address issues related to the operation and installation of the new system. Technical support team shall be described in the Contractor's proposal.

7.2 *Schedules*

Contractor shall provide a program schedule as part of the proposal, and shall update the schedule on a monthly basis throughout the program.

7.3 *Progress Meetings*

Progress meetings shall be held on a regular basis, as agreed to by Contractor and Authority, and shall serve as the venue for discussing any problems with the program on schedule and developing a plan for correction of issues.

7.4 *Design Reviews*

Preliminary and Final Design Reviews shall be conducted by the Contractor, to allow the Authority to review and comment on the Contractor's proposed design. Submittals are outlined in the Contract Deliverables Requirements List. The specific schedule for Design Reviews shall be included in the Project Schedule, and shall allow a minimum of 30 days for review of design documentation by Authority, followed by discussion and comment resolution, prior to approval of the design review.

7.4.1 *Preliminary Design*

The Contractor shall submit to the Authority a Preliminary Design Package for each element of the AFC system and for the entire system as a complete entity. A Preliminary Design Review shall be conducted after submittal of the Preliminary Design Package to discuss the Authority's comments on the Preliminary Design Package submitted by the Contractor. Following the completion of the preliminary design review, the Contractor shall incorporate the Authority's comments into the final design of the AFC System.

7.4.2 *Final Design*

Following the Preliminary Design Review, the Contractor shall submit to the Authority a Final Design Package for each element of the AFC System and for the entire system as a complete entity. This package shall consist of the final drawings and specifications for the AFC System.

A Final Design Review shall be conducted following the submittal of the Final Design Package to discuss the Authority's comments on the Final Design Package submitted by the Contractor. Following the completion of the Final Design Review, the Contractor shall incorporate the Authority's comments into the plans and specifications for the AFC System and submit the revisions to the Authority for final review and approval prior to the commencement of production of the System.

7.5 Documentation

The Contractor shall submit all required samples, prototype equipment, performance data, product information, program plans, software listings, and designs and installation drawings to the Authority for approval. The Contractor shall not proceed with the fabrication or procurement of equipment or materials until such items have been approved by the Authority. The Authority's approval shall be for the purpose of minimizing changes and delays in the field and shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated system and subsystems for Automatic Fare Collection System which is compliant with these Technical Provisions.

7.6 Submittals

Submittals required as part of this contract, as well as schedule for delivery of submittals, are detailed in the Contract Deliverables Requirements List. Contractor shall submit all deliverables electronically in a format approved by the Authority, such as Microsoft Word, Excel, or Project, and in hard copy. Design Review documentation package shall be submitted on CD and paper, with a minimum of 10 CDs and 2 master paper copies provided to the Authority.

7.7 Quality Assurance

Contractor shall perform all work according to a Quality Assurance Program in accordance with ANSI or ISO 9000 guidelines. Contractor shall submit a Quality Assurance Program, which shall detail procedures to be applied throughout the contract, and shall include but not be limited to Records, Inspection and Testing, Document Change Control, Personnel, Nonconformances and Corrective Actions.

7.8 Configuration Management

Contractor shall establish and maintain a configuration management program. This program shall identify the product or software configuration, control changes to the product or software during production, test and operational use, and report implementation status of approved changes on a periodic basis. The Contractor shall maintain records such that the configuration of any item shall be defined in terms of its component numbers; and the status of change approvals and incorporations shall be known and recorded at any point in development, test or operational use, and can be made available to Authority upon request. The Contractor's engineering and technical documentation shall be of a quality level at least equal to that of the industry, capable of legible reproduction, and adequate in use for its intended purposes. The Contractor shall maintain accurate and current configuration records, available to the Authority throughout the contract and for a three-year period after final contract payment. The Contractor shall also assure that all subcontractors' configuration management programs comply with these requirements.

7.9 Site Requirements

7.9.1 Working Hours and Schedule

The Contractor shall perform all work at the rail stations between the hours of 6 am and 9 pm. Contractor must coordinate its work schedule in advance with Authority to ensure that there is no conflict between Contractor activities and other station construction. The Contractor may be restricted from working in locations and at times when special events are taking place. In preparing the Project Schedule, the Contractor shall incorporate the above constraints and generate a 60 day look-ahead on-site work schedule from the Project Schedule, prior to the commencement of work at each site. The schedule shall be updated by the Contractor and resubmitted to the Authority for approval whenever a change to it is planned or required. All work shall be supervised by Authority representatives.

7.9.2 Damage to Facilities

The Contractor shall be solely responsible for repairing, at no cost to the Authority, any damage inflicted on the Authority's facilities and/or systems by the Contractor's employees or any of its Subcontractors or agents.

8 Testing

8.1 Test Program

Contractor shall provide a comprehensive testing program to validate that each device, and the system as a whole, meets the requirements for functional operation, quality, software configuration, safety, reliability, and maintainability. Contractor's test program shall provide the following types of testing detailed in this section.

8.2 Test Support

8.2.1 Test Management

Contractor shall assign a Test Manager to coordinate with the Authority for all required test activity performed by the Contractor. For testing to be conducted at Authority's locations, the Authority will coordinate access to test sites and arrange for the availability of Authority facilities and personnel.

8.2.2 Test Personnel

Contractor shall provide qualified technical personnel to conduct testing according to the approved test procedures, record test data or ensure that it is properly recorded by others, and produce test reports. Personnel shall be fully familiar with the equipment before being assigned to the test program.

8.2.3 Authority Witnesses

Authority reserves the right to witness all test activities including all preparations such as pre-tests, burn-in, troubleshooting, and retests. The Contractor shall give a minimum of 14 calendar days advance notice to the Authority to provide for such witnessing.

8.2.4 Test Equipment and Instruments

The Contractor shall provide all test equipment and instruments necessary to conduct all required tests. All test equipment and instruments shall be calibrated as specified herein.

8.3 Test Documentation

The Contractor shall prepare and submit for Authority's review and approval a Test Program Plan, a Testing Schedule, Test Procedures and Test Reports. Contractor shall conduct the testing according to the approved plan, schedule and procedures.

8.3.1 Program Plan

Contractor shall submit a Test Program Plan to the Authority for review and approval (CDRL). The Test Program Plan shall:

- Describe each test and its objectives.
- List each test, by a unique test procedure number or name, that will be conducted for the main types of tests required in this section.
- Describe the test program personnel organization and the responsibilities and qualifications of each organization level and each person.
- Describe applicable prerequisites for testing.

- Include samples of test data sheets and test logs, and instructions for using them.
- Describe procedures for identifying, evaluating, and correcting the causes of problems or failures that occur during tests, and describe procedures for reworking and retesting.
- Describe procedures for preparing and submitting test data sheets.
- Identify the primary test agency if other than the Contractor.
- Describe procedures for notifying the Authority of the actual date of each test.

8.3.2 Schedule

The Contractor shall prepare and submit to the Authority for review and approval within 90 days after Date of Award, a Test Program Schedule of factory and on-site testing. The schedule shall show each test scheduled for each location or area and the start and finish dates

The Contractor shall provide a detailed written schedule one week before the actual start of each test. The schedule shall include the test procedure number, test location, date and time that tests will be conducted, and the responsible test engineer.

The Authority reserves the right to direct the Contractor to change the test sequence or the test hours as determined to be necessary by Authority.

8.3.3 Procedures

The Contractor shall prepare a test procedure for each required test. (CDRL) Test procedures shall be submitted to the Authority for review and approval 60 days before the scheduled start of the tests and will not be approved before the Test Program Plan has been approved. Tests shall not be scheduled prior to approval of test procedures. Each procedure shall contain:

- A statement of test objective and scope
- A list of equipment required to set up and conduct the test.
- A list of equipment and facilities, which are only available from the Authority, and which are required to conduct the test.
- A list of prerequisite tests that shall be completed before the test can be conducted.
- A description of the required test setup, including diagrams illustrating test equipment connections and identifying test points, where applicable.
- Step-by-step instructions for conducting the test, identifying the points where data is to be recorded, and the limits for acceptable data.
- Instructions for recording data on data sheets or verifying that procedural steps have been completed.

All test data sheets on which results of testing shall be recorded when the test is performed by the Contractor. Test data sheets shall be used to record items being tested, test location, test date, signature of person performing the test, and signature of Authority's test witness. Test data sheets shall be used to record applicable drawing numbers, test data, test equipment, tool serial numbers and calibration dates where applicable, discrepancies, and corrective actions required. Data entries shall refer to the applicable procedures, and allowable limits for each entry shall be indicated on the data sheet.

8.3.4 Reports

The Contractor shall prepare and submit to the Authority for review and approval a test report for each test conducted. (CDRL) Test reports shall be submitted within 10 days after conducting a test and shall contain:

- All test data sheets as completed at time of test.
- The Contractor's analyses and conclusions of the test results.
- A complete list of discrepancies and/or deviations from expected results including how and when each item is to be resolved.
- A list of items to be retested.
- A revised test procedure, if corrections or revisions were made during the test.
- A general summary of the item, subsystem, or system being tested indicating any open items that are yet to be resolved and any test that is yet to be conducted.

8.4 Tests

8.4.1 First Article Inspection Tests (FAIT)

First Article Inspection Tests shall be performed on new equipment, or equipment that has new functionality, to verify that the equipment meets the specified requirements. FAIT includes the following:

- **Environmental Test** – To be performed to demonstrate that equipment is capable of performing satisfactorily in the environmental conditions in which it will be operating, as defined herein.
- **Software Acceptance Test** – To be performed to verify that all system functions are operating as intended and meet the specified requirements, including user interface and basic function of each type of equipment, as well as enhancements to existing equipment.
- **Equipment-Level Subsystem Integration Test** – To be performed to verify data transfer and response among equipment subsystems, and confirm that they system functions as an integrated whole

8.4.2 Acceptance Tests

- **Production Acceptance Test** – To be performed on all production equipment to verify proper production
- **Installation Acceptance Test** – To be performed on all equipment after it has been installed in the station locations to verify proper installation and configuration
- **System Integration Test** – To be performed to verify that installed AFC equipment properly interfaces with each type of equipment, other Authority systems as applicable, and infrastructure. The tests shall thoroughly demonstrate the correct execution of each functional operation that passes across the interface, and the capacity of the interface to handle the maximum amount of simultaneous data.

8.4.3 System Reliability Test

A System Reliability Test shall be performed on the system as a whole after it has been installed in the field and is operating in revenue service, to confirm that the system has

been designed, built, and installed to meet system requirements. The first 30 days following completion of installation of the entire system shall be designated as the settling period. The test shall not begin until the equipment reliability is at a minimum of 50% of the specified reliability requirement for that subsystem over a period of 30 consecutive days.

Each test shall be conducted over a period of 180 consecutive days under revenue service conditions. Each test shall consist of three 60-consecutive-day minimum test periods, during which the equipment shall perform as follows:

Test Period	Minimum Reliability Requirement
0 – 60 Days	60% of acceptance criteria
60 – 120 Days	80% of acceptance criteria
120 – 180 Days	100% of acceptance criteria

Under no circumstances shall the test be allowed to proceed to the next 60-consecutive-day test period until the requirements for the previous period have been met. Successful completion of the test shall be a prerequisite for final acceptance of the Fare Collection System.

8.4.4 Testing Exemption

In the case where First Article Inspection Testing has already been successfully conducted on the equipment hardware and/or software that will be supplied to the Authority, Contractor may request an exemption from conducting First Article Inspection Tests and provide the test procedures and test reports for Authority review and consideration. In the event that Authority deems the testing to be unsatisfactory, Authority reserves the right to request testing to be conducted.

8.5 Testing Performance

8.5.1 Failure Review Board

A Failure Review Board will be established, consisting of representatives from the Authority and the Contractor, to evaluate testing performance, determine whether failures are chargeable or non-chargeable, and determine testing status with respect to successful completion. The failure review board will convene on a regular basis, frequency to be determined, throughout the testing period.

8.5.2 Chargeable Failures

The following conditions shall be considered chargeable failures for which the Contractor shall be held accountable:

- Failure of a component or system to perform its function.
- Failure to accept payment or fare media in serviceable condition.
- Bill jams.
- Coin jams.
- Media jams.
- Failure to process payment or fare media.
- Data storage or alarm failure.
- Exposed money.

- Failure to return correct change.
- Failure to issue media with correct information.
- Failure of a patron display.
- Failure due to any option selected.
- Failure of the communication system.
- Failure of AFC System monitoring/reporting functions.

"No Problem Found" determinations shall be held for further analysis.

8.5.3 Non-Chargeable Failures.

The following non-chargeable failures shall not affect the reliability requirement:

- Accident or mishandling.
- Failure of test facility or test instrumentation.
- Equipment failures caused by externally applied overstress conditions in excess of the approved specification requirements.
- Dependent failures occurring with the independent non-relevant failure that caused them.
- Failures caused by incorrect operating procedures.
- Jams caused by foreign materials other than U.S. bills, U.S. coins, bank cards, and fare media inserted into their appropriate slots.
- Jams caused by excessively worn bills or coins.
- Failures resulting from vandalism.

8.5.4 Test Approval

After 180 days of cumulative test time, test records shall be examined to determine conformance with the requirements. If test objectives have not been met, the test shall continue until the specified requirements are met.

8.5.5 Deficiencies

If it has been determined from the test data acquired from any test that the equipment, material, technical documentation, or services furnished do not conform to all specification requirement(s), the Contractor shall recommend appropriate remedial action based on an analysis of the test results within thirty (30) days after notification from the Authority. The Contractor shall correct all deficiencies at no additional cost to the Authority. Retesting after the corrections have been completed shall be required in whole or in part as determined by the Authority at no additional cost to the Authority. If the timely correction of all deficiencies is not completed to exact specification compliance as evidenced by the test results, the Authority shall initiate remedial actions. Such actions may include correction of the deficiency at the Contractor's expense, default and termination actions in accordance with the General Provisions, or other actions or benefits to the Authority in accordance with any combination of these and other rights available to the Authority.

9 Installation

Contractor shall be responsible for installation of all equipment hardware, software, interfaces, infrastructure, and communications required for a fully operational system

9.1.1 Installation Plan and Schedule

Contractor shall develop an installation plan and schedule detailing the installation activities at each station, site preparation, personnel requirements, working hours, task durations, contingency plans, equipment requirements, interface with other Contractors, and any other information relevant to installation. (CDRL)

9.1.2 Responsibilities of others

Contractor shall fully identify, as part of the proposal, all areas related to installation that are considered by Contractor to be outside of its scope of work, for example, provision of conduit in the new stations between the SOC and fare collection devices. Any areas not identified prior to award will be the responsibility of the Contractor.

10 Training

10.1 Training Requirements

Contractor shall be responsible for providing training on the following aspects of the new fare collection system:

Training Course	Hours per Class	Number of Students per Class	Number of Classes
TVM Operation	16	8	2
Gate Operation	8	8	2
SOC Operation	8	8	1
TVM Maintenance (Field)	24	8	1
Gate Maintenance (Field)	24	8	1
SOC Maintenance (Field)	16	8	1
Reporting	16	8	2
Graphical User Interface	16	8	1
Configuration and Policy Implementation	24	8	1
Revenue Collection and Servicing	8	8	1
OPTIONAL: Ticket Encoder Operation	8		
OPTIONAL: Ticket Encoder Maintenance	16		
OPTIONAL: MPOS Operation	8		
OPTIONAL: MPOS Maintenance	8		
OPTIONAL: TVM Maintenance (Shop Level)	40		
OPTIONAL: Gate Maintenance (Shop Level)	40		

Should the training space, provided by Authority, accommodate sufficient people, the Authority reserves the right to include up to 4 additional attendees in each class at no additional cost.

10.2 Training Schedule

Contractor shall propose a preliminary schedule of training at Preliminary Design Review, and a detailed training schedule at Final Design Review, for Authority review and approval. Training shall be conducted no earlier than 30 days prior to beginning of installation.

10.3 Training Plan

The Contractor shall submit to the Authority for approval a plan to train Authority personnel in all aspects of the fare collection equipment as required to enable the Authority to operate, revenue service, and maintain the equipment satisfactorily. (CDRL) The training plan shall include details on classroom and shop training given by the Contractor's personnel, including training concepts, topical outline of each course, course objectives, materials to be used, devices, training aids and supplies required.

The anticipated duration of each class is included in section 10.1 , however should Contractor believe that additional time will be required to satisfactorily train personnel in the subject areas, Contractor shall include additional hours in the recommend the number of hours of classroom training necessary to satisfactorily train all subject areas listed above. In addition, the Contractor shall recommend appropriate levels of personnel classification for each system element and provide job descriptions for each level.

Training shall be delivered by an instructor in the classroom and when appropriate, in the field or shop where actual equipment is used. The Authority reserves the right to videotape all training sessions provided by Contractor, for use by Authority in training personnel in the future.

The Contractor's training shall include formal and informal instructions, models, manuals, diagrams, and component catalogs. All materials used in the programs, such as models, manuals, mock-ups, and drawings shall become the property of the Authority for reproduction and use as necessary to train personnel. Training materials shall be updated as required throughout the duration of the contract.

10.4 Training Location

The Authority will provide a training classroom for all training sessions to be conducted by Contractor, including shop space as necessary for maintenance sessions. The classroom will be equipped with tabletop space for students.

10.5 Training Materials

The Contractor shall provide materials to support each course in the training program, including instructor guides, training aids, student workbooks, and operator and maintenance manuals. All training materials shall become the property of the Authority, and Authority reserves the right to reproduce portions or all of the training materials for use by the Authority.

The instructor guides and student workbooks shall be submitted in a paper form that allows easy reproduction; that is three-hole punched in a three ring binder, printed in black ink on 8 1/2 by 11 inch white paper, printed on both sides, and numbered sequentially within units of training. Each student attending training sessions shall receive a paper copy, supplied by Contractor, of the applicable training materials. Master paper copies of all materials shall be provided to the Authority to allow for reproduction as necessary.

Additionally, all training materials shall be submitted in an electronic format acceptable to the Authority, such as MS Word or Acrobat PDF, as requested by the Authority. A **directory of all files on the CD will be listed in hard copy showing filenames, date, and file**

size. Filenames will be descriptive so as to indicate course covered, chapter, and section.

Draft training materials shall be submitted for Authority review and comment at Final Design Review (CDRL). Updated training materials shall be submitted for review and comment 60 days before training is to be conducted, with the version for use during training to be submitted 30 days prior to training. Following training, any necessary modifications shall be made and the documents resubmitted as final.

Contractor shall provide updated training materials as they become available for a period of 2 years following completion of installation of all equipment.

10.5.1 Instructor Guides

The Contractor shall provide an instructor guide for each training course. The instructor guide shall include:

- Course agenda
- Course objectives
- Procedures for managing both classroom and on-the-job training sessions
- Resources and facilities required
- Guidelines for preparing for training
- Detailed lesson plans, including outlined presentations and discussion guides.
- Training and job aids
- Instructions for using any audio/visual support, mock-ups, and scale models.
- Post-training examination
- Criteria and methodology of measuring performance in the classroom and in the shop/field

10.5.2 Student Guides

The Contractor shall provide, for each course, a student workbook which shall include course agenda, course objectives, paper copies of all presented materials, class outlines, lesson summaries, and any other information that will facilitate the learning process.

10.6 Training Equipment

Contractor shall supply all training equipment necessary for conducting the classes, such as computer projectors, CD-ROM players, screens, easels, etc. as required by Contractor.

Contractor shall supply all training aids, such as mock-ups, scale models, diagnostics and test equipment, and any special tools required for training. All training aids shall become the property of the Authority.

Authority shall supply from the equipment spares inventory one TVM, gate array consisting of one entry/exit aisle and one Accessible aisle, and one Station Operator Console, for use during Contractor-provided training. Contractor shall install the training equipment and maintain it in the Authority-designated location throughout the training period to ensure that the equipment is in proper working condition for training, including the current software and configuration versions.

Warranty

11.1 Warranty Period

Contractor shall warrant that all equipment, software, and products furnished under this contract shall be free from defects in material, workmanship, and functionality and shall remain so for one year after the successful completion of the post-installation System Integration Test, termed "acceptance" for purposes of this section.

11.2 Warranty Scope

Contractor will repair or replace defective equipment, software, and products delivered under this contract, regardless of the source, manufacturer, or contractor. If within 12 months after the product acceptance, any such product is found to be defective in software, material or workmanship, Contractor shall repair or, at its option, replace such defective products at no additional cost to the Authority.

Warranty shall not cover consumable items as identified by Contractor and approved by Authority on the Spare Parts list.

Provisions of this warranty shall not apply in the event of negligence on the part of the Authority, its customers, employees, or representatives. Conditions of operating use, including but not limited to temperature, humidity, vibration, dust, and dirt within the limits specified in the requirements, and normal customer use are not considered negligence.

11.3 Defects

Authority shall provide written notice of defects within 30 days after the defect becomes apparent.

A "fleet defect" shall be any group of failures, reported by Authority in writing, that affect 10% or more of a single component or product. Fleet defect designation cannot be applied to consumable items. Should Authority designate a fleet defect, Contractor may be required by Authority to take remedial action on the entire group of components or products.

Unless otherwise agreed by both Contractor and Authority, remedial action on any fleet defect shall begin within 10 working days of being notified of the defect, and corrective action must be approved by Authority before the work is performed. Should the Contractor fail to take appropriate remedial action within the 10-day period, Authority may take action to correct the defect and may invoice the Contractor for labor, material, and handling costs associated with the action.

2 Options

The following options are of interest to the Authority. Contractor is requested to provide technical and pricing information as described below, for review and consideration by Authority

12.1 Alternative Fare Collection Solution

Contractor is encouraged to propose alternatives for the Caguas fare collection system that will accomplish the primary objective of providing fare media interoperability between Tren Urbano and Caguas, but offer benefits to the Authority such as lower capital and/or operating costs, ease of implementation, etc.

As part of the proposal, Contractor shall fully describe any alternative solutions, their benefits and limitations, and cost savings, for Authority consideration.

12.2 Removal of smartcard hardware from equipment

Contractor shall provide line item pricing for cost savings resulting from delivery of the fare collection equipment without smartcard hardware, for Authority consideration. Contractor shall also describe the process for installing hardware and upgrading equipment for acceptance of smartcards, as well as estimated pricing for completing the upgrade in the future.

12.3 Bi-parting leaf gates

As an option, Contractor shall provide pricing for supplying bi-parting leaf fare gates in lieu of tripod style gates. Pricing shall indicate the delta between tripod gates, as the baseline, and the bi-parting leaf gates.

12.4 Computer Workstations for Reporting

As an option, Contractor shall provide computer workstations for reporting access in locations not currently equipped with computers. Authority shall provide the power and network connections as required, as long as the power and network connectivity requirements are detailed in Contractors Infrastructure Requirements Plan.

12.5 Multi-function Point of Sale (MPOS)

As an option, Contractor shall provide MPOS devices to enable Authority to initialize and encode smartcards, as well as create replacement smartcards. The MPOS shall communicate with the central computer for the purposes of initializing smart cards and adding rider information and products such as employee ID employee passes. Contractor shall provide a summary of the technical capabilities of proposed equipment for review by Authority as part of evaluating the option.

12.6 Ticket Encoders

As an option, a ticket encoder shall be provided to automatically encode magnetic and smartcard fare media as directed by communications with the CC. Contractor shall provide a summary of the technical capabilities of proposed equipment for review by Authority as part of evaluating the option.

12.7 Additional Training

As an option, Contractor shall provide training for 10 Authority personnel for each of the training classes listed in the Training section as "Optional." Each optional training classes shall be priced separately, to allow Authority to select specific classes as appropriate.

12.8 Uninterruptible Power Supply (UPS)

Authority plans to equip each station with a backup power supply, which shall provide power to fare collection equipment in the event of a failure of the primary power source. As an option, Contractor shall equip the TVMs with a UPS capable of completing a transaction in progress and shutting down the TVM in an orderly fashion in case of a power failure.

12.9 Software Maintenance Agreement

As an option, Contractor shall provide a 3-year software maintenance agreement. Software maintenance shall include Contractor provision of all software upgrades developed by Contractor during the 3-year period, as well as Contractor installation of software and troubleshooting of software issues identified during operation or testing by Authority.

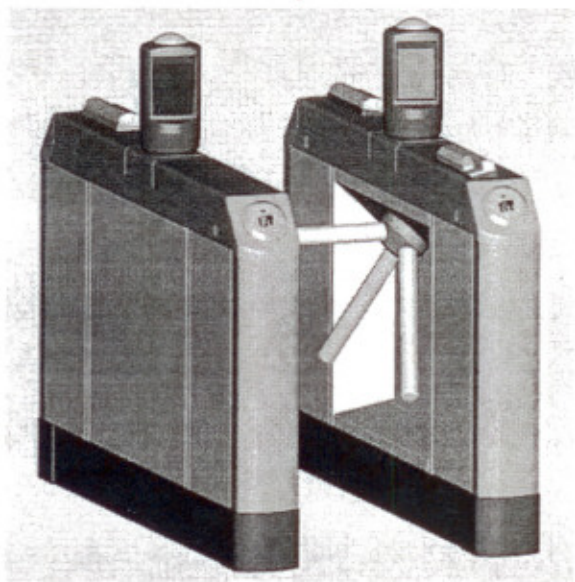
12.10 Extended Warranty Agreement

As an option, Contractor shall provide an extended 3-year warranty, which shall begin following the standard 1 year warranty period and shall provide the same coverage and provisions as the standard 1 year warranty described herein.

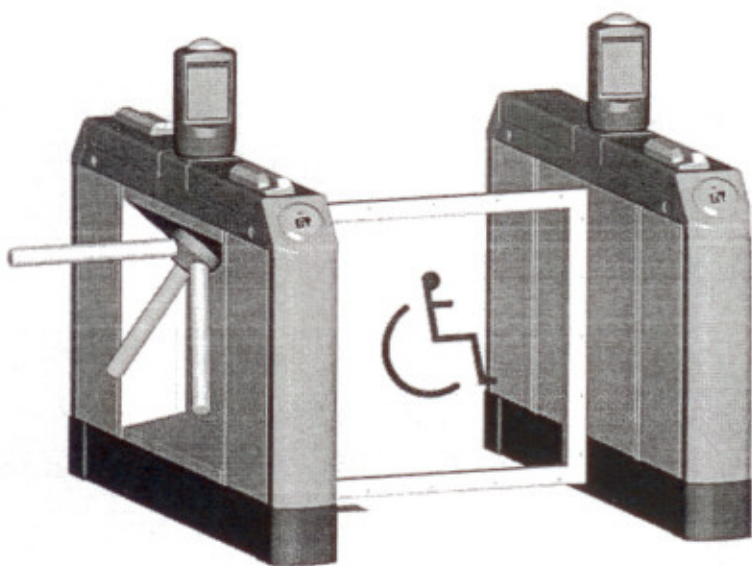
13 Contract Deliverables Requirements List (CDRL)

To be completed.

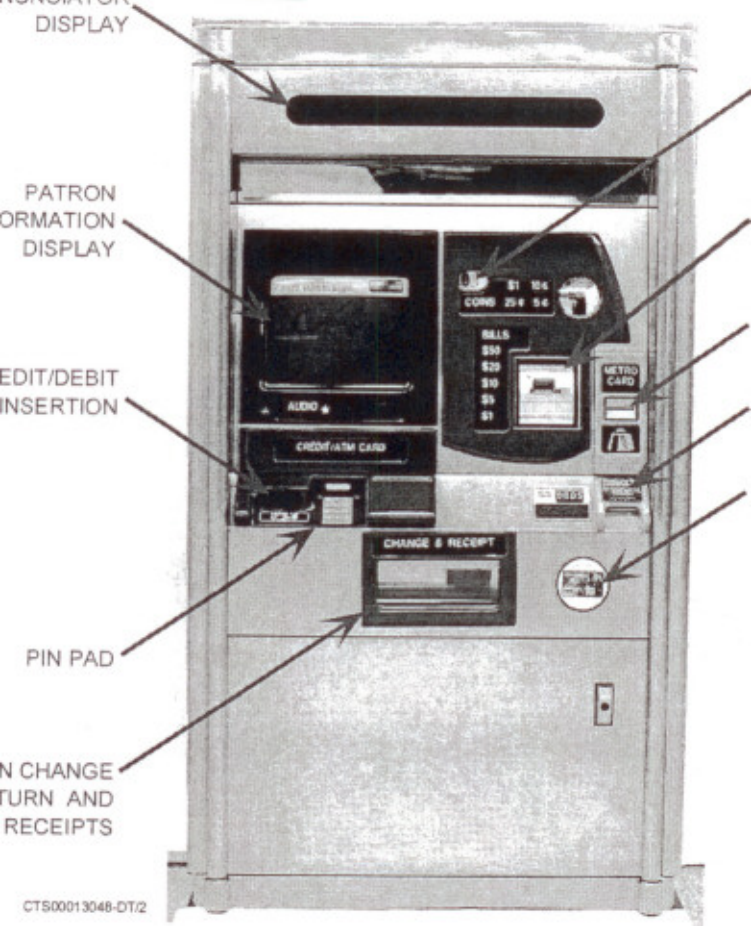
APPENDIX A – Representative Equipment



Standard Aisle with Tripod Barrier



ADA Accessible Aisle with Swing Gate



INDICATOR
DISPLAY

PATRON
FORMATION
DISPLAY

CREDIT/DEBIT
INSERTION

PIN PAD

CHANGE
TURN AND
RECEIPTS

APPENDIX B – Proposed Station Layout

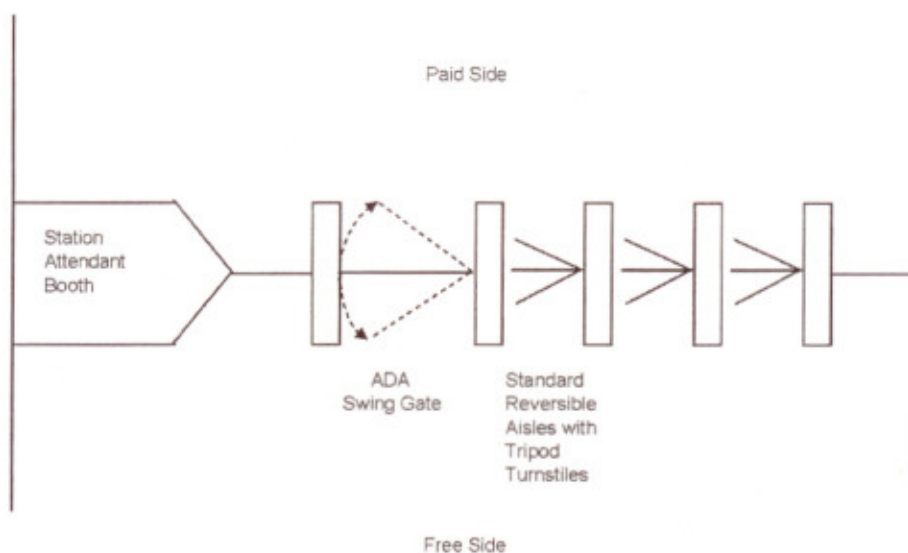


FIGURE: Conceptual Fare Gate Array