

FOR INFORMATIONAL USE ONLY - NOT TO BE USED FOR BIDDING PURPOSES

**NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
 BID SHEET FOR LONG BEACH ROAD SIGNAL EXPANSION PHASE 9
 CONTRACT: T62457-01G**

Nassau County DPW

SCHEDULE OF PRICES

ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
203.02	545 CY	UNCLASSIFIED EXCAVATION AND DISPOSAL FOR: _____				
203.06	5 CY	SELECT FILL FOR: _____				
206.03010010	7415 LF	CONDUIT EXCAVATION AND BACKFILL - (RESTORING TOP SURFACES NOT INCLUDED) FOR: _____				
206.03100010	100 LF	TRAFFIC SIGNAL CONDUIT EXCAVATION AND BACKFILL FOR: _____				
206.05	10 EACH	TEST PIT EXCAVATION FOR: _____				
402.098101	277 TON	9.5 F1 TOP COURSE ASPHALT, 80 SERIES COMPACTION FOR: _____				
404.258901	1902 TON	25 F9 BINDER COURSE ASPHALT, 80 SERIES COMPACTION FOR: _____				

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 Long Beach Road Traffic Signal Expansion Ph 9-PIN 0760 46

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS			
407.0102	1443 GAL	DILUTED TACK COAT FOR: _____			
418.7603	6032 LF	ASPHALT PAVEMENT JOINT ADHESIVE FOR: _____			
520.09000010	6032 LF	SAW CUTTING ASPHALT CONCRETE FOR: _____			
608.0101	552 CY	CONCRETE SIDEWALKS AND DRIVEWAYS FOR: _____			
608.01050010	215 CY	CONCRETE SIDEWALKS - UNREINFORCED (GRADING INCLUDED) FOR: _____			
608.03	50 SY	BRICK PAVED SIDEWALKS AND DRIVEWAYS (SAND SETTING BED) FOR: _____			
608.21	104 SY	EMBEDDED DETECTABLE WARNING UNITS FOR: _____			

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
609.04010510	46 LF	CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE VF-150 FOR: _____				
610.1403	3 CY	TOPSOIL - LAWNS FOR: _____				
610.1602	25 SY	TURF ESTABLISHMENT - LAWNS FOR: _____				
610.19	10 MGAL	WATERING VEGETATION FOR: _____				
619.01	1 LS	BASIC WORK ZONE TRAFFIC CONTROL FOR: _____				
619.1611	336 INT/MO	MAINTAIN TRAFFIC SIGNAL EQUIPMENT, REQUIREMENT "A" FOR: _____				
625.01	1 LS	SURVEY OPERATIONS FOR: _____				

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635.0103	40186 LF	CLEANING AND PREPARATION OF PAVEMENT SURFACES - LINES FOR: _____				
635.0303	21 EACH	CLEANING AND PREPARATION OF PAVEMENT SURFACES - SYMBOLS FOR: _____				
645.5101	56 SF	GROUND-MOUNTED SIGN PANELS WITHOUT Z-BARS FOR: _____				
645.81	29 EACH	TYPE A SIGN POSTS FOR: _____				
645.85	7 EACH	POLE MOUNTED SIGN SUPPORT SYSTEM (BAND MOUNTED) FOR: _____				
647.31	29 EACH	RELOCATE SIGN PANEL, SIGN PANEL ASSEMBLY SIZE I (UNDER 30 SQUARE FEET) FOR: _____				
647.51	1 EACH	REMOVE AND DISPOSE SIGN PANEL, SIGN PANEL ASSEMBLY SIZE I (UNDER 30 SQUARE FEET) FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
647.61	2 EACH	REMOVE & DISPOSE SIGNS, GROUND MOUNTED TYPE A SIGN SUPPORTS & FOUNDATIONS (UNDER 30 SQ FT) FOR: _____				
647.64	6 EACH	REMOVE AND DISPOSE HIGH CAPACITY TYPE A GROUND MOUNTED SIGN SUPPORT AND FOUNDATION FOR: _____				
662.60030008	3 EACH	ALTERING ELEVATION OF GAS VALVE BOXES FOR: _____				
662.62000010	5 EACH	RESETTING CASTINGS ON EXISTING UTILITY MANHOLES FOR: _____				
663.33	2 EACH	ADJUST EXISTING VALVE BOX ELEVATION FOR: _____				
670.1206	2 EACH	6 FT ALUMINUM SINGLE MEMBER BRACKET ARM FOR: _____				
680.050200NA	8 EACH	FURNISH AND INSTALL VIDEO VEHICLE DETECTION EQUIPMENT FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.110008NA	36 EACH	FURNISH AND INSTALL 8 FOOT SIGNAL POST FOR: _____				
680.110010NA	16 EACH	FURNISH AND INSTALL 10 FOOT SIGNAL POST FOR: _____				
680.130001NA	1 EACH	FURNISH AND INSTALL ELECTRICAL DISCONNECT / GENERATOR TRANSFER SWITCH FOR: _____				
680.321001NA	14 EACH	FURNISH & INSTALL MODEL 2070 LX LITE CONTROLLER UNIT FOR: _____				
680.332002NA	3 EACH	FURNISH & INSTALL MODEL 332 CABINET WITH AUXILIARY OUTPUT FILE AND EQUIPMENT FOR: _____				
680.336002NA	10 EACH	FURNISH & INSTALL MODEL 336SX CABINET AND AUXILIARY EQUIPMENT FOR: _____				
680.5001	160 CY	POLE EXCAVATION AND CONCRETE FOUNDATION FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.5002	4 EACH	CONCRETE BASE FOR CONTROLLER CABINET FOR: _____				
680.51000010	15 EACH	ALTER ELEVATION OF PULLBOXES FOR: _____				
680.51050010	63 EACH	PULLBOX, RECTANGULAR REINFORCED CONCRETE (26" X 18") FOR: _____				
680.51100010	12 EACH	CLEAN EXISTING PULLBOX FOR: _____				
680.51300010	1 EACH	CAST-ALUMINUM PULLBOX FOR: _____				
680.51400010	1 EACH	CONCRETE FIBER OPTIC PULLBOX FOR: _____				
680.520102	251 LF	CONDUIT, METAL STEEL, ZINC COATED, 3/4" FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.520104	929 LF	CONDUIT, METAL STEEL, ZINC COATED, 1 1/4" FOR: _____				
680.520106	160 LF	CONDUIT, METAL STEEL, ZINC COATED, 2" FOR: _____				
680.520108	7604 LF	CONDUIT, METAL STEEL, ZINC COATED, 3" FOR: _____				
680.53010010	250 LF	CLEAN EXISTING CONDUIT FOR: _____				
680.54	3636 LF	INDUCTANCE LOOP INSTALLATION FOR: _____				
680.700606	10 EACH	RISER ASSEMBLY, 2" DIAMETER FOR: _____				
680.72	7830 LF	INDUCTANCE LOOP WIRE FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.730214	23308 LF	SIGNAL CABLE 2 CONDUCTORS, 14 AWG FOR: _____				
680.730314	18733 LF	SIGNAL CABLE 3 CONDUCTORS, 14 AWG FOR: _____				
680.730514	4758 LF	SIGNAL CABLE 5 CONDUCTORS, 14 AWG FOR: _____				
680.730714	3386 LF	SIGNAL CABLE 7 CONDUCTORS, 14 AWG FOR: _____				
680.731014	3767 LF	SIGNAL CABLE 10 CONDUCTORS, 14 AWG FOR: _____				
680.731514	1197 LF	SIGNAL CABLE 15 CONDUCTORS, 14 AWG FOR: _____				
680.732014	1168 LF	SIGNAL CABLE 20 CONDUCTORS, 14 AWG FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.76610010	14 EACH	FURNISH & INSTALL 30 AMP POWER CONNECTION FOR: _____				
680.77000010	1 LS	MODIFY TRAFFIC SIGNAL EQUIPMENT FOR: _____				
680.79000010	1 LS	REMOVE TRAFFIC SIGNAL EQUIPMENT FOR: _____				
680.810101	150 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, RED BALL, LED FOR: _____				
680.810102	2 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, RED ARROW, LED FOR: _____				
680.810103	145 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, YELLOW BALL, LED FOR: _____				
680.810104	19 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, YELLOW ARROW, LED FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.810105	141 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, GREEN BALL, LED FOR: _____				
680.810106	23 EACH	TRAFFIC SIGNAL MODULE - 12 INCH, GREEN ARROW, LED FOR: _____				
680.810107	480 EACH	TRAFFIC SIGNAL SECTION - TYPE I, 12 INCH FOR: _____				
680.8111	66 EACH	TRAFFIC SIGNAL BRACKET ASEMBLY - 1 WAY FOR: _____				
680.8112	24 EACH	TRAFFIC SIGNAL BRACKET ASEMBLY - 2 WAY FOR: _____				
680.8113	15 EACH	TRAFFIC SIGNAL BRACKET ASEMBLY - 3 WAY FOR: _____				
680.8114	1 EACH	TRAFFIC SIGNAL BRACKET ASEMBLY - 4 WAY FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.813108NA	106 EACH	LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY 16" X 18" FOR: _____				
680.81422010	5 EACH	AUXILIARY POLE AND FOUNDATION FOR: _____				
680.8151	45 EACH	ACCESSIBLE PEDESTRIAN SIGNAL (APS) W/O POST FOR: _____				
680.8152	15 EACH	ACCESSIBLE PEDESTRIAN SIGNAL (APS) W/ POST FOR: _____				
680.8204	12 EACH	OVERHEAD SIGN ASSEMBLY, TYPE D FOR: _____				
680.82162510	2 EACH	16 FT MAST ARM POLE WITH A 25 FT MAST ARM (NASSAU COUNTY) FOR: _____				
680.82163010	6 EACH	16 FT MAST ARM POLE WITH A 30 FT MAST ARM (NASSAU COUNTY) FOR: _____				

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680.82163510	6 EACH	16 FT MAST ARM POLE WITH A 35 FT MAST ARM (NASSAU COUNTY) FOR: _____				
680.82164010	8 EACH	16 FT MAST ARM POLE WITH A 40 FT MAST ARM (NASSAU COUNTY) FOR: _____				
680.82164510	12 EACH	16 FT MAST ARM POLE WITH ROTATING 45 FT ARM LENGTH FOR: _____				
680.82165010	5 EACH	16 FT MAST ARM POLE WITH A 50 FT MAST ARM (NASSAU COUNTY) FOR: _____				
680.8225	32 EACH	PEDESTRIAN PUSHBUTTON AND SIGN - WITHOUT POST FOR: _____				
680.8226	14 EACH	PEDESTRIAN PUSHBUTTON AND SIGN - WITH POST FOR: _____				
680.84100210	1 EACH	NO TURN ON RED (NTOR) LED OVERHEAD SIGN 24" W x 30" H FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
680.950208	1347 LF	SERVICE CABLE 2 CONDUCTOR No. 8 AWG FOR: _____				
683.030300NA	2 EACH	HD CCTV TOP MOUNT IP CAMERA ASSEMBLY FOR: _____				
683.030600NA	2 EACH	HD CCTV DOME IP CAMERA ASSEMBLY FOR: _____				
683.072012NA	2 EACH	FURNISH AND INSTALL 12 PORT RACK MOUNT FIBER PATCH PANEL FOR: _____				
683.072048NA	2 EACH	FURNISH AND INSTALL 48 PORT RACK MOUNT FIBER PATCH PANEL FOR: _____				
683.072072NA	1 EACH	FURNISH AND INSTALL 72 PORT RACK MOUNT FIBER PATCH PANEL FOR: _____				
683.090100NA	14 EACH	8 PORT HARDENED 10/100 ETHERNET SWITCH WITH ON DUAL PURPOSE 10/100/1000 OR SFP PORT FOR: _____				

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683.090200NA	1 EACH	10/100 ETHERNET OVER TWP COPPER MODEM 8 PAIR WITH SFP PORT FOR: _____				
683.090600NA	14 EACH	10/100 MBPS OPTICAL ETHERNET CONVERTER, SHELF MOUNT FOR: _____				
683.091000NA	2 EACH	24 PORT HARDENED ETHERNET SFP SWITCH FOR: _____				
683.100100NA	1 EACH	COMMUNICATIONS HUB CABINET AND AUXILIARY EQUIPMENT FOR: _____				
683.115100NA	4 EACH	WI-FI TRAVEL TIME READER FOR: _____				
683.200100NA	1 LS	ITS SUBSYSTEM INTEGRATION FOR: _____				
683.921048NA	8717 LF	SINGLE MODE FIBER OPTIC TRUNK CABLE, 48 FIBERS FOR: _____				

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ITEM NO.	ESTIMATED QUANTITIES	ITEMS WITH UNIT PRICES WRITTEN IN WORDS				
683.921072NA	10722 LF	SINGLE MODE FIBER OPTIC TRUNK CABLE, 72 FIBERS FOR: _____				
683.921500NA	1042 LF	FIBER OPTIC DROP CABLE FOR: _____				
685.07200110	35385 LF	WHITE EPOXY REFLECTORIZED PAVEMENT STRIPES - 20 MILS (WET NIGHT VISIBILITY SPHERES) FOR: _____				
685.07200210	2 EACH	WHITE EPOXY REFLECTORIZED PAVEMENT LETTERS - 20 MILS (WET NIGHT VISIBILITY SPHERES) FOR: _____				
685.07200310	23 EACH	WHITE EPOXY REFLECTORIZED PAVEMENT SYMBOLS - 20 MILS (WET NIGHT VISIBILITY SPHERES) FOR: _____				
685.07200610	7902 LF	YELLOW EPOXY REFLECTORIZED PAVEMENT STRIPES - 20 MILS (WET NIGHT VISIBILITY SPHERES) FOR: _____				
697.03	290000 DC	FIELD CHANGE PAYMENT FOR: _____				

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698.04	100 DC	ASPHALT PRICE ADJUSTMENT FOR: _____				
698.05	100 DC	FUEL PRICE ADJUSTMENT FOR: _____				
698.06	100 DC	STEEL/IRON PRICE ADJUSTMENT FOR: _____				
699.040001	1 LS	MOBILIZATION FOR: _____				

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LIST OF NYSDOT SPECIAL SPECIFICATIONS

PIN 0760.46 – LONG BEACH ROAD TRAFFIC SIGNAL EXPANSION PHASE 9 FROM WAUKENA AVENUE TO LINCOLN AVENUE

206.03010010	Conduit Excavation and Backfill – (Restoring Top Surfaces Not Included)
206.03100010	Traffic Signal Conduit Excavation and Backfill
520.09000010	Saw Cutting Asphalt Concrete
608.01050010	Concrete Sidewalks – Unreinforced (Grading Included)
609.04010510	Cast-in-place Concrete Curb (Grading Included) Type VF150
662.60030008	Altering Elevation of Gas Valve Boxes
662.62000010	Resetting Casting on Existing Utility Manholes
680.050200NA	Video Vehicle Detection Equipment
680.110008NA	Furnish and Install 8 Foot Signal Post
680.110010NA	Furnish and Install 10 Foot Signal Post
680.130001NA	Furnish and Install Electrical Disconnect / Generator Transfer Switch
680.321001NA	Model 2070 LITE Controller
680.332002NA	Model 332 Cabinet with Auxiliary Output File and Equipment
680.336002NA	Model 336SX Cabinet and Auxiliary Equipment
680.51000010	Alter Elevation of Pullboxes
680.51050010	Rectangular Reinforced Concrete Pullbox (26 inches by 18 inches)
680.51100010	Clean Existing Pullbox
680.51300010	Cast-Aluminum Pullbox
680.51400010	Concrete Fiber Optic Pullbox
680.53010010	Clean Existing Conduit
680.76610010	Power Service Connection (Nassau County)
680.77000010	Modify Traffic Signal Equipment
680.79000010	Remove Traffic Signal Equipment
680.813108NA	LED Pedestrian Signal with Countdown Timer Assembly 16" X 18"
680.81422010	Auxiliary Pole and Foundation
680.82XXYY10	Mast Arm Pole with Rotating Arm Length Up to 50 ft
680.84100210	No Turn on Red (NTOR) LED Overhead Sign 24" W x 30"
683.030300NA	HD CCTV Top Mount IP Camera Assembly
683.030600NA	HD CCTV Dome IP Camera Assembly
683.072012NA	12 Port Rack Mount Fiber Patch Panel
683.072048NA	48 Port Rack Mount Fiber Patch Panel
683.072072NA	72 Port Rack Mount Fiber Patch Panel
683.090100NA	8 Port Hardened 10/100 Ethernet Switch with One Dual Purpose 10/100/1000 OR SFP Port

683.090200NA 10/100 Ethernet Over TWP Copper Modem 8 Pair with SFP Port
683.090600NA 10/100 MBPS Optical Ethernet Converter, Shelf Mount
683.091000NA 24 Port Hardened Ethernet SFP Switch
683.100100NA Communications Hub Cabinet and Auxiliary Equipment
683.115100NA Wi-Fi Travel Time Reader
683.200100NA ITS Subsystem Integration
683.921048NA Single Mode Fiber Optic Trunk Cable, 48 Fibers
683.921072NA Single Mode Fiber Optic Trunk Cable, 72 Fibers
683.921500NA Fiber Optic Drop Cable
683.0720XX00 Epoxy Reflectorized Pavement Markings 20 Mils Thick (Wet Night Visibility Spheres)

NO TEXT ON THIS PAGE

ITEM 206.03010010 - CONDUIT EXCAVATION AND BACKFILL - (RESTORING TOP SURFACES NOT INCLUDED)

The provisions of Section 206 pertaining to conduit excavation and backfill shall apply except as noted:

Subsection 206-5.04 shall not apply. The following shall apply; “The unit price bid per linear foot shall include the cost of all labor, materials and equipment necessary to excavate and backfill the trench. The cost of replacing pavement, shoulder and sidewalk courses, subcourses, curbs, drives, lawns and other top surfaces necessary to complete the work will be paid for under their respective items, or under various items of the Contract, as noted in the Contract Documents.”

The cost of any necessary saw cutting will be paid for under specific saw cutting items.

ITEM 206.03100010 - TRAFFIC SIGNAL CONDUIT EXCAVATION AND BACKFILL

DESCRIPTION. This work shall consist of the excavation and necessary backfill required for traffic signal conduits. All such excavation shall be unclassified excavation as defined in subsection 203-1.01.

The work shall include saw cutting any existing portland cement concrete and asphalt concrete top surfaces and the restoration of any pavement, shoulder, and sidewalk courses, subcourses, curbs, drives, lawns and other top surfaces.

MATERIALS. Materials for the restoration of top surfaces shall be as indicated in the plans and as approved by the Engineer.

CONSTRUCTION DETAILS. The requirements of subsection 206-3 shall apply with the following additions:

When the Contractor is required to excavate through portland cement concrete and asphalt concrete pavement, sidewalk, curb, or other top surfaces, he shall saw cut along neat lines as shown in the plans or as ordered by the Engineer. An approved power saw shall be used to saw cut to the depth specified in the plans or as directed by the Engineer.

The conduit excavation and backfill, and the restoration of top surface courses shall also conform to the applicable Notes and Details shown in the plans.

Any damage to existing pavement, sidewalk, curb, or other facilities caused by the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer.

METHOD OF MEASUREMENT. Subsection 206-4.03 shall apply.

BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work including excavation, backfill, saw cutting, and restoring any pavement, shoulder, and sidewalk courses, subcourses, curbs, drives, lawns and other top surfaces.

Any repairs to existing pavement, sidewalk, curb, or other facilities made necessary by the Contractor's operations shall be done to the satisfaction of the Engineer at no additional cost to the State.

ITEM 520.09000010 - SAW CUTTING ASPHALT CONCRETE

DESCRIPTION. This work shall consist of saw cutting existing asphalt concrete pavement or sidewalk at the locations indicated on the plans or where directed by the Engineer.

MATERIALS. All equipment proposed for this work shall be approved by the Engineer prior to actual use.

CONSTRUCTION DETAILS. Saw cutting shall be along a neat line as indicated on the plans or where directed by the Engineer. Saw cuts shall be made to the depth(s) indicated on the plans.

Any damage to material not indicated for removal, caused by the Contractor's operations shall be repaired by the Contractor. All repair shall be done in a manner satisfactory to the Engineer.

METHOD OF MEASUREMENT. This work will be measured by the number of linear feet of saw cutting done. No allowances will be made for saw cuts of different depths.

No saw cutting will be measured for payment under this item which the Contractor may choose to do for his own convenience.

BASIS OF PAYMENT. The unit price bid per linear foot of saw cutting shall include the cost of all labor, materials, and equipment necessary to complete the work.

Any repairs made necessary by the Contractor's operations shall be done to the satisfaction of the Engineer at no additional cost to the State.

ITEM 608.01050010 - CONCRETE SIDEWALKS - UNREINFORCED
(GRADING INCLUDED)

DESCRIPTION.

The work shall consist of the construction of portland cement concrete sidewalks and necessary grading as shown on the plans.

MATERIALS.

The following requirements of Sections 203 and 608 shall apply: 203-2.02A, 608-2, and 608-2.01.

CONSTRUCTION DETAILS.

The requirements of Subsection 203-3.12 shall apply to the placement of embankment.

The requirements of Subsection 608-3.01 shall apply except that all references to driveways and wire fabric for reinforcement shall be disregarded. The sidewalk shall be constructed without wire fabric for concrete reinforcement.

The location of the sidewalks shall be properly graded to conform with the sidewalk cross-section and line and grade. The graded area shall be firm and dry before placing the concrete and all organic or unsuitable materials, existing curbs, sidewalks, and driveways shall be removed.

METHOD OF MEASUREMENT.

Concrete sidewalks will be measured by the number of cubic yards of cement concrete computed from payment lines shown on the plans.

BASIS OF PAYMENT.

The unit price bid per cubic yard will include all excavation, embankment, preparation of subgrade, and all other materials, equipment, and labor necessary to complete the work as called for on the plans and to the satisfaction of the Engineer.

No separate payment will be made for excavation or embankment above, below, or within the volume of sidewalk placed.

Payment at the unit bid price will be made after the concrete sidewalks and curing application have been properly placed.

ITEM 609.04010510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE VF150
ITEM 609.04020510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE VF150A
ITEM 609.04030510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE M150
ITEM 609.04040510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE M150A
ITEM 609.04050510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE M100
ITEM 609.04060510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE M100A
ITEM 609.04070510 - CAST-IN-PLACE CONCRETE CURB (GRADING INCLUDED) TYPE T100
ITEM 609.05010510 - CAST-IN-PLACE CONCRETE CURB AND GUTTER (GRADING INCLUDED)
TYPE VF150G
ITEM 609.05020510 - CAST-IN-PLACE CONCRETE CURB AND GUTTER (GRADING INCLUDED)
TYPE M100G

DESCRIPTION

The work shall consist of the construction of concrete curb or curb and gutter and necessary grading as shown on the plans or as specified by the Engineer.

MATERIALS

The requirements of Subsection 609-2 shall apply. The curb or curb and gutter shall conform to the dimensions shown on the standard sheets, except that the depth of the curb shall be as shown on the plans.

CONSTRUCTION DETAILS

The requirements of Subsections 609-3.01 and 609-3.04 shall apply.

The location of the concrete curb or curb and gutter shall be properly graded to conform to the curb line and grade. The graded area shall be firm and dry before placing concrete and all organic or unstable materials, existing curbs, sidewalks, and driveways shall be removed.

METHOD OF MEASUREMENT

Concrete curb or curb and gutter placed under these specifications will be measured by the number of linear feet, measured to the nearest foot. The measurement will be taken along the top front arris line of the curb or curb and gutter.

BASIS OF PAYMENT

The unit price bid per foot shall include all excavation, embankment, preparation of subgrade, curb anchors, and all other materials, equipment and labor necessary to complete the work as called for on the plans or as specified by the Engineer. The unit price bid shall also include: replacement of curb and curb and gutter that was produced out of tolerance; cleaning of curb, or curb and gutter found to be dirty prior to final acceptance; and repair or replacement of curb and curb and gutter damaged by the Contractor's operations.

No separate payment will be made for excavation or embankment above, below, or within the volume of curb placed

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ITEM 662.60030008 - ALTERING ELEVATION OF GAS VALVE BOXES

DESCRIPTION:

Under this item, the contractor shall alter the elevation of gas valve boxes to meet new grades as shown on the plans or as directed by the Engineer.

MATERIALS:

Concrete shall meet the requirements for Class A Concrete in Section 555 of the Standard Specifications.

CONSTRUCTION DETAILS:

Paved Areas:

Unless an alternate method is approved by the owner and directed by the Engineer, the following method shall be used:

The top section of the gas valve box shall be raised to meet the finished grade and supported on a concrete collar at least 6 inches in depth and at least 6 inches wider than the outer edges of the top section of the gas valve box casting. The existing pavement shall be cut and removed as needed in order to place the concrete collar. Cutting shall be done with tools or equipment acceptable to the Engineer and in such a manner as to avoid cracking the abutting portions of pavement. The concrete shall be allowed to cure for the required period before paving around the gas valve box.

Non-Paved Areas:

The method of raising the gas valve box shall be as approved by the owner and as directed by the Engineer.

METHOD OF MEASUREMENT:

The quantity to be paid for under this item will be the number of gas valve boxes altered.

BASIS OF PAYMENT:

The unit price bid per each shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work including any pavement cutting, excavation, backfill and pavement restoration. Any gas valve box castings or covers broken through carelessness on the part of the contractor shall be replaced at the contractor's expense.

**ITEM 662.62000010 - RESETTING CASTINGS ON EXISTING UTILITY
MANHOLES**

DESCRIPTION

This work shall consist of removing, storing, and resetting existing utility castings, complete with covers, and appurtenances, to grade on existing utility manholes.

MATERIALS

Masonry chimney materials shall meet the requirements of the following subsections of Section 700:

Precast Concrete Pavers	704-13
Masonry Mortar	705-21

Concrete shall be Class A meeting the requirements of Section 501.

CONSTRUCTION DETAILS

The existing castings, covers, and appurtenances shall be removed, stored if necessary, cleaned and reset to the line and grade as indicated in the Plans or as directed by the Engineer.

The existing masonry adjustment collar, or a portion of it, shall be removed where necessary for resetting of the existing casting. The existing castings shall be set to grade using precast concrete pavers and mortar and/or Class A concrete. The castings shall be set in a mortar bed on the existing structure. If an adjustment ring was removed from the structure, the casting shall be set at such grade that no adjustment ring is needed, and the adjustment ring shall become the property of the Contractor and shall be removed from the site of work.

Any pavement and shoulder courses, subcourses, curbs, sidewalks, lawns and other top surfaces removed or damaged during the work of removing the existing castings and setting the new castings, shall be replaced in kind, unless otherwise shown on the plans or directed by the Engineer. This shall include all sawcutting necessary for this removal.

METHOD OF MEASUREMENT

This work will be measured by the number of existing utility castings, complete with covers, reset to grade on existing utility manholes.

BASIS OF PAYMENT

The unit price bid for resetting each utility casting shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

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ITEM 662.62000010 - RESETTING CASTINGS ON EXISTING UTILITY
MANHOLES

Any castings, covers or appurtenances broken through carelessness on the part of the Contractor shall be replaced at the Contractor's expense.

The cost of pavement cutting, excavation, backfill, and pavement restoration will be paid for under their respective items.

ITEM 680.050200NA - VIDEO VEHICLE DETECTION EQUIPMENT

DESCRIPTION

This work shall consist of furnishing and installing a system that detects vehicles on a roadway by processing video images sent from a camera to an image processor with detector outputs that can be received by a 2070L series traffic signal controller within a 336S or 332 traffic signal control cabinet.

MATERIALS

1. Hardware

- 1.1. This specification shall include furnishing and installing (1) one fixed position closed circuit video camera as shown on the plans or as ordered by the engineer.
- 1.2. This includes any and all mounting hardware for attachment to a horizontal member such as a traffic signal mast arm or a light duty camera standoff cantilever arm, as well as the required video, power, and control cables routed back to the traffic signal control cabinet.
- 1.3. This specification shall include furnishing and installing (1) one video camera image processor capable of receiving images sent from the camera, decoding them, and using the camera images to determine the need for a vehicle detection call to be placed on the respective roadway approach. This item includes all wiring and configuration of the unit to make it functional. The IP shall be modular by design and housed in a standard input file for a 336S or 332 signal control cabinet. Each IP shall occupy no more than two file slots, with four (4) separate programmable outputs. All power shall come directly from the input rack.

2. Software

- 2.1. The system shall be capable of detecting vehicles in multiple lanes of traffic simultaneously. Detection zones shall be user-defined by utilizing a laptop connected directly to the image processor. The user must be able to define virtual vehicle detectors by placing lines and boxes on the video display on the laptop. Software must allow the user to re-define the parameters of the video detection at any time. Once saved, the image processor must be able to acknowledge the presence of a vehicle and send a call to the 2070L controller via the input file assignment.
- 2.2. The software must also allow real time streaming video to be introduced to an Ethernet network within the traffic signal controller cabinet. The image processor must be IP (internet protocol) addressable to allow for this streaming video output. The video output will be stripped of the lines and boxes necessary to make the video detection possible, and must not interfere with the functionality of the video detection system.

3. Functionality

- 3.1. Real time video detection
- 3.2. Image processor must be capable of processing the images from a video camera at a speed of 30 times per second.

ITEM 680.050200NA - VIDEO VEHICLE DETECTION EQUIPMENT

- 3.3. The system shall be capable of detecting the presence of vehicles in multiple vehicle detection zones simultaneously.
- 3.4. System shall be capable of stop line detection, presence detection, directional presence detection, and system sensors.
- 3.5. It shall be possible to set-up and view the image processor software by using a standard laptop computer and connecting via Ethernet, USB, or serial connection. No special video capture cards will be required.
- 3.6. All set-up parameters and settings shall be saved on the image processor card and shall be saved and automatically recovered in the event of a disconnect or a power fail.
- 3.7. The system shall have the ability to upload / download the set-up parameters directly to or from a laptop.

4. Vehicle Detection

- 4.1. The video detection system shall provide flexible detection zone placement anywhere and at any orientation within the combined field of view of the cameras. A single detector shall be able to replace multiple conventional detector loops connected in series.
- 4.2. Placement of detection zones shall be by means of a laptop computer operating in the Windows XP or higher operating environment, and a mouse or by using a simple keyboard and monitor. The monitor screen of a laptop computer shall show images of the detection zones superimposed on the video image of traffic. This configuration shall allow the display of detection superimposed on the video image of traffic directly on the laptop computer.
- 4.3. The detection zones shall be created by using the mouse or simple keyboard to draw detection zones on the laptop computer.
- 4.4. It shall be possible to use the mouse or other input device to edit previously defined detector configurations so as to fine-tune the detection zone placement. Once a detection configuration has been created, the computer system shall provide a graphic display of the new configuration the laptop computer.
- 4.5. It shall be possible to individually adjust sensitivity for each detection zone in the system.
- 4.6. When a vehicle is under a detection zone, the detection zone shall change in color or intensity on the laptop computer screen, thereby verifying proper operation of the detection system.
- 4.7. Overall performance of the video detection system shall be comparable to inductive loops.

Using standard camera optics and in the absence of occlusion, the system shall be able to detect vehicle presence with 98% accuracy under normal conditions (day & night) and 96% accuracy under adverse conditions (fog, rain, snow).

ITEM 680.050200NA - VIDEO VEHICLE DETECTION EQUIPMENT

5. Environmental

- 5.1. The system shall be designed to operate reliably in the adverse environment found in the typical roadside traffic controller cabinet. It shall meet the environmental requirements set forth for Type 2070L controllers. Operating temperature shall be from -31 F to +165 degrees F at 0% to 95% relative humidity, non-condensing.

6. Electrical

- 6.1. Serial communications to the modem shall be through an RS-232 serial port. This port can be used for communications to a modem, or laptop.
- 6.2. The Image Processor shall be equipped with a detector interface for at least 4 detector outputs. Output levels shall be compatible with the Type 2070L standards, for a standard model 336S or 332 cabinet.
- 6.3. The Image Processor shall be equipped with (1) one BNC composite video input.
- 6.4. The Image Processor shall be equipped with at least (1) one BNC composite video output.
- 6.5. The Image Processor shall have error detection, and shall provide a closed output in the event of camera failure or IP malfunction or loss of video due to inclement weather (fog/whiteout).
- 6.6. The Image Processor shall have the capability transmitting real time streaming MPEG-4 video. MPEG-4 video will be transmitted via Ethernet communications to the existing traffic signal network where it can be remotely decoded and displayed and/or stored.
- 6.7. The Image Processor shall have separate light emitting diodes that indicate power, video, serial communications, and detector actuations.

7. Camera

- 7.1. The video system shall use medium-resolution full color camera as the video source for real-time vehicle detection. Each camera shall provide at least 383-line resolution and at least a 510 x 492 pixel CCD sensing element that produces useable video at a scene luminance level of 0.15 lux. It shall have automatic gain, automatic iris, and absolute black reference controls. The limits of gain, iris, and sensitivity shall be adjustable to minimize blooming during nighttime hours.
- 7.2. The camera lens shall provide power zoom capability from .31 inches to 1.9 inches, or a fix focal length in the range from .15 inches to 2.95 inches, as specified by the manufacturer. The auto-iris capability of the lens shall operate reliably at -7 degrees F.
- 7.3. The camera and lens assembly shall be housed in an environmental NEMA-4 enclosure that is watertight and dust proof. The camera shall employ the use of a heater, not to consume more than 15-watts of power. Heater shall be attached to the faceplate of the enclosure to avoid ice and condensation in cold weather. The enclosure shall be light-colored and shall include a sun shield to minimize solar heating and glare.

ITEM 680.050200NA - VIDEO VEHICLE DETECTION EQUIPMENT

- 7.4. A video interface panel shall be mounted inside the traffic signal controller cabinet. The panel shall provide a terminal block for power connection and grounding, coaxial cable connection points, and a transient voltage suppressor for each image sensor.
- 7.5. The camera shall be connected to the IP in such a manner that the attenuation of the MPEG-4 video signal from the image sensor is not attenuated more than 3 db when measured at the IP. The connection between the cameras and the video interface panel shall be coaxial cable suited for outdoor installation and the cost shall be included in this item.

CONSTRUCTION DETAILS

8. Installation and Training

- 8.1. The manufacturer of the video detection system or their representative shall design the camera layout, placement and lens size, and shall supervise the installation and testing of the video and computer equipment. A factory certified representative from the supplier shall be on-site for a minimum of one (1) day.
- 8.2. Training shall be provided "As Needed" to personnel of the contracting agency and County personnel in the operation, setup, and maintenance of the video detection system. Two (2) operations manuals shall be provided for each unit installed.
- 8.3. The manufacturer shall provide 4 complete sets of maintenance manuals for the installed equipment. These manuals shall have complete set-up, maintenance, and troubleshooting procedures presented in an organized format.

METHOD OF MEASUREMENT

This work will be measured as the number of Video Vehicle Presence Detectors that are satisfactorily furnished and installed in accordance with the contract documents and as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid to furnish and install Video Vehicle Detection Equipment shall include the cost of furnishing all labor, tools, materials, installation, hardware, software, mounting bracket, power, control and video cables, training, and technical support associated with providing fully functional and accepted Video Vehicle Presence Detectors. No payment will be made until the equipment has operated properly and satisfactorily for fifteen (15) days and the equipment is accepted.

ITEM 680.110004NA - FURNISH AND INSTALL 4 FOOT SIGNAL POST
ITEM 680.110008NA - FURNISH AND INSTALL 8 FOOT SIGNAL POST
ITEM 680.110010NA - FURNISH AND INSTALL 10 FOOT SIGNAL POST
ITEM 680.110012NA - FURNISH AND INSTALL 12 FOOT SIGNAL POST

DESCRIPTION

This work shall consist of furnishing and installing aluminum signal posts in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Materials and Finish

1.1 The shaft shall be one piece seamless round aluminum tubing conforming to the Aluminum Association Alloy 6061-T6. The aluminum shaft shall have a satin brushed finish.

2.2 Screws, nuts, bolts, washers and miscellaneous hardware other than anchor bolts, shall be made of Stainless Steel Alloy No. 302.

1.3 Anchor bolts, nuts, and washers shall conform to the Standard Specifications for Low Carbon Steel Externally and Internally Threaded Standard Fasteners, latest edition AISI C 1035 special quality. Nuts, washers, base plate, and the anchor bolts shall be galvanized in accordance with ASTM 153. Bolts shall be galvanized after threading.

2. Design Requirements

2.1 The post shall be designed to support two thirty-five (35) pound traffic signal faces with backplates, each with a surface area of five (5) square feet and two (2) pedestrian signals, each with a surface area of 1.8 square feet. The post shall be designed to support these signal heads when subjected to a load from a hundred (100) mile per hour wind.

2.2 The base shall be fabricated from steel plate. The corners shall be rounded. A hole shall be cut in the center of the plate to receive a standard 4" diameter steel coupling. The coupling shall be fillet welded on the top and bottom of the plate. The base shall be of sufficient cross section to fully develop the ultimate strength of the post. The base shall be designed to fully transfer the load to the anchor bolts. The top of the installed 4" diameter pole coupling and the top of the anchor bolt nuts shall be a maximum of 4" above grade.

2.3 The base shall be fabricated to receive four (4) anchor bolts spaced ninety (90) degrees apart on a 12-3/4" diameter bolt circle, indicated on the Standard Traffic Drawings.

3. Specific Requirements

3.1 The posts shall be round. If welded longitudinally, the exposed weld shall be ground or rolled smooth and flush with the base metal. All welds shall be continuous. Transverse welds, other than fillet welds shall not be permitted.

ITEM 680.110004NA - FURNISH AND INSTALL 4 FOOT SIGNAL POST
ITEM 680.110008NA - FURNISH AND INSTALL 8 FOOT SIGNAL POST
ITEM 680.110010NA - FURNISH AND INSTALL 10 FOOT SIGNAL POST
ITEM 680.110012NA - FURNISH AND INSTALL 12 FOOT SIGNAL POST

3.2 A handhole with aluminum cover plate shall be provided. The longer dimension shall be vertical. The handhole shall be centered above the base plate, at a distance indicated on the Standard Drawings. The cover plate shall be secured by two (2) stainless steel “tamper proof” screws.

3.3 A grounding stud with a bronze lock washer and nut shall be mounted inside the shaft opposite the handhole for attaching the equipment grounding conductor.

3.4 Each post shall be provided with four (4) anchor bolts. Each anchor bolt shall be provided with a leveling nut and an “acorn type” top nut.

3.5 The size of each anchor bolt shall be as indicated on the Standard Traffic Drawings.

3.6 The top of the shaft shall be designed to receive a slip fitter.

3.7 When required, the aluminum shaft shall be furnished with a weatherproof spun aluminum pole cap, complete with three (3) stainless steel set screws for fastening to the top of the shaft.

3.8 The total height of the shaft and base shall be as specified.

3.9 All dimensions shall be as indicated on the Standard Traffic Drawings.

4. Certification and Drawings

4.1 The Contractor shall provide descriptions and drawings of the signal post for approval.

4.2 The manufacturer, when required, shall provide a certificate that the post meets the material requirements of this specification.

CONSTRUCTION DETAILS

5. Installation

5.1 The signal post shall be erected on a foundation installed under another item.

5.2 The handhole shall be located as ordered by the Engineer.

5.3 The post shall be properly plumbed by the use of the leveling nuts and secured in place by “acorn type” top nuts.

5.4 The signal post, conduit, and ground rod shall be interconnected by a bare solid copper equipment grounding conductor indicated on the Standard Traffic Drawings.

METHOD OF MEASUREMENT

This work will be measured as the number of signal posts satisfactorily furnished and installed.

ITEM 680.110004NA - FURNISH AND INSTALL 4 FOOT SIGNAL POST
ITEM 680.110008NA - FURNISH AND INSTALL 8 FOOT SIGNAL POST
ITEM 680.110010NA - FURNISH AND INSTALL 10 FOOT SIGNAL POST
ITEM 680.110012NA - FURNISH AND INSTALL 12 FOOT SIGNAL POST

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, tools, transportation, handling, incidentals and equipment necessary to satisfactorily complete the work including the signal post, anchor bolts, acorn nuts, leveling nuts, pole cap (if required), bare copper equipment grounding conductor, ground rod.

**ITEM 680.130001NA – FURNISH AND INSTALL ELECTRICAL
DISCONNECT / GENERATOR TRANSFER SWITCH**

1. Description

Under this item, the Contractor shall furnish and install an exterior surface mounted electrical disconnect / generator transfer switch as shown in the contract documents or as directed by the Engineer.

2. Materials

a. General

The electrical disconnect / generator transfer switch shall allow for easy switching between utility power and generator power in the event of loss of utility power. Transfer switches may be used for traffic signal cabinets, HUB cabinets, or any other traffic control or ITS cabinets.

b. Housing Requirements

The electrical disconnect / generator transfer switch shall be housed in a sealed unit; and be surface mounted onto the exterior of the traffic cabinet so as not to interfere with the accessibility of the cabinet, its components, or any pedestrian right-of-way. The electrical disconnect / generator transfer switch housing door shall be lockable with a #2 Corbin lock, tamper proof, and weatherproof in a closed position. The electrical disconnect / generator transfer switch housing shall be constructed with heavy duty 12 gauge rust and corrosion proof aluminum and be 9”h x 6”w x 4.375”d. A 3/16-inch-thick ethylene propylene diene monomer (EPDM) closed-cell sponge rubber gasket shall be used to weatherproof the connection between the electrical disconnect / generator transfer switch housing and the traffic cabinet.

c. Electrical Disconnect / Generator Transfer Switch Requirements

The electrical disconnect / generator transfer switch shall be a 30 Amp model specifically designed for traffic signal applications and have a simple manually operated toggle type transfer switch to allow for easy switching between utility power and generator power in under 250 milliseconds to allow for the traffic controller cabinet to operate normally without interruption during the transfer to utility power. The electrical disconnect / generator transfer switch generator connection shall be one (1) male 30 Amp twist lock type flush mount connector, and one (1) male 20 Amp NEMA type flush mount connector. The electrical disconnect / generator transfer switch shall contain an LED indicator light that illuminates when in generator mode and utility power is restored, and automatically turns off when transferring to utility power is complete. A minimum of one #2 key shall be provided with each transfer switch provided.

**ITEM 680.130001NA – FURNISH AND INSTALL ELECTRICAL
DISCONNECT / GENERATOR TRANSFER SWITCH**

d. **Cable Requirements**

Each electrical disconnect / generator transfer switch shall be provided with sufficient 2c#8 service cable to allow for the connection from the local power feed to the electrical disconnect / generator transfer switch, and from the electrical disconnect / generator transfer switch to the terminal block located within the traffic cabinet.

Each electrical disconnect / generator transfer switch shall also be provided with two 12 foot generator cables:

Cable 1 – shall have a female 30 Amp twist lock connector on one end and a male 30 Amp twist lock connector on the other.

Cable 2 – shall have a female 30 Amp twist lock connector on one end and a male 20 Amp duplex plug on the other.

3. **Construction Details**

The electrical disconnect / generator transfer switch and housing shall be mounted to an exterior side of the traffic cabinet and not to any door. The electrical disconnect / generator transfer switch and housing shall be mounted to the traffic cabinet as shown on the plans, or the standard sheets or as ordered by the Engineer; so as not to interfere with the accessibility of the traffic cabinet, its components, or any pedestrian right-of-way. For post mounted traffic cabinets, the electrical disconnect / generator transfer switch and housing shall be mounted to the lower portion of the traffic cabinet. For ground mounted traffic cabinets, the electrical disconnect / generator transfer switch shall be mounted a minimum of four feet above the foundation to avoid flood and splash water. The electrical disconnect / generator transfer switch shall be wired from inside the existing traffic cabinet, and the connection between the transfer switch and cabinet shall be weatherproofed by a 3/16-inch-thick ethylene propylene diene monomer (EPDM) closed-cell sponge rubber gasket. Service cable shall be installed as shown on the plans, on the standard sheets, or as ordered by the Engineer. The Contractor must demonstrate proper operation of each installed electrical disconnect / generator transfer switch utilizing a separate electrical power generator or inverter.

4. **Method of Measurement**

This item will be measured for payment as the number of electrical disconnect / generator transfer switches furnished, installed, tested, and accepted by the Engineer-in-Charge.

**ITEM 680.130001NA – FURNISH AND INSTALL ELECTRICAL
DISCONNECT / GENERATOR TRANSFER SWITCH**

5. Basis of Payment

The unit price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

ITEM 680.321001NA - MODEL 2070 LITE CONTROLLER

DESCRIPTION

This work shall consist of furnishing and installing Model 2070 LITE (2070L) Controllers in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Qualification

- 1.1 All components supplied under this specification shall be listed on the CalTrans Qualified Product List (QPL) that is in effect on the issue date of this invitation (see section 1.2 for 2070L controller qualification). Equipment that is not defined by the CalTrans "Transportation Electrical Equipment Specifications" (TEES) that is in effect on the issue date of this invitation is not covered by this requirement. For each piece of equipment that is covered by this requirement, the vendor shall submit a notarized certification the equipment is listed on the QPL that was in effect as of the date of issue of this invitation. Failure to provide this certification shall cause the bid to be rejected as unresponsive. If during the course of the contract, any piece of equipment ceases to be listed on the current QPL, the County may, at its option, require the vendor to provide a suitable replacement that is listed on the current QPL at no additional cost.
- 1.2 Model 2070L controllers furnished as part of this item specification must be listed on the Nassau County Qualified Products List (QPL) for 2070L Traffic Signal Controllers.

2. Requirements

- 2.1 All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the latest provisions set forth by the California Department of Transportation (CalTrans) Specifications.

The specifications for the Model 2070L Controller Unit will be as stated in the CalTrans document TEES, August 16, 2002 or latest revisions and all addenda thereof.

- 2.2 The Model 2070L Controller Unit shall be delivered in the following configuration:

- Unit Chassis
- Model 2070 – 1B CPU Card (LITE)
- Model 2070 – 2A Field I/O Card
- Model 2070 – 3B Front Panel Interface
- Model 2070 – 4A Power Supply
- Model 2070 – 7A 2070 RS-232 Card (EIA-232 Serial Port)

- 2.3 The Model 2070L Controller Units supplied to this specification shall have the chassis openings for any unused Motherboard connector covered with the appropriate cover plates so that the entire rear of the controller is closed.

ITEM 680.321001NA - MODEL 2070 LITE CONTROLLER

- 2.4 The Model 2070L Controller Units shall be supplied with 2X Wide Cover Plates installed over the chassis openings for connectors A1 and A2 so that the rear of the controller is completely enclosed.

CONSTRUCTION DETAILS

3. Installation

- 3.1 The Contractor shall install the Model 2070L Controller Unit and all related hardware in the Model 336S or 332 Cabinet at locations specified on the plans.
- 3.2 The County will provide the signal control software and the Contractor shall be required to program and test the Controller prior to installation in the field.
- 3.3 The Contractor shall program each Model 2070L Controller Unit with a unique internet protocol (IP) address provided by the County and recorded in each equipment cabinet.

4. Documentation Requirements

- 4.1 One (1) complete set of operations and maintenance manuals shall be placed in each field cabinet and one (1) complete set shall be delivered to Nassau County. The manuals shall, as a minimum, include the following:
- Complete and accurate schematic diagrams.
 - Complete installation procedures.
 - Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
 - Pictorial of components layout on circuit board.
 - Complete maintenance and trouble-shooting procedures.
 - Complete stage-by-stage explanation of circuit theory and operation.

5. Testing Requirements

- 5.1 Design Approval Tests shall include all functional and environmental tests specified in the most current version of the CALTRANS TEES Specifications.

A complete Quality Control (QC)/ final test report for the 2070L shall be supplied with each unit. The test report shall indicate the name of the tester and shall be signed by a responsible manager. The QC procedure shall include the following:

- Acceptance of all supplied components.
- Physical and functional testing of all modules and items.
- A minimum 100-hour burn-in of all equipment

ITEM 680.321001NA - MODEL 2070 LITE CONTROLLER

METHOD OF MEASUREMENT

This work will be measured as the number of Model 2070 LITE Controllers satisfactorily furnished, installed, tested and made fully operational.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work. Payment for all documentation and testing specified herein shall be included under this contract item.

ITEM 680.332001NA - MODEL 332 CABINET AND AUXILIARY EQUIPMENT
ITEM 680.332002NA - MODEL 332 CABINET WITH AUXILIARY OUTPUT FILE AND
EQUIPMENT

DESCRIPTION

This work shall consist of furnishing and installing Model 332 Cabinet and Auxiliary Equipment in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. **Controller Requirements**

1.1 All components and plug-in modules supplied under this item shall conform to the New York State Transportation Management Equipment Specifications for peripheral equipment. Model 2070L controllers shall be on the latest Nassau County Qualified Products List and be approved by NCDPW. Model 2070L controllers will be paid under a separate item.

2. **Qualification**

2.1 All Model 332 components supplied under this specification shall be listed on the CalTrans Qualified Product List (QPL) that is in effect on the issue date of this invitation. In the case of the modified 332 Cabinet, the vendor's standard model shall be listed on the CalTrans QPL that is in effect on the issue date of this invitation. All auxiliary equipment shall be listed on the CalTrans QPL that is in effect on the issue date of this invitation. Equipment that is not defined by the CalTrans "Traffic Signal Control Equipment Specifications" (TSCES) or "Transportation Electrical Equipment Specifications" (TEES) that is in effect on the issue date of this invitation is not covered by this requirement. For each piece of equipment that is covered by this requirement, the vendor shall submit a notarized certification the equipment is listed on the QPL that was in effect as of the date of issue of this invitation. Failure to provide this certification shall cause the bid to be rejected as unresponsive. If during the course of the contract, any piece of equipment ceases to be listed on the current QPL, the County may, at its option, require the vendor to provide a suitable replacement that is listed on the current QPL at no additional cost.

3. **Requirements**

3.1 All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the latest provisions set forth by the California Department of Transportation (CalTrans) Specifications.

The specifications for the Model 332 Cabinet and auxiliary equipment shall conform to the requirements in CalTrans documents TSCES and TEES, and to all addenda thereto current on the issue date of this invitation.

3.2 This specification shall consist of a wired Model 332 Cabinet with all auxiliary equipment, and cable harnesses required to control the site specific project intersections

ITEM 680.332001NA - MODEL 332 CABINET AND AUXILIARY EQUIPMENT
ITEM 680.332002NA - MODEL 332 CABINET WITH AUXILIARY OUTPUT FILE AND
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and interface with the communications systems shown on the plans, as specified in these specifications, and as ordered by the Engineer. Model 2070L Controller Units shall not be furnished under this item.

3.3 As a minimum, this item shall include, but not be limited to, the following equipment:

Model 332 Cabinet, Plug-in Modules and Auxiliary Equipment

<u>Model No.</u>	<u>Quantity</u>	<u>Description</u>
332	1	Model 332 Cabinet
2010ECLip Kit	1	Enhanced Conflict Monitor Unit with Red Monitoring Kit
200	*	Solid State Switchpack
204	2	Solid State Flasher
222	*	Dual Loop Vehicle Detector Module
242	*	Dual Isolation Module (DC)
430	*	Flash Transfer Relays
-	12	Flash Program Plugs (8 red, 2 yellow, 2 white)
-	10	2w/4k bleeding resistors for unused outputs
-	1	Fiber Optic Distribution Panel

Model 332 Cabinet with "Auxiliary" Output File, Plug-in Modules & Auxiliary Equipment

<u>Model No.</u>	<u>Quantity</u>	<u>Description</u>
332A	1	Model 332 Cabinet with "Auxiliary" Output File
2010ECLip Kit	1	Enhanced Conflict Monitor Unit with Red Monitoring Kit
200	*	Solid State Switchpack
204	2	Solid State Flasher
222	*	Dual Loop Vehicle Detector Module

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242	*	Dual Isolation Module (DC)
430	*	Flash Transfer Relays
-	12	Flash Program Plugs (8 red, 2 yellow, 2 white)
-	10	2w/4k bleeding resistors for unused outputs
-	1	Fiber Optic Distribution Panel

* The contractor shall supply the appropriate quantity of the noted components in accordance with the signal design plans and cabinet wiring diagram.

3.4 Model 332 Cabinet

3.4.1 Dimensions

The cabinet shall be a Model 332 type with a height of 66", width of 24", and a depth of 30".

3.4.2 Traffic Signal Identification

The traffic signal number shall be painted on both sides of the cabinet as directed by the Engineer. It shall be painted in black with the letters 3" high in type "C" series.

3.4.3 Locks

The cabinet doors shall be equipped with a brass cylinder lock keyed for a Number Two Corbin Key, with a dust cover. Two (2) keys for each cabinet shall be furnished and provided in the cabinet drawer. Cabinet shall be equipped with a removable handle that shall be provided with the cabinet.

3.4.4 Finish

All surfaces of the cabinet shall be bare, unpainted aluminum.

3.4.5 Police Door

The cabinet shall be equipped with an auxiliary police access door. The police access door shall include a Signal ON/OFF switch, Flash/Auto switch, and an Auto/Manual switch with hardwired police cord. One (1) police master key shall be provided in the cabinet drawer.

3.4.6 Cabinet Light

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Fluorescent lamps shall be installed in the top of the front and rear of the cabinets. Switches shall be installed on the front and rear doors. Opening of either door shall illuminate both lights.

Each fluorescent lamp and switch shall be equipped with noise suppression devices. Activation of the fluorescent lamps and associated switches shall not cause any disruption of the Model 2070L Controller or any other electrical device in the cabinet. The vendor shall install sufficient RFI and surge suppression equipment to assure that operation of the fluorescent lamps will not disrupt the operation of other equipment in the cabinet.

Fluorescent lamps and associated ballast transformers shall be rated for high output in cold environments, providing high light output in ambient temperature of -13° F.

The cabinet lamp circuit shall be fused. The fuse holder shall be easily accessible from the front the cabinet. It shall not be necessary to reach into the cavity above the 2070L controller in order to access the fuse holder for the cabinet lamps.

3.4.7 Interconnect Terminal Block

Two twelve (12) position terminal blocks for interconnection shall be installed. The Contractor shall submit the proposed terminal block schematic and mounting location to the County for approval prior to installation in the cabinet. The cabinet shall be furnished with a plug-in Data/Signal 2 pair surge suppressor device, EDCO Model PC642 series, mounted on Socket PCB1B or approved equal. The voltage clamp value for the protector shall be selected to be appropriate for the communication equipment used in the cabinet.

3.4.8 Cabinet Drawer

An aluminum pullout drawer hinged at the top and having sliding tracts shall be provided in the cabinet. The drawer shall have the approximate dimensions of 1.75 inches in height, 13 inches deep and 16 inches wide and be capable of holding 40 pounds in weight when the drawer is extended. This drawer should be located between the Model 2070L Controller and the power distribution assembly. Provide a top for the storage compartment that has a non-slip plastic laminate attached, which covers a minimum of 90% of the surface area of the top.

3.4.9 Door Alarm

A door ajar alarm switch shall be installed on front and back doors. Each switch shall be of heavy duty, spring- loaded design with single pole normally closed contacts.

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Each switch circuit shall be closed whenever the corresponding door is open at an angle of 15 degrees or more. The switches shall be installed so that they will not restrict removal of the cabinet rack assembly in any way. The door ajar switches shall only be used to support the door ajar alarm function; they shall not be used to support any other function (such as cabinet illumination or conflict monitor interlocking).

Each switch shall be wired to 2 point barrier style terminal block on the input side of the cabinet. One point of the terminal block shall also be connected to pin C1-75 of the controller's C1 connector. The other point of the terminal strip shall be connected to controller logic ground.

3.4.10 Input File Slot 14

Input File Slot 14 shall be disabled by means of jumping Channel 1 Out (F) to Channel 1 In (D), and Channel 2 In (W) to Channel 2 Out (J). The front opening of Input File Slot 14 shall be covered with a faceplate constructed of the same material as the input file housing.

3.4.11 Cabinet Filters

The cabinets shall have vents on both the front and back doors and metal water deflection panels mounted inside the vents. A disposable paper filter element shall be provided in lieu of a metal filter.

3.4.12 Surge Protection

The cabinet shall be furnished with a plug-in RFI filter and surge protection device, EDCO MODEL SHA 1250, mounted on the cabinet service panel assembly on Socket BEAU S-5412 SB or approved equal.

3.5 Conflict Monitor

3.5.1 The conflict monitor shall meet the requirements of the CalTrans specifications, plus the additional requirements as specified below:

3.5.2 The conflict monitor shall provide a guaranteed minimum flash time on power-up, brownout restore, and short AC Line interrupts to allow the 2070L controller time to boot and set signal outputs.

3.5.3 The conflict monitor shall provide red monitoring and the Model 332 Cabinet shall be adapted for red signal monitoring. All required cables, wiring and equipment for red signal monitoring shall be included under this item.

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- 3.5.4 The conflict monitor display on the front panel shall clearly indicate the following tripped conditions: 24VDC Fail, Conflict, Watchdog Error, Switch or Dual Indication, Red Fail, and Yellow or Sequence Fail.
- 3.5.5 The conflict monitor shall have an Ethernet port installed on the front panel for communicating with a laptop computer, or for communications to a network switch. The conflict monitor shall be compatible with Siemens Se-PAC software. The software for communicating with the conflict monitor shall be provided.
- 3.5.6 The conflict monitor shall be capable of storing in non-volatile memory a minimum of 100 events. Each event shall be marked with the time and date of the event. These events consist of fault events, AC Line events, reset events, and configuration change events.
- 3.5.7 An Ethernet cable shall be provided with each conflict monitor furnished.
- 3.6 Model 200 Solid State Switchpack
 - 3.6.1 The Model 200 Solid State Switchpack shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.7 Model 204 Flasher Unit
 - 3.7.1 The Model 204 Flasher Unit shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.8 Model 222 Dual Channel Loop Vehicle Detector
 - 3.8.1 The Model 222 Dual Channel Loop Vehicle Detector shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.9 Model 242 Dual DC Isolation Module
 - 3.9.1 The Model 242 Dual DC Isolation Module shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.10 Model 430 Flash Transfer Relays
 - 3.10.1 The Model 430 Flash Transfer Relays shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.

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3.11 Fiber Optic Distribution Panel

- 3.11.1 Fiber optic distribution panels shall be provided in each cabinet specified for the termination and optical continuation of the fiber optic cables as required. The unit shall act as an interface between the fiber optic drop cable and the fiber optic patch cables located within the cabinet. In addition, the distribution panel shall facilitate the reassignment of the fibers within and testing of the optical fiber cable plant. The rack shall be configured in connector fields consisting of rack mounted bulkhead connectors. The fields shall contain a sufficient quantity of connectors to accommodate the maximum number of fibers entering the equipment cabinet. Each connector field shall consist of up to 12 type LC single mode connectors per row, with the connector fields clearly identified by function. The distribution panel shall be capable of mounting in the standard 19" rack assembly of the cabinet. The patch panel shall be provided with a minimum of twelve (12) LC style fiber optic bulkhead connectors.
- The distribution panel shall have sufficient room for slack fiber and shall have multiple entrances. All connections to active optical transmission equipment within the cabinet shall be via this panel.

3.12 Terminal Block for Communications Signal Conductors (Twisted Pair)

- 3.12.1 Communications cable pairs, including systems sensors and interconnect, shall have surge protectors installed between the cable pairs and the equipment they are wired to. The conductor leads and the surge protector leads shall be kept as short as possible with all conductor bends formed to the maximum possible radius. The protector units shall be located as near as possible to the entry point and as far as possible from any electrical equipment. The protector ground lead shall be made directly to the cabinet wall or ground plane.
- 3.12.2 The surge protectors shall contain both primary and secondary protection. The primary and secondary protectors may be packaged in the same housing, provided sufficient impedance is provided between the protector segment to allow proper operation. If the individual equipment input circuitry is provided with secondary protectors, the corresponding secondary protector need not be provided.
- 3.12.3 The primary and secondary protectors shall have the following characteristics:

Working Voltage:

The unit shall not introduce a series or shunt impedance to the signal path such that it interferes with the operation of the equipment.

Surge Voltage:

For the primary protector, the unit shall limit the surge voltage between the signal leads and ground to 300 volts or less while conducting a peak surge current of at least

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20,000 amperes. The surge current shall cause both signal leads to be grounded simultaneously under surge conditions and shall not allow a transient transverse signal to appear on the protected output signal conductors. The surge operation delay shall not exceed one micro-second.

For the secondary protector, the unit shall limit the surge voltage to a level that is less than the maximum specified operating voltage of the equipment being protected. This surge voltage shall occur when the primary protector is being subjected to its rated surge current.

Energy Rating:

For the primary protector, the unit shall be capable of dissipating 100 joules of surge energy without damage to itself.

For the secondary protector, the unit shall be capable of dissipating 20 joules of energy without being damaged.

CONSTRUCTION DETAILS

4. **Installation**

- 4.1 The Model 332 Cabinet shall be mounted on a foundation as prescribed by the plans or item sheet. The installation shall include the drilling of posts or poles and the fastening of supports. The Contractor shall supply all bolts, nuts, straps, condulets, nipples, lock washers, mounting plates, and other material required to secure the cabinet properly, and in accordance with the Traffic Signal Standard Drawings.
- 4.2 The Contractor shall make all field cable connections in the cabinet with approved insulated solderless lugs. All cabinet wiring shall be neat and firm.
- 4.3 The controller and cabinet assembly with auxiliary equipment shall be tested in the field with the prescribed timing schedules for forty-eight (48) trouble-free hours prior to on-line activation.

5. **Installation Details**

- 5.1 The Contractor shall install the Model 2070L Controller Unit and all related hardware in the Model 332 Cabinets at locations specified on the plans.
- 5.2 The County will provide the signal control software and the Contractor shall be required to program and test the Controller prior to installation in the field.
- 5.3 After all cables are installed and tested entering the cabinet, the Contractor shall seal all conduits using duct seal and/or steel wool to deter rodent entry in the cabinet.

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- 5.4 The cabinet doors shall be perpendicular and open away from the curb as specified on the plans. If the plans do not indicate this information, the Contractor shall confirm with the Engineer regarding the orientation of the cabinet.
- 5.5 All wiring connected to terminal blocks, flashers, relays, switches, radio interference suppressor, etc. shall be identified by use of insulated pre-printed tags over the wire including, but not limited to, signal control wires, loop detector lead-in, etc. The wire markers shall carry the legend in plain words with sufficient details so that a translating sheet will not be required.

Cabinets shall be wired to accept and implement all of the features of the specified equipment.

6. Documentation Requirements

- 6.1 One (1) complete set of operation and maintenance manuals shall be placed in each field cabinet and ten (10) complete sets shall be delivered to the County. The manuals shall, as a minimum, include the following:
- 6.1.1 Complete cabinet and equipment layout drawings for all cabinet mounting configurations.
 - 6.1.2 Complete cabinet wiring and harness drawings.
 - 6.1.3 Complete installation procedures.
 - 6.1.4 Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
 - 6.1.5 Pictorial of components layout on circuit board.
 - 6.1.6 Complete maintenance and trouble-shooting procedures.
 - 6.1.7 Complete stage-by-stage explanation of circuit theory and operation.
- 6.2 The cabinet wiring diagram provided by the manufacturer shall reflect the C1 wiring/pin assignment in accordance with the C1 pin/assignment of the Siemens Se-PAC program.
- 6.3 The cabinet/equipment layout and cabinet wiring diagram shall be submitted for review and approval prior to actual cabinet fabrication.

7. Testing Requirements

At a minimum the following cabinet tests shall be performed on all cabinets, with a designated representative from the County. Test procedures shall be submitted for approval prior testing.

- 7.1 48 hour hot and cold for cabinet and controller - documented and certified.
- 7.2 Run STEP (Self Test Evaluation Program) on controller - documented and certified.
- 7.3 Run 336 Cabinet tests on cabinet. - documented and certified. It should test the following:

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- 7.3.1 Input file wiring
- 7.3.2 Output file wiring
- 7.3.3 Timing of all possible conflict combinations
- 7.3.4 Watchdog error

- 7.4 Test proper brownout voltage calibration between conflict monitor and controller. Manufacturer to submit procedure for approval. Documentation and certification to be shipped with cabinet.

- 7.5 Perform conflict monitor unit (CMU) testing as follows:
 - 7.5.1 Test all channel to channel conflicts
 - 7.5.2 Test all voltage threshold levels
 - 7.5.3 Test all auxiliary functions (watchdog, 24 VDC, program card ajar, etc.)
 - 7.5.4 Test all enhanced (absence of red, sequence, etc.)
 - 7.5.5 A printed record of each test to be provided; in particular all threshold voltages shall be documented.

METHOD OF MEASUREMENT

This work will be measured as the number of Model 332 Cabinets and Auxiliary Equipment that are satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid to furnish and install Model 332 Cabinets and auxiliary equipment shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work in accordance with the contract documents.

ITEM 680.336002NA - MODEL 336SX CABINET AND AUXILIARY EQUIPMENT
DESCRIPTION

This work shall consist of furnishing and installing a Model 336SX (Extra Stretch) Cabinet and Auxiliary Equipment in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Controller Requirements

1.1 All components and plug-in modules supplied under this item shall conform to the New York State Transportation Management Equipment Specifications for peripheral equipment. Model 2070LX controllers shall be on the latest Nassau County Qualified Products List and be approved by NCDPW. Model 2070LX controllers will be paid under a separate item.

2. Qualification

1.1 All Model 336SX components supplied under this specification shall be listed on the CalTrans Qualified Product List (QPL) that is in effect on the issue date of this invitation. In the case of the modified 336SX Cabinet, the vendor's standard model shall be listed on the CalTrans QPL that is in effect on the issue date of this invitation. All auxiliary equipment shall be listed on the CalTrans QPL that is in effect on the issue date of this invitation. Equipment that is not defined by the CalTrans "Traffic Signal Control Equipment Specifications" (TSCES) or "Transportation Electrical Equipment Specifications" (TEES) that is in effect on the issue date of this invitation is not covered by this requirement. For each piece of equipment that is covered by this requirement, the vendor shall submit a notarized certification the equipment is listed on the QPL that was in effect as of the date of issue of this invitation. Failure to provide this certification shall cause the bid to be rejected as unresponsive. If during the course of the contract, any piece of equipment ceases to be listed on the current QPL, the County may, at its option, require the vendor to provide a suitable replacement that is listed on the current QPL at no additional cost.

3. Requirements

3.1 All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the latest provisions set forth by the California Department of Transportation (CalTrans) Specifications.

The specifications for the Model 336SX Cabinet and auxiliary equipment shall conform to the requirements in CalTrans documents TSCES and TEES, and to all addenda thereto current on the issue date of this invitation.

3.2 This specification shall consist of a wired Model 336SX Cabinet with all auxiliary equipment, and cable harnesses required to control the site-specific project intersections and interface with the communications systems shown on the plans, as specified in these specifications, and as ordered by the Engineer. Model 2070LX Controller Units shall not be furnished under this item.

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3.3 As a minimum, this item shall include, but not be limited to, the following equipment:

<u>Model No.</u>	<u>Quantity</u>	<u>Description</u>
336SX	1	Model 336 Extra Stretch Cabinet
2010 ECLip	1	Enhanced Conflict Monitor Unit with Red Monitoring Kit
200	*	Solid State Switchpack
204	2	Solid State Flasher
222	*	Dual Loop Vehicle Detector Module
242	*	Dual Isolation Module (DC)
430	*	Flash Transfer Relays
-	12	Flash Program Plugs (8 red, 2 yellow, 2 white)
-	10	2w/4k bleeding resistors for unused outputs
-	1	Mounting Bracket Assembly (Pole Mt. Only)
-	1	Aluminum Cover Plate for Cabinet Bottom (Pole Mt. Only)
-	1	Fiber Optic Distribution Panel
-	1	Exterior Surface Mount 30A Transfer Switch

* The contractor shall supply the appropriate quantity of the noted components in accordance with the signal design plans and cabinet wiring diagram.

3.4 Model 336SX Cabinet

3.4.1 Dimensions

The cabinet shall be a Model 336SX Extra Stretch type with a minimum height of 55”, width of 24”, and a depth of 22”.

The unoccupied rack space of the Model 336SX Cabinet shall be provided at the bottom of the cabinet.

3.4.2 Traffic Signal Identification

The traffic signal number shall be painted on both sides of the cabinet as directed by the Engineer. It shall be painted in black with the letters 3” high in type “C” series.

3.4.3 Locks

The cabinet doors and transfer switch access door shall be equipped with a brass cylinder lock keyed for a Number Two Corbin Key, with a dust cover. Two (2) keys

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for each cabinet shall be furnished and provided in the cabinet drawer. Cabinet shall be equipped with a removable handle that shall be provided with the cabinet.

3.4.4 Finish

All surfaces of the cabinet shall be bare, unpainted aluminum.

3.4.5 Police Door

The front door of the cabinet shall be equipped with an auxiliary police access door. The police access door shall include a Signal ON/OFF switch, Flash/Auto switch, and an Auto/Manual switch with hardwired police cord. One (1) police master key shall be provided in the cabinet drawer.

3.4.6 Cabinet Light

LED lamps shall be installed in the top of the front and rear of the cabinets. Switches shall be installed on the front and rear doors. Opening of either door shall illuminate both lights.

Each LED lamp and switch shall be equipped with noise suppression devices. Activation of the LED lamps and associated switches shall not cause any disruption of the Model 2070L Controller or any other electrical device in the cabinet. The vendor shall install sufficient RFI and surge suppression equipment to assure that operation of the LED lamps will not disrupt the operation of other equipment in the cabinet.

LED lamps and associated ballast transformers shall be rated for high output in cold environments, providing high light output in ambient temperature of -13° F.

The cabinet lamp circuit shall be fused. The fuse holder shall be easily accessible from the front the cabinet. It shall not be necessary to reach into the cavity above the 2070LX controller in order to access the fuse holder for the cabinet lamps.

3.4.7 Interconnect Terminal Block

Two twelve (12) position terminal blocks for interconnection shall be installed. The Contractor shall submit the proposed terminal block schematic and mounting location to the County for approval prior to installation in the cabinet. The cabinet shall be furnished with a plug-in Data/Signal 2 pair surge suppressor device, EDCO Model PC642 series, mounted on Socket PCB1B or approved equal. The voltage clamp value for the protector shall be selected to be appropriate for the communication equipment used in the cabinet.

3.4.8 Cabinet Drawer

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An aluminum pullout drawer hinged at the top and having sliding tracks shall be provided in the cabinet. The drawer shall have the approximate dimensions of 1.75 inches in height, 13 inches deep and 16 inches wide and be capable of holding 40 pounds in weight when the drawer is extended. This drawer should be located between the Model 2070LX Controller and the power distribution assembly. Provide a top for the storage compartment that has a non-slip plastic laminate attached, which covers a minimum of 90% of the surface area of the top.

3.4.9 Door Alarm

A door ajar alarm switch shall be installed on front and back doors. Each switch shall be of heavy duty, spring-loaded design with single pole normally closed contacts. Each switch circuit shall be closed whenever the corresponding door is open at an angle of 15 degrees or more. The switches shall be installed so that they will not restrict removal of the cabinet rack assembly in any way. The door ajar switches shall only be used to support the door ajar alarm function; they shall not be used to support any other function (such as cabinet illumination or conflict monitor interlocking).

Each switch shall be wired to 2 point barrier style terminal block on the input side of the cabinet. One point of the terminal block shall also be connected to pin C1-75 of the controller's C1 connector. The other point of the terminal strip shall be connected to controller logic ground.

3.4.10 Input File Slot 14

Input File Slot 14 shall be disabled by means of jumping Channel 1 Out (F) to Channel 1 In (D), and Channel 2 In (W) to Channel 2 Out (J). The front opening of Input File Slot 14 shall be covered with a faceplate constructed of the same material as the input file housing.

3.4.11 Cabinet Filters

The cabinets shall have vents on both the front and back doors and metal water deflection panels mounted inside the vents. A disposable paper filter element shall be provided in lieu of a metal filter.

3.4.12 Surge Protection

The cabinet shall be furnished with a plug-in RFI filter and surge protection device, EDCO MODEL SHA 1250, mounted on the cabinet service panel assembly on Socket BEAU S-5412 SB or approved equal.

3.5 Conflict Monitor

- 3.5.1 The conflict monitor shall meet the requirements of the CalTrans specifications, plus the additional requirements as specified below:

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- 3.5.2 The conflict monitor shall provide a guaranteed minimum flash time on power-up, brownout restore, and short AC Line interrupts to allow the 2070LX controller time to boot and set signal outputs.
 - 3.5.3 The conflict monitor shall provide red monitoring and the Model 336SX Cabinet shall be adapted for red signal monitoring. All required cables, wiring and equipment for red signal monitoring shall be included under this item.
 - 3.5.4 The conflict monitor display on the front panel shall clearly indicate the following tripped conditions: 24VDC Fail, Conflict, Watchdog Error, Switch or Dual Indication, Red Fail, and Yellow or Sequence Fail.
 - 3.5.5 The conflict monitor shall have an Ethernet port installed on the front panel for communicating with a laptop computer, or for communications to a network switch. The conflict monitor shall be compatible with Siemens Se-PAC software. The software for communicating with the conflict monitor shall be provided.
 - 3.5.6 The conflict monitor shall be capable of storing in non-volatile memory a minimum of 100 events. Each event shall be marked with the time and date of the event. These events consist of fault events, AC Line events, reset events, and configuration change events.
 - 3.5.7 An Ethernet cable shall be provided with each conflict monitor furnished.
- 3.6 Model 200 Solid State Switchpack
- 3.6.1 The Model 200 Solid State Switchpack shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.7 Model 204 Flasher Unit
- 3.7.1 The Model 204 Flasher Unit shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.8 Model 222 Dual Channel Loop Vehicle Detector
- 3.8.1 The Model 222 Dual Channel Loop Vehicle Detector shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.
- 3.9 Model 242 Dual DC Isolation Module
- 3.9.1 The Model 242 Dual DC Isolation Module shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.

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3.10 Model 430 Flash Transfer Relays

- 3.10.1 The Model 430 Flash Transfer Relays shall conform to the requirements in the latest Transportation Management Equipment Specifications and be on the NYSDOT Qualified Products List on the issue date of this invitation.

3.11 Fiber Optic Distribution Panel

- 3.11.1 Fiber optic distribution panels shall be provided in each cabinet specified for the termination and optical continuation of the fiber optic cables as required. The unit shall act as an interface between the fiber optic drop cable and the fiber optic patch cables located within the cabinet. In addition, the distribution panel shall facilitate the reassignment of the fibers within and testing of the optical fiber cable plant. The rack shall be configured in connector fields consisting of rack mounted bulkhead connectors. The fields shall contain a sufficient quantity of connectors to accommodate the maximum number of fibers entering the equipment cabinet. Each connector field shall consist of up to 12 type LC single mode connectors per row, with the connector fields clearly identified by function. The distribution panel shall be capable of mounting in the standard 19" rack assembly of the cabinet. The distribution panel shall have sufficient room for slack fiber and shall have multiple entrances. All connections to active optical transmission equipment within the cabinet shall be via this panel.

3.12 Exterior Surface Mount 30A Transfer Switch

- 3.12.1 The transfer switch will allow for easy switching between utility power and generator power and shall be a sealed unit surface mounted on the exterior lower portion of the cabinet. Transfer switch door shall be lockable, tamper proof, and weather proof in the closed position. Transfer switch housing shall be constructed with heavy duty 12 gauge rust and corrosion proof aluminum. Transfer switch interlock prevents generator and power utility from feeding the circuit concurrently. Transfer switch shall be wired from inside the traffic cabinet. Transfer switch generator connection shall be a male 30 Amp twist lock type flush mount connector. An LED indicator light illuminates when in generator mode and utility power is restored. A simple switch allows the user to choose between utility power and generator power. Approximate dimensions – 9" Wide X 4.25" High.

CONSTRUCTION DETAILS

4. Installation

4.1 Mounting

4.1.1 Base Mount

When base mounted, the Model 336SX Cabinet shall be mounted on a foundation with an "M" base adapter as prescribed by the plans or item sheet. The Contractor shall supply all bolts, nuts, lockwashers, mounting plates, and other material required to

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secure the cabinet properly to the “M” Base Adapter and foundation in accordance with the Traffic Signal Standard Drawings.

4.1.2 The M Base Adaptor will be paid for under another Item when required.

4.1.3 Pole Mount

When pole mounted, the Model 336SX Cabinet shall be mounted on a pole as prescribed by the plans and as directed by the Engineer. Pole mounted cabinets shall be furnished with two (2) exterior pole mounting brackets and an aluminum plate to cover the opening on the bottom of the cabinet. The manufacturer shall reinforce the cabinet sidewalls/bracket mounting holes with metal plates of adequate size and strength, welded longitudinally across the inside depth of the cabinet. The cabinet shall provide sufficient resistance to flexing and shall withstand pole mounting without warping the cabinet when doors are opened or closed.

The installation shall include the drilling and welding of posts or poles and the fastening of supports. The Contractor shall supply all bolts, nuts, straps, condulets with screw on covers, nipples, lock washers, mounting plates, and other material required to secure the cabinet properly to the pole in accordance with the Traffic Signal Standard Drawings. The conduit shall be 3” or 4” in diameter as required and as directed by the Engineer.

4.2 The Contractor shall make all field cable connections in the cabinet with approved insulated solderless lugs. All cabinet wiring shall be neat and firm.

4.3 The controller and cabinet assembly with auxiliary equipment shall be tested in the field with the prescribed timing schedules for forty-eight (48) trouble-free hours prior to on-line activation.

5. Installation Details

5.1 The Contractor shall install the Model 2070LX Controller Unit and all related hardware in the Model 336SX Cabinets at locations specified on the plans.

5.2 The County will provide the signal control software and the Contractor shall be required to program and test the Controller prior to installation in the field.

5.3 After all cables entering the cabinet are installed and tested, the Contractor shall seal all conduits using duct seal and/or steel wool to deter rodent entry in the cabinet.

5.4 The cabinet doors shall be perpendicular and open away from the curb as specified on the plans. If the plans do not indicate this information, the Contractor shall confirm with the Engineer regarding the orientation of the cabinet.

5.5 All wiring connected to terminal blocks, flashers, relays, switches, radio interference suppressor, etc. shall be identified by use of insulated pre-printed tags over the wire

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including, but not limited to, signal control wires, loop detector lead-in, etc. The wire markers shall carry the legend in plain words with sufficient details so that a translating sheet will not be required.

Cabinets shall be wired to accept and implement all of the features of the specified equipment.

6. Documentation Requirements

- 6.1 One (1) complete set of operation and maintenance manuals shall be placed in each field cabinet and ten (10) complete sets shall be delivered to the County. The manuals shall, as a minimum, include the following:
 - 6.1.1 Complete cabinet and equipment layout drawings for all cabinet mounting configurations.
 - 6.1.2 Complete cabinet wiring and harness drawings.
 - 6.1.3 Complete installation procedures.
 - 6.1.4 Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
 - 6.1.5 Pictorial of components layout on circuit board.
 - 6.1.6 Complete maintenance and trouble-shooting procedures.
 - 6.1.7 Complete stage-by-stage explanation of circuit theory and operation.
- 6.2 The cabinet wiring diagram provided by the manufacturer shall reflect the C1 wiring/pin assignment in accordance with the C1 pin/assignment of the Siemens Se-PAC program.
- 6.3 The cabinet/equipment layout and cabinet wiring diagram shall be submitted for review and approval prior to actual cabinet fabrication.

7. Testing Requirements

At a minimum the following cabinet tests shall be performed on all cabinets, with a designated representative from the County. Test procedures shall be submitted for approval prior testing.

- 7.1 48 hour hot and cold for cabinet and controller - documented and certified.
- 7.2 Run STEP (Self Test Evaluation Program) on controller - documented and certified.
- 7.3 Run 336SX Cabinet test on cabinet. - documented and certified. It should test the following:
 - 7.3.1 Input file wiring
 - 7.3.2 Output file wiring
 - 7.3.3 Timing of all possible conflict combinations
 - 7.3.4 Watchdog error
- 7.4 Test proper brownout voltage calibration between conflict monitor and controller. Manufacturer to submit procedure for approval. Documentation and certification to be shipped with cabinet.

ITEM 680.336002NA - MODEL 336SX CABINET AND AUXILIARY EQUIPMENT

7.5 Perform conflict monitor unit (CMU) testing as follows:

- 7.5.1 Test all channel to channel conflicts
- 7.5.2 Test all voltage threshold levels
- 7.5.3 Test all auxiliary functions (watchdog, 24 VDC, program card ajar, etc.)
- 7.5.4 Test all enhanced (absence of red, sequence, etc.)
- 7.5.5 A printed record of each test to be provided; in particular all threshold voltages shall be documented.

METHOD OF MEASUREMENT

This work will be measured as the number of Model 336SX Cabinets and Auxiliary Equipment that are satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid to furnish and install a Model 336SX Cabinet and auxiliary equipment shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work in accordance with the Contract Documents.

**ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY,
16" X 18"**

DESCRIPTION

The work of this item shall consist of furnishing and installing LED Pedestrian Signal Assemblies with Countdown timers and mounting brackets in accordance with the contract documents and as directed by the Engineer.

MATERIALS

The pedestrian signal shall be a single unit housing for both the symbol messages and the countdown pedestrian signal display. It shall be designed to illuminate the alternate symbol message "WALKING PERSON"/"UPRAISED HAND," and "COUNTDOWN TIMER" in conformance with ITE standards.

The illumination shall be supplied by light emitting diodes (LEDs) in a uniform appearance. The LED Pedestrian Countdown Module shall be rated for a minimum useful life of 60 months and meet all parameters of this specification during this period.

Pedestrian Signal mounting brackets, attachments, and fittings shall be designed in accordance with AASHTO standard specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.

Housing

The Pedestrian signal housing shall be a one piece corrosion resistant aluminum alloy die casting complete with integrally cast top, bottom, sides, and back, or polished sheet aluminum.

Four integrally cast hinge lugs, two at the top and two at the bottom, shall be provided for the operation of a swing-down door.

A mounting hole shall be provided in the top and bottom of the housing for connection to standard pipe fittings as indicated in the standard drawings. The mounting holes shall be reinforced with an integral casting.

The door frame shall be a one piece corrosion resistant aluminum alloy die casting, complete with cast hinge lugs and latch lugs.

Latching or unlatching of the door shall require no tools.

The housing shall be dust proof, weather proof, and corrosion resistant. The housing shall provide for easy access and replacement of all components.

Each signal shall be provided with a visor approximately 8 inches in depth.

LED Countdown Pedestrian Module

Basic Requirements:

The LED Countdown Pedestrian Module shall be a single, self-contained device (16" High x 18" Wide), not requiring on-site assembly for installation into existing traffic signal housings.

**ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY,
16" X 18"**

The LED Countdown Pedestrian Module shall conform to the current version of the MUTCD Chapter 4E - Pedestrian Control Features for operation, shape, size and color.

The LED Countdown Pedestrian Module shall have a no glare lens and be UV treated for protection from the sun.

The standard colors, as defined in the MUTCD, for the LED Countdown Pedestrian Module shall be white for the "WALKING PERSON" and Portland orange for the "UPRAISED HAND" and "COUNTDOWN TIMER".

The LED Countdown Pedestrian Module shall consist of a double overlay message combining the graphic symbols of a "WALKING PERSON" and "UPRAISED HAND," and two seven segment digits for the "COUNTDOWN TIMER".

In the graphic symbols, the LEDs shall be arranged in a manner to form a solid icon symbol.

The countdown numbers shall be 9" in height.

The graphic symbols and the countdown numbers shall be located on a black opaque background.

The Portland Orange LED shall be of the latest ALLnGaP technology and the white LED shall be of the latest GaN technology.

The individual LED light source shall be interconnected so that a catastrophic failure of a single LED will result in a total loss of not more than 5% of the signal light output.

When not energized, the symbols and countdown timer shall be dark with no phantom image regardless of solar intensity or alignment.

Countdown Functionality

The LED Pedestrian Countdown Module shall be operationally compatible with currently used Model 2070L microcomputer controller and cabinet assemblies (solid state load switches, flashers, and conflict monitors).

The countdown timer section shall have a microprocessor capable of learning or recording the clearance timing when connected to a traffic controller.

When first connected, the module shall blank out the digital display during the initial countdown display "learning phase" while it records the countdown time using the Don't Walk signal indications.

This "learning phase" shall be two cycles or less.

The countdown timer module shall continuously monitor the traffic controller for any changes to the pedestrian phase time and reprogram itself automatically if needed.

The countdown timer display shall start only at the beginning of the pedestrian change interval.

ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY, 16" X 18"

After the countdown timer displays zero, the display shall remain dark until the beginning of the next countdown.

The countdown timer shall be able to follow the controller through any NEMA defined operations.

The countdown timer display remains synchronized with the signal indications and always reaches zero at the end of the flashing hand.

The countdown module shall prevent any possible conflicts between the "WALKING PERSON"/"UPRAISED HAND" signal indications at the time display.

It shall be impossible for the display to countdown during a solid hand indicator.

The countdown display shall be located immediately adjacent to the associated hand icon.

Electrical Requirements

Power Consumption

Maximum power consumption for LED Pedestrian Countdown Module shall be in accordance with the following:

	HAND	PERSON	COUNTDOWN
Operating Voltage @ 77 F	11 watts	8 watt	6 watts

The modules shall operate from a 60Hz +3Hz AC line over a voltage ranging from 80 V to 135 V. The fluctuations of line voltage shall have no visible effect on the luminous intensity of the LED modules.

Operating voltage of the modules shall be 120 VAC. All parameters shall be measured at this voltage.

Power Factor

The LED Pedestrian Countdown Module shall have a power factor of 0.90 or greater.

Total Harmonic Distortion

Total harmonic distortion (current and voltage) induced into an AC power line by a LED Pedestrian Countdown Module shall not exceed 20%.

Surge Suppression

The LED Pedestrian Countdown Module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.8 of NEMA Standard TS-2, 2003.

The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.

All wiring and terminal blocks shall meet the requirements of Section 13.02 of the ITE VTCSH standard.

**ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY,
16" X 18"**

Compatibility

The LED Pedestrian Countdown Module shall be operationally compatible with currently used Model 2070L microcomputer controller and cabinet assemblies (solid state load switches, flashers, and conflict monitors).

When a current of 20mA (or less) is applied to the unit, the voltage read across the two leads shall be 15 VAC or less.

The modules and associated onboard circuitry shall meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Sub Part B, Section 15 regulations concerning the emissions of electronic noise.

Each symbol/number shall reach 90% of their illumination (turn-on) within 75 msec. of the application of the nominal operating voltage. The module shall not be illuminated (turn-off) after 75 msec. of the removal of the nominal operating voltage.

Photometric Requirements

The minimum maintained luminous intensity values for the LED Countdown Pedestrian Module shall be in accordance with the ITE "Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED)," latest edition throughout the useful life based on normal use in a traffic signal operation over the operating temperature range.

The measured chromaticity coordinates of the LED Countdown Pedestrian Module shall conform to the chromaticity requirements of ITE "Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED)," latest edition throughout the useful life based on normal use in a traffic signal operation over the operating temperature range.

Environmental Requirements

The LED Countdown Pedestrian Module shall be rated for use in the operating temperature range of -40 F to +165 F. The modules shall meet all specifications throughout this range.

The LED Countdown Pedestrian Module shall be protected against dust and moisture intrusion per the requirements of NEMA Standard 250-1991 for Type 4 enclosures to protect all internal components.

Module Construction

The LED Countdown Pedestrian Module shall not require special tools for installation.

The circuit board and power supply shall be contained inside the module.

The assembly and manufacturing process for the LED Countdown Pedestrian Module shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

**ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY,
16" X 18"**

Module Identification

Each LED Countdown Pedestrian Module shall have the manufacturer's name, trademark, model number, serial number, date of manufacture, and lot number as identification permanently marked on the back of the module.

The following operating characteristics shall be permanently marked on the back of the module: rated voltage and rated power in Watts and volt-ampere.

Documentation Requirements

Each LED Countdown Pedestrian Module unit shall be provided with a complete and accurate installation wiring guide.

Complete name, address, and telephone number for the representative, manufacturer, or distributor for warranty repair.

Painting

The cast aluminum or sheet aluminum shall be painted with two coats of silver aluminum paint. The interior of the visor shall be finished with two coats of high quality, synthetic resin flat enamel paint, black in color, baked after application.

Drawings and Certifications

The Contractor shall provide descriptions and drawings of each type of pedestrian signal for approval

The Manufacturer shall provide a certified report that the pedestrian signal is in compliance with this specification.

Units or parts found damaged or imperfect when inspected after delivery and/or installation shall be replaced by the Contractor at his own expense, including all subsequent delivery, shipping, and reinstallation charges.

CONSTRUCTION DETAILS

Shop drawing and/or catalog cuts shall be submitted to the Engineer for approval. The Contractor is not to order materials until the shop drawings are approved.

The pedestrian signal shall be installed on steel, wood, or aluminum poles as indicated on the plans.

Post Top Mount

The lower supporting assembly of the pedestrian signal shall consist of an aluminum slipfitter assembly with an approved locking device. A close nipple with locknuts or equivalent shall be utilized to secure the slipfitter to the pedestrian signal. The top of the signal face shall be sealed with a threaded cap assembly

When two or more signals are installed on a pedestal an approved bracket assembly shall be utilized for the top and bottom of the signals and secured to the side of the post.

**ITEM 680.813108NA LED PEDESTRIAN SIGNAL WITH COUNTDOWN TIMER ASSEMBLY,
16" X 18"**

The bracket shall have as many arms as the number of signal faces to be installed. A locking device shall firmly and positively hold the signal face in the required alignment shall be furnished and installed.

Shaft Mount

The upper and lower support assembly shall consist of two cast aluminum pole mounting brackets. The pole mounting brackets shall be cast with a threaded hub to receive a pipe and two guides for stainless steel bands.

The bracket shall be secured to the pole with stainless steel bands, steel conduit and elbows shall be used to secure the top and bottom of the pedestrian signal to the brackets. Steel lock nuts shall be installed on all conduits at the juncture of the conduit, bracket or elbow.

Locking devices, which shall firmly and positively hold the signal head in the required alignment, shall be furnished and installed.

The Pedestrian signal shall be installed and aligned in accordance with the plans or as ordered by the Engineer.

The electrical cable for the pedestrian signal shall be routed through the bracket assembly and conduit, and connected to the proper terminal block within the signal housing.

When the pedestrian signal is mounted on the side of a pole, the lower portion of the pedestrian signal support shall provide a vertical clearance as indicated on the Contract Documents. No portion of any pedestrian signal shall be closer than the clearance indicated in the Contract Documents.

METHOD OF MEASUREMENT

This work will be measured by the number of LED Pedestrian Signals with Countdown Timer assemblies that are furnished and installed as shown on the plans or as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid to furnish and install each LED Pedestrian Signal with Countdown Timer Assembly shall include the cost of the 16" X 18" LED pedestrian signal and countdown module, the pedestrian signal housing, all necessary internal wiring, mounting hardware including all post top and shaft mount brackets, elbows, strapping, and all labor, incidental materials, tools, transportation, and equipment necessary to complete this work to produce a fully functional pedestrian display including all tests to the satisfaction of the Engineer.

ITEM 680.51000010 - ALTER ELEVATION OF PULL BOXES

DESCRIPTION:

Under this item the Contractor shall alter the elevation of existing pull boxes in accordance with this specification, the details included in the contract plans, and the directions of the Engineer.

MATERIALS:

Existing pull box frames and covers shall be reused.

Concrete shall meet the material requirements for Portland Cement Concrete, Class A, as outlined under Section 501 of the Standard Specifications.

CONSTRUCTION DETAILS:

The Contractor shall exercise care in removing and reinstalling pull box frames and covers so as not to damage any part thereof. Any component parts damaged by the Contractor shall be repaired or replaced at the Contractor's expense to the satisfaction of the Engineer.

Pull box walls shall be reconstructed as shown on the contract plans.

METHOD OF MEASUREMENT:

This work will be measured as the number of pull boxes altered in accordance with the plans, specifications, and directions of the Engineer.

BASIS OF PAYMENT:

The unit price bid for this item shall include the cost of all labor, equipment, and materials necessary to complete the work.

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680.51050010- RECTANGULAR REINFORCED CONCRETE PULLBOX

(26 inches X 18 inches)

DESCRIPTION

Under this item the Contractor shall furnish and install a rectangular reinforced concrete pullbox in accordance with this specification and the directions of the Engineer.

MATERIALS

Subsections 680-2.01, 680-2.02, and 680-2.05 shall apply.

CONSTRUCTION DETAILS

The requirements of Subsections 680-3.01, 680-3.04, 680-3.06, 680-3.09 and 680-3.14 shall apply with the following modifications:

The pullbox cover text shall read "NYS TRAFFIC" on the first line and "SIGNALS" on the second line in place of the text "TRAFFIC SIGNALS" as shown on the State Standard Sheet titled "Precast Standard Rectangular Pullboxes, Frames and Covers."

METHOD OF MEASUREMENT

This work will be measured for payment as the number of rectangular reinforced concrete pullboxes installed in accordance with the contract documents to the satisfaction of the Engineer.

BASIS OF PAYMENT

Subsection 680-5.05 shall apply.

ITEM 680.51100010 - CLEAN EXISTING PULLBOX

DESCRIPTION:

The Contractor shall clean existing pullboxes as indicated on the plans or as directed by the Engineer.

MATERIALS:

Not applicable.

CONSTRUCTION DETAILS:

Existing pullboxes shall be cleaned to the base of its walls in a workmanlike manner and maintained clean as determined by the Engineer for the duration of the contract.

Existing pullboxes shall be dried by pumping, bailing, hauling or by any other method approved by the Engineer. Drying operations shall not cause soil erosion and shall be performed so as to avoid contamination of other new or existing facilities.

Material removed from the pullboxes shall be disposed of in accordance with provisions of Subsection 203-3.08, Disposal of Surplus Excavated Materials.

The Contractor shall execute care and protect all facilities within the pullboxes and the area adjacent to the work.

The Contractor shall replace in kind, any pullboxes or other facilities damaged by his operations at his own expense.

METHOD OF MEASUREMENT:

Cleaning existing pullboxes will be measured by the number of pullboxes actually cleaned and maintained in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT:

The unit price bid to clean each existing pullbox shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. Payment will be made for only those existing pullboxes designated by the Engineer to be cleaned. Only one payment for each existing pullbox will be made regardless of the number of times it is cleaned. No payments will be made for pullboxes which are installed by the Contractor under this contract. No separate payments will be made for pullboxes damaged by the Contractor's operations.

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ITEM 680.51300010 - CAST-ALUMINUM PULL BOX

DESCRIPTION.

The Contractor shall furnish and install a cast-aluminum pull box as shown on the plans.

MATERIALS.

The cast-aluminum pull box shall be approximately 8 ¼ inches long, 7 inches wide, and 5-1/8 inches deep unless detailed otherwise on the plans. The box shall have a removable cover to provide easy access and shall be made moisture-proof with gasket material and stainless steel bolts. The service entrances in the cast-aluminum box shall be threaded for 1 1/4 NPS conduit. The pull box shall have sufficient mechanical strength to withstand the transmitted shock of traffic without damage.

Concrete shall meet the requirements of Section 501, "Portland Cement Concrete-General" and shall be Class F.

All polyvinyl chloride plastic appurtenances shall meet the requirements of Subsection 723-19 "Rigid Plastic Conduit," Class 1.

Basis of Acceptance. Cast-aluminum pull boxes will be accepted upon the manufacturer's certification that they meet the requirements of this specification.

CONSTRUCTION DETAILS.

Subsection 680-3.01, "Equipment List and Drawings" shall apply.

The service entrances in the cast-aluminum pull box that are not utilized shall be capped with standard polyvinyl chloride plastic caps. All cast-aluminum boxes shall have a polyvinyl chloride plastic drain installed utilizing the 1 1/4 NPS threaded hub on the bottom of the box.

The cast-aluminum pull box shall be installed in a concrete foundation flush with the roadway pavement as shown in the Plans, or as directed by the Engineer.

METHOD OF MEASUREMENT.

The work will be measured by the number of pull boxes furnished and installed.

BASIS OF PAYMENT.

The unit price bid for furnishing and installing the pull boxes shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work.

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ITEM 680.51400010-CONCRETE FIBER OPTIC PULLBOX

DESCRIPTION:

Under this item, the contractor shall furnish and install concrete fiber optic pullboxes in accordance with this specification and as shown on the plans.

MATERIALS:

In addition to the requirements shown on the plans, the pullbox, frame and cover shall be in accordance with the minimum requirements specified in sub-section 680-2.02 and .05 of the Standard Specifications.

The minimum internal dimensions of the pullbox shall be 36 inches L x 36 inches W x 36 inches D. The pullbox, frame and cover shall have sufficient mechanical strength to withstand the impact of the repeated MS-23 vehicle live loads without damage. The cover of the pullbox shall have "NYSDOT - FIBER" embossed on it. At least two (2) Penta bolts shall be used to lock the cover in place.

CONSTRUCTION DETAILS:

The pullbox shall be installed in accordance with the details shown on the plans.

Subsections 680-3.01, .04, .06, .09, .12, .13 and .14 of the Standard Specifications shall apply to the work of this item.

The pullbox shall be constructed in conformance to this specification and as shown in the plans. Any holes for conduit and cable entry shall be carefully drilled or punched into the side of the pullbox. After insertion of conduits or cables, holes shall be tightly and thoroughly sealed to the satisfaction of the engineer.

Soil in the vicinity of the pullbox shall be vibrated and thoroughly compacted around the entire pullbox up to grade.

The top of the cover shall be set at grade. A concrete lock-in feature shall be provided around the top of the pullbox.

METHOD OF MEASUREMENT:

The item will be measured for payment as the number of each unit furnished and installed in accordance with the contract documents or as directed by the engineer.

BASIS OF PAYMENT:

The unit price bid for the concrete fiber optic pullbox shall include the cost of furnishing all equipment, materials, incidentals, labor, tools and documentation required to complete the work. All concrete, frames, covers, reinforcing steel, crushed stone or gravel, extensions, saw cutting, excavation, backfill and restoration of adjacent surfaces shall be included in the cost of this item.

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ITEM 680.53010010 - CLEAN EXISTING CONDUIT

DESCRIPTION –

The Contractor shall clean existing conduit at the locations indicated on the plans or as directed by the Engineer to make certain that the conduit is clear and satisfactory for the installation of cable. The work does not include cleaning of a conduit following repair in place or replacement of a defective conduit.

MATERIALS –

Not applicable.

CONSTRUCTION DETAILS –

All existing cable shall be removed and a steel mandrel with wire brush cleaner no less than 2 inches long and having a diameter no less than 70 percent of the inside diameter of the conduit shall be passed through the entire run of conduit from one end to the other between pullboxes and/or poles without binding. Conduits which will not allow the mandrel with brush to be pulled through will be repaired under other contract pay items. After the conduit has been cleaned, the Contractor shall furnish and install a No. 10 AWG galvanized steel drag wire or nylon or polypropylene rope with a tensile strength of at least 495 lbf in the conduit from one end to the other, leaving no less than 3 ft of slack at each end in each pullbox or base of pole. The galvanized wire shall be grounded to a suitable grounding device at each end of the conduit in accordance with Section 680-3.12.

METHOD OF MEASUREMENT –

This work will be measured for payment as the number of feet of existing conduit actually cleaned in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT –

The unit price bid shall include the cost of furnishing all labor, materials and equipment required to satisfactorily complete the work.

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ITEM 680.76610010 - POWER SERVICE CONNECTION (NASSAU COUNTY)

DESCRIPTION

Under this item the Contractor shall furnish and install a power service connection.

MATERIALS

The power connection assembly shall be a fused insulated connector kit. The kit shall be adaptable for use with No. 14 through No. 4 AWG cable. The power connection shall be two piece.

The length of the power connection shall be 4 ¼ inch. The cable shall be attached to the power connection assembly with standard crimping tools. The jacket of the power connection shall be rubber. The fuse shall be sized to the existing load not to exceed the capacity or rating of the cables. The power connection shall be approved by the Department of Public Works, County of Nassau, prior to installation. The circuit shall be energized only after approval has been received from the electric utility company.

CONSTRUCTION DETAILS

The power connection shall be installed and located in accordance with the electric utility company requirements and shall be connected to the No. 8 AWG power conductor installed under another item.

The power connection shall be installed in a designated pull box or as ordered by the Engineer.

METHOD OF MEASUREMENT

This work will be measured as the number of power connections furnished and installed in accordance with the plans, specifications and orders of the Engineer.

BASIS OF PAYMENT

The unit price bid for this item shall include the cost of the fuse, the power connection assembly, all tools, labor, equipment and transportation necessary to complete the work.

ITEM 680.77000010 - MODIFY TRAFFIC SIGNAL EQUIPMENT
ITEM 680.79000010 - REMOVE TRAFFIC SIGNAL EQUIPMENT

DESCRIPTION.

This work shall consist of modifying existing traffic signal equipment and removing existing traffic signal equipment, in accordance with the plans, specifications, or directions of the Engineer.

MATERIALS.

When the existing system is to be modified, the existing material shall be reused in the revised system, removed, salvaged, or disposed of as shown on the plans, as specified in the special provisions, or as directed by the Engineer.

New material required shall conform to the requirements of Subsection 680-2 of the Standard Specifications.

CONSTRUCTION DETAILS.

Where shown on the Contract Plans or directed by the Engineer, existing traffic signal equipment shall be either modified or removed and disposed of as specified in the Contract Documents.

The requirements of Subsections 680-3.01, 680-3.03, 680-3.04, 680-3.06, 680-3.07, 680-3.08, 680-3.09, 680-3.10, 680-3.12, 680-3.14, 680-3.16, 680-3.22, 680-3.30, and 680-3.32, as applicable, shall apply.

Care shall be exercised in removing and salvaging electrical equipment so that it will remain in its original form and existing condition wherever possible. The Contractor will be required to replace, at his expense, any traffic signal equipment which is determined by the Engineer to have been damaged or destroyed by reason of the Contractor's operations.

Existing material required to be modified and found to be unsatisfactory by the Engineer shall be replaced by new material and the cost therefor will be paid for as extra work.

METHOD OF MEASUREMENT.

The items will be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT.

The lump sum price bid shall include the cost of furnishing all labor, materials, tools, equipment, safety requirements as determined by U.S. Department of Labor's Occupational Safety and Health Standards, and incidentals necessary to complete the work including excavation, backfill, concrete, and restoration of surfaces.

Monthly payments will be made in proportion to the amount of work done under each item as determined by the Engineer.

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ITEM 680.81422010 - AUXILIARY POLE AND FOUNDATION

DESCRIPTION

The Contractor shall furnish and install auxiliary steel poles as shown by the plans and as directed by the Engineer. Auxiliary poles are intended for use to provide overhead connections to and support pedestrian push buttons and/or other traffic control devices.

MATERIALS

Auxiliary pole and foundation shall meet all the materials requirements of section 680-2 with the same requirements as span wire traffic signal poles.

CONSTRUCTION DETAILS

Auxiliary pole and foundation shall meet the construction details of section 680-3. The auxiliary pole shall be raked so that it appears vertical when loads are applied.

BASIS OF ACCEPTANCE

Acceptance for auxiliary poles covered by this specification will be based on the following:

- Submission of fabrication details for each pole intended for a worst case configuration of the load as specified in the contract documents, approved, stamped and signed by a Professional Engineer licensed and registered to practice in New York State.
- Submission of the manufacturer's certificate of compliance with these specification requirements and the approved fabrication details.
- Appearance of the manufacturer's name on the Department's list of approved manufacturers.

METHOD OF MEASUREMENT

This work shall be measured for payment by the number of auxiliary poles furnished and installed in accordance with the contract documents and as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

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ITEM 680.82XXYY10 – MAST ARM POLE WITH ROTATING ARM LENGTH UPTO 50 ft

DESCRIPTION

Under these items, the Contractor shall furnish and install the combined mast arm poles and mast arms which will support traffic control signals and auxiliary equipment as shown on the Contract Documents or as ordered by the Engineer.

MATERIALS

A GENERAL

1. The mast arm pole and mast arm may be fabricated of pipe, tube, or cold-formed hot rolled steel conforming to one of the following alloys:

ASTM A53 Grade B
ASTM A252 Grade 2 or 3
ASTM A595 Grade A or B

All alloys used shall be subject to approval of the Engineer.

2. The yield of this pipe or tube shall be not less than 48 ksi. The yield of the cold-formed hot rolled steel shall not be less than 55 ksi for ASTM A595 Grade A or 60 ksi for Grade B.
3. The mast arm pole, mast arm, and base shall be hot-dipped galvanized in accordance with ASTM 123.
4. The anchor bolts, nuts, and washers shall conform to the standard specifications for low-carbon steel, "Externally and Internally Threaded Standard Fasteners," A.S.T.M. Designation A307, current edition AISI, C1035, special quality. The bolts, nuts, and washers shall be galvanized in accordance with ASTM 123. The bolts shall be galvanized after threading and assembly.
5. All other miscellaneous hardware shall be stainless steel.
6. Nut covers shall be cast aluminum or spun aluminum.
7. All hardware shall be packaged for each pole furnished.

B DESIGN REQUIREMENTS: GENERAL

1. Design stress for mast arm poles, mast arms, and all its components shall not exceed 55% (percent) of yield strength of the specified material used, equivalent to a 1.8 factor of safety.
2. All poles shall be designed to support at the free end of the mast arm a load of 463 lb applied vertically downward and a load of 701 lb applied perpendicular to the axis of the mast arm and the vertical force.
3. The mast arm pole and mast arm of the length designated shall be designed such that when assembled as a unit, the maximum horizontal deflection of the pole shall not exceed 3 inches at the top of the shaft in any direction.
The manufacturer shall certify by a load test in each arm, that the Maximum Vertical Deflection with an applied dead load of 190 lbs. to the free end of the mast arm (as measured in the installed position) shall be limited to the following:

ITEM 680.82XXYY10 – MAST ARM POLE WITH ROTATING ARM LENGTH UPTO 50 ft

Mast Arm Length (ft.)	Max. Vertical Arm Deflection (in.)
40 and below	6
45	9
50	12

The maximum horizontal (sideways) deflection of the free end of the mast arm, from the no load position, shall not exceed those indicated on the contract plans.

4. The dimension and roadway clearances shall be as indicated on the contract plans.
5. The assembled unit of mast arm and pole shall be so designed as to permit the arm to be rotated to any angle (0° – 360°) in a horizontal plane and to be secured in that position. This rotation capability shall be provided for at the top of the vertical shaft, where the arm is attached.

C DESIGN REQUIREMENTS: MAST ARM POLES

1. The mast arm pole shall be designed under the load and design requirements set forth in Section B.
2. The cross section of the poles shall be symmetrical about its axis. The poles shall be round. They may be uniformly tapered or have a constant nominal diameter not exceeding those indicated on the details at the base. If longitudinally welded, the exposed weld shall be ground or rolled smooth and flush with the base metal. All such welds shall be continuous. All pipe or tubings shall be full lengths for poles. No splicing will be permitted.
3. The base shall be designed to fully develop the ultimate strength of the pole. The base may have a cross section similar to the pole; it may be round or a regular polygon and shall be designed to fully transfer the load to the anchor bolts.
4. The base of each pole, shall be fabricated to receive anchor bolts spaced equally apart on a bolt circle, indicated on the details symmetrically about the axis of the pole.
5. Each anchor bolt shall be supplied with a leveling nut and a stop nut. Each anchor bolt shall be sized and threaded as indicated on the details. A flat steel plate shall be either welded with a fillet weld or threaded or bolted to the imbedded end.
6. Each pole shall be furnished with bolt cover plates for concealing the exposed ends of the anchor bolts and nuts. A means shall be provided to secure the bolt covers to the base.
7. Each pole shall be provided with a reinforced handhole, as indicated on the details. The removable cover shall be equipped with two (2) Allen keyed, stainless steel bolts.
8. The pole shall be designed and fabricated to accommodate mast arms of 15, 20, 25, 30, 35, 40, 45, and 50 feet. The mast arms and pole shall be completely interchangeable.
9. A bronze grounding stud with bronze lock washer shall be installed inside the pole welded to the shaft opposite the handhole.

ITEM 680.82XXYY10 – MAST ARM POLE WITH ROTATING ARM LENGTH UPTO 50 ft

D DESIGN REQUIREMENTS: MAST ARMS

1. The mast arm shall be designed for the load and design requirements set forth in Section B.
2. The mast arm shall be designed as a single member without spreader arms, tie rods, or truss members. The mast arm shall have the appearance of an upsweep curving arc.
3. The mast arm shall have a cross section similar to that of the mast arm pole.
4. The rise of the mast arm from the pole end to the free end shall be as indicated on the details. This rise shall be accomplished by sloping the mast arm upward and curving it such that the middle ordinate distance between the curved mast arm and the chord shall not be less than 6 inches for any mast arm length.
5. The arm shall consist of a straight section and a constant radius curved section. These sections shall be dimensioned as indicated on the details. The curved arm shall meet the horizontal plane at the free end with an upward angle of three (3) degrees. The diameter of the arm shall not be greater than the diameter of the pole. Any difference between the diameters shall be made through a smooth appearing tapered reduction fitting at the point of joining. The minimum length of taper shall be as indicated on the details.
6. The mast arm shall be provided with a standard pipe sized as indicated on the details to support standard traffic signal heads to be located at the end of the mast arm.
7. There shall be means provided for a weather tight entrance of electrical conductors from the traffic control devices to the mast arm. This entrance shall be located through the end of the mast arm pipe fitting. At the juncture of the mast arm and mast arm pole, a weather tight exit from the mast arm to the mast arm pole for electrical conductors shall be provided internally.

E BASIS OF ACCEPTANCE

1. The Contractor shall provide descriptions and drawings of each type of mast arm pole for approval.
2. All testing for deflections, when required, shall be made on the mast arm pole and mast arm assembled as a unit. The deflection shall not exceed those specified on the details subject to the loads specified in Section B.2.
3. The manufacturer shall provide when required, a certified report from a certified independent test laboratory that the mast arm and pole have been tested and meet these specifications for deflections and materials. Additional field tests of a complete unit, pole with mast arm attached, may be required as determined by the Engineer.

F GUARANTEE

1. All material and workmanship furnished under this specification, shall be guaranteed for a period of one year from the date of completion of this contract.
2. The Contractor shall be responsible for any defective parts, due to faulty material or workmanship, free from any expense to the State during the term of this guarantee, where such material is exposed to normal operation conditions.

ITEM 680.82XXYY10 – MAST ARM POLE WITH ROTATING ARM LENGTH UPTO 50 ft

- 3. Units or parts found damaged or imperfect when inspected after delivery, shall be replaced by the Contractor at his own expense, including all subsequent delivery and shipping charges.

CONSTRUCTION DETAILS

Subsections 680-3.01 to 680-3.12 and 680-3.32 shall apply.

The mast arm pole and mast arm shall be erected upon a foundation, installed under another item, with the handhole located in a direction as approved by the Engineer. The mast arm shall be aligned as shown on the plans or as ordered by the Engineer.

The mast arm pole shall be raked when the mast arm is under a full load as shown on the intersection drawing. The pole shall be raked to a vertical position.

The pole shall be grounded with a solid copper equipment grounding conductor.

All holes and openings shall be field drilled and tapped to insure the proper alignment of attachments and fittings.

All scraped or bruised areas on the mast arm pole or mast arm shall be regalvanized in the field to the satisfaction of the Engineer.

METHOD OF MEASUREMENT

This work shall be measured by the number of mast arm poles with mast arm furnished and installed in accordance with the Contract Documents or as directed by the Engineer.

BASIS OF PAYMENT

Subsection 680-5.01 of the Standard Specifications shall apply.

The unit price bid for each pole shall include the necessary grounding system, anchor bolts, mast arms, pole assembly and erection, field galvanizing as required and the following items. Breakaway transformer bases, when specified, shall be included in the price bid for each pole.

- a. Anchor bolt covers if specified.
- b. Weather heads and couplings as required.
- c. Service bracket.
- d. Pole cap and mast arm end caps.
- e. Cabinet mounting fittings, plates, brackets as needed for the cabinet being installed.
- f. Reinforced couplings for wire entrances to cabinets.
- g. Galvanized eyebolt, nuts and washers for attaching span wire assembly.
- h. Galvanized pole clamps with eyes for attaching tether wires.

Payment will be made under:

Item No.	Item	Pay Unit
680.82XXYY10	Mast Arm Traffic Signal Pole	Each
	XX = Mast Arm mounting height in feet.	
	YY = Mast Arm length in whole feet.	

ITEM 680.84100210 - NO TURN ON RED (NTOR) LED OVERHEAD SIGN 24" W x 30"

1.0 DESCRIPTION

The work shall consist of furnishing and installing a No Turn On Red (NTOR) LED sign in accordance with all applicable NYSDOT standard sheets and specifications and in accordance with the contract documents.

2.0 GENERAL REQUIREMENTS

The NTOR sign shall be installed overhead at the intersection, supported by either mast arm or span wire.

3.0 FUNCTIONAL REQUIREMENTS

The NTOR sign shall be powered by the traffic signal control cabinet at intersection.

4.0 MECHANICAL CONSTRUCTION REQUIREMENTS

- 4.1 The sign body shall be powder-coated or clear-coated natural aluminum construction.
- 4.2 Face material to be 1/4" impact resistant polycarbonate.
- 4.3 Back material to be 1/4" high density black polyethylene (HDPE).
- 4.4 LEDs to be double row configuration for sign characters.
- 4.5 Viewable size of LED sign shall be 24"W x 30"H.
- 4.6 Design of LED sign shall allow for replacement of LEDs.
- 4.7 12 VDC @ 4.4 Amps, approx. 53 Watts.

5.0 ENVIRONMENTAL OPERATIONS

The NTOR sign shall be capable of continuous operation over a temperature range of -30 degrees F to +165 degrees F (-34 degrees C to 74 degrees C).

6.0 CONSTRUCTION DETAILS

The NTOR sign shall be installed and constructed in accordance with the details specified on the standard sheets. The NTOR sign assembly shall be installed on either an existing mast arm, newly installed mast arm, or on a span wire as specified on the plans.

The orientation shall be convenient to vehicles intending to make a right turn.

7.0 METHOD OF MEASUREMENT

The NTOR LED sign will be measured for payment as the number of NTOR LED signs, as specified, that are satisfactorily installed.

ITEM 680.84100210 - NO TURN ON RED (NTOR) LED OVERHEAD SIGN 24" W x 30"

8.0 BASIS OF PAYMENT

The unit price bid for each NTOR LED sign shall include the cost of furnishing all labor, material, tools, and equipment required to complete the installation, and to make the unit fully operational.

ITEM 683.030300NA - HD CCTV TOP MOUNT IP CAMERA ASSEMBLY

DESCRIPTION

This work shall consist of furnishing and installing HD CCTV Top Mount IP Camera Assemblies in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Product Description

- The camera system specified herein shall provide an integrated network IP camera positioning system (IPCPS) providing 720p/30 video with H.264/MJPEG compression and encoding for providing low bandwidth, low latency, high quality video images transported over standard ethernet infrastructures.
- The (IPCPS) shall integrate an HDTV standards 720p resolution @ 30 frames/sec day/night camera with integral 18x motorized zoom optics, an H.264/MJPEG ASIC based encoding engine and network communication circuitry, a wide dynamic range variable speed positioning drive, completely protected by an IP67/IP66 camera/positioner enclosure system.
- The H.264/MJPEG encoded video shall support 30 frames per second @ HDTV 720p resolution with support for uni-cast and multi-cast connections, using RTP/RTSP network layers.
- The (IPCPS) shall provide an integral web HTTP server allowing password protected administration/configuration capabilities along with full camera and positioning system control and viewing functions.
- The (IPCPS) camera manufacturer shall provide a software development kit (SDK) for allowing any 3rd party developers all necessary tools for integrating the (IPCPS) system into the users control system environment.
- The (IPCPS) shall provide hybrid capability delivering both ethernet and analog composite video and RS422 serial connections for external system connections and control.
- The (IPCPS) positioning drive system shall provide wide dynamic range speed capability of 0.1 to 80 degrees per second, with a 0.25 degree repeatability, 360 degree continuous pan rotation, and +90 to -90 degree tilt range as a minimum.
- The (IPCPS) shall include an advanced ID generation capability for indications of viewing direction, compass setting, azimuth/elevation position, location descriptors and user defined image/logo.
- The (IPCPS) shall be designed for use in harsh operational environments conforming to NEMA TS2 requirements for power, shock and vibration as well as IP66 and IP67 environmental standards.
- The (IPCPS) units shall be fully assembled, pressurized and tested at the original manufacturing facility and shipped as a complete unit, ready for installation and commissioning.

2. Quality Assurance

- Equipment: The HD CCTV Assembly shall have been satisfactorily used in projects of similar size and complexity for not less than two years.

ITEM 683.030300NA - HD CCTV TOP MOUNT IP CAMERA ASSEMBLY

3. Delivery, Storage and Handling

- Deliver materials in manufacturer's original, unopened, protective packaging.
- Store materials in a clean, dry space, protected from weather.
- Handle in a manner to prevent damage to finished surfaces.
- Where possible, maintain protective covering until installation is complete and remove such coverings as part of final clean up.
- Touch up damage to finishes to match adjacent surfaces, including recoating of galvanized or plated surfaces where damaged, cut, or drilled.

4. Product Specifications

The (IPCPS) shall meet or exceed the following design and performance specifications.

A. Camera Module

1. Image Sensor: Progressive Scan Ex-View ICX445AKA CCD
2. Image Size: Diagonal 6mm (1/3" type)
3. Image Resolution: 1280 horizontal; 720 vertical
4. Picture Elements (total) 1348 (H) x 976 (V)
5. Video Output: 16 Bit Digital YUV: 4.2.0
6. Day/Night Operation: Adjustable (Auto, Color and Mono Modes) via removable IR cut filter
7. Maximum Lens Aperture: f/1.6 (wide) to f/2.8 (tele)
8. Optical Zoom Range: 18X, 4.7mm to 84.6mm
9. Optical Zoom Speed: Two speeds, from approximately 3.5 seconds to 5 seconds full range
10. Horizontal Angle of View: Optical: 55.2° to 3.2
11. Minimum Focus Distance: 0.01m (w); 1.0m (t)
12. Auto Focus: Selectable Auto/Manual; Minimum Scene Illumination for Reliable Auto Focus shall be no more than 50% video output.
13. Manual Shutter: Selectable shutter speeds shall be from 1/30 to 1/10,000.
14. Auto Iris; Selectable auto/manual; Iris shall automatically adjust to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications.
15. Sensitivity: Scene Illumination; F1.6 @ 50% Video
 - a. 1.8 Lux (0.18 fc) @ 1/30 shutter, color mode
 - b. 0.1 Lux (0.01 fc) @ 1/30 shutter, mono mode

B. H.264/MJPEG Encoding Engine

The (IPCPS) system shall fully integrate within its positioning system enclosure the H.264/MJPEG encoding component with functions as specified below;

1. Video Encoding: H.264 (Main Profile/Level 3.1) and MJPEG standards
2. Video Streams: Two independently configurable streams; (2) H.264 streams or (1) H.264 and (1) MJPEG or (1) H.264 or MJPEG and 1 NTSC or PAL.

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3. Video Stream Configuration Properties;
 - a. Stream Settings
 1. Video Stream 1: H.264
 2. Video Stream 2: H.264 or MJPEG
 - b. Image Resolution: 720p, D1, VGA, CIF
 - c. Streaming Mode: CBR or VBR. Image Settings: (GOP (M, N)), Quality Value
 - d. Frame Rate: 30, 15, 7, 4, 2, 1
4. Data Rate: Adjustable from 64k to 8Mb/sec
5. Connection Types: Uni-cast, multi-unicast or multi-cast
6. IPCPS Video Latency: <150ms
7. Network Protocol Layers: RTP, RTSP, UDP, TCP, IP, HTTP, IGMPv2, ICMP, ARP as a minimum

C. Positioning Drive

1. Pan Movement; 360 degrees continuous rotation
2. Pan Speed; Variable from 0.1 to 80 degrees/second.
3. Pan Repeatability; +/- 0.25 degree precision
4. Pan Preset Speed; 180 degree movement < 2 Seconds
5. Tilt Movement; Minimum of +90 to -90 degrees
6. Tilt Speed; Variable from 0.1 to 40 degrees/second.
7. Tilt Repeatability; +/- 0.25 degree precision
8. Tilt Preset Speed; 180 degree movement < 2.5 Seconds
9. Positioning control shall allow variable pan/tilt speeds based on zoom position. This shall scale the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.

D. Operational

1. Presets; Minimum of 64, with each preset consisting of a pan, tilt, zoom and focus coordinate and ID label.
 - a. ID Label: Provide 1 line of up to 24 ASCII characters on video for Preset ID description. When a preset position is recalled the corresponding preset ID shall be displayed. The preset ID shall remain displayed until a pan, tilt, zoom or another preset command is received.
2. Preset Tours; Minimum 8 tours required, each tour shall consist of up to 32 pre-programmed presets, with individual dwell time property per preset per tour.
 - a. Tours shall stop upon receipt of any pan/tilt positioning command.
 - b. Tour data shall be stored in non-volatile memory and shall not be lost if a power failure occurs.
3. Scalable Zoom; Variable speed pan/tilt ranges based off of zoom position. This adds the capability of limiting the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.

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4. Updates: The (IPCPS) shall allow updates of firmware for new features via the ethernet network communication channel. An internal (IPCPS) web server shall be provided for performing this task.
5. The (IPCPS) system shall return to previous position and state of operation upon power loss and restoration.

E. On Screen Display

1. Location/Camera Site Message
 - a. Single Line of up to 128 alpha-numeric characters
 - b. Enable / Disable Mode
 - c. Selectable X-Y Position
2. Logo Display
 - a. Maximum logo size of up to 128x128 pixels
 - b. Shall be a 24-BPP Bitmap
 - c. Enable / Disable Mode
 - d. Selectable X/Y Position
 - e. Selectable Foreground Opacity Setting
3. Time/Date Display
 - a. Enable / Disable (ON/OFF)
 - b. Selectable X-Y Position
 - c. Date: DD/MM/YY or MM/DD/YY
 - d. Time Format: 24 Hour or AM/PM
4. Network Time Protocol (NTP) (CENTRAL TIME SERVER)
 - a. Enable / Disable NTP
 - b. NTP Server IP Address
5. Internal Temperature Display
 - a. Metrics (US or Europe (Ft or M; °F or °C)

F. Maintenance Functions

The camera system shall support maintenance features as defined below;

1. The camera system shall support querying of camera parameters via the Ethernet connection. The camera parameters shall consist of the following items
 - a. Serial number
 - b. Software revision
 - c. Assembly date
 - d. Camera Model Number

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2. Internal Temperature Monitoring and Reporting
3. Remote Software Upload/Updates via ethernet
4. Camera Device Auto Discovery of IP address
5. Camera System Auto Re-connect
6. Camera System Reset
7. Save and Restore camera system start-up configuration

G. IP Management

The (IPCPS) shall provide at minimum the following network configuration properties;

1. IP Configuration: DHCP or Static IP address entry
2. Net mask address entry
3. Gateway address entry
4. Domain name entry
5. DNS server entry

H. Power Input

The (IPCPS) system shall fully comply with and include independent laboratory test results confirming compliance with the following electrical operating conditions;

1. Power; <40 Watts (exclusive of PT Heater Option)
2. Operating Voltage; 89 to 135Vac +/-3hz. Shall comply with NEMA-TS2 para 2.1.2 and 2.1.3
3. The (IPCS) system shall NOT require any external to Camera System step-down power supply transformer/interface box for accepting the specified operating voltage. Products requiring this shall not acceptable.

I. Mechanical

1. Connectors; 18 Pin MS style PT06E-14-18S(SR) weatherproof non-corrosion type or equal
2. Weight; Maximum 18.5lbs
3. Dimensions; Maximum 6.7" D x 11.4" H x 13.30" W.
4. Construction; Powder Coated 6061 T6 aluminum; all internal and external parts corrosion protected, stainless steel fasteners. Faceplate shall be optically correct 0.230" thick glass.
5. Camera Mount; 6" Base plate with (4) 1/4-20 threaded holes 4.75 BC. Options for larger base plates with 7.00" BC shall be available.

J. Environmental

The (IPCPS) system shall fully comply with and include independent laboratory test results confirming compliance with the following environmental operating conditions;

1. Temperature; -29 F to 165 F tested across low and high voltage ranges per Nema-TS2 paragraphs 2.1.2 and 2.1.3.
2. Vibration; Per Nema-TS2 paragraphs 2.1.9, 2.2.3, 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.
3. Shock; Per Nema-TS2 paragraphs 2.1.10, 2.2.4, 10g applied in each of 3 mutually perpendicular planes.

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4. Water Spray; Per IEC 60529+A1, 1999, Para 14.2.6, Solid water stream delivered thru 12.5mm nozzle @ 25 gallons/minute @ 9ft for 3 minutes
5. External Icing; Per Nema-TS2 250-2003, paragraphs 5.6
6. Corrosion Protection; Per Nema 250-2003, paragraphs 5.10
7. Humidity; 0-100% N.C per MIL-E-5400T, paragraphs 3.2.24.4
8. Standards; IP66, IP67, ASTM-B117 Marine

K. Certifications

1. Safety; CE (24Vac)
2. Emissions; FCC Class A

CONSTRUCTION DETAILS

This item will consist of furnishing and installing a HD Closed Circuit Television (CCTV) Top Mount IP Camera Assembly at locations shown on the plans or as directed by the Engineer. The HD CCTV Top Mount Camera Assembly (CCTV Assembly) shall be installed on poles as shown in plans. Poles shall be existing or provided under other contract items. All materials, labor, workmanship, equipment, testing, documentation, and incidental items required to install and test a complete and operational Furnish and Install CCTV Top Mount Camera Assembly shall be supplied including but not limited to the following:

HD CCTV Top Mount IP Camera Assembly

- Camera with optical and digital zooms, automatic iris and daylight and nightlight sensitivity.
- Environmental enclosure
- Pan-tilt unit with preset
- Pole Top Camera Mount
- Camera / pan-tilt interface cable.

7. Examination

- Inspect all System equipment and accessories prior to installation. Replace any damaged items.
- Ensure that the spaces where any electronic equipment is to be stored and/or installed is completely free from any foreign substances, such as concrete dust, water, or any other material that may otherwise be harmful to electronic equipment and connections. No allowances shall be made to the Contractor for equipment damage, or delays due to environmental/security damage.

8. Preparation

- The Contractor shall be responsible for field verification of dimensions and coordination of conduit entry and all other mounting conditions with the entity manufacturing the equipment.
- The entity manufacturing the equipment shall provide on-site technical supervision and assistance during installation and interconnection of the system equipment installed by the Contractor. Said supervision is to insure the safety of the proper installation and operation of the system equipment, prior to the installed system beginning the 30-day operational test.

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- An on-site inspection will be made by the Engineer after the system equipment has been delivered,. If any equipment has been damaged or for any reason does not comply with the requirements of this Section, the Contractor will be notified in writing, and shall be required to replace the equipment at his own cost and expense, even though the equipment has been previously inspected, tested, and approved for shipment. After such satisfactory replacement, the Contractor shall install the system.

9. Installation Details:

- The Contractor shall install the specified HD CCTV assembly at locations shown on the plans and as directed by the Engineer. The equipment shall be installed on a pole at locations shown in the Contract Documents and Specifications. Particular care shall be given to the interconnection of all the components and the cabling, especially cabling through the conduit in the pole.
- All incidental parts which are necessary to complete the installation, but are not specified herein or on the plans, shall be provided as necessary to provide a complete and properly operating system. The Contractor shall prepare a shop drawing that details the complete Camera assembly and all components to be supplied.
- Install all System equipment in accordance with the manufacturers written instructions in the locations shown on the Contract Drawings.
- All control power and data communications wire shall be wired and harnessed within the equipment enclosures to meet the NEC requirements and utilize standard industry practices.
- All wiring shall be clearly labeled with function and wire identification number corresponding to the manufacturer's wiring diagrams and/or approved Shop Drawings.
- Where external circuit connections are required, terminal blocks shall be provided and the manufacturer's drawings must clearly identify the interconnection requirements including wire type to be used.
- All wiring required to externally connect equipment lineups shall be installed by the electrical contractor.
- Contractor interconnection wiring requirements shall be clearly identified on the "AS-BUILT" system drawings.

10. Testing Requirements

The HD CCTV assembly shall be subjected to several levels of testing (post installation, and 30-day operational acceptance) as described in these Specifications. The Engineer reserves the right to inspect and/or factory test any completed assemblies prior to delivery of the material to the project site. Any deviation from these specifications that are identified during testing shall be corrected prior to shipment of the assembly to the project site.

A post installation test shall be performed for each completed Camera assembly. The test shall be conducted from the field equipment cabinet utilizing PC diagnostic to be supplied. The Contractor shall verify that the camera can be fully used and moved through the entire limit of Pan, Tilt, Zoom, and Focus.

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The test shall also verify capabilities that all cabinet alarms (door open, temperature, etc) are operable, controllable and the appropriate status can be read via the control port of the control receiver driver. In addition, with the use of a monitor the video signal shall be demonstrated to be according to specification.

30-day operational acceptance shall be performed for the completed Camera system. The test shall be conducted from the field equipment cabinet and central operations. The Contractor shall verify that the camera can be fully used and moved through the entire limit of Pan, Tilt, Zoom, and Focus. The test shall also verify capabilities that all cabinet alarms (door open, temperature, etc) are operable, controllable and the appropriate status can be read via the control port of the camera controller module. In addition, with the use of a monitor the video signal shall be demonstrated to be according to specification.

Post-Installation Tests

After installation, a post installation test of the equipment shall show compliance with this Section and the manufacturers specifications. The Contractor shall submit the proposed testing procedure to the Engineer for approval two weeks prior to proposed start of test. Said testing shall continue until the results surpass the test criteria and are satisfactory to the Engineer. The Contractor shall perform any repairs, construction, or modifications as required complying with this Section without additional cost to the County.

The Contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the requirements of this Section, the manufacturers specifications and sequences of operation submitted. Correct any malfunctions as they occur, said malfunctions shall include, but not be limited to, equipment failure or failure of the system to comply with the requirements of this Section and to the manufacturers specifications.

The Contractor shall submit a test report detailing compliance with the requirements of post- installation testing.

After satisfactory completion of post installation testing and after construction is complete, a 30-day operational test shall commence on the entire CCTV surveillance system.

30-Day Operational Test

The 30-day operational test shall commence with the approval of the engineer after post installation testing of all components and the complete CCTV surveillance system is operational.

The Contractor shall submit the proposed testing procedure to the Engineer for approval two weeks prior to proposed start of test. Said testing shall continue until the results surpass the test criteria and are satisfactory to the Engineer. The Contractor shall perform any repairs, construction, or modifications as required complying with this Section without additional cost to the County.

Testing shall be performed to verify compliance with the requirements of this Section and the manufacturer's specifications and shall be performed in accordance with the approved testing plan. Correct any malfunctions as they occur, said malfunctions shall include, but not be limited to, equipment failure or failure of the System to comply with the requirements of this Section and to the manufacturers specifications.

Malfunctions shall stop the 30-day operational test for repair of the equipments. After corrections have

ITEM 683.030300NA - HD CCTV TOP MOUNT IP CAMERA ASSEMBLY

been made, the 30-day operational test shall restart a new 30-day period and shall continue until the results are satisfactory to the Engineer for a period of 30 consecutive days.

Maintain a log during all operational testing. Include a narrative description of corrective measures required and items required or replaced.

11. Documentation Requirements

- Five (5) complete sets of operation and maintenance manuals shall be provided. The manuals shall include detail and complete information as follows:
 - Equipment operation
 - Installation procedures
 - Accurate schematic diagrams
 - Performance specification (functional, electrical, mechanical, and environmental)
 - Accurate troubleshooting, diagnostic and maintenance procedures
 - Parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA
 - Communications protocol
 - One copy of the final pole mounted cabinet-wiring diagram shall be placed in the cabinet and one reproducible and two copies delivered to the Engineer.

- Training Requirements
 - Prior to installation of any specified equipment, the Contractor's personnel shall have received training from the vendor/supplier on installation, operations, testing, maintenance, and repair procedures of all equipment.
 - In addition, training shall be provided for up to 10 individuals designated by the Engineer. The training shall include all material and manuals required for each individual. The training shall be as follows:
 - Engineering Training - A minimum of 8 hours of training for up to ten (10) engineering and operations personnel shall be provided. The training shall include both classroom and hands on CCTV equipment assembly operation and all equipment capabilities including interface to the TMC and the Video Switching and Control Equipment.

Maintenance Training - A minimum of 8 hours of training for ten (10) maintenance personnel shall be provided. The training shall include both classroom and hands on equipment operation and maintenance. It shall include the CCTV equipment theory of operation, operation instructions, circuit description, and troubleshooting, preventative maintenance, including interface to the TMC and Video Switching and Control Equipment for diagnostics

METHOD OF MEASUREMENT

This work will be measured as the number of HD CCTV Top Mount IP Camera Assemblies satisfactorily furnished and installed.

ITEM 683.030300NA - HD CCTV TOP MOUNT IP CAMERA ASSEMBLY

BASIS OF PAYMENT

The unit bid shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work including camera assemblies, camera enclosure, controller module, composite Video and camera control cable, integrations, testing, training, cable. All miscellaneous hardware required for the installation of the unit, including but not limited to coaxial cables, fiber optic jump cables, control and power cabling, connectors, terminations, and mounting hardware, between the video and communication equipment. Payment for all documentation, testing, and test equipment used for the testing of the HD CCTV Top Mount IP Camera Assembly shall be included in this item.

ITEM 683.030600NA – HD CCTV DOME IP CAMERA ASSEMBLY

DESCRIPTION

This work shall consist of furnishing and installing HD CCTV Dome IP Camera Assemblies in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Product Description

- The dome camera system specified herein shall provide an integrated network IP dome positioning system (IPDPS) providing 720p/30 video with H.264/MJPEG compression and encoding for providing low bandwidth, low latency, high quality video images transported over standard Ethernet infrastructure.
- The (IPDPS) shall integrate an HDTV standards 720p resolution @ 30 frames/sec day/night camera with integral 18x motorized zoom optics, an H.264/MJPEG ASIC based encoding engine and network communication circuitry, a wide dynamic range variable speed positioning drive, completely protected by an IP67 sealed and pressurized dome enclosure system.
- The H.264/MJPEG encoded video shall support 30 frames per second @ HDTV 720p resolution with support for uni-cast and multi-cast connections, using RTP/RTSP network layers.
- The (IPDPS) shall provide an integral web HTTP server allowing password protected administration/configuration capabilities along with full camera and positioning system control and viewing functions.
- The (IPDPS) camera manufacturer shall provide a software development kit (SDK) for allowing any 3rd party developers all necessary tools for integrating the (IPDPS) system into the users control system environment.
- The (IPDPS) shall provide hybrid capability delivering both ethernet and analog composite video and RS422 serial connections for external system connections and control.
- The (IPDPS) positioning drive system shall provide wide dynamic range speed capability of 0.1 to 200 degrees per second, with a 0.1 degree repeatability, 360 degree continuous pan rotation, and +5 to -90 degree tilt range as a minimum.
- The (IPDPS) shall include an advanced ID generation capability for indications of viewing direction, compass setting, azimuth/elevation position, location descriptors and user defined image/logo.
- The (IPDPS) shall be designed for use in harsh operational environments conforming to NEMA TS2 requirements for power, shock and vibration as well as IP67 environmental standards.
- The (IPDPS) units shall be fully assembled, pressurized and tested at the original manufacturing facility and shipped as a complete unit, ready for installation and commissioning.

2. Quality Assurance

- Equipment: The HD CCTV Assembly shall have been satisfactorily used in projects of similar size and complexity for not less than two years.

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3. Delivery, Storage and Handling Quality Assurance

- Deliver materials in manufacturer's original, unopened, protective packaging.
- Store materials in a clean, dry space, protected from weather.
- Handle in a manner to prevent damage to finished surfaces.
- Where possible, maintain protective covering until installation is complete and remove such coverings as part of final clean up.
- Touch up damage to finishes to match adjacent surfaces, including recoating of galvanized or plated surfaces where damaged, cut, or drilled.

4. Product Specifications

The (IPDPS) shall meet or exceed the following design and performance specifications.

A. Camera Module

1. Image Sensor: Progressive Scan Ex-View ICX445AKA CCD
2. Image Size: Diagonal 6mm (1/3" type)
3. Image Resolution: 1280 horizontal; 720 vertical
4. Picture Elements (total) 1348 (H) x 976 (V)
5. Video Output: 16 Bit Digital YUV: 4.2.0
6. Day/Night Operation: Adjustable (Auto, Color and Mono Modes) via removable IR cut filter
7. Maximum Lens Aperture: f/1.6 (wide) to f/2.8 (tele)
8. Optical Zoom Range: 18X, 4.7mm to 84.6mm
9. Optical Zoom Speed: Two speeds, from approximately 3.5 seconds to 5 seconds full range
10. Horizontal Angle of View: Optical: 55.2° to 3.2
11. Minimum Focus Distance: 0.01m (w); 1.0m (t)
12. Auto Focus: Selectable Auto/Manual; Minimum Scene Illumination for Reliable Auto Focus shall be no more than 50% video output.
13. Manual Shutter: Selectable shutter speeds shall be from 1/30 to 1/10,000.
14. Auto Iris; Selectable auto/manual; Iris shall automatically adjust to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications.
15. Sensitivity: Scene Illumination; F1.6 @ 50% Video
 - a. 1.8 Lux (0.18 fc) @ 1/30 shutter, color mode
 - b. 0.02 Lux (0.002 fc) @ 1/4 shutter, mono mode

B. H.264/MJPEG Encoding Engine

The (IPDPS) system shall fully integrate within its positioning system enclosure the H.264/MJPEG encoding component with functions as specified below;

1. Video Encoding: H.264 (Main Profile/Level 3.1) and MJPEG standards
2. Video Streams: Two independently configurable streams; (2) H.264 streams or (1) H.264 and (1) MJPEG or (1) H.264 or MJPEG and 1 NTSC or PAL.

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3. Video Stream Configuration Properties;
 - a. Stream Settings
 - 1) Video Stream 1: H.264
 - 2) Video Stream 2: H.264 or MJPEG
 - b. Image Resolution: 720p, D1, VGA, CIF
 - c. Streaming Mode: CBR or VBR.
 - d. Image Settings: (GOP (M, N)), Quality Value
 - e. Frame Rate: 30, 15, 7, 4, 2, 1
4. Data Rate: Adjustable from 256k to 8Mb/sec
5. Connection Types: Uni-cast, multi-unicast or multi-cast
6. IPDPS video latency: <133ms
7. Network Protocol Layers: RTP, RTSP, UDP, TCP, IP, HTTP, IGMPv2, ICMP, ARP as a minimum

C. Positioning Drive

1. Pan Movement; 360 degrees continuous rotation
2. Pan Speed; Variable from 0.1 to 80 degrees/second.
3. Pan Repeatability; +/- 0.1 degree precision
4. Pan Preset Speed; 180 degree movement < 2 Seconds
5. Tilt Movement; Minimum of +5 to -90 degrees
6. Tilt Speed; Variable from 0.1 to 40 degrees/second.
7. Tilt Repeatability; +/- 0.1 degree precision
8. Tilt Preset Speed; 90 degree movement < 2 Seconds
9. Positioning control shall allow variable pan/tilt speeds based on zoom position. This shall scale the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.

D. Camera/ pan-tilt interface cable (Composite Cable)

1. The Camera/ pan-tilt interface cable (Composite Cable) for composite Video, camera control and power shall be furnished by and meet the requirements of the camera manufacturer and be furnished at the lengths required for the installation. The cable shall be furnished and installed with factory-installed connectors to mate to the CCTV Assembly and to the camera controller, modem or switch in the camera cabinet. The Contractor shall verify the required cable length and connector type prior to furnishing.

E. Operational

1. Required camera control functions shall include the features and capabilities as a minimum to control the Day/night Mode, Shutter Speed, White balance, Maximum AGC Level, Wide Dynamic Range, Backlight Compensation, Focus; Auto or manual mode, Iris; Auto or manual mode, Zoom Lens Control, Pan/Tilt Positioning, etc.

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2. Presets; Minimum of 64, with each preset consisting of a pan, tilt, zoom and focus coordinate and ID label.
 - a. ID Label: Provide 1 line of up to 24 ASCII characters on video for Preset ID description. When a preset position is recalled the corresponding preset ID shall be displayed. The preset ID shall remain displayed until a pan, tilt, zoom or another preset command is received.
3. Preset Tours; Minimum 8 tours required, each tour shall consist of up to 32 pre-programmed presets, with individual dwell time property per preset per tour.
 - a. Tours shall stop upon receipt of any pan/tilt positioning command.
 - b. Tour data shall be stored in non-volatile memory and shall not be lost if a power failure occurs.
4. Scalable Zoom; Variable speed pan/tilt ranges based off of zoom position. This adds the capability of limiting the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.
5. Updates: The (IPDPS) shall allow updates of firmware for new features via the ethernet network communication channel. An internal (IPDPS) web server shall be provided for performing this task.
6. The (IPDPS) system shall return to previous position and state of operation upon power loss and restoration.

F. On Screen Display

1. Camera ID
 - a. Two Lines of up to 24 alpha-numeric characters
 - b. Enable / Disable Mode
2. Logo Display
 - a. Maximum logo size of up to 128x128 pixels
 - b. Shall be a 24-BPP Bitmap
 - c. Enable / Disable Mode
 - d. Selectable X/Y Position
 - e. Selectable Foreground Opacity Setting
3. Time/Date Display
 - a. Enable / Disable (ON/OFF)
 - b. Selectable X-Y Position
 - c. Date: DD/MM/YY or MM/DD/YY
 - d. Time Format: 24 Hour or AM/PM
4. Network Time Protocol (NTP) (CENTRAL TIME SERVER)
 - a. Enable / Disable NTP

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- b. NTP Server IP Address
- 5. Internal Temperature Display
 - a. Metrics (US or Europe (Ft or M; °F or °C))

G. Maintenance Functions

The camera system shall support maintenance features as defined below;

- 1. The camera system shall support querying of camera parameters via the Ethernet connection. The camera parameters shall consist of the following items.
 - a. Serial number
 - b. Software revision
 - c. Assembly date
 - d. Camera Model Number
- 2. Internal Temperature Monitoring and Reporting
- 3. Remote Software Upload/Updates via ethernet
- 4. Camera Device Auto Discovery of IP address
- 5. Camera System Auto Re-connect
- 6. Camera System Reset
- 7. Save and Restore camera system start-up configuration

H. IP Management

The (IPDPS) shall provide at minimum the following network configuration properties;

- 1. IP Configuration: DHCP or Static IP address entry
- 2. Net mask address entry
- 3. Gateway address entry
- 4. Domain name entry
- 5. DNS server entry

I. Power Input

The (IPDPS) system shall fully comply with and include independent laboratory test results confirming compliance with the following electrical operating conditions;

- 1. Power; <40 Watts (exclusive of PT Heater Option)
- 2. Operating Voltage; 89 to 135Vac +/-3hz. Shall comply with NEMA-TS2 para 2.12 and 2.1.3
- 3. The (IPDPS) system shall NOT require any external to Camera System step-down power supply transformer/interface box for accepting the specified operating voltage. Products requiring this shall not acceptable.

J. Mechanical

- 1. Connectors; 18 Pin MS style PT06E-14-18S(SR) weatherproof non-corrosion

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- type or equal
2. Weight; Maximum 14.0lbs
 3. Dimensions; Maximum 11.05" D x 13.74" W.
 4. Construction; Powder Coated 6061 T6 aluminum; all internal and external parts corrosion protected, stainless steel fasteners. Faceplate shall be optically correct 0.230" thick glass.
 5. Camera Mount; 6" Base plate with (4) 1/4-20 threaded holes 4.75 BC. Options for larger base plates with 7.00" BC shall be available.

K. Environmental

The (IPDPS) system shall fully comply with and include independent laboratory test results confirming compliance with the following environmental operating conditions;

1. Temperature; -29 F to 165 F tested across low and high voltage ranges per NEMATS2 paragraphs 2.1.2 and 2.1.3.
2. Vibration; Per Nema-TS2 paragraphs 2.1.9, 2.2.3, 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.
3. Shock; Per NEMA-TS2 paragraphs 2.1.10, 2.2.4, 10g applied in each of 3 mutually perpendicular planes.
4. Water Spray; Per IEC 60529+A1, 1999, Para 14.2.6, Solid water stream delivered thru 12.5mm nozzle @ 25 gallons/minute @ 9ft for 3 minutes
5. External Icing; Per NEMA-TS2 250-2003, paragraphs 5.6
6. Corrosion Protection; Per Nema 250-2003, paragraphs 5.10
7. Humidity; 0-100% N.C per MIL-E-5400T, paragraphs 3.2.24.4
8. Standards; IP67, ASTM-B117 Marine

L. Certifications

- 1 Safety; CE (24Vac)
- 2 Emissions; FCC Class A

CONSTRUCTION DETAILS

This item will consist of furnishing and installing a HD Closed Circuit Television (CCTV) Dome IP Camera Assembly at locations shown on the plans or as directed by the Engineer. The HD CCTV Dome Camera Assembly (CCTV Assembly) shall be installed on poles as shown in plans. Poles shall be existing or provided under other contract items. All materials, labor, workmanship, equipment, testing, documentation, and incidental items required to install and test a complete and operational Furnish and Install CCTV Dome Camera Assembly shall be supplied including but not limited to the following:

1. HD CCTV Dome IP Camera Assembly

- Camera with optical and digital zooms, automatic iris and daylight and nightlight sensitivity.
- Environmental enclosure
- Pan-tilt unit with preset
- Pole Top Camera Mount
- Camera / pan-tilt interface/ power cable (Composite cable) of the length required from the camera to the camera cabinet.

2. Examination

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- Inspect all System equipment and accessories prior to installation. Replace any damaged items.
- Ensure that the spaces where any electronic equipment is to be stored and/or installed is completely free from any foreign substances, such as concrete dust, water, or any other material that may otherwise be harmful to electronic equipment and connections. No allowances shall be made to the Contractor for equipment damage, or delays due to environmental/security damage.

3. Preparation

- The Contractor shall be responsible for field verification of dimensions and coordination of conduit entry and all other mounting conditions with the entity manufacturing the equipment.
- The entity manufacturing the equipment shall provide on-site technical supervision and assistance during installation and interconnection of the system equipment installed by the Contractor. Said supervision is to insure the safety of the proper installation and operation of the system equipment, prior to the installed system beginning the 30-day operational test.
- An on-site inspection will be made by the Engineer after the system equipment has been delivered. If any equipment has been damaged or for any reason does not comply with the requirements of this Section, the Contractor will be notified in writing, and shall be required to replace the equipment at his own cost and expense, even though the equipment has been previously inspected, tested, and approved for shipment. After such satisfactory replacement, the Contractor shall install the system.

4. Installation Details

- The Contractor shall install the specified HD CCTV assembly at locations shown on the plans and as directed by the Engineer. The equipment shall be installed on a pole at locations shown in the Contract Documents and Specifications. Particular care shall be given to the interconnection of all the components and the cabling, especially cabling through the conduit in the pole.
- All incidental parts which are necessary to complete the installation, but are not specified herein or on the plans, shall be provided as necessary to provide a complete and properly operating system. The Contractor shall prepare a shop drawing that details the complete Camera assembly and all components to be supplied.
- Install all System equipment in accordance with the manufacturer's written instructions in the locations shown on the Contract Drawings.
- All control power and data communications wire shall be wired and harnessed within the equipment enclosures to meet the NEC requirements and utilize standard industry practices.
- All wiring shall be clearly labeled with function and wire identification number corresponding to the manufacturer's wiring diagrams and/or approved Shop Drawings.
- Where external circuit connections are required, terminal blocks shall be provided and the manufacturer's drawings must clearly identify the interconnection requirements including

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wire type to be used.

- All wiring required to externally connect equipment lineups shall be installed by the electrical contractor.
- Contractor interconnection wiring requirements shall be clearly identified on the "AS-BUILT" system drawings.

5. Testing Requirements

The HD CCTV assembly shall be subjected to several levels of testing (post installation, and 30-day operational acceptance) as described in these Specifications. The Engineer reserves the right to inspect and/or factory test any completed assemblies prior to delivery of the material to the project site. Any deviation from these specifications that are identified during testing shall be corrected prior to shipment of the assembly to the project site.

A post installation test shall be performed for each completed Camera assembly. The test shall be conducted from the field equipment cabinet utilizing PC diagnostic to be supplied. The Contractor shall verify that the camera can be fully used and moved through the entire limit of Pan, Tilt, Zoom, and Focus. The test shall also verify capabilities that all cabinet alarms (door open, temperature, etc) are operable, controllable and the appropriate status can be read via the control port of the control receiver driver. In addition, with the use of a monitor the video signal shall be demonstrated to be according to specification.

30-day operational acceptance shall be performed for the completed Camera system. The test shall be conducted from the field equipment cabinet and central operations. The Contractor shall verify that the camera can be fully used and moved through the entire limit of Pan, Tilt, Zoom, and Focus. The test shall also verify capabilities that all cabinet alarms (door open, temperature, etc) are operable, controllable and the appropriate status can be read via the control port of the camera controller module. In addition, with the use of a monitor the video signal shall be demonstrated to be according to specification.

Post-Installation Tests

After installation, a post installation test of the equipment shall show compliance with this Section and the manufacturer's specifications. The Contractor shall submit the proposed testing procedure to the Engineer for approval two weeks prior to proposed start of test. Said testing shall continue until the results surpass the test criteria and are satisfactory to the Engineer. The Contractor shall perform any repairs, construction, or modifications as required complying with this Section without additional cost to the County.

The Contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the requirements of this Section, the manufacturer's specifications and sequences of operation submitted. Correct any malfunctions as they occur, said malfunctions shall include, but not be limited to, equipment failure or failure of the system to comply with the requirements of this Section and to the manufacturer's specifications.

The Contractor shall submit a test report detailing compliance with the requirements of post- installation testing.

After satisfactory completion of post installation testing and after construction is complete, a 30-

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day operational test shall commence on the entire CCTV surveillance system.

30-Day Operational Test

The 30-day operational test shall commence with the approval of the engineer after post installation testing of all components and the complete CCTV surveillance system is operational.

The Contractor shall submit the proposed testing procedure to the Engineer for approval two weeks prior to proposed start of test. Said testing shall continue until the results surpass the test criteria and are satisfactory to the Engineer. The Contractor shall perform any repairs, construction, or modifications as required complying with this Section without additional cost to the County.

Testing shall be performed to verify compliance with the requirements of this Section and the manufacturer's specifications and shall be performed in accordance with the approved testing plan. Correct any malfunctions as they occur, said malfunctions shall include, but not be limited to, equipment failure or failure of the System to comply with the requirements of this Section and to the manufacturer's specifications.

Malfunctions shall stop the 30-day operational test for repair of the equipments. After corrections have been made, the 30-day operational test shall restart a new 30-day period and shall continue until the results are satisfactory to the Engineer for a period of 30 consecutive days.

Maintain a log during all operational testing. Include a narrative description of corrective measures required and items required or replaced.

6. Documentation Requirements

- Five (5) complete sets of operation and maintenance manuals shall be provided. The manuals shall include detail and complete information as follows:
- Equipment operation
- Installation procedures
- Accurate schematic diagrams
- Performance specification (functional, electrical, mechanical, and environmental)
- Accurate troubleshooting, diagnostic and maintenance procedures
- Parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA
- Communications protocol
- One copy of the final pole mounted cabinet-wiring diagram shall be placed in the cabinet and one reproducible and two copies delivered to the Engineer.

7. Training Requirements

- Prior to installation of any specified equipment, the Contractor's personnel shall have received training from the vendor/supplier on installation, operations, testing, maintenance, and repair procedures of all equipment.
- In addition, training shall be provided for up to 10 individuals designated by the Engineer. The training shall include all material and manuals required for each individual. The training shall be as follows:
- Engineering Training - A minimum of 8 hours of training for up to ten (10) engineering and

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operations personnel shall be provided. The training shall include both classroom and hands on CCTV equipment assembly operation and all equipment capabilities including interface to the TMC and the Video Switching and Control Equipment.

Maintenance Training - A minimum of 8 hours of training for ten (10) maintenance personnel shall be provided. The training shall include both classroom and hands on equipment operation and maintenance. It shall include the CCTV equipment theory of operation, operation instructions, circuit description, and troubleshooting, preventative maintenance, including interface to the TMC and Video Switching and Control Equipment for diagnostics

METHOD OF MEASUREMENT

This work will be measured as the number of HD CCTV Dome IP Camera Assemblies satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit bid shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work including camera assemblies, camera enclosure, controller module, composite Video and camera control/ power cable, integrations, testing, training, cable. All miscellaneous hardware required for the installation of the unit, including but not limited to coaxial cables, fiber optic jump cables, control and power cabling, connectors, terminations, and mounting hardware, between the video and communication equipment. Payment for all documentation, testing, and test equipment used for the testing of the HD CCTV Dome IP Camera Assembly shall be included in this item.

ITEM 683.072012NA - 12 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072024NA - 24 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072048NA - 48 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072072NA - 72 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072144NA - 144 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072288NA - 288 PORT RACK MOUNT FIBER PATCH PANEL

DESCRIPTION

This work shall consist of furnishing and installing 12, 24, 48, 72, 144 or 288 Port Rack Mount Fiber Patch Panels and all accessories in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Basic Requirements

1.1. The basic fiber optic patch panel shall be used in traffic signal control cabinets or termination cabinets to protect fiber optic cable splices. The patch panel shall be constructed of 16 gauge steel capable of withstanding severe conditions of moisture, vibration, impact; cable stress, flexing, and temperature extremes.

1.2. The patch panel shall be constructed to mount in a standard 19 inch rack and shall be constructed of 16 gauge steel with a powder coat finish and shall be on sliding rails for easy access from the front or the rear.

1.3. Patch panel shall come from the manufacturer with LC style fiber optic connectors capable of receiving single mode fiber optic cable.

1.4. No special tools shall be required for installation of the patch panel. The patch panel shall make use of standard hardware.

1.5. Contractor shall be responsible to clearly mark or display the cable descriptions on the front of the patch panel.

1.6. The patch panel shall be accessible from the front or rear without disruption of fibers.

1.7. The patch panel shall include hardware and accessories to protect the fiber optic cable from being pulled or pinched between other equipment mounted above or below.

1.8. The patch panel, including the patch panel enclosure shall have dimensions that are no larger than;

- 12 Port - 1.9 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.
- 24 Port – 1.9 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.

ITEM 683.072012NA - 12 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072024NA - 24 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072048NA - 48 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072072NA - 72 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072144NA - 144 PORT RACK MOUNT FIBER PATCH PANEL
ITEM 683.072288NA - 288 PORT RACK MOUNT FIBER PATCH PANEL

- 48 Port – 3.5 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.
- 72 Port – 5.3 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.
- 144 Port – 7.0 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.
- 288 Port – 14.0 inches high x 17 inches wide (not including rack mount hardware) x 12 inches deep.

1.9. Once installed, access to the front and rear of the patch panel must be easily accomplished without the use of tools. A quarter turn device or thumbwheel type screw device will be acceptable.

1.10. Fiber optic break out cable shall be run up the back of the cabinet and neatly inserted into the patch panel where the fiber is to be terminated on the LC connectors provided by the manufacturer.

1.11. Dust covers shall be provided for all connectors not being utilized

CONSTRUCTION DETAILS

Patch panels shall be installed in strict accordance with manufacturer's instructions.

Patch panels shall be installed in traffic signal control cabinets as indicated on the contract plans and as directed by the Engineer.

METHOD OF MEASUREMENT

This work will be measured as the number of complete Rack Mount Fiber Patch Panels and panel enclosures satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid to furnish and install a Rack Mount Patch Panel shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily install the patch panel, all necessary hardware, accessories, patch cables, and other incidentals necessary to satisfactorily complete the work.

ITEM 683.090100NA – 8 PORT HARDENED 10/100 ETHERNET SWITCH WITH ONE DUAL PURPOSE 10/100/1000 OR SFP PORT

DESCRIPTION

This work shall consist of furnishing and installing An 8 Port Hardened 10/100 Ethernet Switch with one Dual Purpose 10/100/1000 or SFP Port in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Requirements

1.1. All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the requirements set forth in this specification.

1.2. This specification shall consist of an Ethernet Switch, as specified in these specifications. The switch shall provide Ethernet connectivity from the field cabinets to the NCDPW Traffic Management Center or any other designated locations as specified by the Engineer.

The Ethernet Switch shall be fully-compatible with all of the software management functions of the existing central switch and Cisco Works, the existing Traffic Management Center Network Management Software.

The Ethernet Switch must be registered and licensed to Nassau County Department of Public Works, Traffic Management Center..

1.3. The switch shall have (8) 10/100 baseTX (RJ-45) Ports, and (1) Dual Purpose 10/100/1000 or SFP Port.

2. Dimensions

2.1. The Ethernet Switch shall be rack-mountable in a standard 19 inch rack in accordance with EIA-310D and shall not exceed external dimensions of 1.73” (H) x 10.6” (W) x 6.4” (D).

2.2. The Ethernet Switch shall comply with the following standards:

- 2.2.1. RMON I and II standards
- 2.2.2. SNMPv1, v2c, and v3
- 2.2.3. IEEE 802.1d Spanning Tree Protocol
- 2.2.4. IEEE 802.1p CoS classification
- 2.2.5. IEEE 802.1q VLAN
- 2.2.6. IEEE 802.1w Rapid Convergence Spanning Tree Protocol
- 2.2.7. IEEE 802.1x Port Access Authentication
- 2.2.8. IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- 2.2.9. IEEE 802.3af PoE
- 2.2.10. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports
- 2.2.11. IEEE 802.3 10BASE-T
- 2.2.12. IEEE 802.3u 100BASE-T/TX
- 2.2.13. IEEE 802.3ab 1000BASE-T
- 2.2.14. IEEE 802.3z 1000BASE-X

3. Regulatory Agency Approvals

ITEM 683.090100NA – 8 PORT HARDENED 10/100 ETHERNET SWITCH WITH ONE DUAL PURPOSE 10/100/1000 OR SFP PORT

- 3.1.1. Safety certifications: UL 1950/CSA 22.2 No. 950
- 3.1.2. IEC 950-EN 60950
- 3.1.3. AS/NZS 3260, TS001
- 3.1.4. CE Marking

4. Electromagnetic Emissions Certifications

- 4.1.1. FCC Part 15 Class A
- 4.1.2. EN 55022: 1998 Class A (CISPR22 Class A)
- 4.1.3. EN 55024: 1998 (CISPR24)
- 4.1.4. VCCI Class A
- 4.1.5. AS/NZS 3548 Class A
- 4.1.6. CE Marking
- 4.1.7. CNS 13438
- 4.1.8. BSMI Class A
- 4.1.9. MIC

5. Environmentally Hardened

- 5.1. The Contractor shall provide an Ethernet Switch that is environmentally hardened and capable of operating in the following conditions: temperatures ranging from 32° F to 113° F, relative humidity from 10 to 85% (noncondensing) and altitudes up to 10,000 feet.

6. Power

- 6.1. The Ethernet Switch shall contain an internal power supply that shall support input voltages between 100 and 240 VAC. The supplied AC power cord shall be used to connect the AC power conductor to an AC duplex outlet within the cabinet. If the Ethernet Switch is installed at location where an AC duplex outlet is not readily available, the Contractor shall coordinate with the Engineer in order to modify the AC power cord, or provide other power cabling that the Contractor shall utilize, in order to make appropriate connections to the available AC power.

The Ethernet Switch shall permit input voltages ranging from 100 through 127 Volts AC (RMS) at 60 Hz, or permit voltages from 200 through 240 Volts AC (RMS) at 50 Hz. The Ethernet Switch shall have a DC input voltage of +12 V at 13 amps.

7. Communications Aspects and Switching Attributes

The Ethernet Switch shall provide acceptable levels of Quality of Service (QoS) and provide switching capabilities appropriate for interfacing with the equipment within the field cabinet. In specific:

- 7.1.1. The Ethernet Switch shall support the metering/policing of incoming packets to restrict incoming traffic flows to a certain rate: The Ethernet Switches shall support four (4) egress queues per port to enable differentiated management of up to four (4) types of traffic. The Ethernet Switch shall support a minimum of 128 aggregate or individual ingress policers and 8 aggregate ingress policers on each Gigabit Ethernet port.
- 7.1.2. The Ethernet switch shall support auto-sensing on each non-GBIC port to detect the

ITEM 683.090100NA – 8 PORT HARDENED 10/100 ETHERNET SWITCH WITH ONE DUAL PURPOSE 10/100/1000 OR SFP PORT

speed of the attached device and automatically configures the port to 10, 100 or 1000 Mbps operation, easing the deployment of the switch in mixed 10, 100, 1000 BASE-T environments.

- 7.1.3. The Ethernet Switch shall be equipped with multifunction LED's per port for port status, half-duplex or full-duplex, 10BASE-T/100/BASE-T/1000BASE-T. LED's for system redundant power supply and bandwidth usage shall also be available.
- 7.1.4. The Ethernet Switch shall support SNMP protocol and telnet for remote monitoring and troubleshooting. The Ethernet Switch shall support Remote Monitoring (RMON) software agent for RMON groups, where data history, statistics, alarms, events can be collected for traffic management, monitoring and analysis.
- 7.1.5. The Ethernet Switch shall support Switched Port Analyzer (SPAN) port to monitor the traffic going through a single or multiple ports.
- 7.1.6. The Ethernet Switch shall support Remote Switched Port Analyzer (RSPAN), where the network administrator can monitor the port switch traffic from any other switch in the same network.
- 7.1.7. The Ethernet Switch shall support Network Timing Protocol (NTP) to provide an accurate and consistent time stamp on all switches within the network.
- 7.1.8. The Ethernet Switch shall support Trivial File Transfer Protocol (TFTP) for software upgrade and configuration deployment.
- 7.1.9. The Ethernet Switch shall support filtering of incoming traffic based on the following:
 - Layer2, Source Media Access Controller (MAC) Address, Destination MAC address
 - Layer3, Source IP Address, Destination IP address
 - Layer4, TCP source or destination port number, UDP source or destination port number.
- 7.1.10. The Ethernet Switch shall support the 802.x1 standard that allows users to be authenticated, regardless of which LAN port is being accessed. The Ethernet Switch shall support 802.x1 with VLAN assignment in order to permit dynamic VLAN assignment for a specific user, regardless of where the user is connected. In addition, the Ethernet Switch shall support time-based ACL's in order to allow the implementation of security settings during specific periods of the day, or days of the week.
- 7.1.11. The Ethernet Switch shall support IGMP Filtering providing multicast authentication by filtering out non-subscribers and limits the number of concurrent multicast streams available per port.
- 7.1.12. The Ethernet Switch shall support Intrusion Detection System (IDS) to allow the IDS to take action when an intruder is detected.
- 7.1.13. The Ethernet Switch shall support Secure Socket Shell (SSH), Kerberos, and

ITEM 683.090100NA – 8 PORT HARDENED 10/100 ETHERNET SWITCH WITH ONE DUAL PURPOSE 10/100/1000 OR SFP PORT

SNMPv3 providing network security by encrypting administrator traffic during Telnet and SNMP sessions.

- 7.1.14. The Ethernet Switch shall support 802.x1 with port security authentication using access lists. In addition, the Ethernet Switch shall support MAC address notification allowing the administrator to be notified of new users as they are added or removed from the network.
- 7.1.15. The Ethernet Switch shall support QoS classification of incoming packets for QoS flows based on Layer 2–4 fields: Layer 2 fields (or a combination) for classifying incoming packets to define QoS flows: source MAC address, destination MAC address, and 16-bit Ethertype. Layer 3 and 4 fields (or a combination) for classifying incoming packets to define QoS flows: source IP address, destination IP address, TCP source or destination port number, and UDP source or destination port number.
- 7.1.16. The Ethernet Switch shall offer the ability to limit data flows based on MAC source/destination address, IP source/destination address, TCP/UDP port numbers, or any combination of these fields. The switch shall also offer the ability to manage data flows asynchronously upstream and downstream from the end station or on the uplink.
- 7.1.17. The Ethernet Switch shall support Layer3 routing including Multiplayer Switching (MLS) for inter-VLAN routing. In addition, the Ethernet Switch shall support local proxy ARP working in conjunction with private VLAN edge to minimize broadcasts and maximize available bandwidth.
- 7.1.18. The Ethernet Switch shall support Spanning-Tree protocol on both the RJ45 ports and the SFP Port in order to provide path redundancy while preventing undesirable loops in the network
- 7.1.19. The Ethernet Switch shall support Port Aggregation Protocol (PAgP) in order to automate the creation of Fast EtherChannel or EtherChannel groups, thus enabling linking to another switch, router, or server.
- 7.1.20. The Ethernet Switch shall support multicast VLAN Registration (MVR) as required for the deployment of multicast traffic across an Ethernet network. The MVR allows a subscriber on a port to subscribe and unsubscribe to a multicast stream on the network-wide multicast VLAN.
- 7.1.21. The Ethernet Switch shall support the Internet Group Management Protocol (IGMP). IGMP is utilized in order to permit the Ethernet Switch to receive all IGMP conversation between hosts and routers. When the Ethernet Switch detects an “IGMP join” request from a host for a given multicast group, the
- 7.1.22. The Ethernet switch shall provide full IPv4 dynamic routing.
- 7.1.23. Ethernet switch is to add the host’s port number to the group destination address (GDA) list for that group. When the Ethernet Switch detects an “IGMP leave” request, it is to remove the host’s port from the content-addressable memory (CAM) table entry.

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- 7.1.24. The Ethernet Switch shall support distance Vector Multicast Routing Protocol (DVMRP) tunneling for interconnecting two multicast-enabled networks across nonmulticast networks.
- 7.1.25. The Ethernet Switch shall support IP multicast routing to enable the network to receive the multicast feed requested and for switches not participating in the multicast to be pruned support for The Protocol Independent Multicast (PIM) sparse mode (PIMSM), PIM dense mode (PIM-DM), and PIM sparse-dense mode.
- 7.1.26. The Ethernet Switch shall support high-performance IP routing, supporting fallback bridging for forwarding of non-IP traffic between two or more VLAN's.
- 7.1.27. The Ethernet Switch shall support switch port Auto-recovery (or "errDisable") automatically attempts to re-enable a link that becomes disabled due to a network error.
- 7.1.28. The Ethernet switch shall support bandwidth aggregation per port, per destination and origin, using the MAC or IP addresses. It also shall aggregate the bandwidth per-port for multicast and unicast to control and prevent faulty end stations to degrade the overall system performance The Ethernet Switch is to be capable of sharing a minimum of 64 MB DRAM and 16 MB Flash memory among all ports.
- 7.1.29. The Ethernet Switch shall support a minimum of 12000 configurable MAC addresses.
- 7.1.30. The Ethernet Switch shall be compatible with Cisco Works management software
- 7.1.31. The Ethernet Switch must utilize Cisco Discovery Protocol.

8. Cables and Connectors

- 8.1. The Ethernet Switch shall utilize the following cables and connectors:
 - 8.1.1. 10BASE-T ports: RJ-45 connectors; two pair Category 3, 4, 5e, 6 or 7 unshielded q twisted pair UTP cabling.
 - 8.1.2. 100BASE-T ports: RJ-45 connectors; two pair Category 5e, 6 or 7 unshielded q twisted pair UTP cabling.
 - 8.1.3. 1000BASE-T ports: RJ-45 connectors; two-pair Category 5e, 6 or 7 UTP cabling.
 - 8.1.4. SFP Gigabit Ports: Single mode fiber optic cable with ST connectors
 - 8.1.5. Management console port: 8-pin RJ-45 connector, RJ-45-to-RJ-45 rollover cable with RJ-45-to-DB9 adapter for PC connections; for terminal connections, RJ-45-to-DB25 female data-terminal-equipment (DTE) adapter.
 - 8.1.6. Each Ethernet switch provided shall include Two (2) 10/100 Ethernet LX Single Mode Fiber SFP Modules capable of transmitting data over a distance of 6.2 miles. In the event that the Ethernet switches require an SFP Module that will transmit in excess of 6.2 miles, an SFP module with a longer transmit capacity will be substituted at no additional charge. SFP modules provided must be compatible with

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the existing Cisco switches and network software in the County Traffic management Center.

CONSTRUCTION DETAILS

9. Installation

- 9.1. The Contractor shall furnish and install the Ethernet Switches at the designated locations as specified by the Engineer. The Contractor shall install the switches in full compliance with the manufacturer's recommendations.
- 9.2. The Contractor shall mount the rack-mountable Ethernet onto the rack within the equipment cabinet, at each location.
- 9.3. The Contractor shall be responsible to integrate the Ethernet Switch with the other devices within the cabinet that communicate utilizing Ethernet Protocol.
- 9.4. The Contractor shall reserve two (2) Ethernet Ports on the Ethernet Switch for connecting the NCDPW maintenance computers.
- 9.5. The physical layout of the Ethernet Switch and its cables, in relation to the other equipment within the cabinet shall be acceptable to the Engineer.
- 9.6. The Contractor shall maintain all furnished equipment and software in good working condition and shall provide replacement, at no additional cost to the County, due to breakdown, damage, or theft within ten (10) working days.

10. Documentation

- 10.1. Three (3) advanced copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten (10) days prior to the scheduled start of the 30 day operational test. The manuals shall include the following:
 - 10.1.1. Complete installation and operation procedures
 - 10.1.2. Complete performance specifications (functional, electrical, mechanical and environmental) of the unit
 - 10.1.3. Complete schematic diagrams
 - 10.1.4. Complete maintenance and troubleshooting procedures

11. 30 Day Operational Test

- 11.1. The 30 day operational test shall commence with the approval of the engineer after all the communications equipment in a zone or local fiber ring has been installed and operational.

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- 11.2. The contractor shall submit the proposed testing procedure to the engineer for approval two weeks prior to the proposed test start date.
- 11.3. The contractor shall perform any repairs, construction or modifications as required in order to comply with the acceptance test at no additional cost to the County.
- 11.4. Any malfunctions that occur shall stop the 30 day test. Upon completion of the necessary repairs, a new 30 day test period shall commence.
- 11.5. The contractor shall be responsible to maintain a log during the test period documenting any repairs or modifications made during the test period.

METHOD OF MEASUREMENT

This work will be measured as the number of 8 Port Hardened Ethernet Switches satisfactorily furnished and installed in accordance with the plans and as specified herein.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing, installing, and integrating the Ethernet Switch with all equipment, software and cabling within the equipment cabinet and with existing switches and network software in the County Traffic management Center.

ITEM 683.090200NA - 10/100 ETHERNET OVER TWP COPPER MODEM 8 PAIR WITH SFP PORT

ITEM 683.090300NA - 10/100 ETHERNET OVER TWP COPPER MODEM 4 PAIR WITH SFP PORT

DESCRIPTION

This work shall consist of furnishing and installing 10/100 Ethernet over Twisted Pair (TWP) Copper Modems in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. System Architecture

- 1.1. The traffic interconnect network element (network element) is required to operate on existing or proposed copper pair facilities that are part of the traffic interconnect communications network. The network element will support G.SHDSL.bis line encoding and decoding with signal processing capabilities to extend the rate and reach of the transmitted signals in the presence of external interference. Line rates per pair must be able to operate at a rate of up to 10+ Mb/s symmetrical with the ability to bond multiple pairs for a total bandwidth of 40+ Mb/s. The bonding protocol of the Network element must comply with the EFM/G.bond standards.
- 1.2. The network element will have the capability to bond copper pairs operating in an east and west direction supporting linear add drop networking. The network element must have the ability to continue operating over a single copper pair even if all other pairs have been damaged. In addition the system must be able to return to normal working status and highest available bandwidth once the damaged copper pairs are restored without intervention from a field technician.
- 1.3. The network element must have the ability to be configured in a point to point, point to multi point, and daisy chain configuration.
- 1.4. An integrated and fully managed multi port Ethernet switch is required to perform the add drop function. This multi port Ethernet switch must have the capability of rate shaping and port prioritization. The switch must have the ability to support current and future applications to include simultaneous deployment of traffic controller, Camera(s), WAP, and DMS.
- 1.5. All operating parameters described above must be contained in a one RU high housing and capable of supporting two network elements with all of the functionality included in this document in one Rack unit.
- 1.6. The Network Element must have the capability of being either AC or DC powered for flexibility in installation applications.

2. Enhanced Signal Processing and System Resiliency

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2.1. Signal processing will include at a minimum coordinated line management to enable maximum rate and reach performance of each copper pair working together in a bond copper pair configuration. In the event of an individual copper pair failure the system will remain in operation with a minimal impact on the existing working pairs.

3. Integrated Ethernet Switching Capabilities

3.1. Each network element will include an integrated managed Ethernet switch capable of providing multiple 10/100 ports to communicate with various devices within a traffic controller cabinet and one port for local management. The integrated Ethernet Switch will also offer the following Local Area Network capabilities:

3.1.1. Dynamic Bridging	IEEE 802.1, 8K MAC address
3.1.2. VLAN Tagging	IEEE 802.1Q
3.1.3. Double Tagging	Q-in-Q, VMAN
3.1.4. MSTP, RSTP, STP	IEEE 802.1d
3.1.5. OAM/CFM	IEEE 802.3ah, 802.1ag

4. Quality of Service

4.1. Classes of Service	4
4.2. Scheduler	WFQ, SP
4.3. Classification	L2 802.1p/Q priorities L3 ToS/DiffServ

5. Integrated Optics

5.1. Each network element will have the option to support an additional optical interface operating up to a 100 Mb/s line rate. The optical port upgrade option will be available via a SFP optical plug in module and be capable of working in conjunction with both high speed links (East and West). In addition, should the network be upgraded to fiber backhaul, the system must be able to support the fiber connection while continuing to provide existing Ethernet services over existing hardware, thus allowing for a fiber upgrade without replacing the existing hardware.

6. Network Management

6.1. In order to support ease of operation and the lowest possible on-going operating expense the network elements will need to be supported by both a craft Graphical user Interface and an Element Management System that can be located at the County Traffic Management Center or any other appropriate location.

7. Management Protocols

7.1. SNMP	SNMP v1 and v2c
7.2. Command Line Interface	TL1
7.3. Remote Access	Telnet
7.4. Secure Access (option)	SSH v2

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- 7.5. Time Synchronization SNTP v3
- 7.6. Web Access HTTP
- 7.7. File transfer FTP, TFTP

8. Front Panel Indicators (LEDs)

- 8.1. Power
- 8.2. Status
- 8.3. Alarm
- 8.4. MLP per modem/pair
- 8.5. ACT (Activity)
- 8.6. LNK (Link) per Ethernet/HSL port

9. Safety

- 9.1. UL 60950, CSA C22.2 60950
- 9.2. ETSI EN 60950, IEC 60950

10. EMC

- 10.1. FCC Part 15 Class B
- 10.2. ICES-003 Class B
- 10.3. ETSI EN 300 386 Class B
- 10.4. ETSI ETS 300 132-2

11. NEBS

- 11.1. Level III (GR-1089-CORE, GR-63-CORE)

12. NEMA

- 12.1. Rated -34 to +74 C

13. Documentation Requirements

- 13.1. For each item provided, one (1) complete set of operations and maintenance manuals shall be placed in each field cabinet and one (1) complete set shall be delivered to the Nassau County Traffic Management Center. The manuals shall, as a minimum, include the following:
 - 13.1.1. Complete and accurate schematic diagrams.
 - 13.1.2. Complete installation procedures.
 - 13.1.3. Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
 - 13.1.4. Pictorial of components layout on circuit board.
 - 13.1.5. Complete maintenance and trouble-shooting procedures.
 - 13.1.6. Complete stage-by-stage explanation of circuit theory and operation.

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CONSTRUCTION DETAILS

14. Installation

- 14.1. The Contractor shall furnish, install and test all communications and any required ancillary equipment.
- 14.2. All Ethernet over TWP Copper modems shall be furnished complete with a shelf or rack mount kit that is capable of mounting in a standard nineteen (19) inch rack. The installation shall include all hardware and wire management equipment necessary to mount the modem.

15. 30 Day Operational Test

- 15.1. The 30 day operational test shall commence with the approval of the engineer after all the communications equipment in a zone or local fiber ring has been installed and operational.
- 15.2. The contractor shall submit the proposed testing procedure to the engineer for approval two weeks prior to the proposed test start date.
- 15.3. The contractor shall perform any repairs, construction or modifications as required in order to comply with the acceptance test at no additional cost.
- 15.4. Any malfunctions that occur shall stop the 30 day test. Upon completion of the necessary repairs, a new 30 day test period shall commence.
- 15.5. The contractor shall be responsible to maintain a log during the test period documenting any repairs or modifications made during the test period.

16. Ancillary Equipment

- 16.1. Each 10/100 Ethernet over TWP Copper Modem 4 Pair with 100/1000 SFP Port provided shall come complete with three (3) 10/100 Ethernet LX Single Mode Fiber SFP Modules capable of transmitting data over a distance of 6.2 miles. In the event that the Ethernet over TWP Copper modems require an SFP Module that will transmit in excess of 6.2 miles, an SFP module with a longer transmit capacity will be substituted at no additional charge. SFP modules provided must be compatible with the network element and Cisco Network elements.
- 16.2. All required hardware, wiring and jumper cables required shall be provided as part of this item.

METHOD OF MEASUREMENT

This work will be measured as the number of 10/100 Ethernet over TWP Copper Modems satisfactorily furnished and installed.

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PORT**
**ITEM 683.090300NA - 10/100 ETHERNET OVER TWP COPPER MODEM 4 PAIR WITH SFP
PORT**

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work in accordance with the Contract Documents. Payment for all documentation and testing specified herein shall be included under this contract item.

ITEM 683.090600NA - 10/100 MBPS OPTICAL ETHERNET CONVERTER, SHELF MOUNT
ITEM 683.090700NA - 10/100 MBPS OPTICAL ETHERNET CONVERTER, RACK MOUNT
ITEM 683.090800NA - 1000 MBPS OPTICAL ETHERNET CONVERTER, RACK MOUNT

DESCRIPTION

This work shall consist of furnishing and installing Optical Ethernet Converters of the type designated in the contract documents and as directed by the Engineer.

MATERIALS

1. Requirements

1.1. All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the provisions set forth in this specification.

1.2. This specification shall consist of:

- 10/100 Mbps Optical Ethernet Converters used to transmit and receive Ethernet data over fiber between the communication hubs and the field control equipment.
- 10/100/1000 Mbps Optical Ethernet Converters used to transmit and receive Ethernet data over fiber between the communication hubs and NCDPW Traffic Management Center equipment.
- Shelf-mount Optical Ethernet Converters shall be installed in the field at traffic signal equipment cabinets and rack-mount Optical Ethernet Converters shall be installed in the field at hub cabinets as designated on the plans or as ordered by the Engineer.
- One (1) 10/100 Ethernet LX Single Mode fiber SFP Module with LC connector shall be furnished with each 10/100 Mbps unit provided.
- Two (2) 10/100/1000 Ethernet LX Single Mode fiber SFP Modules with LC connectors capable of transmitting over a distance of 10 km shall be furnished with each 1000 mbps unit provided. In the event that the 1000 Mbps units require an SFP Module that will transmit in excess of 6.2 miles, an SFP module with a longer transmit capacity will be substituted at no additional charge.
- All SFP Modules furnished and installed shall be compatible with the existing Cisco switches and network software in the County Traffic management Center.

1.3. The equipment furnished as part of these items shall meet the following requirements:

- Be from the same manufacturer
- Not require manual adjustment
- Transmit Ethernet 10/100 Mbps (10/100 Mbps units) and 10/100/1000mbps (1000Mbps units) data over two (2) single mode fibers that exist or are furnished as part of this contract.

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1.4. Optical:

- Optical port 100 BASE -FX (10/100 Mbps units)
- Optical port: 1000 BASE-FX (1000 Mbps units)
- Fiber type: Single mode
- Optical transmitter: Laser
- Optical Wavelength: 1310nm
- Link loss budget range: minimum 0 to 15 dB (10/100 Mbps units)
- Link loss budget range: minimum 0 to 10 dB (1000 Mbps units)
- Dynamic range 0 to 15 dB w/o external attenuators (10/100 Mbps units)
- Dynamic range 0 to 10 dB w/o external attenuators (1000 Mbps units)
- Connector: LC
- A loss of optical link contact closure shall be provided for remote alarm sensing

1.5. Data:

- Data rate 10/100 Mbps Auto-sensing (10/100 Mbps units)
- Data rate 10/100/1000 Mbps Auto-sensing (1000 Mbps units)
- BER $< 10^{-9}$
- Data Interface: Ethernet (IEEE 802.3)
- Ethernet connector: RJ-45

1.6. Indicators:

- Led indicators shall be provided to indicate the following:
 - Data transmit/ receive status
 - Power-on

1.7. Environmental:

- The Optical Ethernet Converters shall meet the environmental requirements for operating and storage ambient Temperature, Mechanical Shock, Vibration, Humidity with Condensation, High-Line/Low-Line Voltage Conditions, and Transient Voltage Protection of NEMA TS-1/TS-2 and the CALTRANS specification for Traffic Signal Control Equipment.

1.8. Electrical Requirements:

- Voltage 115 -120 VAC. An adapter may be used to provide the required power to the stand-alone data transceivers. A power supply shall be contained in the rack.
- Current: 200 mA max (10/100 Mbps units)
- Current: 600 mA max (1000 Mbps units)

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- Re-settable circuit breakers or fuses shall be provided to protect the equipment. The protection may be provided either as part of the cabinet wiring or on the equipment.
- All equipment shall be hot swappable.

1.9. Mechanical:

- Shelf-Mount
 - The shelf-mount Ethernet converters shall be suitable for mounting on a shelf or attached to a wall/ rack cage rail of the cabinet and shall have the following maximum dimensions: 7" x 6" x 1".
- Rack Mount
 - The rack shall be fully wired to accommodate a minimum of ten (10) Ethernet Converters. All power to the converters shall be distributed through the rack.
 - The slots shall be assigned in accordance with the plans or as directed by the Engineer. The rack shall comply with EIA 19 mounting spacing.
 - The maximum dimensions of the rack shall be as follows: 19" wide x 7" high by 5.25" deep.

CONSTRUCTION DETAILS

The Contractor shall install the shelf and rack mounted Optical Ethernet Converters in the equipment cabinets designated on the plans. The converters shall be connected to the fiber optic cable through the fiber optic patch panel furnished as part of the cabinet items and fiber optic patch cables.

2. Documentation Requirements:

2.1. Manuals

- Six (6) advance copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten-days prior to the scheduled start of the first Operational Stand-Alone Test. The Engineer will verify the manufacturer's equipment manual as part of the test and integration process. The equipment manual incorporating the Engineer's corrections and comments shall be integrated by the Contractor into the operations and maintenance manual. The manuals shall, as a minimum, include the following:
 - Complete and accurate schematic diagrams
 - Complete installation and operation procedures
 - Complete performance specifications (functional, electrical, mechanical and environmental) of the unit.

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- Complete list of replaceable parts including names of vendors for parts not identified by universal part numbers such as JEDEC/ RETMA or EIA.
- Complete maintenance and troubleshooting procedures.

3. Stand Alone Test

- 3.1. After installation of the equipment in the field and prior to integration of the equipment into the system, the Contractor shall perform a 30 day operational test in the field for each of the optical Ethernet converters installed.
- 3.2. The test shall demonstrate as a minimum the ability of the converter to transmit and receive Ethernet data between the field equipment and hubs or the hubs and central as appropriate. As part of the operational test the optical transmit and receive levels shall be recorded for each converter.
- 3.3. If the Stand Alone Test fails, the equipment shall be repaired or replaced and the test shall be rerun for that site. If a component has been modified as a result of a failure, that component shall be replaced in all like units and the test shall be rerun for each unit.

METHOD OF MEASUREMENT

This work will be measured as the number of Optical Ethernet Converters satisfactorily furnished, installed, made fully operational, and tested in accordance with the contract documents, specifications, and as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid to furnish and install an Optical Ethernet Converter shall include the cost of furnishing all labor, materials, tools, documentation, testing, 19 inch rack equipment, Ethernet and fiber optic cables and equipment necessary to satisfactorily complete the work in accordance with the Contract Documents.

ITEM 683.091000NA - 24 PORT HARDENED ETHERNET SFP SWITCH
ITEM 683.091100NA - 48 PORT HARDENED ETHERNET SFP SWITCH

DESCRIPTION

This work shall consist of furnishing and installing a 24 or 48 port hardened Ethernet SFP Switch in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Requirements

- 1.1. All materials furnished, assembled, fabricated, and installed shall be new, corrosion resistant and in strict accordance with the requirements set forth in this specification.
- 1.2. This specification shall consist of an Ethernet SFP Switch, as specified in these specifications, and as ordered by the Engineer. The switch shall provide Ethernet connectivity from the field cabinets to the NCDPW Traffic Management Center or any other designated locations as specified by the Engineer.

The Ethernet SFP Switch shall be fully compatible with all of the software management functions of the existing central switch and Cisco Works, the existing Traffic Management Center Network Management Software.

The Ethernet SFP switch must be registered and licensed to the Nassau County Department of Public Works Traffic Management Center.

- 1.3. The 24 port switch shall have twenty four (24) Gigabit SFP Ethernet Ports, and two (2) 1/10 Gigabit Ethernet SFP+ Ports.
- 1.4. The 48 port switch shall have forty eight (48) 1/10 Gigabit SFP+ Ports.

2. Dimensions

- 2.1. The Ethernet SFP Switch shall be rack-mountable in a standard 19 inch rack in accordance with EIA-310D and shall not exceed external dimensions of 1.73" (H) x 17.5" (W) x 9.9" (D).

3. The Ethernet SFP Switch shall comply with the following standards:

- 3.1. RMON I and II standards
- 3.2. SNMPv1, v2c, and v3
- 3.3. IEEE 802.1d Spanning Tree Protocol
- 3.4. IEEE 802.1p CoS classification
- 3.5. IEEE 802.1q VLAN
- 3.6. IEEE 802.1w Rapid Convergence Spanning Tree Protocol
- 3.7. IEEE 802.1x Port Access Authentication
- 3.8. IEEE 802.3ad Link Aggregation Control Protocol (LACP)

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- 3.9. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T port
- 3.10. IEEE 802.3 10BASE-T specification
- 3.11. IEEE 802.3u 100BASE-T/TX
- 3.12. IEEE 802.3ab 1000BASE-T
- 3.13. IEEE 802.3z 1000BASE-X

4. Regulatory Agency Approvals

- 4.1. Safety certifications: UL 1950/CSA 22.2 No. 950
- 4.2. IEC 950-EN 60950
- 4.3. AS/NZS 3260, TS001
- 4.4. CE Marking

5. Electromagnetic Emissions Certifications

- 5.1. FCC Part 15 Class A
- 5.2. EN 55022: 1998 Class A (CISPR22 Class A)
- 5.3. EN 55024: 1998 (CISPR24)
- 5.4. VCCI Class A
- 5.5. AS/NZS 3548 Class A
- 5.6. CE Marking
- 5.7. CNS 13438
- 5.8. BSMI Class A
- 5.9. MIC

6. Environmentally Hardened

- 6.1. The Contractor shall provide an Ethernet SFP Switch that is environmentally hardened and capable of operating in the following conditions: temperatures ranging from 32° F to 113° F, relative humidity from 10 to 85% (noncondensing) and altitudes up to 10,000 feet.

7. Power

- 7.1. The Ethernet SFP Switch shall contain an internal power supply that shall support input voltages between 100 and 240 VAC. The supplied AC power cord shall be used to connect the AC power conductor to an AC duplex outlet within the cabinet. If the Ethernet Switch is installed at location where an AC duplex outlet is not readily available, the Contractor shall coordinate with the Engineer in order to modify the AC power cord or provide other power cabling that the Contractor shall utilize, in order to make appropriate connections to the available AC power.

The Ethernet SFP Switch shall permit input voltages ranging from 100 through 127 Volts AC (RMS) at 60 Hz, or permit voltages from 200 through 240 Volts AC (RMS) at 50 Hz. The Ethernet Switch shall have a DC input voltage of +12 V at 13 amps.

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8. Communications Aspects and Switching Attributes

8.1. The Ethernet SFP Switch shall provide acceptable levels of Quality of Service (QoS) and provide switching capabilities appropriate for interfacing with the equipment within the field cabinet. In specific:

- The Ethernet SFP Switch shall support the metering/policing of incoming packets to restrict incoming traffic flows to a certain rate: The Ethernet Switches shall support four (4) egress queues per port to enable differentiated management of up to four (4) types of traffic. The Ethernet SFP Switch shall support a minimum of 128 aggregate or individual ingress policers and 8 aggregate ingress policers on each Gigabit Ethernet port.
- The Ethernet SFP Switch shall be equipped with multifunction LED's per port for port status, half-duplex or full-duplex, 10BASE-T/100BASE-T/1000BASE-T. LED's for system redundant power supply and bandwidth usage shall also be available.
- The Ethernet SFP Switch shall support SNMP protocol and SSH for remote monitoring and troubleshooting. The Ethernet SFP Switch shall support Remote Monitoring (RMON) software agent for RMON groups, where data history, statistics, alarms, events can be collected for traffic management, monitoring, and analysis.
- The Ethernet SFP Switch shall support Switched Port Analyzer (SPAN) port to monitor the traffic going through a single or multiple ports.
- The Ethernet SFP Switch shall support Remote Switched Port Analyzer (RSPAN), where the network administrator can monitor the port switch traffic from any other switch in the same network.
- The Ethernet SFP Switch shall support Network Timing Protocol (NTP) to provide an accurate and consistent time stamp on all switches within the network.
- The Ethernet SFP Switch shall support Trivial File Transfer Protocol (TFTP) for software upgrade and configuration deployment.
- The Ethernet SFP Switch shall support filtering of incoming traffic based on the following:
 - Layer2, Source Media Access Controller (MAC) Address, Destination MAC address
 - Layer3, Source IP Address, Destination IP address
 - Layer4, TCP source or destination port number, UDP source or destination port number.
- The Ethernet SFP Switch shall support the 802.1x standard that allows users to be authenticated, regardless of which LAN port is being accessed. The Ethernet SFP Switch shall support 802.1x with VLAN assignment in order to permit dynamic VLAN

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assignment of a specific user, regardless of where the user is connected. In addition, the Ethernet SFP Switch shall support time-based ACL's in order to allow the implementation of security settings during specific periods of the day, or days of the week.

- The Ethernet SFP Switch shall support IGMP Filtering providing multicast authentication by filtering out non-subscribers and limits the number of concurrent multicast streams available per port.
- The Ethernet SFP Switch shall support Intrusion Detection System (IDS) to allow the IDS to take action when an intruder is detected.
- The Ethernet SFP Switch shall support Secure Socket Shell (SSH), Kerberos, and SNMPv3 providing network security by encrypting administrator traffic during Telnet and SNMP sessions.
- The Ethernet SFP Switch shall support 802.1x with port security authentication using access lists. In addition, the Ethernet SFP Switch shall support MAC address notification allowing the administrator to be notified of new users as they are added or removed from the network.
- The Ethernet SFP Switch shall support QoS classification of incoming packets for QoS flows based on Layer 2-4 fields: Layer 2 fields (or a combination) for classifying incoming packets to define QoS flows: source MAC address, destination MAC address, and 16-bit Ethertype. Layer 3 and 4 fields (or a combination) for classifying incoming packets to define QoS flows: source IP address, destination IP address, TCP source or destination port number, and UDP source or destination port number.
- The Ethernet SFP Switch shall offer the ability to limit data flows based on MAC source/destination address, IP source/destination address, TCP/UDP port numbers, or any combination of these fields. The switch shall also offer the ability to manage data flows asynchronously upstream and downstream from the end station or on the uplink.
- The Ethernet SFP Switch shall support Layer3 routing including Multiplayer Switching (MLS) for inter-VLAN routing. In addition, the Ethernet Switch shall support local proxy ARP working in conjunction with private VLAN edge to minimize broadcasts and maximize available bandwidth.
- The Ethernet SFP Switch shall support Spanning-Tree protocol in order to provide path redundancy while preventing undesirable loops in the network
- The Ethernet SFP Switch shall support Port Aggregation Protocol (PAgP) in order to automate the creation of Fast EtherChannel or EtherChannel groups, thus enabling linking to another switch, router, or server.

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- The Ethernet SFP Switch shall support multicast VLAN Registration (MVR) as required for the deployment of multicast traffic across an Ethernet network. The MVR allows a subscriber on a port to subscribe and unsubscribe to a multicast stream on the network-wide multicast VLAN.
- The Ethernet SFP Switch shall support the Internet Group Management Protocol (IGMP). IGMP is utilized in order to permit the Ethernet Switch to receive all IGMP conversation between hosts and routers. When the Ethernet SFP Switch detects an “IGMP join” request from a host for a given multicast group, the switch is to add the host’s port number to the group destination address (GDA) list for that group. When the Ethernet Switch detects an “IGMP leave” request, it is to remove the host’s port from the content-addressable memory (CAM) table entry.
- The Ethernet SFP Switch shall provide full IPv4 dynamic routing, including the following advanced IP unicast routing protocols, Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Border Gateway Protocol Version 4 (BGPv4), and Intermediate System-to-Intermediate System Version 4 (IS-ISv4) for load balancing and constructing scalable networks.
- The Ethernet SFP Switch shall support distance Vector Multicast Routing Protocol (DVMRP) tunneling for interconnecting two multicast-enabled networks across nonmulticast networks.
- The Ethernet SFP Switch shall support full IP multicast routing to enable the network to receive the multicast feed requested and for switches not participating in the multicast to be pruned support for The Protocol Independent Multicast (PIM) sparse mode (PIMSM), PIM dense mode (PIM-DM), and PIM sparse-dense mode.
- The Ethernet SFP Switch shall support high-performance IP routing, supporting fallback bridging for forwarding of non-IP traffic between two or more VLAN’s.
- The Ethernet SFP Switch shall support switch port Auto-recovery (or "errDisable") automatically attempts to re-enable a link that becomes disabled due to a network error.
- The Ethernet SFP switch shall support bandwidth aggregation per port, per destination and origin, using the MAC or IP addresses. It also shall aggregate the bandwidth per-port for multicast and unicast to control and prevent faulty end stations to degrade the overall system performance The Ethernet SFP Switch is to be capable of sharing a minimum of 4 GB DRAM and 2 GB Flash memory among all ports.
- The Ethernet SFP Switch shall support a minimum of 30000 configurable MAC addresses and 20000 IPv4 routes.
- The Ethernet SFP Switch shall be compatible with CiscoWorks management software.

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- The Ethernet Switch must utilize Cisco Discovery Protocol (CDP).

9. Cables and Connectors

9.1. The Ethernet SFP Switch shall utilize the following cables and connectors:

- SFP Gigabit Ports: Single mode fiber optic cable with LC connectors
- SFP+ 10 Gigabit Ports: Single mode fiber optic cable with LC connectors
- Management console port: 8-pin RJ-45 connector, RJ-45-to-RJ-45 rollover cable with RJ-45-to-DB9 adapter for PC connections; for terminal connections, RJ-45-to-DB25 female data-terminal-equipment (DTE) adapter. The IR829/809 Mini-USB Console Cable may be used in place of legacy connectors such as RJ-45-to-DB9.
- The 24 port Ethernet SFP Switch provided shall include twenty-four (24) 10/100/1000 Ethernet LX Single Mode Fiber SFP Modules and two (2) 1/10 SFP-10G-LR Single Mode Fiber SFP modules capable of transmitting data over a distance of 6.2 miles. In the event that the Ethernet switch requires an SFP Module that will transmit in excess of 6.2 miles, an SFP module with a longer transmit capacity will be substituted at no additional charge. SFP modules provided must be compatible with the Ethernet switch.
- The 48 port Ethernet SFP Switch provided will include forty-four (44) 10/100/1000 Ethernet LX Single Mode Fiber SFP Modules and four (4) 1/10 SFP-10G-LR Single Mode Fiber SFP modules capable of transmitting data over a distance of 6.2 miles. In the event that the Ethernet switch requires an SFP Module that will transmit in excess of 6.2 miles, an SFP module with a longer transmit capacity will be substituted at no additional charge. SFP modules provided must be compatible with the Ethernet switch.

CONSTRUCTION DETAILS

The Contractor shall furnish and install the Ethernet SFP Switches at the designated locations as specified by the Engineer. The Contractor shall install the switches in full compliance with the manufacturer's recommendations.

The Contractor shall mount the rack-mountable Ethernet SFP switch onto the rack within the equipment cabinet, at each location.

The Contractor shall be responsible to integrate the Ethernet SFP Switch with the other devices within the cabinet that communicate utilizing Ethernet Protocol.

The Contractor shall reserve two (2) SFP ports on the Ethernet SFP Switch for connecting the NCDPW maintenance computers.

The physical layout of the Ethernet SFP Switch and its cables, in relation to the other equipment within the cabinet shall be acceptable to the Engineer.

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The Contractor shall maintain all furnished equipment and software in good working condition and shall provide replacement, at no additional cost to the state, due to breakdown, damage, or theft within ten (10) working days.

1. Documentation

1.1. Three (3) advanced copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten (10) days prior to the scheduled start of the 30 day operational test. The manuals shall include the following:

- Complete installation and operation procedures
- Complete performance specifications (functional, electrical, mechanical and environmental) of the unit
- Complete schematic diagrams
- Complete maintenance and troubleshooting procedures

2. 30 Day Operational Test

- 2.1. The 30 day operational test shall commence with the approval of the engineer after all the communications equipment in a zone or local fiber ring has been installed and operational.
- 2.2. The contractor shall submit the proposed testing procedure to the engineer for approval two weeks prior to the proposed test start date.
- 2.3. The contractor shall perform any repairs, construction, or modifications as required in order to comply with the acceptance test at no additional cost to the County.
- 2.4. Any malfunctions that occur shall stop the 30 day test. Upon completion of the necessary repairs, a new 30 day test period shall commence.
- 2.5. The contractor shall be responsible to maintain a log during the test period documenting any repairs or modifications made during the test period.

METHOD OF MEASUREMENT

This work will be measured as the number of Ethernet Switches satisfactorily furnished and installed in accordance with the plans and as specified herein.

BASIS OF PAYMENT

The unit price bid for the Ethernet Switch will include the cost of furnishing, installing, integrating and testing the Ethernet Switch with all equipment and software, and cabling within the equipment cabinet to satisfactorily complete the work.

ITEM 683.100100NA - COMMUNICATIONS HUB CABINET AND AUXILIARY EQUIPMENT

DESCRIPTION

This work shall consist of furnishing and installing Model 332 Style Cabinet and Auxiliary Communications Equipment in accordance with the contract documents and as directed by the Engineer.

MATERIALS

1. Qualification

1.1 All Model 332 components supplied under this specification shall be listed on the CalTrans Qualified Product List (QPL) that is in effect on the issue date of this invitation. In the case of the modified 332 Cabinet, the vendor's standard model shall be listed on the CalTrans QPL that is in effect on the issue date of this invitation. Equipment that is not defined by the CalTrans "Traffic Signal Control Equipment Specifications" (TSCES) or "Transportation Electrical Equipment Specifications" (TEES) that is in effect on the issue date of this invitation is not covered by this requirement. For each piece of equipment that is covered by this requirement, the vendor shall submit a notarized certification the equipment is listed on the QPL that was in effect as of the date of issue of this invitation. Failure to provide this certification shall cause the bid to be rejected as unresponsive. If during the course of the contract, any piece of equipment ceases to be listed on the current QPL, the County may, at its option, require the vendor to provide a suitable replacement that is listed on the current QPL at no additional cost.

2. Requirements

2.1 All materials furnished, assembled, fabricated and installed shall be new, corrosion resistant and in strict accordance with the latest provisions set forth by the California Department of Transportation (CalTrans) Specifications.

The specifications for the Model 332 Cabinet and auxiliary communications equipment shall conform to the requirements in CalTrans documents TSCES and TEES, and to all addenda thereto current on the issue date of this invitation.

2.2 This specification shall consist of a Model 332 Cabinet with all auxiliary equipment, and cabling to interface with the communications systems shown on the plans, as specified in these specifications, and as ordered by the Engineer.

2.3 As a minimum, this item shall include, but not be limited to, the following equipment:

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Model 332 Cabinet and Auxiliary Equipment

<u>Model No.</u>	<u>Quantity</u>	<u>Description</u>
332	1	Model 332 Cabinet
-	1	Environmentally Hardened 1200VA UPS
-	2	Exhaust Fans
-	2	Adjustable Shelves
-	1	Heater Assembly
SHA-1250	1	Cabinet Surge Protector
-	2	15A Power Strips
-	1	Environmental Monitor

2.4 Model 332 Cabinet

2.4.1 Dimensions

The cabinet shall be a Model 332 type with a height of 66”, width of 24”, and a depth of 30”.

2.4.2 Rack Assembly

The cabinet shall have a standard EIA 19 inch removable, self-standing rack assembly. The rack shall be capable of mounting communications equipment in a standard mounting screw configuration. Screw mounting holes shall be pre-threaded and labeled using the “RU” rack height identification system.

The cabinet shall be supplied with 50 spare Philips head mounting screws to match the pre-threaded holes in the 19 inch rack.

2.4.3 Locks

The cabinet doors shall be equipped with a brass cylinder lock keyed for a Number Two Corbin Key, with a dust cover. Two (2) keys for each cabinet

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shall be furnished and provided in the cabinet drawer. Cabinet shall be equipped with a removable handle that shall be provided with the cabinet.

2.4.4 Adjustable Shelves

Cabinet shall be provided with 2 rack mountable shelves. These shelves shall be mounted on both the front and rear 19 inch rack rails using standard Philips head screws.

2.4.5 Finish

All surfaces of the cabinet shall be bare, unpainted aluminum.

2.4.6 Cabinet Light

Fluorescent lamps shall be installed in the top of the front and rear of the cabinets. Switches shall be installed on the front and rear doors. Opening of either door shall illuminate both lights.

Each fluorescent lamp and switch shall be equipped with noise suppression devices. Activation of the fluorescent lamps and associated switches shall not cause any disruption of any other electrical device in the cabinet. The vendor shall install sufficient RFI and surge suppression equipment to assure that operation of the fluorescent lamps will not disrupt the operation of other equipment in the cabinet.

Fluorescent lamps and associated ballast transformers shall be rated for high output in cold environments, providing high light output in ambient temperature of -13° F.

The cabinet lamp circuit shall be fused. The fuse holder shall be easily accessible from the front the cabinet

2.4.7 Interconnect Terminal Block

Two twelve (12) position terminal blocks for interconnection shall be installed in the lower 12 inches of the cabinet. The Contractor shall submit the proposed terminal block schematic and mounting location to the County for approval prior to installation in the cabinet. Each position of the 12 position terminals shall be installed with lightning/surge suppressors that are compatible with digital (DSL) type Ethernet communications. Surge

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suppressors shall not interfere with the communications to or from Ethernet over copper modems (Actelis) utilized by Nassau County.

2.4.8 Cabinet Drawer

An aluminum pullout drawer hinged at the top and having sliding tracts shall be provided in the cabinet. The drawer shall have the approximate dimensions of 1.75 inches in height, 13 inches deep and 16 inches wide and be capable of holding 40 pounds in weight when the drawer is extended. This drawer should be located approximately 48 inches from the bottom of the cabinet. Provide a top for the storage compartment that has a non-slip plastic laminate attached, which covers a minimum of 90% of the surface area of the top.

2.4.9 Door Alarm

A door ajar alarm switch shall be installed on front and back doors. Each switch shall be of heavy duty, spring-loaded design with single pole normally closed contacts. Each switch circuit shall be closed whenever the corresponding door is open at an angle of 15 degrees or more. The switches shall be installed so that they will not restrict removal of the cabinet rack assembly in any way. The door ajar switches shall only be used to support the door ajar alarm function; they shall not be used to support any other function (such as cabinet illumination or conflict monitor interlocking).

Each switch shall be wired to terminal block located on the lower portion of the cabinet on the side wall. Terminal block shall be labeled as "Door Alarm".

2.4.10 Sun Shields

The cabinet shall be provided with sun shields on the top, both sides, and both doors to reduce the cabinets ambient temperature. The shields shall be in the form of 1/8 inch aluminum sheets installed utilizing 1 inch spacers, mounted with tamper proof hardware to the cabinets. The areas listed above shall be covered except for the handle and lock location.

2.4.11 Ventilation

The cabinet shall contain (2) two thermostat controlled fans capable of moving a minimum of 300 cubic feet per minute. Fans shall be mounted on the interior ceiling of the cabinet. Thermostat shall be mounted in the upper portion of the cabinet in a position that makes it easy to adjust.

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2.4.12 Heating

The cabinet shall be provided with a cabinet heater located near the bottom of the cabinet. A thermostat shall be provided to activate the heater and shall be set to turn the heater on at 40 degrees F, and off at 55 degrees F. The heater shall be rated at 250 Watts.

2.4.13 Cabinet Filters

The cabinets shall have vents on both the front and back doors and metal water deflection panels mounted inside the vents. A disposable paper filter element shall be provided in lieu of a metal filter.

2.4.14 Electrical

Electrical circuit breakers, GFCI and Standard NEMA outlets, Ground Bars, and all electrical equipment shall be approved and listed by Underwriters Laboratories. All electrical equipment shall be mounted on the side wall of the cabinet, and shall be located in the bottom 12 inches of the cabinet as to not interfere with communications and electronic equipment mounted above.

Two (2) 110 Volt 15 Amp power strips shall be provided with the cabinet. Power strips shall be capable of being mounted on the cabinet sidewall or on a rack mount panel and shall be capable of receiving plugs from 6 devices.

2.4.15 Surge Protection

The cabinet shall be furnished with a plug-in RFI filter and surge protection device, EDCO MODEL SHA 1250, mounted on the cabinet service panel assembly on Socket BEAU S-5412 SB or approved equal. All Surge protection equipment shall be mounted in the lower 12 inches of the cabinet on the side wall.

2.5 Rack Mount Uninterruptable Power Supply (UPS)

- 2.5.1 A 19 inch rack mountable 1,200 Volt Amp UPS shall be provided. The UPS shall be environmentally hardened and rated for outdoor use. UPS shall be capable of operating the equipment in the HUB cabinet for a minimum of 20 minutes. UPS shall be provided with a 110 Volt 15 AMP NEMA plug for easy connection within the cabinet. UPS shall have at least (5) 110 Volt 15 AMP receptacles for communications equipment. UPS shall come with a 10/100 Mbps Ethernet network port and network software that will allow remote access, control, and the ability to send alarms from the UPS.

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2.6 Environmental Monitor

2.6.1 Cabinet shall come with a rack mounted network environmental monitoring device. The monitor shall connect with 10/100 Mbps Ethernet communications utilizing central monitoring software that must be provided as part of this specification. This environmental monitoring device shall come complete with two contact closure user programmable alarm inputs and shall monitor the following environmental parameters:

- Cabinet Temperature
- Cabinet Humidity
- Exterior Temperature
- Exterior Humidity
- Local Power Status
- Cabinet Door Ajar Alarm

2.7 Terminal Block for Communications Signal Conductors (Twisted Pair)

2.7.1 Communications cable terminal blocks for interconnect, shall have surge protectors installed between the cable pairs and the equipment they are wired to. The conductor leads and the surge protector leads shall be kept as short as possible with all conductor bends formed to the maximum possible radius. The protector units shall be located as near as possible to the entry point and as far as possible from any electrical equipment. The protector ground lead shall be made directly to the cabinet wall or ground plane.

2.7.2 The surge protectors shall contain both primary and secondary protection. The primary and secondary protectors may be packaged in the same housing, provided sufficient impedance is provided between the protector segment to allow proper operation. If the individual equipment input circuitry is provided with secondary protectors, the corresponding secondary protector need not be provided.

2.7.3 The primary and secondary protectors shall have the following characteristics:

Working Voltage:

The unit shall not introduce a series or shunt impedance to the signal path such that it interferes with the operation of the equipment.

Surge Voltage:

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For the primary protector, the unit shall limit the surge voltage between the signal leads and ground to 300 volts or less while conducting a peak surge current of at least 20,000 amperes. The surge current shall cause both signal leads to be grounded simultaneously under surge conditions and shall not allow a transient transverse signal to appear on the protected output signal conductors. The surge operation delay shall not exceed one micro-second.

For the secondary protector, the unit shall limit the surge voltage to a level that is less than the maximum specified operating voltage of the equipment being protected. This surge voltage shall occur when the primary protector is being subjected to its rated surge current.

Energy Rating:

For the primary protector, the unit shall be capable of dissipating 100 joules of surge energy without damage to itself.

For the secondary protector, the unit shall be capable of dissipating 20 joules of energy without being damaged.

CONSTRUCTION DETAILS

3. Installation

- 3.1 The Model 332 Cabinet shall be mounted on a foundation as prescribed by the plans or item sheet. The installation shall include the drilling of posts or poles and the fastening of supports. The Contractor shall supply all bolts, nuts, straps, condulets, nipples, lock washers, mounting plates, and other material required to secure the cabinet properly, and in accordance with the Traffic Signal Standard Drawings.
- 3.2 The Contractor shall make all field cable connections in the cabinet with approved insulated solderless lugs. All cabinet wiring shall be neat and firm.

4. Installation Details

- 4.1 The Contractor shall install the Ethernet switch(s), fiber optic patch panels, and all related hardware in the Model 332 Cabinets at locations specified on the plans.
- 4.2 After all cables are installed and tested, the Contractor shall seal all conduits using duct seal and/or steel wool to deter rodent entry in the cabinet.

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- 4.3 The cabinet doors shall be perpendicular and open away from the curb as specified on the plans. If the plans do not indicate this information, the Contractor shall confirm with the Engineer regarding the orientation of the cabinet.
- 4.4 All wiring connected to terminal blocks, relays, switches, radio interference suppressor, etc. shall be identified by use of insulated pre-printed tags over the wire including, but not limited to, communications cables, etc. The wire markers shall carry the legend in plain words with sufficient details so that a translating sheet will not be required.

Cabinets shall be wired to accept and implement all of the features of the specified equipment.

5. Documentation Requirements

- 5.1 One (1) complete set of operation and maintenance manuals shall be placed in each field cabinet and five (5) complete sets shall be delivered to the County. The manuals shall, as a minimum, include the following:
 - 5.1.1 Complete cabinet and equipment layout drawings for all cabinet mounting configurations.
 - 5.1.2 Complete cabinet wiring and harness drawings.
 - 5.1.3 Complete installation procedures.
 - 5.1.4 Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
 - 5.1.5 Pictorial of components layout on circuit board.
 - 5.1.6 Complete maintenance and trouble-shooting procedures.
 - 5.1.7 Complete stage-by-stage explanation of circuit theory and operation.

- 5.2 The cabinet/equipment layout and cabinet wiring diagram shall be submitted for review and approval prior to actual cabinet fabrication.

6. Testing Requirements

At a minimum the following cabinet tests shall be performed on all cabinets, with a designated representative from the County. Test procedures shall be submitted for approval prior testing.

- 6.1 48 hour hot and cold for cabinet - documented and certified.

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- 6.2 Test proper brownout voltage calibration between conflict monitor and controller. Manufacturer to submit procedure for approval. Documentation and certification to be shipped with cabinet.
- 6.3 Test the proper operation and duration of the UPS when LIPA power is terminated.

METHOD OF MEASUREMENT

This work will be measured as the number of Communications HUB Cabinets and Auxiliary Equipment that are satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid to furnish and install Communications HUB Cabinet and auxiliary equipment shall include the cost of furnishing all labor, materials, electrical cables, communications (fiber/copper) patch cables, and equipment necessary to satisfactorily complete the work in accordance with the contract documents.

ITEM 683.115100NA – WI-FI TRAVEL TIME READER

DESCRIPTION:

This work shall consist of furnishing and installing long range, wide angle Wi-Fi detectors capable of measuring vehicle travel flows by measuring Wi-Fi MAC (Media Access Control) addresses. The system will be used to measure and collect high quality travel times, in real-time, from the traffic stream by matching MAC addresses at two or more locations across a network.

MATERIALS:

The Wi-Fi receiver shall consist of the following equipment furnished as part of this item:

1. Wi-Fi Radio receiver, Antenna with cable and all mounting hardware
2. MAC Address Controller Unit with all required interface cabling and software

The receivers will typically be installed on traffic signal span poles, mast arms, control cabinets or as shown on the plans. The antenna/radio shall sense MAC addresses and signal strength from Wi-Fi devices in the configured detection zone. The MAC Address Controller unit shall be powered from and installed into the input card file in a traffic signal control cabinet. MAC Address Controller Unit shall forward the MAC addresses to the existing Nassau County Traffic Management Foundation control server. This will allow Foundation to generate travel times and other performance statistics using the data from multiple Wi-Fi receivers across the County's traffic communications network. The MAC Address Controller will be connected directly to the Ethernet switch in the traffic signal control cabinet.

Wi-Fi field equipment must transmit raw, un-encrypted MAC address information back to the Nassau County Traffic Management Center over the County's existing Ethernet based traffic communications network. This will be completed through TCP/IP socket connections initiated from the TMC servers. Configurable MAC address store and forward ability with a buffer of at least 15 minutes for use during communication outages will be provided. Wi-Fi equipment installed must either have direct communications with the County's existing Foundation management system, or with a central server that will communicate with the field Wi-Fi devices and then with the County's existing Foundation system. NTCIP or the latest National Standard communications protocol must be utilized when communicating across the Nassau Traffic network. If direct communications with the County's existing Foundation servers is not feasible, then a primary and backup server must be provided and installed at the Nassau County Traffic Management Center. This server will communicate directly with the field Wi-Fi readers, and the existing Foundation servers to provide MAC address data, communication statistics and device configuration interfaces. The server must be provided with software that will manage Wi-Fi reader maintenance, operations and communications status providing both GUI and Foundation interfaces. Whether communicating directly with the Foundation servers, or using another server, the Foundation Server must receive raw, unencrypted MAC address information including signal strength and multiple reads per address when obtained in the field in order for the system

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to work.

Any servers, hardware or software provided as part of this specification must include a royalty-free, perpetual license for use by Nassau County. No off site hardware will be permitted and no annual or continual operational fees or licenses will be paid. Any server hardware, as well as the operating systems installed on it, must be standard to the IT industry and commonly available to the County. This will be a closed loop system with all the necessary software and hardware within Nassau County.

All material furnished, assembled, fabricated or installed shall be new, corrosion resistant and in strict accordance with all the details shown in the Contract Documents and in this Special Specification.

The radio, antenna and controller unit shall meet the following minimum system requirements:

Protocols

- IEEE 802.11 g
- IEEE 802.11 b

Frequency Band

- 2400 to 2483.5 MHz (ISM Unlicensed Band)
- A minimum of 10 frequency channels
- Channel Bandwidth – 20 MHz (11 g), 22 MHz (11 b)

Data Rate

- Selectable from 54 to 1 Mbps auto fall back

Antenna Gain

- 9 dBi

Antenna Type

- Omni-directional

Receive Sensitivity

- -87 dBm at 54 Mbps
- -93 dBm at 11 Mbps

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Interfaces (Minimum)

- 10/100Base-T network access via RJ45
- (2) USB 2.0
- TCP/IP 10/100Base-T Ethernet for local configuration IP

Connectivity

- HTTP, PPP, PPTP, SSH

Input Voltage

- 22-26 VDC, 9-15 VDC

Power Consumption

- 2.4 W typical

Antenna Dimensions

- 20" L x 1" D
- 2.5 lbs – with all required mounting hardware

Operating Temperature

- -29°F to +165°F

CONSTRUCTION DETAILS:

The Contractor shall install the Wi-Fi Travel Time Receivers at locations designated on the plans and perform the initial programming and set up of the Wi-Fi reader. Any required control or configuration software shall be provided under this item. The equipment required to connect the Wi-Fi readers to the existing Nassau County Traffic communications network or to a separate communications network will be included under separate contract items.

The Contractor shall submit his proposed antenna mounting scheme to the Engineer for approval prior to installation. In general, the antenna shall be mounted to the specified signal pole, mast arm or cabinet at a height recommended by the Engineer for optimal sensing. The antenna cable shall be routed into the existing signal controller cabinet, HUB or auxiliary cabinet in accordance with the installation detail plans.

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Documentation Requirements

Six (6) advance copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten-days prior to the scheduled start of the first Operational Stand-Alone Test. The Engineer will verify the manufacturer's equipment manual as part of the test and integration process. The equipment manual incorporating the Engineer's corrections and comments shall be integrated by the Contractor into the operations and maintenance manual as described in the General Requirements. The manuals shall, as a minimum, include the following:

- a. Complete and accurate schematic diagrams
- b. Complete installation and operation procedures
- c. Complete performance specifications (functional, electrical, mechanical and environmental) of the unit.
- d. Complete list of replaceable parts including names of vendors for parts not identified by universal part numbers such as JEDEC/ RETMA or EIA.
- e. Complete maintenance and troubleshooting procedures.
- f. Complete documentation of all software interfaces including those used for transmitting MAC address data, maintenance information and device configuration.
- g. Testing Requirements

After installation of the equipment in the field and prior to integration of the equipment into the system, the Contractor shall perform an Operational Test in the field for each of the Wi-Fi Travel Time Receivers installed. The test shall demonstrate as a minimum the ability of the receiver to sense MAC addresses at each field location as designated on the plans under conditions of (1), a range of vehicle speeds from stationary to 20% above the posted speed, and (2), various vehicle densities typical of the installed location. Once integrated with the County's existing Foundation system, a 30-day operational test will be performed. The test must demonstrate continued and un-uninterrupted transfer of MAC address info from field equipment to the Traffic Management Center.

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If the Operational Test fails, the equipment shall be repaired and the test shall be rerun for that site. If a component has been modified as a result of a failure, that component shall be replaced in all like units and the test shall be rerun for each unit.

METHOD OF MEASUREMENT:

The Wi-Fi Travel Time Receivers will be measured for payment as the number of each specified in the Contract Documents satisfactorily installed.

BASIS OF PAYMENT:

The unit price bid for each Ethernet Switch shall include the cost of furnishing all labor, materials and tools and equipment necessary to complete the work and to make the Wi-Fi Travel Time Receiver fully operational and tested. Payment for the antenna, antenna cable, conduit between the antenna and the controller cabinet and all required mounting hardware and materials shall be included under this item.

Payment for all documentation, control software, testing and test equipment shall be included under this item.

ITEM 683.200100NA – ITS SUBSYSTEM INTEGRATION

DESCRIPTION

This work shall consist of furnishing Integration in accordance with the contract documents and as directed by the Engineer. Under this item, the Contractor shall integrate the new and relocated field equipment furnished and installed under this project with the existing Nassau County Traffic Management Center (TMC) central system. The project systems consists of the existing traffic signal system, CCTV system and monitoring equipment, and fiber optic network communication system and shall be alter in accordance with the contract documents and as ordered by the Engineer.

The existing Nassau County ITS subsystems operate as follows:

Traffic Signal subsystem

The field controllers installed under this project will be 2070 Lite controllers as defined in the California Department of Transportation (CALTRANS) 2002 Transportation Electrical Equipment Specifications (TEES), or latest revisions. These controllers shall be integrated into the existing traffic signal central system. The Contractor shall provide all hardware and software components required to integrate the new 2070 Lite controllers. The Contractor will be responsible for all database additions and revisions as required.

Communication Subsystem

The fiber optic communication system furnished and installed under this project shall be integrated with the existing Nassau County communication network. The first system is the new Nassau County Mineola to Westbury 288 strand fiber optic backbone communication and the second is the Old Country Road ITS 144 strand fiber optic backbone and local 48 strand fiber optic distribution fiber optic system. The Contractor shall provide all new hardware, splicing and modify any existing hardware required to integrate the new system with the existing communication system.

CCTV Subsystem

The CCTV equipment and associated communication equipment furnished, relocated and installed under this project shall be integrated with the existing Central CCTV Camera server and monitoring equipment installed at the Nassau County Westbury Office TMC. The Contractor shall modify any existing CCTV central hardware and provide any CCTV central server software required to integrate the new or relocated CCTV's with the existing central equipment. The Contractor shall incorporate any new or updated CCTV protocols into the existing CCTV camera controller and provide all camera control server and video monitoring database modifications required to integrate the new CCTV's. The Contractor will be responsible for all database additions and revisions as required.

ITEM 683.200100NA – ITS SUBSYSTEM INTEGRATION

MATERIALS:

The Contractor shall furnish and install all signal and communications cable assemblies required to connect between the Transportation Management Center (TMC) and Ethernet switches, patch panels, media converters, computer equipment, the existing Central traffic signal, CCTV Camera Controller and monitoring equipment. All wires and cables shall meet the requirements of the applicable special specifications in the contract documents.

The Contractor shall update the software configuration, data base in the Traffic signal, CCTV servers, TMC Workstation Computers and any other applicable equipment for all new equipment implementation under this contract.

The Contractor shall furnish and install two (2) - 19 inch wide by six foot high equipment racks in each of the Nassau County Mineola office IT room and the Nassau County Westbury TMC IT room (total of four (4) racks). The new racks shall house the proposed fiber optic, patch panels and Ethernet equipment.

CONSTRUCTION DETAILS:

The Contractor shall be responsible for the central software, firmware and hardware modifications and additions to implement the field and central equipment furnished and installed under this contract. The Contractor shall have qualified staff meeting the following requirements:

- A minimum of five years experience in the design, development and operation of fiber optic network, traffic control systems and CCTV surveillance systems.
- A minimum of five years experience in the design, development and installation of fiber optic cable systems.
- Familiar with Microsoft operating system, and TCP/IP protocol in an Ethernet network system.

The Contractor shall submit to the Engineer the proof of the above qualifications prior to start of any work.

The Contractor shall minimize any disruption in office to office communications between the two Nassau County offices as described in the General Notes.

The Contractor shall complete the equipment integration and system operation tests of the new fiber optic communications subsystem with no disruptions to the Nassau County operations.

ITEM 683.200100NA – ITS SUBSYSTEM INTEGRATION

The Contractor shall be responsible for ensuring simultaneous integrated operation of the new equipment and the existing Nassau County equipment.

Existing system manuals and software documentation are available, for examination, at the Nassau County Westbury office TMC

The Contractor shall submit, for the approval of the Engineer, a detailed implementation plan prior to beginning work.

Attend Bi-Weekly Integration Meetings with the Engineer

The Contractor will perform final system integration services for this project. This work shall include the activation and control of all devices to be included in the project. In addition, this contractor shall also review the shop drawings for the project and perform the test programs described in this specification.

To accommodate the proposed installation schedule, the forum for supplying these support services shall be through integration meetings at which representatives of the contractor, and the suppliers may attend, and by request of the contractor or Engineer. These meetings may be held at the Nassau County project office. The primary purpose of these meetings is to assist the contractor in preparing the shop drawings for the complex items requiring integration of sub-assemblies. In addition, shop drawings and test program submittals shall be reviewed and discussed at these sessions. The contractor retains the responsibility for developing the shop drawings and receiving approval of the Engineer prior to fabrication and installation of any bid item. The meetings shall also serve as a forum for project management at which issues can be discussed and resolved between the parties. The Engineer may waive the meetings, if project progress is satisfactory or if none of the parties require it.

As a minimum the contractor's project manager shall attend all integration meetings held. In addition technical support personnel shall attend as required including representatives of suppliers and subcontractors who are involved in issues requiring resolution at the integration meetings shall attend.

Prepare Shop Drawings Required for Bid Items

Most bid items for this project include shop drawing submittal requirements. In that many of the bid items interrelate with each other, shop drawings submittals shall be submitted for the following:

- Traffic Signal Controller Equipment and Cabinet
- Hub Cabinets
- Fiber Optic Cable and Enclosure

ITEM 683.200100NA – ITS SUBSYSTEM INTEGRATION

- Hub and Communications Equipment
- CCTV Field Equipment Cabinet
- CCTV Assembly
- Video Image Detection System Processor and Sensor Assembly
- System detection system

Items to be installed in cabinets shall be submitted and approved with shop drawing and layout of equipment to be installed, when packages are being evaluated. All other shop drawings for the remaining bid items shall be submitted and will be approved individually.

All of the items for installation of a device type e.g. CCTV Assembly must be submitted at the same time. Individual components of a package will not be approved until all items in the package are acceptable.

In addition to the shop drawings specified with the individual bid items the contractor shall prepare an integration and installation schedule and work plan for the project which shall be subject to the approval of the Engineer. The contractor schedule should be developed to meet the installation schedule included in the plans. At the same time the contractor shall submit a pulling scheme and equipment for the fiber optic cable to be installed.

System Test and Integration

The Contractor shall submit test procedures to the Engineer for approval before conducting any tests. All tests shall be conducted as described in the specifications and general notes found elsewhere in the contract documents. At a minimum the Contractor shall conduct a subsystem tests as described in the specifications and a 30 Day Final Acceptance Test. The 30 Day Final Acceptance Test shall at a minimum demonstrate daily the functions and communications to each traffic signal controller, VIDS, system detection and CCTV assembly.

Upon final completion of the work specified herein, the overall traffic signal central control system the CCTV system and communication system shall undergo a 30 Day Final Acceptance Test.

Documentation

The Contractor shall provide five (5) copies of all hardware and software/firmware implementations and modifications made under this contract. Documentation on any manufacturer supplied or public domain programs used in the modifications shall be included in the documentation.

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The Contractor shall submit shop drawings that show and document all proposed modifications and additions to the existing traffic signal, fiber optic communication, and CCTV subsystems for approval by the engineer.

Training

Subsequent to delivery of the documentation and installation of the equipment, the contractor and/or manufacturer's representatives shall conduct a training course for all equipment supplied for the project. The manufacturer's representative must be fully knowledgeable concerning the material and now it is being utilized on the project. At a minimum the following items shall be included in the training:

- Fiber optic cabling and splicing maintenance and operation
- 2070 Lite controller maintenance and operation
- VIDs maintenance and operation
- Wireless detection sensor maintenance and operation
- Ethernet communication maintenance and operation
- CCTV maintenance and operation

The training course shall be for a minimum of 40 hours. No more than 7 hours training shall be scheduled for a given day. The training course shall be attended by no more than 5 personnel, in any given session. The training course shall be held at a facility to be provided by the Engineer. The contractor is responsible for supplying all audio visuals and test equipment, which may be required.

The training course shall center on the operation and maintenance of all system equipment. The training shall also include use of all of the test equipment to be supplied as part of the system support material. Concentration shall be on setting up the configurations of all assemblies and diagnosing failures. Use of all manufacturer supplied software programs shall be covered in the sessions. Component level maintenance down to the circuit board level is not required for these sessions. However, the training courses should provide information on how to "replace" failed components with spare equipment.

The contractor shall submit a syllabus of the training course, which specifies what topics are to be covered during each day. The Engineer shall be provided a minimum of one week's notice prior to the scheduling of any training courses. The Engineer must approve the syllabus at least one week prior to starting any training courses. The Engineer reserves the rights to modify the training schedule as appropriate so as to obtain the appropriate number of hours on all of the system components.

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Training shall have been completed prior to the end of system acceptance and can be scheduled during the 30-day observation period in the system acceptance test period. The training must be completed prior to the end of the system acceptance test.

METHOD OF MEASUREMENT

Payment for Central Software and Hardware Integration will be made on a lump sum basis.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of furnishing all equipment, materials, labor, integration, testing, tools, training, source code and documentation to complete the work. Payment shall be made upon successful completion of the 30 Day Final Acceptance Test. Progress payments will be made in the following percentages of the bid price for each item after each milestone is reached.

Approval of Shop Drawings	-	10%
Completion of Communication Trunk Integrity Tests	-	15%
Completion of Central Operations Tests for Remaining Components	-	25%
Completion of Training Program	-	25%
Completion of System Acceptance	-	25%

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DESCRIPTION:

This work shall consist of the furnishing and installation of fiber optic cables, passive components and miscellaneous equipment required for a complete cable plant in accordance with the contract documents and as directed by the Engineer.

MATERIALS:

Equipment to be installed as part of these bid items include the following:

1. Single Mode Fiber Optic Cable
2. Fiber Optic Cable Connectors and Splices
3. Fiber Optic Splice Trays
4. Fiber Optic Splice Cases
5. Fiber Optic Breakout Kits

Other passive components that are required to form a complete communication system include (1) terminators and (2) moisture and water sealants and cable caps for below grade applications. The components supplied shall be commercially available components whose specifications indicate state-of-the-art capability for the application.

1. Single-mode Fiber Optic Trunk Cable

The single-mode fiber optic cable shall incorporate a water swellable tape and be of a loose buffer tube cable design as specified herein. The fiber optic cable shall be all dielectric suitable for conduit and aerial installation in an outside cable plant environment and for indoor cabling environments when installed in accordance with the current NEC and local building code requirements. All cable shall consist of the number of fibers specified in the contract documents.

The cable shall meet the requirements of the United States Department of Agriculture Rural Utility Service (RUS) 7 CFR1755.900 and the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 at a minimum, and shall be new, unused and

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of current design and manufacture. The cable manufacturer shall have a minimum of three years experience in manufacturing fiber optic cable of similar design.

Optical Requirements

The fiber shall meet the requirements of EIA/TIA-492CAAA "Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers".

Attenuation: The nominal attenuation shall not exceed 0.4 dB/km at a wavelength of 1310 nm and 0.3 dB/km at a wavelength of 1550 nm. Fiber attenuation shall be uniform with no discontinuities greater than 0.1 dB. The attenuation at 1383 + 3 nm shall not exceed 2.1 dB/km. The attenuation measurements shall be in accordance with EIA/TIA Standards FOTP-20, 59, 61 and 78. The average change in attenuation at extreme operational temperatures (-40° F to 158° F) shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.15 dB/km at 1550 nm. The change in attenuation measurements shall in accordance with EIA/TIA Standard FOTP-3.

Cutoff Wavelength: Not to exceed 1250 nm. Mode-Field Diameter:

9.30 ± 0.50 μm at 1310 nm.

10.50 ± 1.00 μm at 1550 nm.

Zero Dispersion Wavelength: 1312 nm ± 10 nm.

Zero Dispersion Slope: Not to exceed 0.092 ps/(nm²×km). Polarization Mode Dispersion: Not to exceed 0.5 ps/(km)^{1/2}

Dispersion: Less than 3.5 ps/(nm*km) for 1285 nm through 1330 nm and less than 18 ps/(nm*km) at 1550 nm as measured in accordance with EIA/TIA Standard FOTP-169.

Mechanical Requirements

Fibers

All optical fibers shall be Corning glass fibers or approved equivalent. All fibers within a given cable shall be from the same manufacturer, and shall contain no factory splices. Each fiber shall conform to the following minimum requirements:

- Typical Core Diameter: 8.3 μm (0.327mil)
- Cladding Diameter: 25.0±1.0 μm (1 mil to 0.04mil)

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- Core-to-Cladding Offset: Not to exceed 0.5 μm(0.02 mil)
- Cladding Non-Circularity: Not to exceed 1.0 % Color Coating

Each fiber shall have a color coating applied to it by the manufacturer. The coating shall not affect the optical characteristics of the fiber. The basic color configuration shall be as follows, in accordance with EIA/TIA-598-A:

- | | | | |
|-----------|----------|----------|------------|
| 1. Blue | 4. Brown | 7.Red | 10. Violet |
| 2. Orange | 5. Slate | 8.Black | 11. Rose |
| 3. Green | 6. White | 9.Yellow | 12. Aqua |

The nominal colored fiber diameter shall be 250 μm. (10 mil). Primary Coating

Each fiber shall have a dual layered, UV acrylate coating applied to it by the manufacturer. The coating shall be mechanically strippable without damaging the fiber. The coating diameter shall be 245+10 μm(10 mil±0.4 mil).

Central Strength Member: The strength member shall consist of a dielectric, glass-reinforced plastic rod. Buffering

All fibers shall be enclosed in non-conductive loose buffer tubes. Each buffer tube shall contain up to twelve (12) fibers. The Contractor shall submit the fiber count per buffer tube and the buffer tube count configuration to the Engineer for approval. The fiber shall not adhere to the inside of the buffer tube. Each buffer tube containing fibers shall be color coded in a similar scheme as the fiber color. The basic color configuration shall be as follows, in accordance with EIA/TIA-598-A:

- | | | | |
|-----------|----------|-----------|------------|
| 1. Blue | 4. Brown | 7. Red | 10. Violet |
| 2. Orange | 5. Slate | 8. Black | 11. Rose |
| 3. Green | 6. White | 9. Yellow | 12. Aqua |

In basic color configuration is repeated with the inclusion of a black tracer for buffer tubes 13 through 24.

In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together. Buffer tubes shall be of dual-layer construction.

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The buffer tubes shall be filled with a non-hygroscopic gel to prevent water and moisture penetration. The gel shall contain anti-oxidant additives, and the gel shall be readily removable with conventional solvents. The gel shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive.

Filler Rods: Filler rods shall be used to fill all unused buffer tubes, or shall be used instead of unused buffer tubes. The filler rod shall be a solid polyethylene material and shall be natural in color. The filler rods shall maintain the concentricity of the cable cross section where required.

Stranding: The buffer tubes shall be stranded around the central strength member using the reverse oscillation (S-Z) stranding process. Water swellable yarns shall be applied longitudinally along the central member during stranding.

Water Swellable Tape: A water swellable tape shall be applied longitudinally over the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

Tensile Strength Provisions: Aramid yarn shall be helically stranded evenly around the cable core to provide tensile strength. The yarn shall enable the cable to withstand a maximum pulling force of 607 lbs during installation and 200 lbs long term installed without changing the characteristics of the optical fibers. Each length of cable shall have sufficient strength to be installed in continuous lengths as specified on the plans.

Outer Jacket: A medium density polyethylene (or approved equal) outer jacket shall be applied over the entire cable assembly. The outer jacket shall have a minimum nominal jacket thickness of 1/16 inch. The polyethylene shall contain carbon black and shall not promote the growth of fungus. Jacketing material shall be applied directly over the strength members and the water swellable tape. The outer jacket shall contain no metallic elements and shall be of a consistent thickness.

The MDPE jacketed material shall be as defined in ASTM D1248, Type II, Class C and Grades J4, E7 and E8. The jacket shall be marked in contrasting color at 2 feet intervals with the following information: NYSDOT - INFORM FIBER OPTIC CABLE - XXX - YYYY where XXX shall equal the number of optical fibers in the cable and YYYY shall be the month and year that the cable was manufactured. The height of the markings shall be approximately 3/32 inch.

In addition, the outer jacket shall have sequential meter markings as approved by the Engineer. The actual length of the cable shall be within -0% +1% of the length markings.

Ripcord: The cable shall contain a ripcord under the sheath to facilitate cable preparation.

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Bend Radius: The cable shall be capable of withstanding a minimum bending radius of ten (10) times its outer diameter during operation and fifteen (15) times its outer diameter during installation without changing the characteristics of the optical fibers.

Diameter: The outer diameter of the cable shall be less than 19/32 inch for cables containing 72 fibers or less and 13/16 for cables containing between 72 fibers and 288 fibers.

Other Requirements

Manufacturer's Certification: The cable manufacturer shall certify that each reel of cable furnished, meets or exceeds the following specifications:

Fluid Penetration: When a one meter static head of water or equivalent continuous pressure is applied at one end of a one meter length of filled cable for one hour, no water shall leak through the open cable end. The water penetration testing shall be performed in accordance with EIA/TIA Standard FOTP-82.

Filling Compound Flow: When tested in accordance with EIA/TIA Standard FOTP-81, the cable shall exhibit no flow (drip or leak) of filling or flooding compound at 158° F.

Compressive Strength: When tested in accordance with EIA/TIA Standard FOTP-41, the cable shall withstand a minimum compressive load of 126 lb/inch applied uniformly over the length of the sample and applied at the rate of 0.1 inch per minute. The load shall be maintained for a period of 1 minute and then decreased to 63 lb/in. The 63lb/in load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 63 lb/in load. The change in attenuation shall not exceed 0.15 dB at 885lb/in.

Tensile Loading and Bending: When tested in accordance with EIA/TIA Standard FOTP-33, using a maximum mandrel and sheave diameter of 22 inch, the cable shall withstand a rated tensile load of 600 lbs and a residual load of 30% of the rated installation load. The axial fiber strain shall be $\leq 20\%$ of the fiber proof level after completion of 10 minutes of conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm.

Impact Resistance: When tested in accordance with EIA/TIA Standard FOTP-25 except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be at

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least 3.24lb/ ft (in accordance with ICEA S-87-640), the change in attenuation shall not exceed 0.15 dB at 1550 nm.

Cable Flex: When tested in accordance with EIA/TIA Standard FOTP-104, the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The fibers shall not experience an attenuation change greater than 0.15 dB at 1550 nm. The cable jacket shall exhibit no cracking or splitting when observed under 5X magnification.

Temperature Cycling: When tested in accordance with EIA/TIA Standard FOTP-3, the change in attenuation at extreme temperatures (-40°F to +158° F) shall not exceed 0.15 dB/km at 1550 nm.

Low or High Temperature Bending: When tested in accordance with EIA/TIA Standard FOTP-37, the cable shall withstand four full turns around a mandrel of # 20 times the cable diameter for four hours at test temperatures of -22°F and +140°F. Neither the inner nor outer surfaces of the jacket shall exhibit visible cracks, splits, tears or other openings. The fibers shall not exhibit a change in attenuation greater than 0.30 dB/km at 1550 nm.

Cable Twist: When tested in accordance with EIA/TIA Standard FOTP-85, a length of cable no longer than 6½ft shall withstand 10 cycles of mechanical twisting. The fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The cable jacket shall exhibit no cracking or splitting when observed under 5X magnification.

2. Fiber Optic Drop Cable

Fiber optic drop cables shall be installed in conduit, between the mainline fiber optic backbone cable and equipment cabinets patch panels as shown on the plans. They shall be spliced to the appropriate fiber within approved splice cases in pullboxes adjacent to equipment cabinets as specified.

Optical Requirements: The fiber optic drop cables shall have identical optical characteristics as the single-mode fiber optic trunk cable specified above.

Material Requirements

The drop cable shall have the identical physical configuration as the single-mode fiber optic trunk cable specified above. The fiber optic drop cable shall contain twelve (12) or more fibers. The number of fibers per drop cable shall be selected to allow for a minimum of 50% spare for the drop location.

The drop cable shall be able to withstand a minimum of 100 lbs of pulling force during installation.

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The Contractor shall submit the drop cable buffer tube count configuration and fiber count per buffer tube to the engineer for approval.

The individual fibers in each drop cable shall be unterminated on one end and have a factory installed ST connector on the other end. The unterminated end shall be fusion spliced to the appropriate mainline fiber in a splice case and the terminated end shall interface with the cabinet distribution rack specified under a separate contract item. The manufacturer shall factory test the cable assembly with connectors and provide results to the Engineer for approval prior to field installation.

The drop cable shall be of sufficient length to be installed as shown on the plans, with a minimum of 10 ft of slack provided on either end.

The Contractor shall follow the drop cable manufacturer's recommendation in the installation of the drop cables, including the individual breakout fibers.

3. Fiber Optic Connectors:

Fiber optic connectors shall be factory installed. Field installation of connectors shall only be permitted with the express consent of the Engineer and will be considered on a case by case basis. The connectors shall meet the following requirements:

- Type ST twist lock (bayonet).
- Uses ceramic ferrules
- Fiber secured within the ferrule with epoxy, as specified by the connector or epoxy manufacturer.
- Operating temperature: -4°F to +158°F
- Insertion loss: 0.5 dB maximum
- Return loss: 55 dB minimum

4. Splice Cases

The Contractor shall furnish and install fiber optic splice cases in locations where splices require protection. The typical location where they will be required is in pullboxes where the fiber optic trunk cable will be spliced to fiber optic drop cables. The splice cases shall meet the following minimum requirements:

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<u>ITEM 683.921024NA - SINGLE MODE FIBER OPTIC TRUNK CABLE, 24 FIBERS</u>
<u>ITEM 683.921036NA - SINGLE MODE FIBER OPTIC TRUNK CABLE, 36 FIBERS</u>
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<u>ITEM 683.921060NA - SINGLE MODE FIBER OPTIC TRUNK CABLE, 60 FIBERS</u>
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- The case shall be constructed of a rigid, high strength plastic material. The case shall be waterproof with the appropriate gaskets and protection to provide moisture integrity. When installed, the case shall be capable of withstanding severe conditions of moisture, vibration, impact, cable stress and temperature extremes.
- The case shall be capable of holding the type of splice trays specified herein, for fusion and ribbon splices. The case shall have the capability of holding trays from various manufacturers. The basic case shall have the capacity to hold three (3) splice trays with 24 splices per tray.
- The basic case shall have the input/output capacity for 6 cables.
- The case shall be re-enterable without disturbing the fibers or the fiber splices. No special tools shall be required for installation of maintenance of the case. All hardware and miscellaneous parts shall be standard industry equipment.
- The splice case shall be mountable to standard U-shaped sign channels using stainless steel hardware, or manufacturer approved hardware. Mounting shall be as shown on the details.
- Nominal dimensions of the basic case shall be 22 inch long by 9 inch wide by 9 inch high. The basic case shall weigh 20 lbs maximum.
- The splice case shall have a termination block to terminate the central strength members of the fiber optic cables.
- The case shall be able to accommodate the total cables and number of cable trays and number of splices equal to or greater than the fiber count of the largest cable within the splice case or as called for in the plans.

5. Splice Trays

The Contractor shall furnish and install fiber optic splice trays to organize and store splices within splice cases. The trays shall be compatible with the fiber optic splices and splice cases specified herein and shall meet the following minimum requirements:

- The tray shall have the capacity for 24 splices. It shall be compatible with the fusion splices specified herein but shall also be adaptable to hold mechanical splices.
- The tray shall accommodate up to 8 loose tube buffers. No cable ties are to be used. The loose tube buffers shall be secured with a tube guide or channel snap.
- The tray shall accommodate both 250 micron and 900 micron fiber.

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- Slack fiber within the tray shall be placed in an oval shape along an inside wall of the tray.
- The fiber optic splice trays shall be stackable within the splice case. Any tray within a stack shall be accessible without disassembly of any of the other trays.
- The nominal dimensions of the splice tray shall be 16 inch long by 4 ½ inch wide by ½ inch high.

6. Fiber Optic Breakout Kits

The fiber optic breakout kits contain all the tools and materials necessary to complete the installation of the fiber optic backbone and drop cables. It shall include, as a minimum, the following equipment:

- Pulling eyes with protective covering for the installation of preterminated fiber optic drop cable.
- Fiber optic installer test equipment, fusion splicers, test cables, connector adapters, inspection tools, attenuators, tracers, continuity checkers, consumables and all ancillary equipment.

Quality Assurance Provision

All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 ksi.

All optical fibers shall be attenuation tested. The attenuation of each fiber shall be provided to the Engineer with each reel of cable furnished.

The fiber optic cable shall conform to the following requirements:

Environmental Requirements

The cable shall function within specifications over the following temperature ranges:

- Shipping/Storage: -58°F to 158°F
- Installation: -22°F to 158°F
- Operation: -40°F to 158°F

CONSTRUCTION DETAILS:

All fiber optic cable will be installed in innerduct placed in steel conduit, steel conduit, lashed to or messenger cable, or overlashed to existing cables as indicated in these contract documents or otherwise

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directed by the Engineer. All fibers in the fiber optic cable shall be spliced and/or terminated in designated field cabinets or pullboxes only.

Prior to the installation of the fiber optic cable the Contractor shall submit his proposed cable plant design to the Engineer for approval. No cable shall be installed until the proposed cable plant design submission is approved by the Engineer. The cable plant design shall include the following:

- Catalog cuts and shop drawings for all cable, connectors, splice equipment, splice enclosures, splice trays and cable installation and test equipment.
- Preliminary locations of all proposed splices.
- Proposed pullbox locations where hand assists or intermediate assist winches will be required during installation.
- Proof of the experience requirements as defined in this special specification.
- Cable manufacturer's recommended cable installation techniques, both in conduit and overlashed to messenger or existing cable, such that the optical and mechanical properties of the cables are not degraded at the time of installation. The proposed recommendations shall include the following:
 - Cable manufacture's approved pulling lubricant for use on the cable and method of application.
 - No other lubricants will be permitted.
 - Installation set-up including size and types of rollers, feeder guides, tension gauge make and model number, attachment of pulling jig to jacket and direction of pull.
 - Method to overlash the cables to existing cables including spacing of drip loops, lashing material, slack cable storage.
 - Maximum pulling tensions, which shall specify both pulling from the cable's conductors and for pulling from the cable's outer jacket.
 - Minimum bend radii, which shall specify a radius both loaded and unloaded.
 - Method to install multiple cables.

The cable plant design shall be submitted at the Milestone specified in the Special Note of the Contract Documents.

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Experience Requirements

Personnel involved in the installation, splicing and testing of the fiber optic cable shall meet the following requirements:

- A minimum of seven (7) years experience in the installation of fiber optic cables, including fusion splicing, terminating and testing single mode fibers.
- Five (5) installed systems where fiber optic cables are installed in outdoor conduits and aerial plants and the systems are in continuous satisfactory operation for at least two (2) years. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the fiber optic systems.
- One (1) fiber optic cable system (which may be one of the five in the preceding paragraph) which the Contractor can arrange for inspection and demonstration to INFORM representatives and the Engineer. Test records for the system including cable and splice loss shall be furnished for examination by the Engineer. A system splice enclosure and a patch panel selected at random by the Engineer shall be opened by the Contractor for inspection of workmanship. All inspection activities shall be approved in writing by the system owner prior to actual field inspection.
- Splicers shall have been trained and certified by the manufacturer of the fiber splice material to be used, in fiber optic splicing procedures. Proof of this training must be submitted to the Engineer for approval.
- Installers shall have been trained and certified by the manufacturer of the fiber optic cable to be used, in fiber optic cable installation and handling procedures. Proof of this training must be submitted to the Engineer for approval.
- Personnel involved in testing shall have been trained and certified by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training must be submitted to the Engineer for approval.

Slack Cable Storage

Slack cable shall be stored underground on approved racks in fiber optic pullboxes, at grade in equipment cabinets, and overhead on pairs of approved cable snowshoes. Quantity of slack cable to be stored shall be as indicated in the contract documents and as approved by the Engineer.

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Splicing Requirements

All optical fibers shall be spliced to provide continuous runs. Splices shall be allowed only at locations designated in the approved cable plant layout or as approved by the Engineer. All splices shall be performed in a controlled, clean environment such as a Contractor designated splicing truck/or van.

The splices shall meet the following requirements:

- a. All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated and specifically adjusted to the fiber and environmental conditions at the start of each shift. Splice enclosures, tools and procedures, shall be approved by the cable manufacturer as being compatible with the cable type being delivered.
- b. Only buffered tubes containing fibers to be spliced shall be opened. The other tubes shall be neatly looped and stored in the enclosure.
- c. Each spliced fiber shall be packaged in a protective sleeving or housing. Bare fibers shall be completely re-coated with a protective RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.
- d. Rack mounted organizer trays shall be used to hold the spliced fibers, with each fiber neatly secured to the tray.
- e. Splice loss shall not exceed a mean of 0.1 dB per link. A link is defined as the fiber optic path between two active components. No splice loss shall exceed 0.15 dB. If a splice is measured to exceed 0.15 dB during the splicing process, it shall be remade until its loss falls below 0.15 dB or the Engineer waives the 0.15 dB requirement. Each attempt shall be recorded for purposes of acceptance. If the mean exceeds 0.1 dB in any link, splices in the link shall be remade until the mean loss does not exceed 0.1 dB
- f. All splice losses shall be recorded in tabular form and submitted to the Engineer in paper and electronic formats for approval. If an optical time domain reflectometer (OTDR) is used to record splice loss, chart recordings of the "signature" shall be submitted with the splice data with a record of all OTDR settings and the OTDR locations written on the trace.

Installation

Fiber optic cable shall be installed in accordance with the approved manufacturer's recommendations. In addition the following requirements shall be met:

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- a. The number of pullboxes and their locations shall be as shown on the Contract Documents. The Contractor may be required to install the cable one pullbox at a time. The direction of the cable pull shall be determined by the Contractor and shall require the approval of the Engineer.
- b. A minimum of 30 ft of cable slack, or as approved by the Engineer, shall be provided in pullboxes containing splices or otherwise designated on the Contract Documents or as directed by the Engineer. Additional slack, as indicated on the approved cable installation plan, may be provided for closure preparation and splicing.
- c. No fiber optic cable shall be pulled through more than one 90 degree bend unless so indicated on the approved Contract Documents or specifically approved by the Engineer.
- d. The cable shall not be pulled over edges or corners, over or around obstructions, or through unnecessary curves or bends.
- e. The cable shall be looped in and out of cabinets and pull boxes to provide adequate slack and the least amount of stress on the fibers. The Contractor shall ensure that the cable is not damaged during storage or installation.
- f. Fiber optic cable ends shall be kept sealed at all times during installation, using a method recommended by the cable manufacturer and approved by the Engineer. The cable end shall remain sealed until the Contractor terminates the fiber cables. Cables that are not immediately terminated shall have a minimum of 6 ½ ft of slack.
- g. When using lubricants, the Contractor shall adhere to the cable manufacturer's requirements for the proper amount, application tools and method, and removal of the lubricant from the exposed cable.
- h. Optical fiber cable shall be installed in continuous lengths without intermediate splices throughout the project except where splices are indicated on the Contract Documents or approved by the Engineer. Splices shall only be in reenterable splice enclosures mounted in pullboxes, junction boxes and underground vaults.
- i. The fiber optic drop cable shall be spliced to either the backbone or distribution cable at the locations indicated in the Contract Documents or as directed by the Engineer.
- j. The maximum pulling tensions and minimum bending radii shall not be violated at any time during installation. The Contractor shall consult with the Engineer concerning existing conduit, pull boxes, and risers, which could force the violation of the minimum bending radius for the fiber optic cable. The Contractor shall obtain approval from the Engineer if modifications to these existing facilities are required. Violation of these parameters shall be cause for rejection of the installed cable.

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k. Prior to any installation of cable, the Contractor shall clean existing conduit in accordance with the requirements of these special provisions.

l. Prior to overlashing cable, the Contractor shall inspect the existing aerial cable plant and report any deficiencies that may hinder the proper installation of the new cable to the Engineer who will determine, what, if any, action should be taken.

m. Slack cable and innerduct where pulled through a pullbox shall be racked to the pullbox wall.

Splicing Requirements

a. All optical fibers shall be spliced to provide continuous runs.

b. Prior to splicing the Contractor shall test each fiber of the installed cable for continuity, anomalies (events above 0.3 dB) and attenuation using an Optical Time Domain Reflectometer (OTDR) at wavelengths of 1310 nm and 1550 nm.

c. Only the fibers designated for splicing shall be spliced. All other fibers shall be routed through the splice enclosure with at least 1 ft of slack left within the enclosure. Only buffer tubes containing fibers to be spliced shall be opened.

d. Splices shall be made only at locations designated in the approved cable plant layout or as approved by the Engineer.

e. Where two backbone cables are routed in the same duct bank, both cables shall not be spliced in the same pull box.

Termination Requirements

The connector loss for complete connection to the terminal equipment shall not exceed a mean of 0.5 dB. No connector losses above 1.0 dB shall be permitted.

Unused optical fibers shall be properly protected with sealed end caps.

Documentation Requirements

Ten (10) complete sets of operation and maintenance manuals shall be provided. The manuals shall, as a minimum, include the following:

- Complete and accurate as-built schematic diagrams showing the fiber optic cable plant and locations of all splices.

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- Complete performance data of the cable plant showing the losses at each splice joint and each terminal connector.
- Installation, splicing, terminating and testing procedures.
- Complete parts list including names of vendors.
- Complete maintenance and trouble-shooting procedures.
- One (1) month prior to installation, ten (10) copies of the Contractors Installation Practices shall be submitted for approval. This shall include practices, list of installation equipment, and splicing and test equipment. Field quality control procedures shall be detailed as well as procedures for corrective action.

Testing Requirements

The following tests shall be conducted. All tests shall be conducted in accordance with approved test procedures. The Contractor shall submit test procedures and forms in paper and electronic formats for approval to the Engineer.

Existing Fiber Cable Verification Test: Prior to splicing fibers installed under this contract to existing fibers (where designated in the plans), the Contractor shall verify the loss characteristics of the existing fiber. Any anomalies shall be reported to the Engineer.

Pre-Installation Tests

The fiber optic cable shall be inspected and tested at the site storage area prior to installation.

Proper fiber cladding and fiber tube colors shall be verified by visual inspection. Any difference discovered from approved fiber optic cable plant layout or approved catalogue cut sheets for the cable shall be grounds for rejection of the cable.

Each optical fiber in the cable shall be tested from one end with an OTDR compatible with wavelength and fiber type. Testing shall check for continuity, length, anomalies, and approximate attenuation at both 1310nm and 1550nm wavelengths. Each measurement shall be recorded with color, location and type of fiber measure. In the event that a meaningful measurement cannot be made from one end, it shall be performed from the opposite end of that fiber.

Post-Installation Tests

Pre-splice and Post-splice testing shall be performed as follows:

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Pre-Splice Testing

After installation and prior to splicing or terminating each optical fiber in the cable shall be tested again for the loss characteristics at both 1310nm and 1550nm wavelengths. Both directions of operation of the fiber shall be tested.

Post-splice Testing

After each splice and connector installation, each optical fiber span including all black/spare fibers shall undergo the following tests after installation of all connectors and splices. A span is defined as a continuous length of fiber including all splices and connectors:

- Using an OTDR test each span at 1310 nm and 1550 for fiber attenuation, continuity, length, and anomalies. Each optical fiber shall meet the following acceptance criteria:
- Attenuation: Not to exceed 0.4 dB/km + 0.1 dB/splice + 0.5 dB/connector. The number of splices and cable attenuation shall be based upon the approved cable plant layout.
- Anomalies: No event shall exceed 0.3 dB. If any event is detected that value, the contractor shall repair or replace that section of cable.
- Using an optical source and a power meter measure the attenuation from both ends. The measured attenuation shall be meet the criteria defined for the attenuation using the OTDR.

All cable that fails to meet the aforementioned requirements shall be replaced.

The Contractor shall submit to the Engineer a tabulated list of fibers and the actual end-to-end measured values from the above tests and all traces and loss length printouts.

Each fiber shall be listed according to the color code and span. This test data shall be the basis of acceptance for the fiber.

For optical fibers spliced to existing fibers this test shall be repeated between the control center and the field termination after the new and existing fibers have been spliced together. If a fiber fails to meet the loss characteristics for the spliced section fiber, the Contractor shall determine whether the excessive loss is the result of an anomaly in the new section of fiber, splice or existing section of fiber. The Contractor will not be responsible for repairing the existing fiber. The Contractor shall, however, be responsible for the new section of fiber and the splice between the two sections.

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METHOD OF MEASUREMENT:

The fiber optic cable will be measured for payment as the number of linear feet of each size actually furnished and installed in accordance with the contract documents.

BASIS OF PAYMENT:

The unit price bid per foot for Single Mode Fiber Optic Trunk Cable and Fiber Optic Drop Cable shall include the cost of furnishing all labor, material, tools and equipment and testing of the fiber optic cable to complete the work. The cost of furnishing and installing all passive components shall be incidental to and included in the pay item for fiber optic cable. All splicing, including set-up and individual terminations and connectors shall also be included in the pay item for fiber optic cable. All cable racks, snowshoes and other miscellaneous hardware necessary for slack cable storage shall also be included in the pay item for fiber optic cable.

Progress payment will be made as follows:

- Sixty percent of the bid price of the completed cable plant will be paid upon completion of installation and satisfactory completion of the post-installation tests.
- Twenty-five percent of the bid price will be paid upon satisfactory completion of all subsystem tests as described in the Special Provisions.
- Fifteen percent of the bid price will be paid upon satisfactory completion of Final System Acceptance.

**ITEM 685.0715XX10 - EPOXY REFLECTORIZED PAVEMENT MARKINGS 15 MILS THICK
(WET NIGHT VISIBILITY SPHERES)**

**ITEM 685.0720XX10 - EPOXY REFLECTORIZED PAVEMENT MARKINGS 20 MILS THICK
(WET NIGHT VISIBILITY SPHERES)**

DESCRIPTION:

Under this work the contractor shall furnish and apply epoxy reflectorized pavement markings in accordance with these specifications, the Contract Documents, the NYSMUTCD, or as ordered by the Engineer. Items for Special Markings include stop bars and crosswalks.

Yield line symbols are isosceles triangles with height equaling 1.5 times the base dimension:

A small yield line symbol shall have a base dimension of one foot.

A large yield line symbol shall have a base dimension of two feet.

Yield line symbols are to be installed with the Apex of the triangle oriented towards oncoming traffic.

The epoxy marking material shall be hot-applied by spray methods onto bituminous and portland cement concrete pavement surfaces at the thickness and width shown on the Contract Documents. Following a simultaneous application of Standard Glass Beads (Type 2) and Wet/Night Visibility Beads (Type 1), the cured epoxy marking shall be an adherent reflectorized stripe that will provide wet night retro-reflectivity.

MATERIALS REQUIREMENTS:

Epoxy Paint	727-03
Glass Beads for Pavement Markings	727-05

Reflective Glass Spheres

Retro-reflective beads shall be a double drop system of glass spheres consisting of Standard Beads (Type 2) and Wet/Night Visibility Beads (Type 1) as defined in §727-05 Glass Beads for Pavement Markings.

EPOXY APPLICATING EQUIPMENT

In general, a mobile applicator shall be a truck mounted, self-contained pavement marking machine, specifically designed to apply epoxy resin materials and reflective glass spheres in continuous line patterns. The applying equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. In addition, the truck mounted unit shall be provided with accessories to allow for the marking of cross hatching and other special patterns as directed by the Engineer.

At any time throughout the duration of the project, the Contractor shall provide free access to his epoxy applying equipment for inspection by the Engineer or his authorized representative.

The Engineer may approve the use of a portable applicator in lieu of mobile truck mounted accessories for use in applying special markings only, provided such equipment can demonstrate satisfactory application of reflectorized epoxy markings in accordance with these specifications.

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Mobile applying equipment shall be capable of installing up to 19 miles of epoxy reflectorized pavement markings in an eight hour day and shall include the following features:

1. Individual tanks for the storage of Part A and Part B of the epoxy resin.
2. Individual tanks for the storage of Standard (Type 2) and Wet/Night Visibility (Type 1) glass spheres. Each tank shall have a minimum capacity of 3000 lbs.
3. Heating equipment of sufficient capacity to maintain the individual epoxy resin components at the manufacturer's recommended temperature for spray application.
4. Individual dispensers for the simultaneous application of Standard (Type 2) and Wet/Night Visibility (Type 1) glass spheres. Each dispenser shall be capable of applying spheres at a minimum rate of 10 lbs/gal of epoxy resin composition.
5. Metering devices or pressure gauges on the proportioning pumps, positioned to be readily visible to the Engineer.
6. All necessary spray equipment, mixers, compressors, and other appurtenances for the placement of epoxy reflectorized pavement markings in a simultaneous sequence of operations as described in Construction Details, D. Application of Epoxy ReflectORIZED Pavement Markings.

CONSTRUCTION DETAILS

A. General

All pavement markings shall be placed as shown on the Contract Documents and in accordance with the New York State, Manual of Uniform Traffic Control Devices (MUTCD).

Before any pavement marking work is begun, a schedule of operations shall be submitted for the approval of the Engineer.

At least five (5) days prior to starting striping, the Contractor shall provide the Engineer with the epoxy manufacturer's written instructions for use. These instructions shall include, but not be limited to, material mixing ratios and application temperatures.

When pavement markings are applied under traffic, the Contractor shall provide all necessary flags, markers, signs, etc. in accordance with the MUTCD to maintain and protect traffic, and to protect marking operations and the markings until thoroughly set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow shall not be allowed.

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The Contractor shall be responsible for removing, to the satisfaction of the Engineer, all tracking marks, spilled epoxy, and epoxy markings applied in unauthorized areas.

When necessary the Contractor shall establish marking line points at 30 foot intervals throughout the length of the pavement or as directed by the Engineer.

B. Atmospheric Conditions

Epoxy pavement markings shall only be applied during conditions of dry weather and on substantially dry pavement surfaces. At the time of installation the pavement surface temperature shall be a minimum of 50°F and the ambient temperature shall be a minimum of 50°F and rising. The Engineer shall be the sole determiner as to when atmospheric conditions and pavement surface conditions are such to produce satisfactory results.

C. Surface Preparation

The Contractor shall clean the pavement and existing durable markings to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the epoxy markings application.

At the time of application all pavement surfaces and existing durable markings shall be free of oil, dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item.

In addition, concrete curing compounds on new portland cement concrete surfaces and existing painted pavement markings on both concrete and bituminous pavement surfaces shall be cleaned and paid for in accordance with §635 Cleaning and Preparation of Pavement Surfaces for Pavement Markings.

D. Application of Epoxy ReflectORIZED Pavement Markings

Epoxy reflectORIZED pavement markings shall be placed at the width, thickness, and pattern designated in the Contract Documents.

Marking operations shall not begin until applicable surface preparation work is completed and approved by the Engineer, and the atmospheric conditions are acceptable to the Engineer.

Pavement markings shall be applied by the following simultaneous operation:

1. The pavement surface is air-blasted to remove dirt and residues.
2. The epoxy resin, mixed and heated in accordance with the manufacturer's

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recommendations, is uniformly hot-sprayed onto the pavement surface at the minimum specified thickness.

3. Standard (Type 2) and Wet/Night Visibility (Type 1) reflective glass spheres are injected into or dropped onto the liquid epoxy marking. Standard beads (Type 2) shall be applied first immediately followed by the application of Wet/Night Visibility beads (Type 1). Each type shall be applied at a minimum rate of 10 lbs/gal of epoxy resin (minimum total application = 20 lbs/gal).

E. Defective Epoxy Pavement Markings

Epoxy reflectorized pavement markings, which after application and curing are determined by the Engineer to be defective and not in conformance with this specification, shall be repaired. Repair of defective markings shall be the responsibility of the Contractor and shall be performed to the satisfaction of the Engineer as follows:

1. Insufficient film thickness and line width; insufficient glass bead coverage or inadequate glass bead retention.

Repair Method. Prepare the surface of the defective epoxy marking by grinding or blast cleaning. No other cleaning methods will be allowed. Surface preparation shall be performed to the extent that a substantial amount of the reflective glass spheres are removed and a roughened epoxy marking surface remains.

Immediately after surface preparation remove loose particles and foreign debris by brooming or blasting with compressed air.

Repair shall be made by restriping over the cleaned surface in accordance with the requirements of this specification and at the full thickness indicated on the Contract Documents.

2. Uncured or discolored epoxy*; insufficient bond (to pavement surface or existing durable marking).

Repair Method. The defective epoxy marking shall be completely removed and cleaned to the underlying pavement surface in accordance with the requirements of Section 635 - Cleaning and Preparation of Pavement Surfaces, at the Contractor's expense.

The extent of removal shall be the defective area plus any adjacent epoxy pavement marking material extending three feet in any direction.

After surface preparation work is complete, repair shall be made by reapplying epoxy over the cleaned pavement surface in accordance with the requirements of this specification.

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*Uncured epoxy shall be defined as applied material that fails to cure (dry) in accordance with the requirements of §727-03 Epoxy Paint; or applied material that fails to cure (dry) within a reasonable time period under actual field conditions, as defined by the Engineer.

Discoloration shall be defined as localized areas or patches of brown, grayish or black colored epoxy marking material. These areas often occur in a cyclic pattern and often are not visible until several days or weeks after markings are applied.

Other defects not noted above, but determined by the Engineer to need repair, shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

All work in conjunction with the repair or replacement of defective epoxy reflectorized pavement markings shall be performed by the Contractor at no additional cost to the State.

METHOD OF MEASUREMENT

Pavement striping (regular lines, cross hatching and special markings) will be measured in feet along the centerline of the pavement stripe and will be based on a 4 inch wide stripe. Measurement for striping with a width greater than the basic 4 inches, as shown on the plans or directed by the Engineer, will be made by the following method:

$$\frac{\text{Plan Width of Striping (inches) X Feet}}{4 \text{ inches}}$$

BASIS OF PAYMENT

The accepted quantities of markings will be paid for at the contract unit price, which shall include the cost of furnishing all labor, materials and equipment to satisfactorily complete the work. The cost for maintaining and protecting traffic during the marking operations shall be included in the price bid. The cost of removal of concrete curing compounds and existing pavement markings will be paid under separate items and are not included in this item.

No payment will be made for the repair or replacement of defective epoxy reflectorized pavement markings.

<u>PAY ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
685.07150110	White Epoxy Reflectorized Pavement Stripes – 15 mils	Foot

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685.07150210	(Wet Night Visibility Spheres) White Epoxy ReflectORIZED Pavement Letters - 15 mils	Each
685.07150310	(Wet Night Visibility Spheres) White Epoxy ReflectORIZED Pavement Symbols – 15 mils	Each
685.07150410	(Wet Night Visibility Spheres) White Epoxy ReflectORIZED Cross Hatching -15 mils Thick	Foot
685.07150510	(Wet Night Visibility Spheres) White Epoxy ReflectORIZED Pavement Stripes (Special Markings) 15 mils Thick (Wet Night Visibility Spheres)	Foot
685.07150610	Yellow Epoxy ReflectORIZED Pavement Stripes – 15 mils (Wet Night Visibility Spheres)	Foot
685.07150710	Yellow Epoxy ReflectORIZED Pavement Stripes (Cross Hatching) 15 mils Thick (Wet Night Visibility Spheres)	Foot
685.07150810	White Epoxy ReflectORIZED Pavement Yield Line Symbols - Small - 15 mils (Wet Night Visibility Spheres)	Each
685.07150910	White Epoxy ReflectORIZED Pavement Yield Line Symbols - Large - 15 mils (Wet Night Visibility Spheres)	Each
685.07200110	White Epoxy ReflectORIZED Pavement Stripes – 20 mils (Wet Night Visibility Spheres)	Foot
685.07200210	White Epoxy ReflectORIZED Pavement Letters – 20 mils (Wet Night Visibility Spheres)	Each
685.07200310	White Epoxy ReflectORIZED Pavement Symbols – 20 mils (Wet Night Visibility Spheres)	Each
685.07200410	White Epoxy ReflectORIZED Pavement Stripes (Cross Hatching) 20 mils Thick (Wet Night Visibility Spheres)	Foot
685.07200510	White Epoxy ReflectORIZED Pavement Stripes (Special Markings) 20 mils Thick (Wet Night Visibility Spheres)	Foot

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685.07200610	Yellow Epoxy ReflectORIZED Pavement Stripes – 20 mils (Wet Night Visibility Spheres)	Foot
685.07200710	Yellow Epoxy ReflectORIZED Pavement Stripes (Cross Hatching) 20 mils Thick (Wet Night Visibility Spheres)	Foot
685.07200810	White Epoxy ReflectORIZED Pavement Yield Line Symbols - Small - 20 mils (Wet Night Visibility Spheres)	Each
685.07200910	White Epoxy ReflectORIZED Pavement Yield Line Symbols - Large - 20 mils (Wet Night Visibility Spheres)	Each