

**Texas Department of Transportation
Book 2 - Technical Provisions**

Horseshoe Design-Build Project

Attachment 17-1

TxDOT's Statewide Special Specifications 6025(04)

SPECIAL SPECIFICATION

6025

CCTV Field Equipment

1. **Description.** Furnish and install closed circuit television (CCTV) field equipment.
2. **Materials.** Provide new, corrosion resistant materials in accordance with the details shown on the plans and this item.

Provide CCTV field equipment including, but not limited to, the following:

- Color video camera units.
 - Camera lenses, filters, control circuits and accessories.
 - Camera housings.
 - Medium duty pan and tilt units.
 - Camera control receivers.
 - Video and camera control and power cable harnesses, connectors and coaxial cable.
 - Equipment for accommodating presets.
 - Source ID Generator.
 - When shown on the plans, Local Control Panel.
- A. Functional Requirements.** Provide CCTV Cameras in accordance with NTSC and EIA-170A. Conform the system limiting resolution to FCC regulations for broadcast signals. Provide clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to nighttime scene illumination of 0.1 ft.-candle (fc.). Maintain color quality by a continuous through the lens automatic white balance for color temperatures from 2850°K to greater than 5100°K with less than 10 IRE units unbalance.

Provide field equipment that operates in all weather conditions and able to withstand a wind load of 80 mph without permanent damage to mechanical and electrical equipment, unless otherwise shown on the plans.

Provide equipment from the same manufacturer at each field location.

B. Electrical and Mechanical Requirements.

1. **Video Camera Unit.** Provide color video cameras of solid state design, and that meet the following requirements:
 - Use Digital Signal Processing (DSP):
 - For digital zoom;
 - For Auto/Manual long-term integration (exposure) control, with built-in frame buffer;

- For Auto-focus;
 - For built-in I.D. Generator, with white letters and black outline.
 - **Image Pickup Device:** 1/4 in. single chip interline transfer solid state color matrix CCD microlens sensor
 - **Pickup Device Blemishes:** When viewing a uniform white field, there must be no blemishes for any iris opening producing any signal level between 7.5 and 100 IRE.
 - **Sensitivity:** Maintain full p-p video with 0.1 fc. 3200°K incandescent illumination on the image device face plate with AGC off.
 - **Resolution:** > 350 lines vertical and > 460 lines horizontal, measured per EIA-170A Standard.
 - **Over Exposure Protection:** The camera must not sustain any permanent damage when pointed directly at strong light sources, including the sun, for brief periods of time.
 - **Encoded NTSC Video Signal Format:** EIA-170A Standard, video output 1 Volt p-p composite. Must have up to 16 dB AGC.
 - **Output Impedance:** 75 Ohms \pm 5%.
 - **Aspect Ratio:** 4:3.
 - **Geometric Distortion:** Zero.
 - **Signal to Noise Ratio (AGC Off):** 55 dB minimum (weighted at 4.5 MHz).
 - Sensor with a minimum of 768(H) X 493(V) pixels.
 - Lens must be integral to camera assembly.
 - **Electronic Shutter Speed:** software selectable, remotely.
2. **Camera Lens.** Provide an integral lens assembly for each camera with the following features:
- An f/1.6 or better glass multi-coated zoom lens. The lens must have variable focal length from 3.9 mm to 85.8 mm.
 - Provide motorized iris control with manual override with each lens.

Provide a lens with capabilities for remote control of zoom, focus and iris operations. Provide mechanical or electrical means to protect the motors from overrunning in extreme positions. The lens and controller system must be capable of both auto iris, and remote manual iris operation. Iris must be “motorized”, as opposed to “auto iris” type, for system control compatibility.

3. **Camera Housing.** Furnish and install an environmental resistant and tamperproof housing pressurized to 5 psi dry Nitrogen with Schrader purge fitting and 20 psi relief valve for each camera.

Except for the viewing window, construct the enclosure from 6061-T6 standard aluminum tubing with a wall thickness of 0.20 in. \pm 0.03 in. Label internal wiring properly. Use a gas-tight connector at the rear plate of the housing.

The internal humidity of the housing must be less than 10%, when sealed and pressurized. Securely place desiccant packs inside the housing to absorb any residual moisture and maintain internal humidity at 10% or less.

Provide a low pressure sensor in the camera to put a “low-pressure” annotation on the video signal through the internal I.D. generator.

Construct the viewing window in such a way that unrestricted camera views can be obtained at all camera and lens positions.

Provide a sun shield to shield the entire housing from direct sunlight and vertical rainfall. Construct it in such a way as to allow the free passage of air between the housing and the shield, but it must not form a “sail” to place an excessive load on the pan/tilt unit in high winds.

Provide with an internal 15 W. low temperature heater with its own thermostat control in each housing.

Provide lightning protection as shown on the plans in each housing.

4. **Pan-Tilt Unit.** Furnish and install a medium duty, anodized aluminum weatherproof pan-and-tilt unit at each camera site on top of the camera pole. Provide a mounting plate to install the unit on the pole. Design the mounting for the camera housing and the pan-and-tilt unit to withstand the wind loading specified in Section 2.A.

Provide a unit with vertical movement of + 40° to – 90° and horizontal movement of 360° full, contiguous rotation movement. Tilt speed must be 20° per sec. and the pan speed must be up to 100° per sec. Provide a unit that is capable of simultaneous pan-and-tilt movements.

Provide a unit with a load rating compatible with that of the camera housing, camera and cabling under wind conditions specified in Section 2.A. and acceleration/deceleration conditions specified. Provide analyses of the loading on the pan-and-tilt assembly based on the above criteria.

Use Stepper motors.

Provide pan-and-tilt units that have seals and gaskets to protect the motors, gears, and cables. Provide seals and gaskets that are resistant to ozone, ultraviolet radiation, and other pollutants inherent to local environmental conditions.

5. **Local Control Panel.** Provide Local Control Panel that meet the following specific requirements without use of a laptop:

- Pan Left.
- Pan Right.
- Tilt Up.
- Tilt Down.
- Zoom In.

- Zoom Out.
 - Focus Near.
 - Focus Far.
 - Manual and Auto Iris control.
 - Iris Open.
 - Iris Close.
 - Pan/Tilt Position preset.
 - Camera Power (Latching).
 - Remote white balance control.
 - Auto and Manual white balance control.
 - Zoom and focus position preset.
6. **Control Receivers.** Mount the camera control receiver inside the camera unit. It must execute camera and lens functions and must also forward communication of commands for the pan/tilt functions to the pan/tilt control receiver. Mount the pan/tilt control receiver inside the pan/tilt unit. Provide camera and pan/tilt functions that are operable via RS-422 serial communications.

Provide control receivers that receive the command data from the camera controller and decode the digital command data signals transmitted through the communication transmission interface, perform error checking and act on valid data to drive the pan/tilt unit and the camera controls. Detail the communications transmission interface on the plans. Provide control receivers that are fully compatible with the existing camera controller shown on the plans.

Provide control receivers that meet the following specific requirements:

- **Camera remote control functions:** Provide units with, as a minimum, control and drive circuits for the following functions:
 - **DSP Functions:** Zoom, Long-Term Exposure, Auto-Focus, Auto/Manual focus Control, I.D. Generator Operation, and Alarm function Control.
 - Pan/Tilt Position preset.
 - Pan Left.
 - Pan Right.
 - Tilt Up.
 - Tilt Down.
 - Zoom and focus position preset.
 - Zoom In.
 - Zoom Out.
 - Focus Near.
 - Focus Far.

- Manual and Auto Iris control.
 - Iris Open.
 - Iris Close.
- Camera Power (Latching).
- Remote white balance control.
- Auto and Manual white balance control.
- One auxiliary output (unless specified otherwise in the plans).
- **Controller Address:** Provide each unit with a unique programmable address. Provide units that respond to the central command if and only if they are addressed.
- **Power Supplies:** Provide power supplies required to operate the camera, pan/tilt, and lens movements and include them with the housing, camera control receiver, and pan/tilt unit.
- **Communications Interface:** Provide a camera control receiver that interfaces to the communications backbone through an EIA-232C/D port. When indicated on the plans, provide communications signals, data exchange protocol and timing that is compatible with the communications equipment and with the existing master controller in the satellite building. Use a minimum 9600 Baud data rate. Data must be sent asynchronously as either 8 bit with no parity, or 7 bit with parity. Each block of data must include a camera identifier and be accompanied by a checksum calculated on the entire block. Blocks with a bad checksum must be NAKed. Block with a good checksum must be ACKed. If the field unit must transmit data to the control unit at the Satellite Building, it must raise the RTS line and keep it raised until all data has been sent. Provide a field unit that will not transmit data unless the CTS line from the communications equipment is raised. Provide the camera control receiver connectors and harness to connect to the communications equipment interface. Supply complete hardware interface and protocol description to the Department as part of the required documentation.

Provide RS-232 to RS-422 external powered converter that is an integral part of the video communication junction box.

- **Power Input:** 115 VAC plus or minus 10%, 60 Hz \pm 3 Hz, 50 W. Maximum.
- **Connectors:** Provide and install connectors which are compatible with the communications equipment interface. Use Connectors for connections at the pan/tilt mechanism. Make connections through a pigtail with a connector on it coming out of the bottom center of the pan/tilt unit. Provide the connector on the pigtail that is an AMP type connector. Provide connections down to the pole to the transmission cables to this connector. Supply mating connectors. Provide connector pins and mating connectors that are plated to ensure good electrical connection and resist corrosion. Use pressure tight multi-conductor MS-type cable connectors for camera connections.

7. **Source ID Generator.** Provide the built-in I.D. Generator that inserts camera ID over each of the camera generated videos.

Submit a list of proposed camera identification text to the Engineer for approval before the ID is programmed.

Once programmed, the programmed ID must automatically be displayed with its associated video signal.

Provide the source ID generator that will automatically “pass through” video in case of equipment failure.

When indicated on the plans, provide the source ID generator that is compatible with the existing camera controller shown on the plans.

8. **Video Communication Junction Box.** Install the video communication junction box in the CCTV equipment cabinet or in the surveillance cabinet, as shown on the plan and as directed by the Engineer. Provide the video communication junction box that contains the lightning protection devices for data, power, and video. The junction box must be grounded very well to the earth ground. Provide the junction box that has connectors for inputs and outputs for data, power, and video. Make testing and connections to communication devices through these external connectors.

9. **Surge Protection.** Provide the camera installation that meets the following requirements:

- Pole mounting adapter -- Electrically bonded to pole.
- Pan/tilt mechanism -- Electrically bonded to adapter.
- Camera housing -- Electrically bonded to pan/tilt unit.

10. **Power and Control Cable Surge Protector.** Protect each power conductor and each control conductor (including return conductors) by the appropriate surge protector. House the protective devices in each of the surveillance cabinets.

11. **Power Requirements.** Provide CCTV field equipment that meets its specified requirements when the input power is 115 VAC \pm 10%, 60 Hz \pm 3 Hz. The maximum power required must not exceed 350 W.

Provide equipment operations that are not affected by the transient voltages, surges and sags normally experienced on commercial power lines. Check the local power service to determine if any special design is needed for the equipment. The extra cost, if required, must be included in the bid of this item.

12. **Primary Input Power Interruption.** Provide CCTV field equipment that meets the requirements in Section 2.1.4. “Power Interruption” of the NEMA Standard TS2 for Traffic Control System.

13. **Power Service Transients.** Provide CCTV field equipment that meets the requirements of Section 2.1.6., “Transients, Power Service” of the NEMA Standard TS2.

- 14. Wiring.** Provide wiring that meets the requirements of the National Electric Code. Provide wires that are cut to proper length before assembly. Do not doubled-back wire to take up slack. Lace wires neatly into cable with nylon lacing or plastic straps. Secure cables with clamps. Provide service loops at connections.

Provide coaxial cable between the camera and the communications equipment interface that is of the RG-59 type with a stranded center conductor and 100% shield coverage. Provide coaxial cable that has a cellular polyethylene dielectric.

- 15. Transient Suppression.** Provide DC relays, solenoids and holding coils that have diodes or other protective devices across the coils for transient suppression.

- 16. Power Service Protection.** Provide equipment that contains readily accessible, manually resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

Provide and size circuit breakers or fuses such that no wire, component, connector, PC board or assembly must be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element or wiring.

- 17. Fail Safe Provision.** Provide equipment that is designed such that the failures of the equipment must not cause the failure of any other unit of equipment.

- 18. Modular Design.** Provide CCTV field equipment that is modular in design to allow major portions to be readily replaced in the field. Identify modules and assemblies clearly with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

- 19. Connectors and Harnesses.** Provide external connections made by means of connectors. Provide connectors that are keyed to preclude improper hookups. Color code and/or appropriately mark wires to and from the connectors.

Provide connecting harnesses of appropriate length and terminated with matching connectors for interconnection with the communications system equipment.

Provide pins and mating connectors that are plated to improve conductivity and resist corrosion. Cover connectors utilizing solder type connections by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

- C. Environmental Design Requirements.** Provide equipment that meets its specified requirements during and after subjecting to any combination of the following conditions.

- Ambient temperature range of 0°F to 140°F.
- Temperature shock not to exceed 30°F per hour during which the relative humidity must not exceed 95%.
- Relative humidity range not to exceed 95% over the temperature range of 40°F to 110°F.
- Moisture condensation on exterior surfaces caused by temperature changes.

Provide camera and environmental housing assemblies that perform to stated specifications over an ambient temperature range of -35°F to $+130^{\circ}\text{F}$ and a humidity range of 0% to 100 % condensing. The camera must operate without sustaining damage over temperature range of -35°F to 140°F .

3. Construction Methods.

- A. General.** Provide equipment that utilizes the latest available techniques for design and construction with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

- B. Electronic Components.** Provide electronic components in accordance with Special Specification, "Electronic Components".

- C. Mechanical Components.** Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws will be used. Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass. Protect materials from fungus growth and moisture deterioration. Separate dissimilar metals by an inert dielectric material.

4. **Testing.** Perform testing in accordance with Article 2, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty".
5. **Training.** Provide training in accordance with Article 3, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty".
6. **Documentation.** Provide documentation in accordance with Article 4, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty".
7. **Warranty.** Provide a warranty in accordance with Article 6, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty".
8. **Measurement.** This Item will be measured as each unit furnished, installed, and tested.
9. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "CCTV Field Equipment". This price is for equipment, cables and connectors; documentation and testing; and labor, materials, warranty, training and incidentals.