

SECTION 28 41 29

CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Functional requirements
- B. Equipment

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Closed circuit television system will be measured for payment as a lump-sum unit acceptably installed and tested for compliance.
- B. Payment: Closed circuit television system will be paid for at the Contract lump-sum price for Closed circuit television system or as part of the lump sum price for Communications Work, as determined by the lump sum measurement specified above, as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. Electronic Industries Association (EIA):
 - 1. Bulletin #1 CCTV Definitions
 - 2. RS-170 Electrical Performance Standards Monochrome Television Studio Facilities
 - 3. RS-250B Electrical Performance Standards for Television Relay Facilities
 - 4. RS-310C Racks, Panelboards and Associated Equipment
 - 5. RS-330 Electrical Performance Standards for Closed Circuit Television (CCTV) Camera 525/60 Interlaced
 - 6. RS-343 Electrical Performance Standard for High Resolution Monochrome CCTV Camera
 - 7. RS-375 Electrical Performance Standards for Direct View Monochrome CCTV Monitors
 - 8. RS-420 Electrical Performance Standards for Monochrome CCTV Cameras 525/60 Random Interface
 - 9. RS-439 Engineering Specifications Format for Color CCTV Camera Equipment

- B. Manufacturing Method (MM):
 - 1. MM-33A Process Control Specification for Paint Application
 - 2. MM-42 Process Control Specification of Chromate Conversion Coating
- C. Underwriters Laboratories (UL)
 - 1. UL 2044 Power Supply Standard for Commercial CCTV Equipment
- D. National Fire Protection Association
 - 1. NFPA 70 National Electrical Code
- E. California Occupational Safety and Health Standards

1.04 SYSTEM DESCRIPTION

- A. Furnishing a CCTV System in the passenger station for surveillance of areas in the station, and adjoining parking structure, pocket track, and tail tracks, as applicable and as indicated.
- B. Provide all interfaces with other systems in the station and in the BART operating system, as specified and indicated, to provide a completely integrated operating system.

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit the following:
 - 1. Systems design presented in functional block diagrams and system electrical/electronic signal flow diagrams indicating signal levels and impedance values.
 - 2. Product verification list with pictorial view and full performance specifications.
 - 3. Detailed installation drawings to include all installation configuration and methods of installation.
 - 4. List of proposed lenses for all camera installations. Calculations of coverage shall be provided for all cameras.
 - 5. Operation and maintenance data to include operation instruction, detailed parts list, cable and wire lists, circuit diagrams, maintenance, alignment, and trouble shooting procedures.

1.06 QUALITY CONTROL

- A. Products shall be manufactured by firms regularly engaged in manufacturing products described in this section.

- B. Field testing shall be performed by persons having five or more years of relevant testing experience.

PART 2 - PRODUCTS

2.01 FUNCTIONAL REQUIREMENTS

- A. The CCTV System shall provide for surveillance of areas in Passenger Stations, Parking Structures, pocket track, and end-of-line Tail Tracks.

- 1. Passenger Station Areas.

- a. Platform and Mezzanine Areas. Cameras shall be furnished for viewing platform and mezzanine areas including Rescue Assistance Areas and elevator entrances, as indicated. Cameras focused on elevator entrances shall be equipped with lenses having adequate coverage to allow viewing from the Station Agents Booth of patrons using the elevators. Cameras on the platform shall be oriented to allow viewing from the Station Agents Booth of the platform edges for the length of the platform.

- b. Automatic Fare Collection Equipment: Pan, tilt, zoom cameras shall be furnished to monitor Automatic Fare Collection equipment including the ticket vending machines, add fare machines, and bill-to-bill changers. Intrusion alarms provided with the fare collection equipment shall cause cameras to move to a position to monitor the alarmed machine. Automatic recording shall be initiated upon activation of alarm. Alarm-activated and -detected machines shall be monitored in order of priority. When the system is unalarmed the camera shall return to a pre-assigned position.

- 2. Pocket Track and End-of-Line Tail Tracks: Pan, tilt, zoom cameras shall be furnished for viewing areas in the pocket and end-of-line tracks, as indicated.

- 3. Parking Structures. Cameras shall be provided for viewing internal area and entry area of elevators and stairwell areas. Pan, tilt, zoom cameras shall be furnished for viewing driving lanes, parking areas, and parking machines.

- B. Interfaces of the CCTV system with other Communication subsystems shall be as follows:

- 1. Signal intrusion alarms of ticket vending machines, add fare machines, bill-to-bill changers, and parking machines for automatic positioning of video cameras shall be through the remote Input/Output points from the Supervisory Control and Data Acquisition System.
- 2. Connection to the BART network (BARTnet) for transmission of video images to BART's Central Control.

2.02 EQUIPMENT REQUIREMENTS

- A. General:

1. CCTV equipment providing the same functions shall be uniform and have the same type and model supplied by a single manufacturer.
2. All necessary accessories, devices, wires, and cables shall be furnished for proper interconnection of the equipment specified herein to provide a completely integrated and operational CCTV system.
3. CCTV monitoring and control equipment, as indicated, herein shall be furnished to allow monitoring of selected video images in the Station Agent's Booth, Emergency Management Panel Room, and the Supervisor's Booth at end-of-line stations.
4. CCTV equipment in the Train Control Room shall be designed for mounting in standard 19-inch rack per EIA RS-310C.
5. Convenience outlets with 120 VAC essential power shall be provided at each camera location.

B. Cameras:

1. Cameras shall be colored cameras meeting the following characteristics:
 - a. Input Voltage: Cameras shall operate satisfactorily over a voltage range of 104 to 125 volts AC at 60 Hz, or 24 volts AC \pm 10%, per EIA RS-170A and UL 2044. A 120 Vac power supply shall be provided at all camera sites. Where cameras rated 24 volts are furnished, appropriately rated transformers shall be provided for connection to the 120 V supply.
 - b. Internal Synchronization: In the absence of an external composite synchronization signal the camera shall provide the option of reverting to a crystal-controlled oscillator. The synchronization at the video output shall conform to the timing specified by EIA RS-170A and RS-343.
 - c. Video Format/Line Rate: The video format/line rate shall be determined by the synchronization source and shall be 2:1 interlaced at 525 lines 60 fields (or 30 frames) in compliance with EIA RS-170A.
 - d. Vertical Rate: The rate shall be 59.95 Hz as determined by the RS-170A synchronization source.
 - e. Horizontal Rate: The rate shall be 15.750 KHz as determined by the RS-170A synchronization source.
 - f. Camera Image Sensor: The sensor shall be a 2/3-inch or 1/2-inch Charge Coupled Device. All image sensors supplied shall be of a single type and size.
 - g. Signal to Noise Ratio (SNR): The SNR shall be no less than 48 dB (unweighted).
 - h. Resolution: The horizontal resolution shall be a minimum of 460 TV lines. The vertical resolution shall be 350 TV lines.

- i. Resolution Stability: Resolution shall not be variable and shall be maintained over the specified input voltage and frequency range.
 - j. Automatic Light Range: The composite video output level shall automatically maintain a light range within ± 0.2 volts over scene changes of 1.1 footcandles to 10,000 footcandles with lenses of f/1.4 to f/360.
 - k. Video Output: The video output shall be 1.0 volt peak to peak (0.7V video, 0.3V sync.) unbalanced composite signal, polarity black negative across a load impedance of 75 Ohms.
 - l. Impedance: The camera output impedance shall be 75 Ohms ± 5 percent over the video frequency range, shall be source terminated, and shall be in compliance with EIA RS-170A.
 - m. Lens Mounting: All camera lenses shall be mounted on a standard C- or CS-type mount with 1.0 inch in diameter and 32 threads per inch. Standard single type of mount shall be furnished.
- C. Video Switcher: Video switcher shall be furnished to route the video signal output from cameras to monitors, VCRs, and control units, as indicated. A video switcher shall be designated to provide "Sequential" or "Hold" video to monitors in the Agent's booth and BART Central Control. An alphanumeric I.D. unit shall be provided to display the camera I.D. with the video. The video switcher shall be a Designated Matching Product, Pelco Matrix Switcher 48X8, non-looping, CM9740.
- D. Video Multiplexer. One video multiplexer shall be furnished for each group of 16 cameras. The multiplexer shall be Designated Matching Product, Pelco multiplexer model MX4016CD.
- E. Distribution Amplifier: One distribution amplifier shall be furnished for each group of 16 cameras. Distribution amplifiers shall be Designated Matching Product, Pelco Master Distribution Amplifier model CM9760.
- F. Ethernet Transmitter and Receiver Equipment: Ethernet equipment shall be furnished to interface the CCTV system with the BART network (BARTnet) for transmission of video images to BART Central Control. These equipment shall be Designated Matching Products, Transmitter shall be Pelco NET101-I, and Receiver shall be Pelco NET101-R.
- G. Camera Lenses:
- 1. Lenses shall be auto-iris lenses directly interchangeable without electrical or mechanical modifications or adaptations. Each lens shall have a neutral density spot filter. Lenses shall be capable of mounting in a sealed environmental housing.
 - 2. Lenses for each camera shall be the type as selected by the District from the type of lenses listed below. The District will select the type of lens depending on the location of the cameras relative to the layout of the Station. The District will provide the list of cameras with the required lenses 12 months after NTP.

<u>f/stop</u>	<u>Focal Length</u>	<u>Description</u>
f/1.4	11.5-69 mm	Variable Focal Length
f/1.6	11-110 mm	Variable Focal Length
f/1.4	10-100 mm	Variable Focal Length

3. Zoom lenses shall be equipped with a magnification of 6X. The lenses shall have motorized zoom, iris and focus functions. Zoom and focus shall be remotely controlled; iris shall be automatically controlled at the camera.

H. Camera Housing:

1. Cameras installed outdoors shall be furnished with environmental housings. The housings shall be Designated Matching Product, Pelco E706-16, equipped with heater kit - Pelco HK706-2, blower kit – BK700/24, and power supply – WCS1-4. Housings exposed to direct sunlight at any time of day shall be equipped with a sun shield, Designated Matching Product, Pelco E706V.
2. Cameras monitoring AFC equipment and those installed in elevators shall be furnished with security housing with the following characteristics:
 - a) High security, vandal resistant, and corner mount type. The enclosure shall be tamper-proof with tamper-proof design subject to District approval. The housing shall be compatible with the camera in the elevator.
 - b) Security enclosures shall be domed housings suitable for outdoor service. The housings exterior surface shall be tinted to conceal the interior camera from view. The view from the housing shall encompass a 360 degree horizontal view and 45 degree vertical view. The vertical view shall extend from 5 degrees above the horizontal to 40 degrees below the horizontal. Security enclosures shall be tamper-proof to prevent the general public from accessing the interior of the enclosure. Tamper-proof designs shall be subject to District approval. The camera security enclosure shall also act as an environmental enclosure.

I. Camera Mountings:

1. Wall or Ceiling Mount: The camera mount unit shall be designed to support loads of up to 125 lbs. at an attitude of 90 degrees perpendicular to a wall surface. Each mount assembly shall be equipped with an adjustable head adapter which shall allow 360 degree horizontal and ± 90 degree vertical plane adjustment. Ceiling mount shall be Designated Matching Product, Lucasey ceiling mount Model ACM2333. All parts shall be protected from corrosion.
2. Pan/Tilt Unit:
 - a. The pan/tilt unit shall be designed to meet the following specifications:
 - 1) Pan: 0-355 degrees in horizontal plane.
 - 2) Tilt: ± 90 degrees in vertical plane.

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- 3) Pan Speed: 9 degrees per second
 - 4) Tilt Speed: 3 degrees per second
 - 5) Construction: metal, corrosion protected, painted white.
- b. Drivers for pan/tilt units shall be mounted near the pan/tilt units within tamper-proof and weatherproof enclosures. Tamper-proof designs shall be subject to District approval.
3. Pole Mount: Adapters shall be provided for placing standard wall or ceiling mount units on camera equipped poles. All parts shall be protected from corrosion.
 4. The housing mounts for the elevator cab cameras shall be tamper-proof with tamper-proof design subject to District approval. The mounts shall be heavy duty that shall safely support a load of 120 pounds minimum.
- J. Monitors: Monitors shall be Designated Matching Product, Tatung 17 inch model TCM 1701.
- K. Video Recorders: Digital recorders, one for each 16 cameras shall be furnished, installed in the Train Control Room. Recorders shall be Designated Matching Product, Sony Digital HSR2. Network Station shall be Designated Matching Product, Sony SNTV204.
- L. Control Panel: A camera control panel for camera selection shall be furnished in the Station Agents Booth to provide the operator with the ability to select any camera or cameras for viewing.
- M. The preset position panel shall be capable of positioning a PTZ camera to up to 16 pre-selected positions. This shall include positioning of pan, tilt, zoom, and focus of the individual cameras. Contact closure from the SCADA system signifying intrusion to a vending or add fare machine shall cause the appropriate camera to point and focus to the front of the pre-designated alarmed machine. Pan and tilt accuracy shall be within 1.0 degree. Zoom and focus accuracy shall be within 0.5% of one lens rotation.
- N. Video Patch Panel: Video patch panels shall be designed with 24 insulated non-terminated jacks per panel and with BNC type connectors in the rear. The video jack panel shall be designed to meet the following specifications:
1. Impedance: 75 Ohms
 2. VSWR: Less than 1 to 1.33, DC to 100 MHz
 3. Insertion loss: Less than 0.2 dB DC-100 Hz
 4. Contact Resistance: .025 Ohms plug out
.010 Ohms plug-in
 5. Dielectric Breakdown: 500 VRMS at 60 Hz

- O. Video Cable Equalizers. Video cable equalizers shall be furnished for compensation of high frequency losses due to long coaxial cable runs between the camera and monitoring equipment. The video cable equalizer shall be designed to meet the following specifications:

1. Video input:	75 Ohms
2. Video output:	1 V p-p
3. Compensation at 10 MHz:	30 dB
4. Frequency response:	+ 0.1 dB per MHz up to 10 MHz
5. Differential gain:	2% maximum
6. Differential phase:	+ 1 degree maximum
7. Hum and noise:	50 dB below 0.7 V p-p

- P. Video Loss Detector and Alarm Panel:

1. Video Loss Detector: The video loss detector shall provide alarm closure and visual alarm indications when the video signal exceeds or falls below preset levels or upon loss of sync. The video loss detector shall meet the following specifications:
 - a. Input level: 2V p-p maximum
 - b. Input impedance: 10k looping
 - c. Output impedance: passive loop from input
 - d. Level adjustment: (high) 100 mV to 1V p-p; (low) 100 mV to 700 mV p-P
2. Alarm Panel: The alarm panel shall provide a visual indication of video loss status for each installed camera. The alarm panel shall meet the following specifications:
 - a. LED lamps with lamp test pushbutton
 - b. Display status and alarm states
 - c. Alarm state flashes upon initiation and holds steady upon operator initiation
 - d. Alarm state resets on removal of alarm condition
 - e. Connectorized cabling
 - f. Display expansion by 50% above base camera count
 - g. Power supply and other equipment to make panel fully functional

Q. Wires and cables between equipment assemblies and termination points within each equipment enclosure shall be furnished. Wires and cables shall be listed as being resistant to the spread of fire in accordance with the NEC, and shall be rated at 300 volts, minimum. Wires and cables servicing remote camera units shall be waterproof. Conductor material shall be soft drawn copper.

1. Video Cables: Video cables shall be as specified in Section 20 70 23 - Electronic Circuits, Wires, and Cables.
2. Control Cables: Control cables shall be multi-conductor AWG No. 18 stranded copper conductors with braided shields.
3. Power Cables: Minimum conductor size for power circuits shall be AWG No. 14.
4. Termination: All unused RF and video I/O ports shall be properly terminated to prevent transmission line reflections and mismatched impedance. Video terminators shall be designed to match the line impedance (75-Ohm) from dc to 10 MHz. RF terminators shall be designed to match the line impedance of the video distribution system (75-Ohm) from 54 to 600 MHz minimum bandwidth. Where RF terminators are used on a transmission line port with ac power superimposed on it, they shall be designed to block the power portion of the signal. Adequate care shall be exercised to ensure that all lines and ports are properly terminated and multiple termination of the same line or point shall be prevented.

R. Fiber-optic transceivers for transmission of video signals from tail-track cameras shall be furnished.

1. The transceivers shall meet the following characteristics:
 - a. Compatible with 62.5/125 low loss multi-mode glass fiber.
 - b. Nominal operating wavelength of 850/1300 nm.
 - c. Range up to 3 miles.
 - d. System bandwidth greater than 10 MHz.
 - e. Input and output impedance of 75 Ohms.
 - f. Optical loss budget greater than 15 dB.
 - g. Signal to Noise ratio greater than 45 dB.
 - h. Output adjustable to 1.0 v p-p.
2. Multimode fiber-optic cables for the tail-track cameras shall be as specified in Section 20 70 23 - Electronic Circuits, Wires, and Cables. ST type connectors with strain relief and breakout kits shall be furnished.

- S. Optical to electrical signal converters shall meet or exceed the following characteristics:
1. Input at 1310 or 1550 nm.
 2. Average input power at -12 dBm.
 3. Bandwidth 10 MHz. to 500 MHz.
 4. Output impedance at 75 Ohms.
 5. Output level 30 dBmv (per carrier)
 6. Mountable in a standard 19-inch rack.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. CCTV cameras shall be mounted in locations as indicated.
- B. Monitoring and recording equipment shall be installed in an exclusive police services equipment cabinet in the Train Control Room.
- C. Arrange wires and cables, which will be subject to twisting and bending during operation and maintenance in a manner which, will ensure that twisting and bending will occur only on longitudinal axis.
- D. All camera video coaxial cables shall be installed complying with the requirements of Section 20 70 26 - Common Materials and Methods for Electrical Systems, Section 20 70 23 - Electronic Circuits, Wires, and Cables, and Section 20 50 13 - Raceways for Facility Services.

3.02 TESTING

- A. Testing shall be performed in accordance with Section 01 45 24 - Testing Program Requirements.
 1. Horizontal resolution and video sensitivity of each camera.
 2. Horizontal resolution of each video monitor.
 3. Tests on video transmission links shall include the following requirements:
 - a. Signal levels.
 - b. Insertion gain.
 - c. Frequency response (multi-burst).
 - d. Differential phase and differential gain.

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- e. Signal-to-noise ratio.
 - f. Periodic noise or hum.
4. Input and output signal levels at all systems interfaces.

END OF SECTION 28 41 29