PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Site preparation necessary to support installation of AFC Equipment (AFCE).
B. Installation and testing of AFCE.
C. Materials for installation of AFCE, and connection of the AFCE to the BART Data Communications Network (BARTnet).

1.02 RELATED SECTIONS

A. Section 01 32 16 Construction Progress Schedule
B. Section 01 33 00 Submittal Requirements and Procedures
C. Section 01 33 23 Shop Drawings, Product Data, and Samples
D. Section 01 43 00 Quality Assurance
E. Section 01 45 00 Quality Control
F. Section 01 45 24 Testing Program Requirements
G. Section 01 74 14 Cleaning
H. Section 01 78 23 Operation and Maintenance Data
I. Section 01 78 39 Project Record Documents
J. Section 01 78 44 Spare Parts and Maintenance Materials
K. Section 01 79 00 Demonstration and Training
L. Section 20 50 13 Raceways for Facility Services
M. Section 20 70 19 Indoor Cabinets, Racks, Frames and Enclosures
N. Section 20 72 10 General Requirements for Systems Work
O. Section 20 70 23 Electronic Circuits, Wires, and Cables
P. Section 20 70 26 Common Materials and Methods for Electrical Systems
Q. Section 20 72 15 General Requirements for System Design
R. Section 20 72 25 Factory and Field Testing Requirements
S. Section 20 80 00 Systems Integration Testing
1.03 MEASUREMENT AND PAYMENT

A. Measurement and payment for Fare Collection System Installation will be by the lump-sum method in accordance with Contract Specification Section 01 20 00, Price and Payment Procedures.

B. Fare Collection System Installation will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

A. American National Standard Institute (ANSI):

1. ANSI C2 National Electric Safety Code (NESC)

B. California Electrical Code

C. Code of Federal Registration (CFR):

1. 36 CFR Part 1191 Part of Federal Register, Volume 56, No. 14, the “Americans with Disabilities Act”
D. Electronics Industries Association (EIA):
   1. EIA/ECA-310-E Cabinets, Racks, Panels, and Associated Equipment
   2. EIA 455-11-177A Standards for Test Measurements and Inspection of Fiber Cables, Connectors, and/or Other Fiber Optic Devices

E. Americans with Disabilities Act (ADA):
   1. Americans with Disabilities Act Accessibility Guidelines (ADAAG)

F. San Francisco Bay Area Metropolitan Transportation Commission (MTC):
   1. Clipper® Card Specification

G. Cubic Transportation Systems, Inc. (CTS):
   1. Drawings 9375-4102 Fare Gates Installation.

1.05 **ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFC</td>
<td>Automatic Fare Collection</td>
</tr>
<tr>
<td>AFM</td>
<td>Add-Fare Machine</td>
</tr>
<tr>
<td>AFG</td>
<td>Accessible Fare Gate</td>
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<tr>
<td>BARTnet</td>
<td>BART Data Communications Network</td>
</tr>
<tr>
<td>BBC</td>
<td>Bill to Bill Changer</td>
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<tr>
<td>BOSC</td>
<td>BART Only Smart Card</td>
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<tr>
<td>DAS</td>
<td>Data Acquisition System</td>
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<tr>
<td>DMP</td>
<td>Designated Matching Products</td>
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<tr>
<td>EBO</td>
<td>Emergency Barrier Override</td>
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<tr>
<td>FG</td>
<td>Fare Gate</td>
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<tr>
<td>PVM</td>
<td>Parking Validation Machine</td>
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<tr>
<td>SAB</td>
<td>Station Agent Booth</td>
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<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>TVM</td>
<td>Ticket Vending Machine</td>
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</table>
1.06 DESCRIPTION OF THE EXISTING SYSTEM

A. BART’s AFC system consists of the following Automatic Fare Collection Equipment (AFCE): TVM, AFM, FG, PVM and BBC. The AFCE operates as a stored-value, distance-based system. The system is a closed-barrier type, requiring a magnetic strip ticket or smart (Clipper® or BOSC) card for entry and exit at the station. TVMs issue and upgrade the fare media (e.g., magnetic strip tickets and Clipper® cards). AFMs upgrade magnetic strip tickets and Clipper® cards that require added value to exit the FG. BBCs make change for 10 and 20 dollar bills. An air compressor unit provides air to the FG for controlling the opening and closing of the pneumatic FG barrier.

B. The TVMs, AFMs and FGs are equipped with two communications interfaces. The primary interface connects each machine to the Data Acquisition System (DAS) servers at BART computer rooms via a fiber optic connection to the station network switch and the BARTnet data network system. The second interface connects the SCADA module in each AFC device to the station SCADA system. The SCADA connection provides a back-up communication interface to the DAS system for certain control and status indication functions of the AFC Equipment. For TVMs and AFMs, these functions include status indications such as “Out of Service”, “Intrusion Alarm”, and “Loss of Power”. For Fare Gates, SCADA supports control functions such as “Clock Override”, “Entry/Exit Override”, and “Emergency Barrier Open”. Additionally, there is a 2-conductor cable from the station agent booth to the Fare Gate arrays that provides back-up control of the “Emergency Barrier Open” function. PVMs and BBCs use only the fiber communication interface to the DAS.

1.07 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, Submittal Procedures; Section 01 33 23, Shop Drawings, Product Data and Samples; and Section 01 78 44, Spare Parts and Maintenance Materials.

B. Manufacturer’s data sheets and descriptive information for Contractor furnished equipment.

C. Detail drawings and technical data including list of equipment and material, consisting of manufacturer’s descriptive and technical literature, reliability performance charts and curves, catalog cuts, and installation instructions. Drawings shall show proposed layout and anchoring of equipment. System drawings shall show final configuration, including location, type and termination of inter-cabinet cables.

D. Provide station layout drawings for installation of AFC equipment and ancillary equipment. The drawings shall identify installation sites, equipment placement details, ADA compliance, raceway and conduit runs, cable runs, and equipment installation and termination details.
E. For Contractor furnished equipment, provide the following quality assurance/control submittals:

1. Quality assurance and quality control submittals shall be in accordance with Section 01 43 00, Quality Assurance; and Section 01 45 00, Quality Control.

2. Certificates: Where equipment or materials are specified to conform to the standards or publications and requirements of CFR, ANSI, NFPA, EIA, or UL, submit certificates attesting that the items furnished under this Section conform to the specified requirements.

F. Manufacturer’s instruction: Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the equipment being installed, submit printed copies of these recommendations for approval prior to installation. Submit operating instructions outlining the step-by-step procedures required for system operation including description of each subsystem in its operating mode. Instructions shall include the manufacturer’s name, service manual, parts list, and a brief description of equipment, components, and their basic operating features. Submit maintenance instructions listing regular maintenance procedures, possible system failures, a troubleshooting guide for repairs, and simplified diagrams for the system as installed.

G. Operation and Maintenance Manuals: Updated operation and maintenance manuals for Contractor furnished equipment in accordance with Section 01 78 23, Operation and Maintenance Data.

H. Training: Training shall be provided if repair procedures change due to part replacement of an obsolete part. Submit training materials in accordance with Section 01 79 00, Demonstration and Training.

I. Spare Parts: Provide the spare parts in accordance with Section 01 78 44, Spare Parts and Maintenance Materials.

1.08 NOT USED

1.09 DESIGN REVIEWS

A. Design reviews may be necessary if significant changes are noted during the District’s review of the various documents requested for submittal.

1.10 WARRANTY

A. For equipment provided by Contractor, the following provisions shall apply in place of the warranty provisions in the Contract general conditions where warranty starts after Acceptance:

**GC4.9.4 Warranty of Contractor Furnished Equipment and Materials.**
Notwithstanding the guaranty provisions previously specified, the contractor warrants that all non DFE equipment, materials, and labor furnished or performed to install such equipment under the Contract shall be satisfactory for their intended...
purposes and shall be free of defects in the design, materials, and workmanship for a period of 24 months from and after start of revenue service unless specified otherwise in these specifications, regardless of whether the same were furnished or performed by the Contractor or by any of its Subcontractors. Upon receipt of written notice from the District of any defect in any such equipment, materials, or labor during the applicable warranty period due to defective design, equipment, materials, or workmanship, the affected item or part thereof shall be redesigned, repaired, or replaced within a time period and in a manner acceptable to the District.

PART 2 – PRODUCTS

2.01 GENERAL
A. Furnish the following pieces of equipment for installation unless they are District-Furnished Equipment (DFE) in accordance with Contract. The equipment shall be certified by manufacturer.

2.02 AFC EQUIPMENT
A. Provide:
   1. FGs, AFMs, TVMs, BBCs and PVMs as specified in Contract.
   2. Related installation hardware such as elevation adapters, base plates, filler panels, and afterset inserts as listed in Designated Matching Products.
   3. Installation accessories such as inter-gate air hoses and cables, and anchor rods.
   4. Sealants shall be black color, Dow Corning #780 building sealant or equal, polyurethane-based, either one-part elastomeric sealant or two-part elastomeric sealant. Sealants shall meet the requirements of NFPA 101, Class A, and UBC Chapter 42, Class I.

2.03 SUPPORT EQUIPMENT
A. Provide
   1. Air Compressor Rack as specified in Contract.
   2. DeviceNet cable, fiber patch panels and patch cords for networking as specified in Contract.
   3. Fiber interface box (splice cassette and a housing) as listed in DMP.
PART 3 – EXECUTION

3.01 SITE ACCESS

A. Access to the Jobsite will only be permitted per approval from the Engineer.

B. Provide pedestrian and patron control in accordance with Section 01 57 00, Temporary Controls.

3.02 SITE PREPARATION AND CLEANING

A. Refer to BART Facilities Standard Drawings J001 through J013 for FG, AFM, TVM, and PVM installation details. Air Compressor Rack installation details are as those of vault mounted TVM.

B. Refer to the Contract Drawings for station layout of AFC Equipment.

C. Floor and Ductwork:

1. Inspect locations where the AFC Equipment will be placed to ensure that placement provisions, including raceways, wireways, cabling, and anchor bolts, are satisfactory. Surveys and inspections shall be made as necessary prior to the placement of the AFC Equipment. Any discrepancies that will affect the placement or operation of the AFCE shall be reported in writing to the Engineer.

2. Trench and core drill the finished floor, and install conduits, cable ducts, cable penetrations and hardware in accordance with Section 20 50 13, Raceways for Facility Services, to permit the pass through and connection of power cables, communications cables, and pneumatic airlines (FGs only) to be installed.

3. Standing area and perimeter around AFCE shall be level to meet ADA requirements. Floor refinishing work shall be completed and accepted by the District before AFCE can be installed.

4. Clean up Jobsite in accordance with Section 01 74 14, Cleaning.

D. AFC Equipment Removal and Storage

1. For each AFCE to be relocated, unplug the power cable, disconnect the communication cables, unbolt the AFCE from the mounting hardware, and place the AFCE in a temporary storage area as designated and agreed upon by Contractor and the Engineer. Security at the storage areas shall be the responsibility of the Contractor. Contractor shall take measures to prevent unauthorized entry to the storage area.

2. After removal of the AFCE, remove the mounting hardware and store in the temporary storage. Prepare the floor area for rework by removing obstructions located in the area in which the AFCE was removed including, but not limited to, anchor bolts, raceway collars and pneumatic fittings. Obstructions shall be
removed down to 1/2 inch below grade. Floors not within any rework area and reworked floors shall be repaired and refinished.

E. For each AFCE (FG, TVM, AFM, BBC, PVM) provide the following:

1. A 277 VAC, 20 Amp dedicated circuit from the station power panel with grounding as indicated.

2. For stations where DeviceNet cables are not used, provide a 12-strand multimode fiber optic cable from the station 201 communication cabinet as indicated. Otherwise, provide a 6-strand multimode fiber optic cable. Follow installation instructions in Section 27 13 01, Communication Cables and Related Equipment. Coin and protect a 15-foot slack of the cable. The District will terminate the cable.

F. For each FG, TVM, and AFM provide:

1. SCADA communication cable in accordance with Section 27 13 01, Communication Cables and Related Equipment, from the SCADA cabinet in the train control room to each FG, TVM, and AFM as indicated. The District will terminate the cable in the FGs, after the FGs are installed.

G. For each FG provide:

1. A daisy chained 2-conductor copper communication cable from the station agent booth via Cabinet 44 in the train control room to each FG as indicated for the EBO function. The District will terminate the cable in the FGs after the FGs are installed.

2. Pneumatic air lines from the FG to adjacent FGs, or to an adjacent FG and the air compressor rack as indicated.

H. For air compressor rack installation, prepare the floor surface of the designated vault, and provide the following:

1. A 480 VAC 3-Phase 30 Amp dedicated circuit from the station power panel to the air compressor rack.

2. Pneumatic air line from the air compressor rack to the FGs.

Air compressor rack shall be installed on a metal plate and mounted on a heavy-duty bottom slide listed in DMP. The slide shall mount on a vault-mount leveling plate (see DMP) and anchored to the concrete.

3.03 INSTALLATION

A. The Engineer will oversee the installation and testing of the AFCE and the air compressor rack. Provide a qualified representative from the AFCE manufacturer to support the installation and testing of the AFCE, and a qualified representative from the air compressor rack Supplier to support the installation and testing of the air compressor rack. Make available facilities and equipment at all times to the Engineer,
and meet with and cooperate with the Engineer as needed on installation and testing issues including, but not limited to, scheduling, District AFC support, and performance assurance.

B. AFC Equipment Installation

1. If applicable, transport removed AFCE and associated mounting hardware (bases and base plates) to temporary storage, and transport AFCE and associated mounting hardware from temporary storage to the Jobsites.

2. If applicable, pick up District furnished AFCE from a District designated storage facility and deliver the Fare Gate Consoles to the Jobsite.

3. AFCE installation work shall be under the direction of the AFC equipment or air compressor representative and coordinated with the Engineer.

4. Install the AFCE bases/base plates and set the AFCE at the locations indicated. Shim plates for leveling and eliminating space between the AFCE and its base or baseplate. Apply sealants between the bases/base plates or cabinets and the floor.

5. Prior to setting the FG in place, coordinate with the Engineer on the District’s installation of the inter-gate cabling. Ensure that FGs are plumb, level, and in alignment with one another.

6. Install the FG base plates and set the FGs at the locations indicated. FGs shall be anchored to the station floor and connected to pneumatic airline as indicated. After the FGs are in proper configuration, apply weather proof sealant between the bottom of the FGs and the floor.

7. Install the air compressor as indicated in a vault. The air compressor shall be installed on a slide assembly and installed on top of a TVM leveling plate. For more details, see Standard Drawings J002 and J003.

3.04 TESTING REQUIREMENTS

A. Provide test planning, scheduling, performance, recording of data, and reporting of test results according to Section 01 45 24, Testing Program Requirements.

B. Conduct testing with support from the AFCE Supplier and the District to confirm satisfactory operation after installation and prior to revenue service. Installation testing procedures developed by the AFCE Supplier shall be used.

C. Installation Test

1. Test power and communication cables in each installed AFCE for acceptance by the Engineer. Discrepancies shall be reported to the Engineer and corrected.

   a. Test communication cables (Cat6, DeviceNet, EBO) in accordance with Section 01 45 24, Testing Program Requirements.
b. Test fiber optic cables in accordance with Section 20 70 23, Electronic Circuits, Wires, and Cables.

c. Test grounding system in accordance with Section 26 05 26, Grounding and Bonding for Electrical Systems.

2. Perform installation test on the installed AFCE in accordance with installation test procedures developed by the AFCE Supplier. Testing shall be performed after the equipment is properly installed and secured onsite. Discrepancies shall be reported to the Engineer and corrected.

D. System Integration Test (SIT)

Support SIT. The District will conduct SIT on each installed AFCE in accordance with BART SIT test procedures. The District will also conduct bank certification testing of the credit card function in the TVM/AFM. The SIT and bank certification tests have a duration of three months. Acceptance of the AFCE installation is given upon the District’s completion of these tests.

END OF SECTION 34 50 11