STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625

METRIC SPECIFICATIONS FOR CCTV ASSEMBLY (REMOTE COLOR CONTROL)

N.J. Specification No. EBM-CCTV-COLOR Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for a remotely controlled color closed circuit television camera assembly.

The purpose of these specifications is to describe the minimum acceptable design and operating requirements for this equipment.

GENERAL - I

1-1 Components

The Color CCTV system shall include the camera, zoom lens, environmental enclosure, PTZ mounting, control receiver junction box, and all miscellaneous hardware and incidental components required to deliver a fully operational sub-system. The mounting standard is not included in the assembly described in this specification.

1-2 Environment

All CCTV components, while housed in their associated environmental enclosures, shall operate in the ambient temperature range of -40 °C to +55 °C and shall meet NEMA 4 weatherproof standards.

1-3 Testing

All units shall be subject to factory and prototype testing as described in Section VIII of this specification.

1-4 Mounting

The Color CCTV assembly shall be mounted as described in this specification. The supplier shall provide all incidental components, mounting brackets, and cabling required to achieve a fully functional assembly as illustrated in the contract drawings and in conformance with NJDOT standards.

1-5 Equipment Compatibility

In order to insure compatibility between the components, the camera, environmental enclosure, zoom lens, PTZ mounting, and Receiver Junction Box electronics, must all be integrated by an experienced video system engineering firm. The firm must have delivered at least one hundred (100) outdoor CCTV assemblies comparable to that

required by this document.

The integrator must have at least five (5) full time factory-trained and certified technicians and/or engineers who are rated for the components to be utilized. The video supplier shall be able to provide on-site service anywhere in New Jersey within eight hours notice. The video supplier shall accept full warranty responsibility and regular support service for the complete CCTV package.

1-6 Electrical Power

All CCTV components must operate on standard 120 volts AC electrical service. The equipment shall operate over a voltage range of 105 to 125 volts AC at 60 hertz. Maximum power requirements for the entire assembly must not exceed 1 000 watts.

1-7 Options

The Color CCTV assemblies shall operate in two basic configurations. The first configuration shall connect the CCTV assembly to a Central Site or Video Collection Node (VCN) via a fiber-optic modem. This modem shall transmit full motion video to the receiver in one direction and shall pass control data and return PTZ status in both directions. The second configuration shall return slow-scan video over a dial-up phone connection.

The CCTV assembly shall be able to support both types of operation. However, neither the fiber-optic modem nor slow-scan unit are defined in this specification. Space provisions must be made for either type of communication unit, utilizing typical components, in the Camera Junction Box described in this specification.

COLOR CCTV CAMERA - II

2-1 Basic Configuration

The CCTV camera shall be a 12.7 millimeter or 8.5 millimeter format CCD (Interline transfer Charged Coupled Device) which has been designed to require no preventive maintenance or adjustments. The CCD shall be blemish-free. The CCD shall be designed to minimize or eliminate transfer smear and insure acceptable operation during minimal lighting conditions. The camera shall be capable of unattended, continuous 24 hour per day operation in an outside plant environment.

The camera shall be fully integrated with the zoom lens described under Section III of this specification. The camera shall accept standard C or CS zoom or fixed lenses and shall be equipped with an auto-iris lens connector compatible with the zoom lens supplied. The unit shall produce NTSC compatible video utilizing a 1 volt Peak to Peak composite and S-VHS Y/C output. The camera must be fully compliant with all aspects of the NTSC specification.

2-2 Resolution and Sensitivity

At least 460 horizontal TVL lines must be produced by the camera. At least 786 horizontal and 494 vertical active pixels must be produced by the assembly.

The night sensitivity of the camera is a key concern in that the unit may have to operate in areas with no primary lighting system. Usable video (80% Peak to Peak Video Output Signal) shall be obtainable with a scene illumination of 0.1 lux.

Full video shall be obtainable at 4 lux. Both lux measurements are based on an f/1.4 lens with a 75% highlight reflectance measured at the camera face plate.

Signal-to-noise ratio shall exceed 46 decibels. The camera shall be equipped with AGC (Automatic Gain Control) with 0 - 20 decibel range. The AGC feature shall be switch selectable (On/Off) and be equipped with a variable peak average control.

2-3 Synchronization and Automatic Controls

Synchronization shall be via AC line frequency line-lock with phase adjust. Line-lock synchronization utilizes the AC power frequency (60 hertz) for the vertical sync reference. This synchronization method allows for roll-free vertical interval switching at the monitor station. The camera shall also provide two other modes of synchronization; true NTSC via an internal crystal and Genlock via composite video or black burst. An internal Isolation transformer shall be provided to reduce ground loop potential and allow multiple cameras to be powered from a single power supply.

A variable speed electronic shutter shall also be provided. The automatic shutter speeds shall be adjustable from 1/60 to 1/10 000 in 1-stop increments.

The camera shall have continuous automatic (through the lens) white balance control and black light compensation circuitry to adjust the picture dynamically in response to the varying light conditions encountered in outside environments. In this regard, pictures with an appropriate color balance shall be obtainable within all specified illumination conditions.

2-4 Camera Control Cables

The Camera Control cables shall consist of a Pan-Tilt Cable and a Focus-Zoom Cable. The Pan-Tilt and Focus Zoom Cables shall meet the following criteria, as a minimum:

- 12c/ #22 A WG, tin copper stranded, PVC insulated, PVC jacket, Color coded,
- EIA RS-232, Control and Audio applicable, UL recognized,
- Rated at 600 volt; 80°C, shall be suitable for outdoor applications

The Pan-Tilt cable shall be designated as type PT. The Focus-Zoom cable shall be designated as type FZ and shall be color coded as shown in the contract plans.

2-5 Video Cable

For underground cable runs, (if fiber is not used) the Video Cable shall be specified as a

double shielded RG6U Coaxial type for video applications. Its jacket shall be as specified for outdoor and underground usage and it shall be UL certified.

From the Control/Receiver Junction Box to the camera (up the pole), the Video Cable shall meet the following criteria, as a minimum:

- RG-59/U Type Standard Analog Video Coax
- 22 A WG (7 x 30) stranded bare copper conductor, 0.762mm diameter
- Foam polyethylene insulation, 3.71mm diameter
- Bare copper braid shield, 95% coverage
- Black PVC jacket, 6.15mm diameter
- UL/NEC: CM or A WM 1354, C(UL): CM
- Shall be suitable for outdoor applications

2-6 Camera and Housing Power Cable

The camera and housing power cable shall meet the following criteria, as a minmum:

- 4c/ # 16 A WG, tin copper stranded, PVC insulated, PVC jacket, Color coded,
- EIA RS-232, Control and Audio applicable, UL recognized,
- Rated at 600 volt; 80°C, shall be suitable for outdoor applications

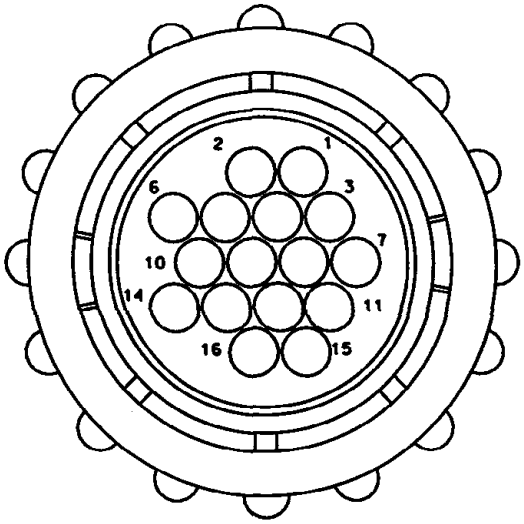
The Camera and Housing Power Cable shall be designated as Type CHP and shall be color coded as shown in the contract plans.

There shall be a free hanging connector assembly midway between the camera housing and CGB outlet on the hand-hole. See contract plans for further details. The connector assembly shall be a CPC type and conform to AMP Specification No. 108-10024 to the latest revisions. This connector assembly shall provide ease of maintenance to the camera and housing. The male end of the connector shall be with the camera and housing. The female end shall accommodate the Video, Camera-Housing Power, and Focus-Zoom Cables. The Pin-out shall be shown in the contract plans. Shrink tubing and Silicone shall be used to seal cable entry ends of all connectors. The Video, Camera-Housing Power, Pan-Tilt and Focus-Zoom Cables shall be contained in a nylon sleeving harness.

A typical pin layout for the female end of the free hanging connector is shown(Figures No. 1 and No. 2) here for convenience.

FIGURE No. 1

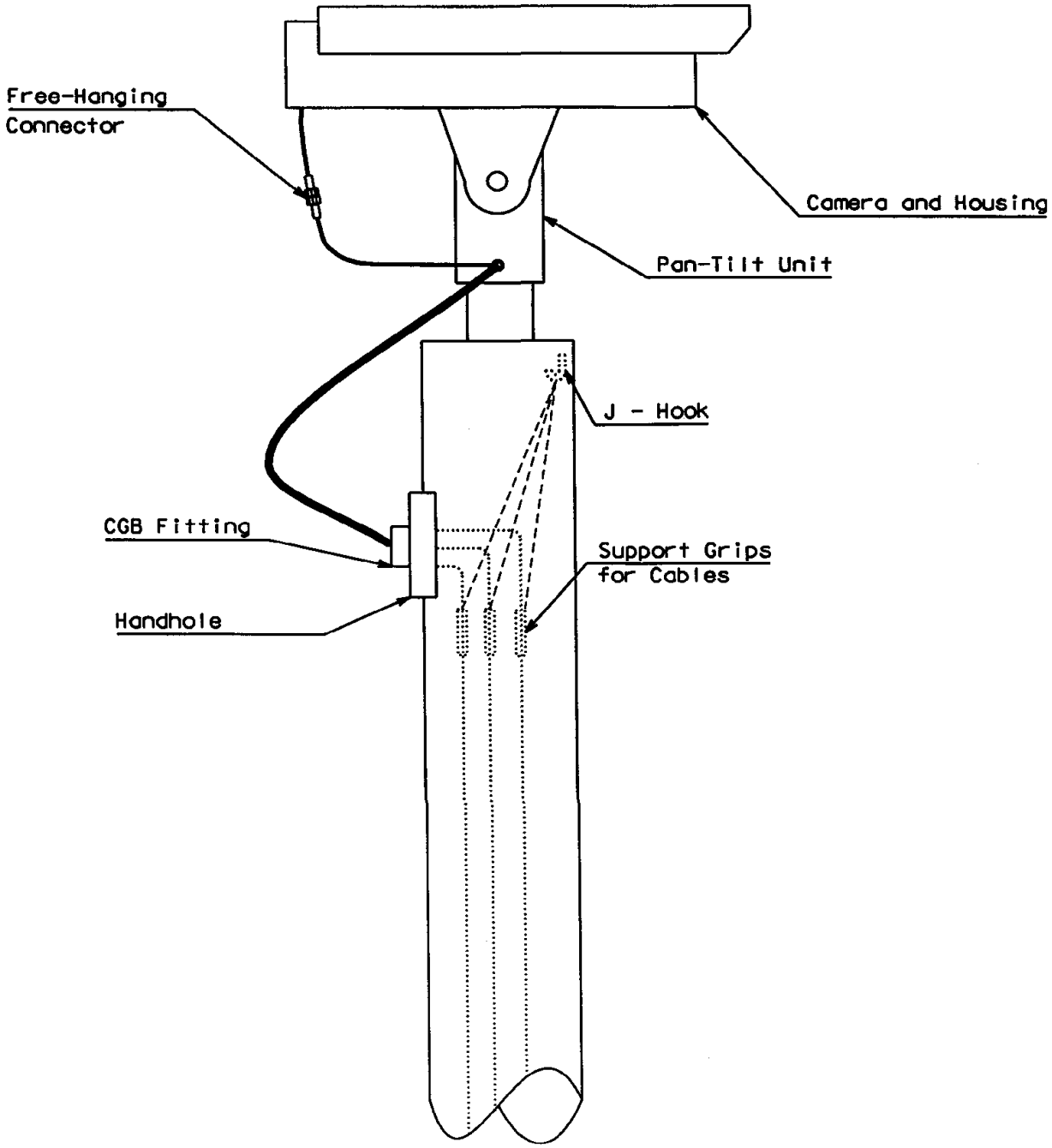
FEMALE END OF CONNECTOR



PIN NUMBER	DESCRIPTION	CABLE TYPE / COLOR DESIGNATION
1	VIDEO SIGNAL	COAX
2	COAX SHIELD	COAX
3	FOCUS MOTOR	F-Z / Orange
4	LENS COMMON	F-Z / Purple
5	(-) REF	F-Z / Green
6	FOCUS POT	F-Z / Blue
7	(+) REF	F-Z / Brown
8	ZOOM MOTOR	F-Z / Yellow
9	LENS COMMON	F-Z / Red
10	(+) REF	F-Z / Grey
11	ZOOM POT	F-Z / White
12	(-) REF	F-Z / Black
13	CAMERA POWER (HOT)	CHP / Red
14	CAMERA POWER (NEUTRAL)	CHP / Green
15	HOUSING POWER (HOT)	CHP / Black
16	HOUSING POWER (NEUTRAL)	CHP / White

FIGURE No. 2

TYPICAL CCTV MOUNT



ZOOM LENS - III

3-1 Basic Configuration

A fully motorized zoom lens fully compatible with the camera specified in Section II is to be supplied. The zoom lens shall be capable of supplying magnification in the range of 1 to 10X. The lens must have an auto-iris capability compatible with the camera. The lens F-STOP shall not exceed 1.2.

3-2 Field of View

The camera and associated zoom lens shall produce the following minimum field of view at 30 meters from the camera face plate in the 1X setting:

Horizontal	=	24 meters
Vertical	=	18 meters

3-3 Remote Control

The zoom magnification shall be fully controllable via the remote PTZ mechanism. The motors controlling the Iris, Zoom, and Focus shall be slip clutch protected to prevent damage due to overload. The following lens travel times from limit to limit shall define the acceptable ranges:

Iris	=	0 to 1 second
Zoom	=	2 to 5 seconds
Focus	=	2 to 5 seconds

ENVIRONMENTAL ENCLOSURE - IV

4-1 Basic Configuration

The environmental enclosure shall be designed to protect the camera and zoom lens from the outdoor environment which the assembly must be designed to function in. The enclosure shall not exceed 176.53 by 158.75 by 558.80 millimeters. The assembly must be supplied with an integral sun shield. The camera, zoom lens, and environmental housing must not weigh more than 11.3 kilograms. If a side mounted enclosure is utilized it shall not weight more than 5.4 kilograms.

The housing shall be constructed of aluminum and be finished with white or beige, weatherproof, heat-reflecting paint. The enclosure shall protect the camera and zoom lens from harsh outdoor weather conditions. It shall provide a sealed, marine climate resistant, protective environment meeting NEMA-4 (IP65) weatherproof standards.

4-2 Zoom Lens Clearances

The camera and zoom lens shall be mounted to insure that the enclosure will not

obstruct the field of view of the camera. Sufficient clearance between the zoom lens extended to its furthest point of travel and the enclosure face plate shall be provided to insure that mirroring on the window will not be obtained.

4-3 Heater

The enclosure shall be equipped with a heater controlled by a thermostat. The heater shall engage when temperature within the enclosure falls below 4 °C. The heater should disengage when temperatures exceed 10 °C. The heater shall minimize internal fogging of the face plate when the assembly is operated in cold weather.

4-4 Cable Entry

Power, composite video output, and remote camera control and monitor functions shall be via weatherproof UL listed connectors intended for outdoor use. Sufficient cable lengths shall be provided to reach the Control Receiver Junction Box which may be located as much as 3 meters away.

4-5 Mounting to PTZ Mechanism

The mounting assembly of the environmental enclosure shall be attached to the PTZ base assembly by stainless steel circular clamps. Each circular clamp shall be torqued to 13.6 kilograms.

WEATHERPROOF HEAVY DUTY PAN AND TILT DRIVE - V

5-1 Basic Configuration

A full feature Pan and Tilt Drive shall be supplied as part of the camera assembly. Heavy duty is defined as the ability of the unit to handle loads of up to 41 kilograms. The PT drive shall meet NEMA-6 weatherproof standards and operate within a temperature range of -20 °C to +80 °C. The unit shall not weigh more than 27 kilograms. The PT drive shall terminate on a circular base suitable for mounting on the top of NJDOT camera poles utilizing 8 bolts arranged in an equidistant circular arrangement.

5-2 Mechanical Specifications

Pan (Horizontal) = 0-355 degrees / 6 degrees per second minimum

Tilt (Vertical) = +/- 90 degrees / 3 degrees per second minimum

The unit shall have an external pan and tilt limit adjustment. For installed units, the Engineer shall direct the appropriate limit adjustment as part of the installation test procedure.

An adjustable worm gear final drive shall be provided to prevent drift and minimize backlash. The unit shall not require springs or counter balances to provide smooth camera movement.

Internal electrical connections shall be made through a retractile cord which eliminates any wire fatigue during normal and random scan operation.

Five-amp limit switches for Pan and Tilt shall be provided to guard against motor burn-out.

The unit shall be supplied with sufficient cable to reach the Control Receiver Junction Box .

5-3 Position Feedback

The Pan and Tilt mount shall be equipped with a position feedback monitor which shall assist in positioning the unit to preset positions. The feedback monitor information shall be available via the data port of the Relay Control box.

CONTROL/RECEIVER JUNCTION BOX - VI

6-1 Basic Configuration

The Control/Receiver Junction Box shall contain the necessary electronics to fully control and monitor the PTZ mechanisms. The controller shall have an RS232 interface port which can provide full control and feedback to any external computer or modem with a compatible asynchronous interface. The controller must be capable of storing at least 16 pre-set specifications of PTZ.

6-2 NEMA Enclosure

All of the components of the Control/Receiver Junction Box shall be housed in a NEMA 3R Small Single Door Enclosure or equivalent. The outside dimension of the cabinet shall not exceed 670 by 441 by 381 millimeters. The cabinet shall be supplied with a 20 amp AC circuit breaker and a minimum of a 3 segment standard 115 volts AC convenience panel. At least one of the AC receptacles must be equipped with a GFCI (Ground Fault Circuit Interrupter). The cabinet shall be supplied with a lock. The lock shall be CCL 2-NJIVHS type, or equal. One key shall be supplied with each lock. The keys shall be removable in the locked position only. The cabinet must be suitable for pole and wall mounting and must be supplied with all required mounting hardware. In addition to the control/receiver, the cabinet must be able to house the following components:

A. Fiber-Optic Patch Panel

The control assembly shall contain a six position fiber-optic patch panel assembly. This assembly shall consist of a flange with six holes drilled out. Standard ST mechanical couplers (Dual-Sided) shall be mounted in these holes. For assemblies designated for use in a fiber-optic network, two (2) standard ST patch cords of at least 2 meters in length, shall be supplied which will allow

connection to the Video/Data short-haul modem.

B. Modular Telephone Plug

The cabinet shall be supplied with a standard 4-wire modular phone jack which is suitable for termination of outside plant phone service.

C. Fiber-Optic/Slow Scan Modems

The Control/Receiver cabinet shall have sufficient space to house either a short haul fiber-optic modem or a slow scan telephone modem as defined by the requirements of the NJDOT specifications for either unit. The modem is not included in this specification. However, the composite video output from the camera and the PTZ control port shall be terminated appropriately for direct connection to either type of communication interface.

D. Heater/Fan

The enclosure shall be equipped with a heater controlled by a thermostat. The heater shall engage when temperature within the enclosure falls below 4°C. The heater should disengage when temperatures exceed 7°C. The heater shall be sufficient to maintain the inside temperature of the cabinet above 0°C as long as the outside temperature remains above -20°C.

A thermostat controlled ventilation fan of adequate capacity for the NEMA 3R enclosure, shall also be provided which shall engage above 35°C and turn off below 29°C. The purpose of the fan is to maintain air flow in the cabinet when the assembly is operated on high temperature days.

6-3 Manual PTZ Controls

The Control/Receiver shall contain a switch panel which can be utilized to manually exercise the Pan, Tilt, and Zoom functions in the field.

6-4 PTZ Protocol

The receiver driver shall interface Pan, Tilt, Zoom and Auxiliary functions with ASCII codes via RS-232 for operation on computer grade cable, modems, fiber optic or rapid-scan phone line data transmitters to interface with the control system.

The PTZ receiver shall interface to an external system over an RS232 port utilizing an asynchronous protocol. The software protocol for the unit must be supplied as part of the submittals for the assembly and in the operations/maintenance manuals provided. All PTZ features shall be supported via this protocol. In addition, feedback shall be provided which contains the current coordinates of the PTZ mountings.

MSDOS PC BASED DIAGNOSTIC SOFTWARE - VII

With the delivery of the first camera assembly and every ten subsequent assemblies from a

given manufacturer, a diagnostic software program on 90 millimeter floppy disk and a null-modem connection cable shall be supplied to NJDOT. This null-modem cable shall contain an RS232 to RS422 converter which will allow a standard DB-9 RS232 port of a notebook computer to communicate with the PTZ controller. The purpose of this program is to allow a camera assembly to be field tested and exercised.

7-1 Hardware Platform

The diagnostic program shall be designed to operate on a typical PC notebook computer operating under MSDOS 5.0 or above. The software shall operate in CGA graphics mode and shall be designed for operation on a monochrome display. The program shall contain settings which will allow selection of COM1, COM2, COM3, or COM4. The program shall operate concurrently with MSDOS 5.0 or above within a standard 640 kilobyte memory. In addition, the program and all required data files shall be operational from a single 720 kilobyte, 90 millimeter floppy disk. State-of-the-art operator interface programming techniques shall be utilized.

A "null-modem" cable of at least 15 meters in length shall be supplied which will allow the standard DB-9 port of a notebook computer to be connected to the Control/Receiver RS232 port.

7-2 Functionality

The Control Program shall allow the operator to fully control and monitor the PTZ functions from the notebook keyboard. The software shall also allow the operator to define and store up to 16 pre-set locations in permanent memory. The program shall utilize standard keyboard keys, such as the arrows, to perform camera functions. In that the program is intended for operation in the field, mouse control is not adequate, but can be utilized as a secondary command source. A user friendly interface shall be provided based on modern programming techniques.

TESTING - VIII

All CCTV assemblies shall be subject to factory and prototype testing as subsequently described. The CCTV factory test shall be held at a facility in New Jersey which is fully equipped to operate under various lighting levels. The facility shall be equipped with measurement devices which can be utilized to verify that the assembly is compliant with the specifications. The indoor test shall verify that the camera, zoom lens, environmental enclosure, and PT mounting are fully operational and compliant. The PC based diagnostic facility shall be utilized to fully exercise the remote capability of the system. In addition, the test shall simulate various lighting conditions and demonstrate that the assembly is operable at the minimum lux levels required by the specifications. The factory test shall also demonstrate or provide confirmation that all of the equipment operates over the specified environmental range for each component.

The second part of the test shall exercise the camera in an outdoor environment in close proximity to a busy highway. The test shall be conducted in daylight and nighttime conditions. The supplier shall be responsible for submitting a test plan which has been designed to exercise and monitor the equipment for the purpose of determining compliance with the

specifications.

TRAINING - IX

Prior to the acceptance of the first unit of each type, training shall be provided for the Department's engineering, maintenance and operations staff, at a facility provided by the Department. The training shall include all material and manuals required for each participant. The training shall be as follows:

9-1 Maintenance Training

The training shall be provided for a minimum of 60 hours for at least five (5) personnel with an electronics background. The training shall include operation instructions, theory of operation, circuit description, field adjustments, preventive maintenance procedures, troubleshooting, operation of diagnostic and configuration software, and repair of all components.

9-2 Engineering Training

The training shall be provided for a minimum of 32 hours for at least twenty (20) engineering and operations personnel. The training shall include a complete demonstration of the operation and capabilities of the equipment. This session should include a complete review of any field adjustments or calibration of the transmission equipment which may be necessary for optimum performance and should stress day-to-day operation and isolation of problems down to the unit level. For example, procedures should be discussed of identifying a faulty module in the field, as opposed to board level repairs covered in Section IX-1. Particular attention shall be given to the operation of the PC based diagnostic control software package.

INSTRUCTIONS AND GUARANTEES - X

10-1 One set of complete schematics and operations/maintenance manuals of the each component of the camera assembly shall be supplied with each five assemblies furnished. Maintenance manuals shall include complete sub-component parts listing.

10-2 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of ITS Engineering, New Jersey Department of Transportation, P.O. Box 613, 1035 Parkway Avenue, Trenton, New Jersey 08625.

10-3 The complete camera assembly shall carry a two-year guarantee from the date of acceptance against any imperfections in workmanship or materials.

10-4 The manufacturer agrees upon the request of the Manager, Office of ITS Engineering to deliver to the Office, a sample of the complete camera assembly to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.

10-5 The supplier shall furnish any and all equipment which they deem necessary for safe and reliable field operation of the camera equipment as part of the quoted price for the specified equipment.

10-6 All camera components furnished under this specification must be current production equipment and of recent manufacturer, identical models of which are in field operation in not less than 100 locations in the United States or Canada. Untried or prototype units shall not be considered for acceptance.

10-7 All major components shall be identified with a metal plate containing the serial number with a bar code identification.

10-8 Any repairs made by a manufacturer or representative shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs must be completed within thirty days of delivery of the equipment to the designated repair depot.