

SECTION 34 50 13

TICKET VENDING MACHINES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Ticket Vending Machines (TVM)
- B. Compatibility with other machines
- C. Customer interface and human factors
- D. Modes of operation
- E. Various assembly requirements

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Ticket vending machines will be measured for payment as a lump sum unit acceptably installed and tested for compliance.
- B. Payment: Ticket vending machines will be paid for at the Contract lump sum price for ticket vending machines or as part of the lump sum price for Fare Collection System Work, as determined by the lump sum measurement specified above, as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. Payment Card Industry (PCI) Security Standards Council
 - 1. Pin Transaction Security (PTS) Point of Interaction (POI)
 - 2. Point-to Point Encryption (P2PE) Solution Requirements and Testing Procedures
- B. EMVCo (Europay, MasterCard and Visa) Specifications
 - 1. Integrated Chip Card to Terminal Interface
 - 2. Security and Key Management
 - 3. Application
- C. Americans with Disabilities Act (ADA)
 - 1. Americans with Disabilities (ADAAG)
- D. California Code of Regulations (CCR):
 - 1. CCR, Title 24 California Building Code

- E. BART Technical Documents
 - 1. Section 34 50 10 Fare Collection System
 - 2. Appendices District Technical Manuals, BART Ticket Specifications

1.04 SUBMITTALS

- A. Refer to Section 34 50 10, Fare Collection System, for submittal requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Functionality. The TVM shall perform the following functions:
 - 1. Encode and dispense stored value magnetic stripe “BART Blue” tickets or Clipper® regional smart card fare media;
 - 2. Upgrade a BART Blue ticket with remaining value;
 - 3. Add value to a Clipper® Smart Card fare media;
 - 4. Vend multiple, identical BART Blue tickets (up to five) in one transaction;
 - 5. Accept cash in one, five, ten and 20-dollar bills with capability to accept 50-dollar bills in future; and nickels, dimes, quarters and dollar coins;
 - 6. Accept credit or debit card with either magnetic stripe, EMV-compliant smart card chips, contactless payment card, or mobile device;
 - 7. Return nickels, dimes, quarters and dollar coins and bills on cash transactions;
 - 8. Provide change up to \$4.95 on a cash transaction. The maximum quantity of change dispensed shall be programmable locally in the service keypad or remotely from EME; and
 - 9. Make change without purchase for one \$1.00 bill.
- B. Design for Accessibility. The TVM shall meet all the requirements of the ADA, the ADAAG, and the State of California Code of Regulations Title 24. All operating controls and identification shall be labeled with Braille. The TVM shall be equipped with a voice module with adjustable volume control to allow visually impaired customers to perform any transaction by following interactive voice instructions, both following displayed messages and providing supplemental messages as needed.
- C. All operating controls and displays shall be located as indicated in the Contract Drawings.

2.02 COMPATIBILITY

- A. Functional Compatibility. The TVM shall be functionally compatible with all currently installed AFC equipment to the extent that the tickets and Clipper® cards dispensed from the TVM shall experience no problems in the existing installations due to compatibility, and that tickets and Clipper® cards dispensed by, or encoded in, the existing equipment shall experience no problems in the new installation.
- B. Physical Compatibility. The TVM shall be physically compatible with the existing installation to the extent that a new TVM can be substituted for any existing TVM by simply removing the existing TVM from the vault, leaving the base plate, installing a new TVM on the existing base plate in the vault, and reconnecting power and communication cabling. If necessary, the TVM shall be fitted with filler panels to fully cover the vault opening.

2.03 CUSTOMER INTERFACE AND HUMAN FACTORS

- A. Front Panel
 - 1. Human Factors Evaluation shall be performed on the layout and operation of the Front Panel. Results of the evaluation shall be submitted as a CDRL Item, Human Factors Report - TVM.
 - 2. Three meetings shall be held to finalize the Front Panel design and the display messages. The first meeting shall be held in conjunction with the Preliminary Design Review. The second meeting shall be held in conjunction with the Mock-up Design Review and the third meeting shall be held 150 Days after the start of Pre-production Field Tests on District property. Any changes resulting from these three meetings shall be at no charge to the District.
- B. Display Format. The customer shall be guided through fully interactive procedures as opposed to memorized instructions. Graphics and displays shall be easily read under all conditions of ambient light and shall be easily understood. Graphics, efficient machine timing, appropriate bezel design, and software efficiency shall be employed. Display timing shall permit new instructions to immediately follow customer input. Interfaces with the customer such as visual displays, display format, display language, printed information and instructions, design and location of slots and operating functions, and keypads shall be evaluated by the Supplier and the Engineer. The displays implemented shall be in the English language. Up to 12 user-selectable languages shall be supported for audible and visual messages. The memory reserved for future messages shall be at least three times that initially required for the messages.
- C. Alternate Concepts. It is recognized that the Supplier's standard designs and other hardware configurations have an impact on the Customer Interface and Human Factors. The Supplier may submit alternate concepts based on consideration of human factors and location of internal components. The Supplier shall identify which features need to stay in a particular location and which features can be relocated. Supplier shall provide alternates for the Message Display Unit (MDU) display messages, and alternates for front panel graphics.

2.04 FRONT PANEL

- A. The operating features on the front panel of the TVM are indicated on the Contract Drawings as typical with the key features indicated herein.
- B. Message Display Unit (MDU): The MDU together with the soft keys and the alpha-numeric keypad shall be the primary means of communication between the TVM and customers.
 - 1. Design: The MDU shall conform to the following design requirements, as a minimum:
 - a. Operate in conjunction with the soft keys and the alpha-numeric keypad to provide messages and menus to the customer regarding cash, credit, or debit card transactions, ticket type, and ticket value selection. Where appropriate, multimedia technology shall be used to provide customer instructions and messages. This includes the use of video clips, animation and graphics.
 - b. Have a viewing area dimension of at least twelve inches measured on the diagonal and capable of displaying text and graphics.
 - c. Employ a high contrast "Active Matrix" LCD display, or equal. Readability shall be enhanced as required to preclude "washout" in direct sunlight and to minimize glare and reflection. The brightness rating of the display in direct sunlight shall be at least 700 cd/m². The display shall have a contrast ratio of at least 8:1 in direct sunlight. Displays that focus the light in a narrow band of viewing to enhance privacy are preferred. The viewing angle shall not exceed 30 degrees horizontally from a vertical plane perpendicular to the surface of the screen.
 - d. The MDU shall be designed and located so that a customer of height ranging from three feet six inches to six feet nine inches can easily read the instructions. In no case shall the height of the top of the MDU exceed 48 inches from the finished floor.
 - e. Be vandal resistant by the use of one-quarter inch transparent polycarbonate front cover panel. The panel shall be attached from the inside of the door and be easily replaceable.
 - f. Minimum average life of five years during which the display remains readable.
 - g. Message contents, font size, and screen layouts shall be easily changeable by parameter modification from BART Central without the need to reprogram the TVM application software.
 - 2. Messages: Messages displayed on the MDU shall be at least 0.4 inch in height. The messages shall be categorized as follows, as a minimum:
 - a. TVM Status
 - 1) Accepts bills only
 - 2) Accepts coins only

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- 3) Accepts exact change only
 - 4) Accepts credit/debit card only
 - 5) Accepts cash only - no credit/debit cards
 - 6) Transaction canceled
 - 7) No receipts available
 - 8) No BART ticket available
 - 9) No smart card available for purchase
 - 10) No Smart Card reload available
 - 11) Out-of-Service
- b. Transaction Type
- 1) Cash transaction
 - 2) Card transaction
 - 3) Ticket purchase
 - 4) Ticket purchase with "Remaining Value Ticket" (RVT)
 - 5) Smart Card purchase
 - 6) Smart Card Fare Media Loading
- c. Customer Instructions
- 1) Insert Money
 - 2) Select Credit or Debit Card payment (cash = default)
 - 3) Enter PIN for non-cash payments
 - 4) Media selection (BART Blue or Clipper®) determined by TVM configuration
 - 5) Select ticket value
 - 6) Press "OK" to issue ticket
 - 7) Press cancel
- d. TVM Feedback Data
- 1) Amount of RVT inserted.
 - 2) Amount of money inserted
 - 3) Amount of money due
- e. "Other" Messages
- 1) Transaction approved
 - 2) Transaction not approved
 - 3) No receipt available - continue or cancel
 - 4) See Agent

- 5) Card type not taken
 - 6) Unable to read card
 - 7) Value not in range
 - 8) Limits exceeded
 - 9) Test transaction approved/not approved
- C. Alpha-numeric Keypad. An alpha-numeric keypad shall be provided on the front panel, located under the MDU in a semi-recessed area for maximum user privacy when using the keypad for PIN entry. The keypad shall be used to select ticket value, and enter PIN required to support the credit/debit feature and the external security system. The alpha numeric keypad shall be a standard 16 button keypad commonly used in the banking industry, with keys for digits from 0 to 9, a star key (*), a pound key (#), a red "Cancel" key in the upper right-hand corner, a "Yes" key, a "No" key, and a green "OK" key in the lower right-hand corner. Each key shall have tactile and audible feedback. The keypad shall prevent moisture from getting inside the unit and shall be vandal resistant. The keypad shall be easily removable from the inside of the TVM. The letters, numbers, symbols, and words on the keys shall be wear resistant. The number 5 key shall contain a raised dot to permit recognition by the visually impaired. The keypad shall be shielded so that the PIN entered is not visible to others standing nearby.
- D. Soft Keys. A minimum of four stainless steel soft keys shall be located on each side of the MDU as indicated in the Contract Drawings. Each soft key shall be approximately one square inch. Each soft key shall have tactile and audible feedback, and shall have Braille labels. The soft keys shall be used in conjunction with the messages displayed on the MDU, for ticket selection, payment mode, and other customer input required to support the transactions. An acceptable alternative to the soft keys will be the use of a touch screen.
- E. Out of Service Annunciator. An "Out of Service" annunciator shall be provided to inform customers when the TVM is out of service. The annunciator shall be a mechanical shutter that drops automatically, or an "Out of Service" message displayed on the MDU. The "Out of Service" annunciator shall be activated, at a minimum, for the following abnormal TVM conditions:
1. Cash boxes not properly in place;
 2. Self-diagnostic check failure;
 3. Both the cash and credit/debit card operating modes are inoperable;
 4. Security breached such as access procedure violated and door open;
 5. Door closed but not locked;
 6. Ticket and bill/coin jams; and
 7. No ticket or smart card stocks.

- F. Coin Bezel: The coin slot shall be of the vertical type. The bezel shall be precisely matched to the coin acceptor to prevent diversion of the coin and unnecessary jams, or shall be part of the coin acceptor itself. The shape of the slot and bezel shall minimize accidental deflections of the coins. Size of coin bezel shall limit insertion of coins larger than those legally accepted. Graphical representations of the accepted coin denominations (nickel, dime, quarter and dollar) shall appear below the coin slot as indicated.
- G. Coin Return: The coin return cup shall be constructed of stainless steel and formed to enable quick and easy removal of returned coins. The cup shall be, at a minimum, 5-inches wide by 4-inches high by 3-inches deep. An inward swinging transparent polycarbonate plastic cover, 1/8-inch thick minimum, shall be used to prevent coins from spilling out of the cup and to enable the customers to see into the cup. The cover shall prevent access to the TVM internal components via the return cup. Whenever any valid coin is returned, the cup shall be illuminated for approximately five seconds. A series of 1/4-inch holes shall be provided for drainage along the bottom of the cup with a drain tube to carry liquids outside the cabinet, onto the floor in front of the machines.
- H. Bill Bezel: The bill bezel shall be constructed of stainless steel or cast aluminum and formed with a ledge and side guides such that the customer can hold the bill down and slide it into the bill validator entry slot to minimize any tendency to skew. No gaps shall exist between the bezel and entry slot that could divert the bill into the inside of the TVM. The bezel shall be of sufficient strength to withstand minor acts of vandalism and shall be a replaceable module. Graphics, located on the bezel below the entry slot, shall illustrate the correct orientation of the bill as indicated. Graphics shall be engraved unless otherwise approved by the Engineer. The bezel shall not extend more than one and one-quarter inch from the surface of the front panel and shall be affixed directly to the bill validator and not to the front panel. Upon rejection, bills shall be returned through the bill bezel. The bills shall protrude at least two inches, and shall be held until forcibly retrieved by the customer.
- I. Bill Return. Upon cancellation of a transaction, the escrowed bills shall be returned through a separate bill return slot. The bills shall protrude at least two inches, and be held until forcibly retrieved by the customer.
- J. Ticket Slot. The following functions shall occur at the ticket slot:
1. Dispense BART ticket or Clipper® card and hold for retrieval upon the completion of a ticket or Clipper® card dispensing transaction;
 2. Accept BART ticket with RVT of less than a programmed amount (presently set at \$11.00) as credit towards a new ticket; and
 3. Dispense receipt for a credit/debit card transaction if plain paper ticket stock is used for the receipt.
- K. Cancel Button
1. Manual Cancellation. The "CANCEL" button shall allow the customer to cancel a transaction at any time prior to the "OK" button being depressed. Upon

cancellation, a “Transaction Cancelled at your Request” message shall blink on the MDU and the money in both escrows shall be returned within three seconds, after which the display shall revert to standby. If an RVT is included in the transaction, the ticket shall also be returned. A beeping sound shall be generated and remain until the returned money and RVT have been retrieved. As soon as the returned money and RVT are retrieved, the TVM shall be ready for use by the next customer.

2. Automatic Cancellation. The “Transaction Canceled” message shall blink on the MDU upon automatic cancellation. A brief message shall indicate the reason for the cancellation. Return of money and RVT, as well as beeping sound shall be the same as for manual cancellation. Conditions that cause automatic cancellation shall include but not be limited to the following:
 - a. Maximum coin or bill escrow capacity has been exceeded.
 - b. Power failed before the “OK” button to issue ticket was depressed.
 - c. More than \$1.00 is inserted for a “Change Only” transaction.
 - d. Conditions not in accordance with acceptable card transactions as specified herein.
 - e. Ticket and bill/coin jams.
3. Reversals. In the event that a ticket cannot be dispensed for an approved credit or debit transaction, such transactions shall be automatically reversed.
4. Front Panel Graphics. Graphics shall be silk screened on a fascia and attached to the front panel as indicated. The fascia shall be secured and vandal resistant. The front panel shall include appropriate graphics to provide the following information:
 - a. Types of tickets sold;
 - b. Types of payment methods accepted; and
 - c. Type of Credit/ATM cards accepted.

2.05 TRANSACTION TIMES

- A. General: The TVM shall be designed to permit a ticket transaction to occur in a minimum of time. The timing between events is of critical importance. Timing within equipment, between modules and assemblies, between displays, between various steps in the transaction and between transactions shall be implemented efficiently. Bills and coins shall be accepted one after the other without causing the customer to wait between insertions; canceling shall be immediate; displays shall be timed such that the messages or instructions are coordinated with the customer’s actions. Transaction times shall be measured in accordance with the transaction step definitions and criteria specified herein. All specified transaction times are for BART-Blue ticket purchases, except Smart Card reload transactions. The transaction time for each transaction type shall be measured based on the average of ten transactions conducted by trained personnel. Cash transactions shall be performed

using standard street money. Customer interaction times between transaction steps shall not be included in the total transaction times measured as specified. Supplier shall submit the transaction time measurement procedures for review and approval during PDR.

B. Transaction Step Definitions

1. Ticket Issuance: Time from “OK” selection or appearance of bank authorization message on MDU to appearance of ticket at ticket bezel.
2. Coin Acceptance: Time from first coin insertion to total coin value registering on the MDU.
3. Bill Acceptance: Time from bill insertion to bill value registering on the MDU.
4. RVT Acceptance: Time from RVT insertion to appearance of ticket value on the MDU.
5. Ticket and Smart Card Value Entry: Time from initiation of ticket value correction or selection to appearance of corrected value on the MDU.
6. Change Return: Time from appearance of vended ticket at ticket bezel to appearance of change at the coin tray.
7. Credit/Debit Card Acceptance: Time from credit or debit card insertion to appearance of subsequent card transaction screen on the MDU.
8. Payment Method Selection: Time from initiation of payment method selection to appearance of subsequent transaction screen on the MDU.
9. PIN Acceptance: Time from initiation of PIN entry to appearance of subsequent card transaction screen on the MDU.
10. Request/Receive Authorization: Time from appearance of “authorization request” MDU screen to appearance of “transaction approval” MDU screen.
11. Smart Card Acceptance: Time from insertion of Smart Card to appearance of Smart Card value on the MDU.
12. Smart Card Reload: For cash transaction, time from “OK” selection to appearance of Smart Card reloaded message on MDU. For Credit/Debit transaction, time from appearance of credit or debit card authorization/approval message to appearance of Smart Card reloaded message on MDU.
13. Smart Card Removal: Time from removal of Smart Card to appearance of “insert Credit/Debit Card” message on MDU.
14. Receipt Issuance: If receipt is issued from the ticket bezel, time from removal of the issued ticket to appearance of the receipt at the ticket bezel. If receipt is issued from the coin return tray, time from “OK” selection to appearance of receipt at the coin return tray.

- C. Transaction Times. The TVM shall meet the maximum transaction times for the different transactions, as follows:
1. Purchase a ticket using one bill of any denomination (\$5, \$10, or \$20): eight seconds.
 2. Purchase a ticket using one nickel, one dime, one quarter, and one bill of any denomination: ten seconds.
 3. Upgrade a remaining value ticket with one bill of any denomination (\$1, \$5, \$10, \$20): ten seconds
 4. Purchase a \$4.50 ticket and return the required change using one \$5 bill: 15 seconds
 5. Purchase a ticket using four bills of any denomination: 15 seconds
 6. Purchase a ticket of any value using a credit card: 15 seconds.
 7. Purchase a ticket of any value using a debit card: 20 seconds.
 8. Reload a Smart Card using one bill of any denomination: ten seconds.
 9. Reload a Smart Card using a credit card: 15 seconds.
 10. Reload a Smart Card using a debit card: 20 seconds.
- D. Reset Times:
1. The time required for the TVM to perform a full logic reset and to return to service after a door closure shall not exceed the time required for the microprocessor operating system to reboot.
 2. The time required for the TVM to return to service after a door closure when logic reset is not required shall not exceed ten seconds.
 3. For the transactions indicated below, the TVM shall be capable of accepting a customer action to initiate a subsequent transaction within the times indicated:
 - a. For ticket purchase or smart card load transaction involving cash, the TVM shall accept a subsequent transaction within 2.0 seconds after the ticket or smart card is taken.
 - b. For a ticket purchase or a smart card recharge transaction involving credit/ATM that does not include the issuance of a receipt, the TVM shall accept a subsequent transaction within 1.0 second after the ticket or smart card is taken.
 - c. For a ticket purchase or a smart card load transaction involving credit/ATM that includes the issuance of a receipt, the TVM shall accept a subsequent transaction within 1.0 second after receipt is taken, or if the receipt is not taken, within 1.0 second after the timeout expires for retrieval of the receipt.

- d. For a ticket upgrade transaction, the TVM shall accept a subsequent transaction within 3.0 seconds after the issued ticket is taken.
- e. For a "Change Giving for \$1.00" transaction, the TVM shall accept a subsequent transaction within 2.0 seconds after the required change appears at the coin return cup.
- f. For "canceled" transaction involving cash, the TVM shall accept a subsequent transaction within 1.0 second after the inserted cash is removed from the bill return slot.
- g. For a "canceled" credit/ATM transaction, the TVM shall accept a subsequent transaction within 1.0 second after the cancel button is pressed.

2.06 OPERATING MODES

A. The TVM shall have three basic modes of operation as follows:

1. Primary Mode

- a. Transaction types: The primary mode shall permit the following transactions:
 - 1) Cash Transactions for purchasing or upgrading tickets or for purchasing or loading of the Smart Card media.
 - 2) Credit/Debit Card Transactions for purchasing or upgrading tickets or for purchasing or loading of the Smart Card media.
 - 3) Issue change for a \$1.00 bill.
- b. Operation: The TVM shall automatically place itself in the correct operating mode depending on the customer's initial action. Once an operating mode is initiated, operation under the other modes shall be prohibited. Initial customer action can be either pressing any key, or in the case of ticket and smart card upgrade, a presentation of existing fare media. The Supplier shall develop and submit for approval detailed menu procedures and flow charts to address care of specific rules, additional information, and step-by-step actions such as determining need for change, handling of RVT, confirmation of transaction and restrictions placed on maximum ticket value, minimum ticket value, maximum RVT value, and maximum change permitted.
 - 1) Ticket Purchase/Upgrade Transaction. The customer shall initiate the ticket transaction by either pressing a soft key to purchase a new ticket, or insert an RVT ticket for a ticket upgrade transaction. The TVM shall recognize this as a ticket transaction and reject any subsequent attempt to process a smart card. A menu-driven format shall appear on the MDU to guide the customer to complete the ticket purchase/upgrade transaction.
 - 2) Clipper® Smart Card Purchase or Add Value Transaction. The customer shall initiate the Clipper® smart card transaction by either pressing a soft key to purchase a new Clipper® card, or tag an existing Clipper® to load value on the card. The TVM shall recognize this as a Clipper® transaction and reject any subsequent attempt to process a ticket. A menu-driven

format shall appear on the MDU to guide the customer to complete the Clipper® card purchase value load transaction.

- 3) Transaction Amount Selection. For both ticket and Clipper® card transactions, a menu-driven format shall appear on the MDU to guide the customer to complete the transaction. If change is desired, the customer shall select the desired transaction value either with the numeric keypad or by increasing/decreasing the value using soft keys. The customer shall then be asked to insert payment in the form of cash or credit/debit card.
- 4) Payment by Cash. The MDU shall indicate the money required if the selected transaction amount is greater than the money inserted. Insertion of money shall disable any subsequent attempt to use credit/debit cards. The inserted money shall be held in escrow until a valid ticket or Clipper® card appears at the ticket slot, or upon the customer tagging the existing Clipper® card a second time to complete the value load transaction, at which point the money is routed to the money receptacle(s). If the transaction cannot be completed, the TVM shall return the escrowed money to the customer and go out-of-service.
- 5) Payment by Credit/Debit Card. The MDU shall indicate the money required to complete the transaction. Inserting a credit or debit card shall disable any subsequent attempt to insert cash, and triggers an authorization request to the bank via DAS. Upon receiving real-time authorization from the bank through DAS, a new ticket or Clipper® card shall be issued. For Clipper® card add value transactions, the customer shall be asked to tag the Clipper® card a second time to complete the transaction. A receipt shall be generated for the completed transaction.
- 6) Change for \$1.00 Transaction.

2. Secondary Operating Mode:

- a. Transaction types: The secondary mode shall permit the following transactions:
 - 1) Card only - Cash section is inoperable;
 - 2) Cash only - Card section is inoperable;
 - 3) Bills only - Coin section is inoperable; and
 - 4) Exact change only - No change returned.
 - 5) Clipper® add-value only - ticket processing and Clipper dispensing transactions are disabled
- b. Operation: The MDU shall indicate the modes within which the TVM is able to operate. The possibilities shall be any of the above transaction types either singly or in combination. The messages "Cash Only", "Bills Only", and "Exact Change Only" shall blink on the MDU.

3. Maintenance Mode: Maintenance Mode shall be an operating condition intended for the testing, trouble-shooting and repair of the TVM without the need to use large amounts of coins and banknotes. TVM operation shall be identical to the primary operating mode except as modified herein.

- a. Activation of Maintenance Mode. The TVM shall be equipped with switches and an interlocking system that shall be used to activate and deactivate the Maintenance Mode. There shall be three switches:
 - 1) door monitor switch;
 - 2) push to activate momentary contact switch; and
 - 3) pull to activate latching switch.
- b. Interlocking: The interlocking system shall operate as follows:
 - 1) With the door opened, the “pull to activate” latching switch shall allow the technician to switch the machine to Maintenance Mode.
 - 2) With the door opened, the “push to activate” switch shall function as a manual logic reset switch.
 - 3) Closing the door shall push the “pull to activate” latching switch to the in position and cause the “push to activate” switch to activate a logic reset. These switch operations shall cause the machine to automatically return to the revenue mode (provided that all other parameters required for revenue service are satisfied). Maintenance mode shall not be possible with the front door closed.
 - 4) It shall not be possible to close the “Door Monitor Switch” unless the door is physically closed so that the potential of fraud is minimized.
 - 5) Table 1, Logic Table for Maintenance Mode Interlock System, describes the operational status of the machines as a function of the three switches.

Door Monitor Switch	“Push-to-Activate” Momentary Switch	“Pull-to-Activate” Latching Switch	Logic Reset	Machine Mode
Open	Out	In	No	Out of Service
Open	Pushed In	Out	Yes	Maintenance
Open	Out	Out	No	Maintenance Mode
Open	Pushed In	In	Yes	Out of Service
Close	Out	In	No	Revenue. See Note
Close	Pushed In	Out	Yes	Revenue. See Note
Close	Out	Out	No	This Change Shall Not Be Mechanically Possible
Close	Pushed In	In	Yes	Revenue. See Note

Note: Provided that all other parameters required for Revenue mode are satisfied.

Table 1: Logic Table for Maintenance Mode Interlock System

- c. Operation. In the Maintenance Mode, the TVM shall be capable of duplicating revenue mode operation with the following exceptions:

- 1) Only Maintenance (Test) Mode tickets or Clipper® cards shall be issued or accepted. A Maintenance Mode ticket is defined as a ticket with its Maintenance Mode bit set to 1. A ticket with this bit set to 1 shall be accepted by AFC machines only when in the maintenance mode of operation. The words "TEST TICKET" shall be printed in large font on the Maintenance Mode ticket. The test ticket value shall be printed on the first print line. Maintenance mode Clipper® cards are specially encoded Clipper® cards.
 - 2) The inserted bills/coins shall not be captured in the bill/coin vault. The inserted bills/coins shall be held in escrow and returned after the Maintenance Mode ticket has been issued or upgraded. Change shall not be returned in Maintenance Mode, with or without the purchase of a ticket.
 - 3) No registers shall be incremented except for the register that counts the number test tickets dispensed.
 - 4) Credit/Debit transactions shall not require approval from the bank. This feature shall allow testing of the Credit/Debit card reader as well as the Credit/Debit operation of the machine at the local level. Tickets "purchased" by the credit/debit method shall also be encoded as Maintenance Mode tickets.
 - 5) Smart card transaction shall be as defined by the District.
- d. DAS Interface: When the machine is in Maintenance Mode its status must continue to be reported in real time to DAS using a priority code as defined herein. All ticket transactions performed in Maintenance Mode shall be reported to DAS in the same format as regular revenue tickets, except that the transaction is identified as a Maintenance Mode ticket.

2.07 MICROPROCESSOR ASSEMBLY:

- A. The microprocessor assembly shall control all operating functions of the TVM. It shall control the performance and timing of all other assemblies, sub-assemblies, modules, displays, and all serial communications with the DAS.
- B. Chip Quality. It is recognized that microprocessor chips will be used for a variety of purposes ranging from control of displays to slave microprocessors operating in conjunction with a master unit to control and monitor a particular function. Microprocessors shall be of the latest production releases of Intel, AMD or Cyrix chips or equal.
- C. Data Storage
 1. Non-volatile RAM Storage. Non-volatile RAM storage shall be provided to store critical data in non-resettable registers as indicated. The RAM storage shall record all sales transaction and equipment status data as they occur, and shall serve as backup in the event of failures in the communication link or the DAS. The RAM storage shall be designed to be polled from DAS and shall allow local extraction of stored data when connected to the PC Notebook, specified in Section 34 50 10, Fare Collection System. The RAM storage shall be divided into

two partitions, the “current period” and the “previous period”. The current period shall contain all data accumulated since the TVM was last successfully polled by the DAS or by the PC Notebook. The previous period shall contain the last polled data. Upon loss of power, the stored data shall be maintained for at least 30 Days.

2. Hard disk Storage. As an alternative to the RAM storage, a hard disk can be provided to satisfy the data storage requirements of the TVM. The hard disk shall be designed to operate in a transit system trackside environment and shall conform to the requirements specified for the RAM storage.
3. Data to be Stored
 - a. Cumulative Sales Data. Each storage partition (current and previous) shall maintain a record of cumulative sales data consisting of:
 - 1) Total sales revenue data;
 - 2) Total revenue from currency by denomination;
 - 3) Total revenue from debit cards by type;
 - 4) Total revenue from credit cards by type;
 - 5) Total number of tickets sold by type and value;
 - 6) Total number of change-only transactions;
 - 7) Number of tickets by type sold by currency;
 - 8) Number of tickets by type sold by each credit/debit card type;
 - 9) Number of tickets upgraded by ticket type and value;
 - 10) Number of smart card reloads by value; and
 - 11) Number of smart card reloads by payment type.
 - b. Individual Sales Transaction Data: Each storage partition (current and previous) shall maintain a record of each individual sales transaction. For each transaction, all applicable information from the following list shall be recorded:
 - 1) TVM identification number;
 - 2) Station location;
 - 3) Date and time of transaction;
 - 4) Transaction number;
 - 5) Amount of transaction;
 - 6) Payment type: Cash, Credit, Debit;
 - 7) Ticket or Smart Card serial number;
 - 8) Currency accepted by denomination;
 - 9) Coins returned by denomination;

- 10) Last 4 digits of the Credit/Debit card number (when applicable). The full credit/debit card number shall not be stored for PCI compliance;
 - 11) Credit/Debit authorization number (when applicable);
 - 12) Type and value of ticket and smart card vended/reloaded;
 - 13) Media cost paid (when applicable)
 - 14) Value of smart card vended or reloaded;
 - 15) Type and value of ticket to be upgraded;
 - 16) Value of upgrade;
 - 17) Value of upgraded ticket;
 - 18) Change only transaction;
 - 19) Coins returned by hopper by denomination;
 - 20) Transaction result, either success or reason for failure; and
 - 21) Clipper® transaction data.
- c. Equipment Summary Data: Each storage partition (current and previous) shall maintain a record of Equipment Summary Data consisting of:
- 1) Number of failure or malfunction incidents by type;
 - 2) Number of access to Bill Vault and Bill Escrow;
 - 3) Number of access to Coin Vault, Coin Hoppers, and Coin Magazines;
 - 4) Number of access to ticket magazine;
 - 5) Number of legitimate entries;
 - 6) Number of intrusions and manipulation entries;
 - 7) Number of accesses to ticket handling mechanism;
 - 8) Number of tickets in reject bin;
 - 9) Number of credit/debit cards not accepted or approved;
 - 10) Number of bills read but not accepted;
 - 11) Number of service and warning incidents by type;
 - 12) Number of tickets remaining in each ticket magazine; and
 - 13) Amount of money in each revenue service component.
- d. Equipment Event Data: Each storage partition (current and previous) shall maintain a record of each equipment event. For each event, following information shall be recorded:
- 1) TVM identification number;
 - 2) Station location;
 - 3) Date and time of event;
 - 4) Type of Event;
 - 5) Failure Code;

- 6) Operator ID, Security Level (if applicable); and
 - 7) Complete financial status of component (if applicable).
4. Storage Capacity: The Data Storage media (RAM or Hard disk) shall be adequate to store the current and previous Cumulative Sales Data and the Equipment Summary Data for at least 30 Days. For the Individual Sales Transaction Data and the Equipment Event Data, the Data Storage media shall have the capacity to store 10,000 transactions or three days' worth of data, whichever is greater, for both the current and previous period. The Storage media shall be adequate for the storage capacity indicated plus a reserve of 300 percent of the capacity used. If RAM storage is used, expansion shall be possible with the simple addition of memory boards or chips.
 5. Data Retrieval: Information in storage shall be transmitted to the DAS or the PC Notebook only upon request and proper authorization. The Cumulative Sales Data and the Equipment Summary Data shall be available locally on the service display upon proper authorization.
- D. Data Interface. The data to be transmitted shall include but not be limited to the following:
1. Real Time Data: The data indicated below shall be transmitted to the DAS as soon as the events occur, in real time. The data transmission process shall be accomplished with no degradation to system performance and transaction times.
 - a. Event Data:
 - 1) TVM Identification number;
 - 2) Station location;
 - 3) Date, Time;
 - 4) Operator ID, Security level;
 - 5) Door open;
 - 6) Door close;
 - 7) Maintenance Mode On;
 - 8) Maintenance Mode Off;
 - 9) Coin box 85 percent full;
 - 10) Coin box 100 percent full;
 - 11) Supplemental hopper 10 percent full (5-cent);
 - 12) Supplemental hopper 10 percent full (25-cent);
 - 13) Supplemental hopper empty (5-cent);
 - 14) Supplemental hopper empty (25-cent);
 - 15) Bill vault 85 percent full;
 - 16) Bill vault 100 percent full;
 - 17) Ticket level low;

- 18) TVM in secondary mode; identify mode;
 - 19) Failure code;
 - 20) Intrusion Alarm;
 - 21) Manipulation Alarm;
 - 22) Reject bin full;
 - 23) Coin jam;
 - 24) Bill jam;
 - 25) Complete financial status of the TVM every time the TVM door is opened;
 - 26) Indication of low-ticket supply;
 - 27) Indication of low-receipt supply;
 - 28) Performed function code;
 - 29) TVM in-service/out-of-service;
 - 30) Hopper recharged;
 - 31) Authorized entry;
 - 32) Loss of power; and
 - 33) Configuration parameter change.
- b. Individual Sales Transaction Data: The data specified in Article 2.07.C.3.b shall be transmitted.
- c. Treasury Service Data:
- 1) TVM ID number and location
 - 2) Date, Time
 - 3) Operator ID, Security level
 - 4) ID of each revenue service component removed
 - 5) ID of each revenue service component inserted
 - 6) Number and type of bills/coins in each revenue service component removed
 - 7) Unauthorized bill vault or coin box removal or insertion
2. Polled Data. The following data for either the current or previous period shall be transmitted upon request from the DAS, usually outside of revenue service hours:
- a. Cumulative Sales Data: The TVM shall transmit the Cumulative Sales Data indicated in Article 2.07C.3.a.
 - b. Individual Sales Transaction Data: The TVM shall transmit the Individual Sales Transaction Data as indicated in Article 2.07C.3.b.
 - c. Equipment Summary Data: The TVM shall transmit the Equipment Summary Data indicated in Article 2.07C.3.c.

- d. Equipment Event Data: The TVM shall transmit the Equipment Event Data as indicated in Article 2.07C.3.d.
 - e. Summary of Treasury Services Actions Since Last Poll: For each treasury servicing action since last poll:
 - 1) TVM Identification number;
 - 2) Station location;
 - 3) Date, Time;
 - 4) Operator ID, security level;
 - 5) ID of revenue service component(s) removed;
 - 6) Number and type of bills/coins in each revenue service component when removed; and
 - 7) ID of revenue service component(s) inserted.
- E. Service Keyboard. A standard or reduced, internally located alpha-numeric computer keyboard shall be used to communicate with the Microprocessor Assembly. The keyboard shall be used to input such data and commands as security codes, follow menu driven instructions or equivalent aids, retrieve data, and initiate repair routines. Access to Maintenance and Treasury commands/data shall not be possible until a valid security code has been entered.

2.08 TICKET TRANSPORT MODULE

- A. General: The ticket transport module shall include the ticket stocks, main transport, and printer as the principal subassemblies. Tickets shall be dispensed from one of two internal ticket supplies to the ticket exit slot. The module shall print the required information on the ticket, and magnetically encode the required information on the magnetic stripe. There shall be at least two ticket supplies in each TVM, both of which will be for the BART Blue Ticket.

Alternatively, the Ticket Vending Machine can be retrofitted to support a smart card transport module to dispense Clipper cards. The module shall include the card stocks, main transport, and smart card encoder/reader as the principal subassemblies. Smart cards (either extended use plastic Clipper cards or limited use cards) shall be dispensed from one of two internal card supplies to the ticket exit slot. The main transport shall stop the smart card above the encoder/reader, and encode and verify the card according to the Clipper card encoding format. The module shall not print on the surface of the smart card. There shall be at least two card supplies in each TVM, supporting extended use Clipper cards, limited use smart cards, or a combination of both.

- B. Ticket Supply. The TVM shall be designed to issue the District's standard thermally coated tickets or smart cards from die cut ticket stocks. The District's ticket specifications are provided for reference in District Technical Manuals, BART Ticket Specifications. The two magazines shall be readily accessible, removable and replaceable from their mounting; and easily fed into the ticket transport mechanism. Whenever one magazine becomes empty, automatic switching shall occur to enable the main transport to draw tickets from the second magazine if the second magazine

is for the same ticket or card type. Both magazines shall feed into the main transport such that the second ticket or card type can be dispensed whenever this ticket type is selected by the customer.

C. Main Transport (magnetic stripe ticket)

1. Concept. The main transport shall employ a concept where the ticket is continuously gripped in a positive manner throughout its movement through the various stations until the ticket is dispensed. The main transport shall obtain a ticket from one of the ticket supplies, then to the write head for magnetic encoding, to the verify head to check that the encoding is correct, and to the printer for printing. The write head shall encode security codes and information on the magnetic stripe. The printer shall print the required information on the ticket.
2. Verification of Encoding. The verify head shall authenticate the information encoded on the magnetic stripe. The ticket transport module shall deliver the ticket either to the customer or send it to the reject bin. Upon rejection of the ticket due to incorrect encoding, as determined by the verify head, the TVM shall attempt two more times to deliver a valid ticket. If a valid ticket is not encoded properly and vended after three consecutive attempts, the TVM shall take itself out of service and return the customer's money or reverse the credit/debit card transactions as appropriate.
3. Output Slot: A brake shall be employed at the output end of the main transport to stop and hold the ticket until retrieved by the customer. The output slot shall also be used as an input slot for RVT tickets.
4. Reject Bin. Once a ticket has been accepted as an RVT and a new upgraded ticket has been issued, the value of the RVT shall be reduced to zero value magnetically and four zeros shall be printed in the ticket value column. The RVT shall then be sent to the reject bin. New tickets which fail the read after write test shall also be encoded with a zero value, four zeros shall be printed in the ticket value column, and the ticket shall be sent to the reject bin. Alternatively, instead of the four zeros, the word "void" may be printed in large fonts lengthwise down the remaining value print column of the ticket. The reject bin shall be an easily removable container with a minimum capacity of 1,000 used tickets.
5. Clearing Jams. Jams in all areas of the transport assembly shall be easily removable without the use of tools. The main transport side, which is accessed most frequently to clear ticket jams shall be hinged to allow that entire side to swung open for maximum exposure in clearing jams.
6. No Adjustments. There shall be no adjustments required in the main transport when replacing consumable items such as magnetic read and write heads, and the printer ribbon.

D. Main Transport (Clipper® card)

1. Concept. The main transport shall employ a concept where the smart card is continuously gripped in a positive manner throughout its movement through the

various stations until the card is dispensed. The main transport shall obtain a smart card from one of the card supplies, and move it to the embedded smart card reader for RF encoding, and verify the encoding at the same reader. The encoding shall conform with Clipper card encoding format including security codes.

2. Verification of Encoding. The same smart card reader used for encoding shall be used to authenticate the information encoded on the smart card. After the card has been encoded, the card shall remain in the same position above the smart card reader to verify the encoding. The card transport module shall deliver the smart card either to the customer or send it to the reject bin. Upon rejection of the smart card due to incorrect encoding, as determined by the verification step, the TVM shall attempt two more times to deliver a valid smart card. If a valid smart card is not encoded properly and vended after three consecutive attempts, the TVM shall take itself out of service and return the customer's money or reverse the credit/debit card transaction as appropriate.
 3. Output Slot: a break shall be employed at the output end of the main transport to stop and hold the smart card until retrieved by the customer. The output slot shall not allow any tickets or smart cards to be inserted.
 4. Reject Bin. New smart cards which failed the encoding and verification process shall be encoded with a zero value, and sent to the reject bin. The reject bin shall be an easily removable container with a minimum capacity of 1,000 cards.
 5. Clearing Jams. Jams in all areas of the transport assembly shall be easily removable without the use of tools. The main transport side, which is accessed most frequently to clear card jams, shall be hinged to allow the entire side to be swung open for maximum exposure in clearing jams.
 6. No adjustments. There shall be no adjustments required in the main transport when replacing consumable items.
- E. Ticket Printer: The ticket printer shall be either a dot-matrix impact printer or a thermal printer and shall meet the following requirements:
1. Print text of different font sizes, and graphics in the printing areas. The printed information shall be easily changeable by parameter modification from EME without the need to reprogram the TVM application software. The printer shall be capable of being configured in the future to print a fifth digit for the hundreds dollar field in the ticket value.
 2. Print the following information on issued tickets as indicated:
 - a. Ticket Value;
 - b. Ticket Serial Number;
 - c. Ticket Vend Date;
 - d. TVM Identification Number: and
 - e. Validity Period Information for BART-Plus Tickets.

3. Provide clear, "smudge-free" printing. The printing shall be quick drying (for dot-matrix printer), non-fading and erasure resistant.
4. Satisfy the following reliability requirements:
 - a. Printer MCBF: 500,000 transactions
 - b. Print Head Life Expectancy: Greater than 2,000,000 transactions (for dot-matrix printer). Greater than 100,000 feet of thermal paper (for thermal printer).
5. Dot-matrix impact printer, if used, shall employ a field replaceable print ribbon cartridge having the following characteristics:
 - a. The print ribbon shall have no noticeable degradation in print quality for at least 250,000 lines of 20 characters per line or six months, whichever occurs first.
 - b. The print ribbon shall have a shelf life of at least two years before initiation of degradation.
6. Thermal printer, if used, shall provide image densities of 1.0 or better at 90 degrees centigrade when printing on medium sensitivity papers such as Appleton T922, Ricoh 120TLB, Kanzaki, or equal.
7. Withstand accelerated cycling during testing without overheating, or sustaining damage, or premature failure of any component.

2.09 COIN HANDLING ASSEMBLY

- A. General. The coin handling assembly shall include the coin slot, coin acceptor, coin recycling system, coin chutes, coin escrow, coin vault, coin box, supplemental coin hoppers, and coin return cup. The Supplier shall submit procedures and furnish applicable equipment for reconfiguring the coin handling system to accept and verify coins, if different from that specified herein. The procedures and a list of the equipment shall be submitted to BART for approval during the Preliminary Design Review. The coin handling assembly shall:
 1. Accept, verify, sort, and store coins inserted for payment, including nickels, dimes, quarters and Presidential dollar coins;
 2. Dispense coins for transaction requiring coin return. The dispensing rate shall be at least two coins of each denomination per second;
 3. Deny access to any of the coins without the use of the Revenue Key;
 4. Deny access to the coin box without the authorized treasury access code and key; and
 5. Provide accumulated readings of the coins accepted and dispensed since the last coin box removal. The data shall include quantity and dollar value of each denomination in each revenue service component.

6. Upgradable to accept half dollar and Susan B. Anthony dollar coins. The Supplier shall identify and report to BART the current U.S. Department of Treasury coin standards during or before the Preliminary Design Review. The coin handling assembly shall be designed in accordance with these standards.
- B. Coin Slot. The coin slot shall be of the vertical type permitting coin denominations of 5, 10, 25-cent and dollar coins to pass without restriction directly into the coin acceptor assembly by the force of gravity. Coins shall go through the coin acceptor for testing. There shall be no transports, conveyors, or other mechanisms employed to move the coin from the coin slot to the input of the coin acceptor assembly. The coin slot shall be normally open so that a cash transaction can be automatically sensed and initiated by insertion of a coin. A mechanical shutter shall be activated to prevent insertion of coins upon initiation of a credit/debit card transaction. The slot shall be sized to physically block the insertion of a 50-cent coin and the simultaneous insertion of two dimes, each at their minimum thickness. The coin slot shall be easily replaceable from the inside of the TVM for a coin slot that will accept a 50-cent coin.
 - C. Coin Acceptor. The coin acceptor shall be of an electronic type. There shall be both minimal mechanical mechanisms and coins rolling on rails. The coin acceptor shall have proven record of use in fare collection system in a rail rapid transit environment. The coin acceptor shall check each coin to ensure that it meets U.S. Department of Treasury standards with regard to diameter, thickness, metal alloy, and mass. The coin acceptor shall reject counterfeit and foreign coins, tokens, and invalid items such as slugs and washers. Coins detected as invalid, such as bent coins, tokens, slugs, washers, counterfeit coins, and foreign coins shall be diverted directly to the coin return cup.
 - D. Coin Escrow. All coins shall be held in escrow until the ticket transaction has been completed. The coin escrow capacity shall be at least 20 coins. If the programmed or physical capacity is exceeded, all coins inserted shall be returned and the transaction automatically cancelled. Sensors shall be used to detect a jam in the escrow and to report such an incident.
 - E. Coin Recycling System. The TVM shall be provided with a coin recycling system to minimize frequency of machine servicing for coin replenishment. The coin recycling shall conform to the following requirements:
 1. Receive 5, 10, 25-cent coins and dollar coins from the escrow, if used, or directly from the coin acceptor, and direct the coins to appropriate self-replenishing coin magazines.
 2. Dispense 5, 10, 25-cent coins and dollar coins from the coin magazines.
 3. Have a capacity of at least 50 coins of each coin type.
 4. Dispense coins down to a level of less than five coins of each denomination remaining before a magazine empty signal is given that will require coin dispensing from the supplemental hoppers.

5. Employ a locking scheme that requires the Treasury Key and adherence to a “menu” procedure and proper personnel identification before removal of a coin-recycling magazine. Access to coins inside the magazines shall require a Revenue Key.
 6. Dump all coins into the coin box upon an authorized command provided that adequate space exists in the coin box.
 7. Be able to purge all coins from magazines after removal from machine using a purging unit.
 8. Communicate with the Microprocessor Assembly to report specified events and data.
- F. Supplemental Coin Hoppers.
1. Supplemental coin hoppers shall serve as backup to the nickel and quarter denominations supplied from the recycling system. The supplemental coin hoppers shall have minimum capacities of 1,000 for each type of coin.
 2. The hoppers shall release coins as change only if coins are not available from the coin recycling system. Once the recycling system receives a prescribed amount of coins of each denomination, the dispensing of coins for change from the supplemental hoppers shall cease until again required as a back-up supply.
 3. Supplemental coin hoppers shall be locked to the machine and be removable only using the Treasury Key and authorized treasury access code. Access to the coins inside the supplemental hopper shall require a Revenue Key. The TVM shall go into manipulation alarm state if both key and authorized access code are not used.
 4. The number of coins in the supplemental hoppers when the hoppers are inserted in the TVM shall default to a predetermined value, which can be set by a Treasury Service command.
 5. The hoppers shall be made of stainless steel, reinforced 18 gauge minimum, all welded construction and provided with about a 4 inches wide by 2 inches deep hinged handle which can support 45 pounds minimum. If a wire handle is used, the handle shall have a minimum diameter of 3/8.” The dimension may be partially achieved by rubberized cushion.
 6. Weight, fully loaded, shall be 30 pounds maximum.
 7. The electronic ID of a coin hopper shall be automatically recognized upon insertion and recorded in transaction memory and transmitted to DAS in real time.
 8. Insertion of a coin hopper with the same ID as one just removed shall be prohibited and shall result in a manipulation alarm.

9. The hopper shall be sufficiently durable to withstand one drop from a height of three feet on concrete, fully loaded, landing on its corner or side, without incurring any damage that would cause access to the coins, or that would prevent its use.
 10. All locking mechanisms and electronic components shall be inaccessible from outside the coin box.
 11. When locked into their position inside the TVM, the supplemental coin hoppers shall be connected automatically to the Microprocessor Assembly via an interface. The interface shall be durable to withstand a minimum of 5,000 insertion and removal cycles without degradation in performance, shall be tamper-proof, and shall be easily replaceable with no cutting or resoldering of existing wires and repinning of connectors.
 12. The hoppers shall be located inside the TVM such that removal and replacement can be performed easily, without causing injury to personnel or damage to components.
 13. The coin hoppers shall be designed to permit bag loading or automatic loading and emptying using customized filling machines.
 14. The coin hoppers shall communicate with the Microprocessor Assembly to report specified events and data.
- G. Coin Vault. The coin vault shall provide security for the coin box by providing a locked compartment or a locking device. Stainless steel runners and guides shall be employed to enable the coin box to slide freely and to prevent damage to the interface. A coin vault key shall be required for removal of the coin box if it is locked to the coin vault frame.
- H. Coin box. The coin box shall conform to the following requirements:
1. Weight, fully loaded, shall be 30 pounds maximum.
 2. The electronic ID of the coin box shall be automatically recognized and recorded upon insertion, and transmitted to DAS in real time.
 3. Insertion of a coin box with the same ID as one just removed shall be prohibited and shall result in a manipulation alarm.
 4. The coin box shall automatically open upon insertion into the TVM to accept coins and shall automatically close and lock upon removal from the TVM.
 5. Treasury Key and adherence to an appropriate menu shall be required to remove the coin box from the coin vault. Revenue Key shall be required to open the coin box to retrieve the coins.
 6. Coin box shall be provided with a hinged, non-removable cover and ergonomically designed handles. If wire handles are used, they shall have a

minimum diameter of 3/8." This dimension may be partially achieved by rubberized cushion.

7. The coin box shall be sufficiently durable to withstand one drop from a height of three feet on concrete, fully loaded, landing on its corner or side without incurring any damage that would cause access to the coins.
 8. The coin box shall be in place, properly set, and ready to accept coins before the TVM can return to service. A feature shall be provided to indicate that an inoperable coin box has been inserted and to prevent the incurring of damage that would prevent its use.
 9. The coin storage area shall be free of obstructions to permit a 100 percent dump in one attempt.
 10. All locking mechanisms and electronic components shall be inaccessible from outside the coin box.
 11. When locked into its position, the coin box shall be connected automatically to the Microprocessor Assembly via an interface. The interface shall be durable to withstand a minimum of 5,000 insertion and withdrawal cycles without degradation in performance, shall be tamper-proof, and shall be easily replaceable with no cutting or resoldering of existing wires and/or repining of existing connectors.
 12. The coin box shall be located inside the TVM such that removal and replacement can be performed easily, without causing injury to personnel or damage to components.
 13. The time to perform a remove and replace cycle on the coin box shall be less than two minutes, measured from the time the TVM is placed out of service by the action of opening the door, until it is placed back in service and ready for customer use.
 14. The coin box shall be furnished with sensors to provide a "near full" signal at approximately the 85 percent level, and a "full" signal at about the 100 percent level. The "full" signal shall cause the TVM to revert to a "Bills or Card Only" mode.
 15. The coin box shall have coin space of approximately 300 cubic inches.
 16. The coin box shall communicate with the Microprocessor Assembly to report specified events and data.
- I. Coin Chutes. Coin chutes shall be of one piece tubular or boxlike construction using stainless steel of 16 gauge minimum. Access to coins shall be precluded to the extent possible. It shall not be possible to "fish" coin from the coin box. Rejected coins of any kind shall use a dedicated chute that bypasses further checks in the coin acceptor and returns the coin directly to the coin return cup.

2.10 BILL HANDLING MODULE

- A. The bill handling module shall include the bill validator, bill escrow, bill box, and the bill vault as required. This module shall be an integral unit that shall be designed, fabricated, and supplied by a single manufacturer. The Supplier shall obtain the current U.S. Department of Treasury standards for one, five, ten, and 20 dollar bills. The bill handling module shall be designed in accordance with these standards. These standards shall be identified in design documents to be submitted to BART before or during the Preliminary Design Review.
- B. Bill Validator. The bill validator shall:
1. Accept the four denominations of one, five, ten, and 20 dollar bills in any combination, or any one singly. The bill validator shall have the capability to accept at least six additional denominations or bill designs in the future.
 2. Perform dimensional and optical checks, or dimensional, optical, and magnetic checks to verify bill authenticity.
 3. Reject counterfeit, foreign, and copied bills. Return rejected bills and hold until forcibly retrieved.
 4. Prevent "milking" by physically blocking the forceful retrieval of a bill already accepted or by preventing the manipulation of two bills or any other fraudulent scheme that would result in a ticket value greater than the actual money received or change being given without capturing the correct bills.
 5. Be designed based on technology that has a minimum of two years of proven and satisfactory performance record in a rail rapid transit environment. The Supplier shall provide written evidence and documentation of MCBF and MCBJ in a rail rapid transit environment, and identification of equipment and properties where used.
 6. Use software controlled techniques to activate motors to clear a jam using more than one attempt if necessary. This requirement shall apply to the total path of the bill from the bill validator to the bill box.
 7. Minimize motor run time. The motor shall be triggered by an inserted bill and the bill automatically drawn in for authenticity checks.
 8. Accept input orientation of bills face up with either end first, or bills face down with either end first (4-way).
 9. Not initiate dispensing of ticket until all money appears in escrow.
 10. Accept at least 95 percent of "street condition" bills in each denomination on the first attempt, and at least 97 percent combined first and second attempt. Street condition bills are bills found in everyday customer use that are not torn, creased, crumbled, folded, or worn beyond what is normally found in street condition bills. Acceptance percentage shall be assured by the use of self-adjusting system that

accounts for differences between bills in circulation caused by production variances and unique aging changes.

11. Have an MCBF greater than 20,000 including jams for bill standards and street money. This figure applies to the entire bill handling assembly.
 12. Reject all bills when escrow capacity has been reached.
 13. Enable a quick exchange of the unit by the use of quick release fasteners.
 14. Set variables or parameters as a bill is being processed in order to reduce the time to start the processing of the following bill.
 15. Have a maximum processing time for one bill of 2.0 seconds. The processing time shall be measured from the time the bill is inserted into the bill validator to the time the bill validator is ready to accept the next bill, including communication with and processing time by the CPU. This shall be measured by processing five bills of any denomination in a row.
 16. Prevent transport of the bill from the bill validator to the escrow until authentication by the bill validator is completed.
 17. Adapt to changes in the bill graphics with only changes to the software. Hardware changes shall not be required unless warranted by dimensional or other physical changes to the bill. The Supplier shall provide a procedure and equipment for reconfiguring the Bill Validator to accept and verify bills other than those specified above. The procedure and equipment shall be submitted to BART for approval during the Preliminary Review.
 18. Allow direct connection to a manufacturers supplied diagnostic unit or the PC Notebook specified in Section 34 50 10, Fare Collection System. The PC Notebook or diagnostic unit in conjunction with the validator shall provide data about the operation of the validator. The diagnostic unit shall provide statistics about the units operation.
 19. Allow temporary storage of bills to allow bills to be returned as change.
- C. Bill Escrow. The bill escrow shall conform to the following requirements:
1. Minimum capacity of 12 bills.
 2. Upon cancellation, all escrowed bills shall be returned at one time, to a separate bill return slot.
 3. Theft of bills shall not be possible without causing major damage to the bill except where access is intentionally provided in order to free a bill jam.
 4. Bills in escrow shall not be affected by rejected bills.
 5. Escrowed bills shall be returned upon insertion of an excessive number of bills.

6. Transfer the bills to the bill stacker upon command to issue a ticket. No bill shall be inserted in the bill stacker without being registered and recorded in the data storage memory.
- D. Bill Vault. The bill vault shall be a locked enclosure containing and providing security for the bill box. The steel design and construction of the vault shall deter forced entry. The Treasury Key and adherence to menus shall be required to open the vault. Machine shall go to a manipulation alarm state if a Treasury Key and authorized access code are not used. The access door shall be hinged or on slides and not removable. At least one mounting bolt that holds the vault to its mounting panel shall be located inside the vault. The other half of the interface connector for the bill box shall be located completely inside the vault. The electronic ID of a bill box shall be automatically recognized upon insertion and recorded in transaction memory and transmitted to DAS in real time. An acceptable alternative to the bill vault is the locking of the bill box directly to its locking device and connector interface, affixed in a secure manner to the TVM.
- E. Bill Box. The bill box shall conform to the requirements specified above for the coin box, and the following:
1. Constructed of stainless steel and durable to the extent that dropping of the bill box from a height of four feet above a structural concrete floor and landing on its weakest areas, edges, or points after ten drops shall not cause access to the bills. When dropped empty, or full, the bill box shall not open.
 2. Weight, fully loaded, 20 pounds maximum.
 3. The handle shall hold 30 pounds.
 4. The Bill Box shall cause the CPU to record and report specified events and data to DAS in real time upon removal.
- F. Bill Stacker. The bill stacker shall be located inside the bill box. The bill stacker shall receive unfolded bills from escrow in a neatly stacked, forceful manner and shall assure that the bills are not trapped, torn, or otherwise mishandled while being stacked. The stacker shall be an internal and easily removable section of the bill box. The capacity shall be a minimum of 2,000 "street" bills. The design shall permit quick and easy removal of the bills from the stacker in a manner that reduces the handling time required to prepare the bills for counting in the District's bill counting equipment. The time to remove and to replace the bill stacker from and back into the bill box shall not exceed five seconds, including unlocking and relocking the bill box.

2.11 CREDIT/DEBIT CARD MODULE

- A. The credit/debit card module shall consist of a card reader and card control electronics, and shall employ the numeric keypad, the soft keys, and the receipt printer for transactions. The card module shall conform to the following requirements:

B. Credit/Debit (Payment) Card Reader:

1. The card reader shall be PCI-compliant and EMV level-1 and level-2 certified. It shall be able to read magnetically encoded credit and debit cards, and contact-type smart cards.
2. The card reader shall read and verify information on credit and debit cards encoded in accordance with current applicable ISO and EMV standards. The card reader shall be of the insert and remove type. The reading of the magnetic stripe tracks shall be accomplished by a manual movement of the card passing through fixed heads. The reading of the data encoded in the smart card chip shall be accomplished by leaving the EMV-compliant card in the card reader slot for the duration of the credit card transaction.
3. The card reader shall have a reliability of at least 50,000 cycles between failures with the reader processing at least 10,000 credit/debit cards per month. Evidence of successful performance in current operating equipment shall be submitted.
4. The card reader shall be capable of reading 99.9 percent of properly inserted cards.
5. The card reader shall be mounted so that the card is in a vertical or horizontal plane when inserted into the reader. The instructional graphic associated with the card reader shall show the location of the magnetic stripe or the smart card chip contact to explain to the customer the required card orientation.
6. The card reader shall be capable of detecting insertion of card to initiate transaction and close bill/coin shutters.
7. The PIN Pad shall have shielding to prevent anyone other than the customer from seeing the PIN being entered by the customer.

C. Card Transaction: The credit/debit module shall operate in conjunction with the MDU, the soft keys and the numeric keypad with associated display if applicable to guide the customer through a transaction. The numeric keypad shall encrypt customer input PIN number. Utilizing unique keys per transaction and managing master keys shall be as specified in PCI PTS POI. The card control electronics shall be secured such that unauthorized entry into the housing that contains the encryption hardware and software shall cause automatic erasure of the encryption key and software.

D. Point to Point Encryption (P2PE) Compliance:

1. The credit/debit card module shall comply with the latest PCI P2PE standards so that reducing the PCI scope is possible. (<https://www.pcisecuritystandards.org/>)
2. The credit/debit card module shall be able to function between a non-P2PE mode and a P2PE mode, and switching from non-P2PE to P2PE mode shall be made available through a software configuration.

3. A non P2PE mode shall remain to function as it is today, and P2PE mode shall function to support P2PE.
 4. The P2PE functions implemented by a vendor or a contractor shall be designed to work for both of the traditional magnetic debit/credit cards and the EMV debit/credit cards.
 5. The TVM software shall prepare P2PE data in formats complying with and meeting requirements of a P2PE solution chosen by BART.
 6. The protocol used to support and send P2PE data to DAS should be modified from the current VEI/EIS protocol in such a way that minimum modification effort is needed from BART to modify DAS.
 7. BART shall be consulted, and will make final decision for modification of the VEI/EIS protocol.
 8. BART will modify DAS to interface with a bank to support P2PE.
- E. Card Control Electronics: The Card control electronics shall be PCI-compliant, level-1 and level-2 certified by EMVCo and conform to the following requirements:
1. Accept credit cards from VISA, MasterCard, American Express and Discover, and provide the capability to accept credit cards from other networks by means of easy configuration.
 2. Accept debit cards from Interlink and Explore, and provide the capability to accept debit cards from other networks by means of easy configuration.
 3. Read and transmit card information to DAS, which sends it to the financial institution and requests authorization.
 4. Prohibit the insertion of cash upon the insertion and recognition of one of the accepted cards.
 5. Permit the balance remaining on a ticket to be credited towards the purchase of higher value ticket, if the balance is within prescribed limits.
 6. Display the necessary steps in an operational sequence to permit purchase of a ticket in the minimum amount of time.
 7. Require acknowledgment of the purchase price.
 8. Permit canceling of the transaction or changes to the ticket value up to the point of acknowledgment of the ticket value. Once ticket value is approved the request for authorization shall be sent immediately.
 9. Limit ticket values to the initial range of \$20.00 minimum to \$75.00 maximum in \$1.00 increments. All limits shall be easily changed remotely from EME or locally using the PC Notebook.
 10. Cause automatic cancellation of the transaction under the following conditions:

- a. Authorization from the DAS is negative.
 - b. Valid ticket cannot be dispensed.
 - c. Procedural constraints are violated.
 - d. Tickets inserted for credit are invalid.
 - e. PIN is invalid after three attempts within a prescribed time period. The time period shall be adjustable from 3 to 30 seconds in one second increments. When exceeded, the display shall indicate the reason and return to the standby mode.
 - f. Upon loss of power/DAS communications.
11. Display to customer the reason for cancellation.
 12. Cause the TVM to automatically return to the standby mode and be ready to perform the next transaction after an automatic cancellation.
 13. Encrypt PIN block data prior to transmission over communication lines. The encryption process (i.e., Derived Unique Key per Transaction) and encryption key management shall conform to latest PCI PTS POI requirements.
 14. Request approval of credit/debit transactions in real time from the DAS. Once a successful read of the credit or debit card has been achieved, a PIN has been entered when required, and the ticket value selected, the TVM shall pass the transaction information to the clearing house through the DAS for immediate approval by the banking network. Transaction requests shall take priority over all non-security related TVM transmissions.
 15. Initiate a signal to the MDU to indicate the non-availability of a journal receipt and prompt the customer to continue or cancel.
 16. The card control electronics may consist of electronics in the OEM card reader found to be useful plus the electronics, memory, and chips in the microprocessor assembly that are devoted to a card transaction.
 17. All messages and receipts related to credit and debit transactions are subject to the approval of the financial institution that BART uses to process these transactions, and will not be considered complete and accepted until approved by BART and the financial institution.
 18. Issue a ticket after notification by DAS of authorization of a pending sale.
 19. Notify DAS only upon successfully vending a ticket of a transaction completion.
 20. Cancel a pending sale to DAS if a ticket cannot be successfully vended.
 21. If requested by the customer through the use of an on-screen prompt, issue a receipt after a ticket has been successfully vended.
 22. Accept EMV compliant cards.

23. Read test credit/debit cards and Smart Cards and transmit card information to DAS, and receive and display test transaction response messages from DAS.

F. Receipt Printing

1. If requested by the customer, a printed receipt shall be provided on credit/debit card transactions. The receipt shall contain all the information required to comply with the "Electronic Fund Transfer Act" as promulgated in the latest revision of Federal Reserve Board, Regulation E, as well as the latest requirements as established by the banking industry including Visa, MasterCard, American Express and Discover. As a minimum, the information shall include:
 - a. The wording "receipt";
 - b. Date and time of purchase;
 - c. TVM ID Number;
 - d. "BART" and the TVM station location;
 - e. The words "debit card sale" or "credit card sale";
 - f. Credit card type, e.g., Visa, MasterCard, American Express or Discover;
 - g. Dollar amount of the transaction;
 - h. Transaction authorization and reference number;
 - i. Ticket serial number;
 - j. Credit/Debit card number truncated to all but the last four digits;
 - k. Credit/Debit card expiration date;
 - l. If debit, an indication that it is from primary account;
 - m. Transaction type (credit or debit);
 - n. Type of ticket vended (BART Blue, BART Plus), or Clipper® Smart Card reload;
 - o. Amount of the transaction paid towards the cost of the fare media; and
 - p. Amount of the transaction paid towards the value loaded onto the fare media card/account balance
2. If blank paper ticket stock (no magnetic stripe) is used for the receipt, the receipt shall be issued from the same printer that is used to print tickets, and shall be issued from the same slot as the ticket within two seconds after the issued ticket is retrieved.
3. The roll stock for the receipts shall have the capacity to issue at least 1,000 receipts.

2.12 FRONT PANEL MOCK-UP

- A. A mock-up shall be provided of the TVM front panel. If actual equipment and construction materials are unavailable for use in the front panel mock-up, the mock-up shall be constructed of material that will retain its shape for the duration of the mock-up evaluation period. The mock-up shall be identical in dimensional details of all the features and approximate in color and texture and shall include all graphics printing and simulated or actual displays. Samples shall be provided for such items as the front panel surface, keypad, decals and MDU to be used. The mock-up shall be self-standing with the front panel vertical and at the exact height above the floor as the production equipment. The mock-up shall become the property of the District upon delivery. No warranty shall apply to the panel mock-up after acceptance by the District.

2.13 DOWNLOADING:

- A. Commands and parameters issued to the TVM from DAS or EME shall include but not be limited to the following:

1. Real-Time Commands issued from DAS
 - a. Reset/synchronize time/date information.
 - b. Initiate self-diagnostic operations.
 - c. In-service/out-of-service control.
 - d. Request for polled data.
 - e. Enabling/Disabling payment types (i.e. card only, credit/ATM only).
 - f. Enabling/Disabling bill/coin denomination.
2. Software/Parameter Downloads from EME
 - a. Transaction menu contents and formats.
 - b. Ticket type and sales period (i.e. first 5 days of month for BART PLUS).
 - c. Frequency of data recording and transmission.
 - d. Modification of all TVM variables such as; minimum fare, RVT maximum value, maximum ticket value, time between events, quantity and denomination of change given.
 - e. Security code assignments for access to specific components.
 - f. PIN assignments for equipment access.
 - g. Ticket type to accept/reject.
 - h. Set automatic vs. optional issuance of receipt for credit/ATM transaction.
 - i. Software/firmware upgraded for all supported components.
 - j. Clipper configuration parameters.

- k. Ticket negative list.

2.14 SMART CARD READER

- A. The Smart Card reader shall be integral to the reader for the credit/debit module specified above.
- B. The smart card reader shall communicate with the Clipper® Smart Card fare media.
- C. Smart card transaction data shall be stored in the TVM and reported to DAS in accordance with the requirements specified in Article 2.07 herein for the Smart Card. Real-time commands and parameter downloads shall be received from DAS.
- D. The card reader/encoder, on the outside of the TVM shall be clearly marked with the color logo of the Clipper® Smart Card fare media. The logo will be furnished by the Engineer to the Supplier at PDR.

2.15 TREASURY SERVICE RECEIPT

- A. Receipt Information: Upon completion of service by the Revenue Service staff, the TVM shall issue a receipt with the following information as a minimum:
 1. TVM identification number
 2. Station location
 3. Date
 4. Time when door was first opened
 5. Time upon completion of revenue service
 6. ID number of all revenue service components removed from TVM
 7. ID number of all revenue service components inserted in TVM
 8. Operator identification and security level
- B. Information on the content of the revenue service components shall not be printed on the receipt.

2.16 AUDIO

- A. For the visually impaired, pressing a “Push for Audio” button shall cause audio announcements of the information on the MDU and shall guide the customer through all possible transactions using interactive voice instructions supplemental to those displayed on the MDU. Adjustment of the volume to the desired level shall be possible from the outside of the machine, with automatic reset to the preset level upon completion of a transaction. Quality of the enunciation shall be subject to approval by the Engineer.

2.17 TVM EXTERNAL SECURITY AND INTRUSION ALARM

- A. An External Security Access feature shall be included in the TVM to authorize a valid request for machine entry. Without authorization, any attempt to open the equipment door on the TVM shall result in an intrusion alarm.
- B. The external security access feature shall use an encoded smart card or magnetic stripe card encoded with the PIN security code and associated access levels, a unique card serial number with a minimum of six digits, and an employee serial number with a minimum of 6 digits or equivalent. A mutually acceptable encoding format shall be determined during the equipment design period. The Supplier shall furnish 2,000 cards encoded with specific information as directed by the Engineer. The Supplier shall provide the cards and the equipment for encoding the cards and maintaining the PIN database.
- C. The card will be inserted and removed by an employee, into and from the Credit/Debit card reader or smart card reader of the TVM, followed by a Personal Identification Number (PIN) entry on the numeric keypad. The PIN shall be validated by the TVM by checking if the PIN is compatible to data stored in local memory. An authorized card/PIN combination, shall result in a response back to the user, authorizing the employee to open the door. The door will be opened by the employee by unlocking the key lock to operate the equipment door handle. The door locking mechanism shall not contain mechanical or electrical interlocking to interface with the External Security System.
- D. An unauthorized card/PIN combination combined with an open door detection (unauthorized door opening), shall immediately activate an intrusion alarm. Repeated failure (more than three attempts) to enter a valid PIN within a predetermined time shall also activate an immediate intrusion alarm.
- E. The cycle time from activation of the equipment access hardware to a displayed feedback to the user shall be user selectable and programmable.
- F. The TVM shall log and store in the machine all door openings and access attempts along with the access date and time as well as the card and employee numbers read from the access card. Access information will be recorded regardless of the success of the access attempt. Access information shall be output to the DAS on a real-time basis and stored in RAM.
- G. The Engineer will furnish the data for development of the card/PIN database. The database shall be such that it can be modified or upgraded remotely and it shall be capable of being downloaded to the individual TVMs from the Treasury Office Workstation (TOW), which is part of the EME platform. Local data storage capacity shall be at least 2000 PINs and associated data. The local database shall be capable of storing and recognizing specific card/PIN combinations which may be labeled as "bad" and downloaded to the TVM from TOW. Recognition of a card/PIN combination not in the local database or a "bad" card/PIN combination by the machine's processor shall cause the TVM to request a repeat entry of the PIN. Repeat failure (more than three attempts) to enter a valid PIN within a predetermined time shall activate an immediate intrusion alarm.

- H. An intrusion alarm shall result in a local audible alarm annunciation in the equipment and remote intrusion alarms being sent by the TVM to the DAS and to the Hardwired Communication interface.
1. The TVM intrusion alarm output shall:
 - a. Be independent of any annunciations or alarm messages that are sent to the DAS or to the Hardwired Communication Interface.
 - b. Include a direct interlock to the incoming power supply that annunciates upon loss of power (Output to the Hardwired Communication Interface and the DAS).
 - c. Require the TVM Microprocessor Assembly to reset a watchdog timer periodically to prevent an intrusion alarm when none exists and to additionally generate an annunciation in the event of primary CPU failure (Output to the Hardwired Communication Interface and the DAS).
 - d. Detect and annunciate upon a failure of security related components or a corruption of the card/Personal Identification Number database (Output to the Hardwired Communication Interface and the DAS).
 - e. Annunciate upon an unauthorized door opening (Output to the Hardwired Communication Interface and the DAS).
 2. The system shall be programmed to detect and annunciate access to modules or assemblies not allowed by an authorization level based on the card data and associated PIN, i.e., “work performance within an unauthorized work area”. The Engineer will supply a list of monitored modules and assemblies with the allowable access of each category of personnel (Output to the Hardwired Communication Interface and the DAS).
 3. The local audible alarm shall be silenced only by insertion of a “Super” PIN at the Service Terminal for the TVM.
 4. Remote alarms shall reset after the equipment has been repaired and/or returned to the proper security level.
 5. In the event of loss of station power or communication with DAS, or upon failures of the locking mechanism itself to operate, the Supplier shall provide means to open the TVM without compromising the security of the machine.

2.18 POWER SUPPLY MANAGEMENT

- A. The TVM shall be designed with the following power supply management features:
1. **Power Switches:** The power supply connections to all major assemblies/modules shall be equipped with in-line power switches to allow each assembly/module to be powered down separately without interrupting power to the CPU. The switches shall be securely mounted and easily accessible. The switches shall be labeled and shall be of heavy-duty construction capable of sustaining repeated operations without breaking, cracking or degradation in performance. The

assemblies/modules requiring in-line power switches shall include but not be limited to the following:

- a. Microprocessor Assembly
 - b. Ticket Transport Module
 - c. Coin Handling Assembly
 - d. Bill Handling Module
 - e. Credit/Debit Card Module
 - f. Message Display Unit
2. Back-up Battery: The TVM shall be equipped with battery back-up to complete the transaction in progress and to maintain power to the Microprocessor Assembly for 30 minutes in the event of a station power loss or deactivation of the TVM main power switch. Upon sensing either of these conditions, the TVM shall report a real-time "loss of power" alarm to DAS. The back-up battery shall operate constantly off a trickle charge between power failures.

PART 3 – EXECUTION

Not Used

END OF SECTION 34 50 13