



TOWN OF SUMMERVILLE

BEAR ISLAND ROAD TRAFFIC SIGNALS PROJECT

Bear Island Road at North Maple Street

and

**Bear Island Road/Azalea Square Boulevard
at Old Light Road**

**TOWN OF SUMMERVILLE BEAR ISLAND ROAD TRAFFIC SIGNALS PROJECT
TABLE OF CONTENTS**

BIDDING AND CONTRACT REQUIREMENTS

Advertisement for Bids

Information to Bidders Bid

Bid Schedule

Bid Bond

Agreement

Payment Bond

Performance Bond

Notice of Award

Notice to Proceed

Change Order

General Conditions

Supplementary Conditions

Special Provisions

Technical Specifications

ADVERTISEMENT FOR BIDS

Owner

Town of Summerville
200 S. Main St.
Summerville, SC 29483

Separate sealed BIDS for the construction of the "Town of Summerville Bear Island Road Traffic Signals Project", will be received by the Town of Summerville at 200 South Main Street, 2nd floor Training Room, Town Hall Annex, Summerville, South Carolina, 29483 at 2:00 P.M. on November 19, 2020 , and then at said office opened and read aloud. **Late bids will not be accepted, NO EXCEPTIONS.**

Questions regarding the bid will be accepted by Russ Cornette until 5:00pm, November 13, 2020. Questions may be emailed to Rcornette@summervillesc.gov. Answers will be provided in form of a contract addendum. **All addendums will need to be signed and included with the submitted bid package.** Any bid packages which do not include the signed addendum(s) will be disqualified.

The Project consists of providing all labor, materials, and equipment for installing temporary traffic signals which will be replaced with permanent mast arm traffic signals at two intersections in the Town of Summerville as shown in the Construction Drawings titled "Bear Island Road Traffic Signals Project" prepared by Ramey Kemp & Associates. Work items include:

- Install temporary signals at the project intersections
- Install permanent mast arm signals at the project intersections, including foundations, poles and arms. Foundation designs will be provided by the mast arm supplier
- Provide and install new signal heads on mast arms.
- Provide and install new pedestrian signals.
- Provide signal programming; coordinate with SCDOT for timing with nearby signal at Millhouse Drive & North Maple Street Intersection.
- Install new 2" PVC by directional boring under existing roads.
- Modify existing sidewalks and construct ADA-compliant ramps with detectable warning.
- Install new Striping and Signage
- Coordinate all work with Town of Summerville.
- Provide new electrical service for signals. Coordinate with utility provider.
- Provide accurate as-built drawings of each intersection.

A mandatory pre-bid conference will be held at the Town of Summerville located at 200 S. Main St., 2nd floor Training Room, Town Hall Annex, Summerville, SC, at 2:00 PM, on November 10, 2020,

The owner reserves the right to waive any informality and to reject any & all bids.

Copies of the CONTRACT DOCUMENTS may be obtained on the Town website (www.summervillesc.gov/rfp) under the Formal Sealed Bids/Proposals/Quotes menu.

INFORMATION FOR BIDDERS

BIDS will be received by the Town of Summerville (herein called the "OWNER"), at 200 S. Main Street, Summerville, South Carolina 29483 until 2:00 PM EDT, on November 19, 2020, and then at said office opened and read aloud. A mandatory pre-bid conference will be held at the Town of Summerville Office located at 200 S. Main St. Summerville, SC, at 2:00 PM on November 10, 2020. Questions regarding the bid will be accepted by Russ Cornette until 5:00pm, November 13, 2020. Questions may be emailed to Rcornette@summervillesc.gov. Answers will be provided in form of a contract addendum.

Each BID must be submitted in a sealed envelope addressed to the Town of Summerville, 200 S. Main St. Summerville, South Carolina 29483. Each sealed envelope containing a BID must be plainly marked on the outside as BID for Town of Summerville Bear Island Road Traffic Signals Project, and the envelope should bear on the outside the name of the BIDDER, his address, his license number, if applicable, and the name of the Project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to OWNER. All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within 60 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID Schedule by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID Bond payable to the OWNER for five percent of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the bonds of all except the three lowest responsible BIDDERS. When the Agreement is executed, the bonds of the two remaining successful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until the Payment BOND and Performance BOND have been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A Performance BOND and Payment BOND, each in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract.

Attorneys-in-fact who sign BID BONDS or Payment BONDS and Performance BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the Contract is awarded will be required to execute the Agreement and obtain the Performance BOND and Payment BOND within ten (10) calendar days from the date when the NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary Agreement and BOND forms. In case of failure of the BIDDER to execute the Agreement, the OWNER may at his option consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the OWNER.

The OWNER within ten (10) days of receipt of acceptable Performance BOND, Payment BOND and Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the OWNER not execute the

Agreement within such period, the BIDDER may, by WRITTEN NOTICE, withdraw his signed Agreement. Such Notice of Withdrawal shall be effective upon receipt of the Notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended if mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

The OWNER may make such investigations as he deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award may be made to the lowest responsible BIDDER.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the Contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID.

The low BIDDER must supply the names and addresses of major material suppliers and subcontractors when requested to do so by the OWNER.

The ENGINEER is: TOWN OF SUMMERVILLE

The PROJECT MANAGER is: TOWN OF SUMMERVILLE

Town of Summerville
Bear Island Road Traffic Signals Project
Schedule of Bid Items

Bear Island Road at North Maple Street – Temporary Traffic Signals

Pay Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1031000	MOBILIZATION	1	LS		
1071000	TRAFFIC CONTROL	1	LS		
2027005	REMOVAL & DISPOSAL OF CONCRETE MEDIAN BARRIER	80	LF		
6271010	4" WHITE SOLID LINES (PVT. EDGE LINES) THERMO.- 90 MIL.	90	LF		
6271015	8" WHITE SOLID LINES THERMOPLASTIC - 125 MIL.	315	LF		
6271025	24" WHITE SOLID LINES (STOP/DIAG LINES)-THERMO.-125 MIL	70	LF		
6319505	REMOVAL OF PAVEMENT MARKINGS	80	LF		
6510108	FLAT SHEET, TYPE VIII OR IX, SIZE DETERMINED BY MSG. - OVERHEAD	20.00	SF		
6513015	MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON SPAN WIRE	1.00	EA		
6531210	U-SECTION POST FOR SIGN SUPPORTS - 3P	3.00	LF		
6750275	FURNISH & INSTALL 1.0" SCHEDULE 80 PVC CONDUIT	70	LF		
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	835	LF		
675027C	FURNISH & INSTALL 3.0" SCHEDULE 80 PVC CONDUIT	5	LF		
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	1412	LF		
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	2410	LF		
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	1622	LF		
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	788	LF		
6770413	FURNISH & INSTL NO. 14 COPPER WIRE,1-CONDUCTOR FOR LOOP WIRE	1130	LF		
6780495	SAWCUT FOR LOOP DETECTOR	570	LF		
6800499	FURNISH & INSTALL ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	1	EA		
6800508	F&I-12"X12"X12"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	2	EA		
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	13	EA		
6800528	17"X30"X18"D.ELEC.FLUSH UNDGRD.ENCLOSURE-(STR.POLY.CONC.)HD	1	EA		
6825020	FURNISH & INSTALL - 35' WOOD POLE-CLASS II-CCA TR(0.60)	4	EA		
6825092	FURNISH & INSTALL 3/8" GALVANIZED STEEL CABLE	400	LF		
6825484	FURNISH & INSTALL 10' BREAK-AWAY ALUM PEDESTAL POLE AND BASE	4	EA		
6845511	F&I - CONTR 332/336 CABINET ASSEMBLY - BASE MOUNTED	1	EA		
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	1	EA		
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	7	EA		
6865782	FURNISH & INSTALL PEDESTRIAN SIGNAL HEAD	6	EA		
6865797	F&I-PED PUSH BUT.SOLID STATE W/ LIGHT&TONE ASSEM 9"X15"&SIGN (R-10-3E or R10-4a)	6	EA		
6865834	FURNISH & INSTALL BACKPLATE W/ RETROREFL.BORDERS FOR TRAFFIC SIGNAL	8	EA		
6888177	DESIGN, FURNISH & INSTALL STEEL POLE WITH TWIN MAST ARMS INCLUDING FOUNDATION	0	EA		
7209000	PEDESTRIAN RAMP CONSTRUCTION	67	SY		

Bear Island Rd at North Maple St, Temporary Signals Sub-Total \$ _____

Bear Island Road at North Maple Street – Mast Arm Traffic Signals

Pay Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1031000	MOBILIZATION	1	LS		
1071000	TRAFFIC CONTROL	1	LS		
6510108	FLAT SHEET, TYPE VIII OR IX, SIZE DETERMINED BY MSG. - OVERHEAD	2.5	SF		
6513020	F&I MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON MAST ARM	1	EA		
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	300	LF		
6760065	FURNISH & INSTALL 2" SCHEDULE 80 HDPE CONDUIT (DIRECTIONAL BORED)	250	LF		
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	893	LF		
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	866	LF		
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	1,281	LF		
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	467	LF		
6800500	MOD. EXIST ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	1	EA		
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	6	EA		
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	1	EA		
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	6	EA		
6865834	FURNISH & INSTALL BACKPLATE W/ RETROREFL.BORDERS FOR TRAFFIC SIGNAL	7	EA		
6888177	DESIGN, FURNISH & INSTALL STEEL POLE WITH TWIN MAST ARMS INCLUDING FOUNDATION	2	EA		

Bear Island Rd at North Maple St, Mast Arms Signals Sub-Total \$_____

Bear Island Road/Azalea Square Blvd at Old Light Road – Temporary Traffic Signals

Pay Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1031000	MOBILIZATION	1	LS		
1071000	TRAFFIC CONTROL	1	LS		
6510108	FLAT SHEET, TYPE VIII OR IX, SIZE DETERMINED BY MSG. - OVERHEAD	20	SF		
6513015	MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON SPAN WIRE	2	EA		
6531210	U-SECTION POST FOR SIGN SUPPORTS - 3P	3	LF		
6750275	FURNISH & INSTALL 1.0" SCHEDULE 80 PVC CONDUIT	50	LF		
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	325	LF		
675027C	FURNISH & INSTALL 3.0" SCHEDULE 80 PVC CONDUIT	5	LF		
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	1538	LF		
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	1628	LF		
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	1176	LF		
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	903	LF		
6770413	FURNISH & INSTL NO. 14 COPPER WIRE,1-CONDUCTOR FOR LOOP WIRE	1470	LF		
6780495	SAWCUT FOR LOOP DETECTOR	700	LF		
6800499	FURNISH & INSTALL ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	1	EA		
6800508	F&I-12"X12"X12"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	2	EA		
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	13	EA		
6800528	17"X30"X18"D.ELEC.FLUSH UNDGRD.ENCLOSURE-(STR.POLY.CONC.)HD	1	EA		
6825020	FURNISH & INSTALL - 35' WOOD POLE-CLASS II-CCA TR(0.60)	4	EA		
6825092	FURNISH & INSTALL 3/8" GALVANIZED STEEL CABLE	410	LF		
6825484	FURNISH & INSTALL 10' BREAK-AWAY ALUM PEDESTAL POLE AND BASE	4	EA		
6845511	F&I - CONTR 332/336 CABINET ASSEMBLY - BASE MOUNTED	1	EA		
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	2	EA		
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	8	EA		
6865782	FURNISH & INSTALL PEDESTRIAN SIGNAL HEAD	8	EA		
6865797	F&I-PED PUSH BUT.SOLID STATE W/ LIGHT&TONE ASSEM 9"X15"&SIGN (R-10-3E or R10-4a)	8	EA		
6865834	FURNISH & INSTALL BACKPLATE W/ RETROREFL.BORDERS FOR TRAFFIC SIGNAL	10	EA		

Bear Island Rd/Azalea Square at Old Light Rd, Temporary Signals Sub-Total \$ _____

Bear Island Road/Azalea Square Blvd at Old Light Road – Mast Arm Traffic Signals

Pay Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1031000	MOBILIZATION	1	LS		
1071000	TRAFFIC CONTROL	1	LS		
6510108	FLAT SHEET, TYPE VIII OR IX, SIZE DETERMINED BY MSG. - OVERHEAD	5	SF		
6513020	F&I MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON MAST ARM	2	EA		
6531210	U-SECTION POST FOR SIGN SUPPORTS - 3P	0	LF		
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	10	LF		
6760065	FURNISH & INSTALL 2" SCHEDULE 80 HDPE CONDUIT (DIRECTIONAL BORED)	275	LF		
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	1055	LF		
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	662	LF		
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	1423	LF		
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	562	LF		
6800500	MOD. EXIST ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	1	EA		
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	2	EA		
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	2	EA		
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	8	EA		
6865834	FURNISH & INSTALL BACKPLATE W/ RETROREFL.BORDERS FOR TRAFFIC SIGNAL	10	EA		
6888177	DESIGN, FURNISH & INSTALL STEEL POLE WITH TWIN MAST ARMS INCLUDING FOUNDATION	2	EA		

Bear Island Rd/Azalea Square at Old Light Rd, Mast Arms Signals Sub-Total \$ _____

Bear Island Rd at North Maple St:

Temporary Signals + Mast Arms Signals Total \$ _____

Bear Island Rd/Azalea Square at Old Light Rd:

Temporary Signals + Mast Arms Signals Total \$ _____

Total Contract \$ _____

BID

Proposal of _____ (hereinafter called the "BIDDER"), organized and existing under the laws of the State of South Carolina doing business as _____.

To the Town of Summerville (hereinafter called "OWNER").

In compliance with your Advertisement for Bids, the BIDDER hereby proposes to perform all Work for the construction of the Town of Summerville Bear Island Road Traffic Signals Project in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this Contract on or before a date to be specified in the NOTICE TO PROCEED and to fully complete the PROJECT within 180 consecutive calendar days thereafter.

BIDDER acknowledges the receipt of the following ADDENDUM:

* Insert "a corporation", "a partnership", or "an individual" as applicable.

NOTE: THE OWNER RESERVES THE RIGHT TO DELETE PORTIONS OR ALL OF THE WORK. ALL WORK AS SHOWN, SPECIFIED, OR IMPLIED MUST BE ACCOUNTED FOR IN THE CONTRACTOR'S BID.

TOTAL LUMP SUM BID for furnishing and installing all materials and labor listed for the construction of the Town of Summerville Bear Island Road Traffic Signals Project, complete as indicated by the Contract Documents (in words and figures):

_____ **Dollars** _____ **Cents**

(\$ _____)

Respectfully submitted,

Contractor Name Printed Out

Address

Signature

Title: _____

License Number _____ Date: _____
Seal if bid is from a corporation

Attest: _____ Town of Summerville Bear Island Road Traffic Signals Project

BID BOND

KNOW ALL MEN THESE PRESENTS, that we, the undersigned

_____ as Principal, and _____ as
Surety, are hereby held and firmly bound unto _____ as Owner in the
penal sum of _____ for the payment of which , well and
truly to be made, we hereby jointly and severally bind ourselves, successor and assigns.

Signed, this _____ day of _____, 2020. The condition of the above
obligation is such that whereas the Principal has submitted to _____ a
certain bid, attached hereto and hereby made a part thereof to enter into a contract in writing, for
the _____

NOW THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate.
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the Agreement created by the acceptance of said Bid. Then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees: that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____(L.S)
PRINCIPAL

SURETY

BY: _____

IMPORTANT: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of South Carolina.

AGREEMENT

THIS AGREEMENT, made this ____ day of _____ 2020, by and between the Town of Summerville, hereinafter called "OWNER" and _____, hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR will commence and complete the construction of the "Town of Summerville Bear Island Road Traffic Signals Project".
2. The CONTRACTOR will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT described herein.
3. The CONTRACTOR will commence the Work required by the CONTRACT DOCUMENTS within ten (10) calendar days after the date of the NOTICE TO PROCEED and will complete the same within 180 consecutive calendar days unless the period for completion is extended otherwise by the CONTRACT DOCUMENTS.
4. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS for the sum of \$_____ or as shown on NEGOTIATED BID Schedule.
5. The term "CONTRACT DOCUMENTS" means and includes the following:
 - A) ADVERTISEMENT FOR BIDS
 - B) INFORMATION FOR BIDDERS
 - C) BID
 - D) BID BOND
 - E) AGREEMENT
 - F) PAYMENT BOND
 - G) PERFORMANCE BOND
 - H) NOTICE OF AWARD
 - I) NOTICE TO PROCEED
 - J) CHANGE ORDER

- K) GENERAL CONDITIONS
- L) SUPPLEMENTARY CONDITIONS
- M) SPECIAL PROVISIONS
- N) TECHNICAL SPECIFICATIONS
- O) DRAWINGS Prepared By: RAMEY KEMP & ASSOCIATES
- P) ADDENDA:

6. The OWNER will pay to the CONTRACTOR in the manner and at such time as set forth in the GENERAL CONDITIONS such amounts as required by the CONTRACT DOCUMENTS.
7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed, by their duly authorized officials, this Agreement in three (3) copies each of which shall be deemed an original on the date first above written.

TOWN OF SUMMERVILLE, OWNER

BY:

(SEAL)

NAME

TITLE

ATTEST

NAME

TITLE

CONTRACTOR

(SEAL)

BY:

NAME

TITLE

ATTEST

NAME

TITLE

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

NAME OF CONTRACTOR:

ADDRESS OF CONTRACTOR

a corporation, hereinafter called Principal, and

NAME OF SURETY

ADDRESS OF SURETY

Hereinafter called Surety, are held and firmly bound onto

TOWN OF SUMMERVILLE, 200 SOUTH MAIN STREET, SUMMERVILLE, S.C. 29483
NAME AND ADDRESS OF OWNER

hereinafter called OWNER, in the penal sum of _____ Dollars

(\$ _____ .00), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, 2020 a copy of which is hereto attached and made a part hereof for the construction of: _____

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension of modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on

said WORK, and for all labor, performed in such WORK whether by SUBCONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition of terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any ways affect its obligations on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ () counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2020.

ATTEST:

PRINCIPAL

(PRINCIPAL) SECRETARY

BY _____ (S)

(SEAL)

(ADDRESS)

(WITNESS AS TO PRINCIPAL)

(ADDRESS)

SURETY

ATTEST:

BY: _____
Attorney-In-Fact

(SURETY) SECRETARY

(ADDRESS)

(SEAL)

(WITNESS AS TO SURETY)

(ADDRESS)

NOTE: Date of Bond must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of South Carolina.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

NAME OF CONTRACTOR

ADDRESS OF CONTRACTOR

a corporation, hereinafter called Principal, and

NAME OF SURETY

ADDRESS OF SURETY

hereinafter call Surety, are help and firmly bound unto

TOWN OF SUMMERVILLE, 200 SOUTH MAIN STREET, SUMMERVILLE, S. C. 29483
NAME AND ADDRESS OF OWNER

hereinafter called OWNER, in the penal sum of _____ Dollars

(\$ _____ .00), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, 2020, a copy of which is hereto attached and made a part hereof for the construction of _____

_____.

NOW, THEREFORE, if the Principal shall well, truly, and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition of terms of the contract or to the WORK to be performed thereunder or the specifications accompanying the same shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the specifications.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ () counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2020.

ATTEST:

PRINCIPAL

BY _____(S)

(PRINCIPAL) SECRETARY

(SEAL)

(ADDRESS)

(WITNESS AS TO PRINCIPAL)

(ADDRESS)

SURETY

BY: _____
Attorney-In-Fact

ATTEST:

(SURETY) SECRETARY

(ADDRESS)

(SEAL)

(WITNESS AS TO SURETY)

(ADDRESS)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the PROJECT is located.

NOTICE OF AWARD

TO: _____

DATE: _____

PROJECT: _____ Bear Island Road Traffic Signals Project _____

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____ and Information for BIDDERS.

You are hereby notified that your BID has been accepted for items in the amount of _____.

You are required by the Information for BIDDERS to execute the Agreement and furnish the required CONTRACTOR'S Performance BOND, Payment BOND and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said BONDS within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this _____ day of _____, 2020.

Town of Summerville

Owner

By: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by:

this the _____ day of _____ 2020.

By: _____

Title: _____

NOTICE TO PROCEED

TO: _____

DATE: _____

PROJECT: _____

You are hereby notified to commence WORK in accordance with the Agreement dated _____, on or before _____ and you are to complete the WORK within 180 consecutive calendar days.

The date of completion for the _____.

Town of Summerville

Owner

By: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by:

_____, this the _____ day of _____, 2020.

By: _____

Title: _____

CHANGE ORDER

Order No.: _____

Date: _____

Agreement Date: _____

NAME OF PROJECT: Bear Island Road Traffic Signals Project

OWNER: _____

CONTRACTOR: _____

The following changes are hereby made to the CONTRACT DOCUMENTS:

Justification:

Change to CONTRACT PRICE:

Original CONTRACT PRICE: \$ _____

Current CONTRACT PRICE adjusted by previous CHANGE ORDER \$ _____

The CONTRACT PRICE due to this CHANGE ORDER will be (increased)(decreased) by:
\$ _____

The new CONTRACT PRICE including this CHANGE ORDER will be \$ _____

Change to CONTRACT TIME:

The Original CONTRACT TIME:

The CONTRACT TIME will be (increased)(decreased) by _____ calendar days.

The date for completion of all WORK will be _____ (Date).

CHANGE ORDER

To be effective this Order must be approved by the Federal agency if it changes the scope or objective of the PROJECT, or if it will increase the budgeted amounts of Federal funds needed to complete the PROJECT, or as may otherwise be required by the SUPPLEMENTAL GENERAL CONDITIONS.

Requested by: _____

Recommended by: _____

Approved by: _____

Town of Summerville

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Whenever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

- 1.1 **ADDENDA:** Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents.
- 1.2 **AGREEMENT:** The written contract between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.
- 1.3 **APPLICATION FOR PAYMENT:** The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
- 1.4 **ASBESTOS:** Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
- 1.5 **BID:** The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
- 1.5 **BIDDING DOCUMENTS:** The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of the Bids).
- 1.6 **BIDDING REQUIREMENTS:** The advertisement or invitation to Bid, instructions to bidders, and the Bid form.
- 1.7 **BONDS:** Performance and Payment bonds and other instruments of security.
- 1.8 **CHANGE ORDER:** A document recommended by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
- 1.9 **CONTRACT DOCUMENTS:** The Agreement, Addenda (which pertain to the Contract Documents) CONTRACTOR'S Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders and ENGINEER'S written interpretations and clarifications issued pursuant to paragraphs 3.5, 3.6.1 and 3.6.3 on or after the Effective Date of the Agreement. Shop Drawing submittals approved pursuant to paragraphs 6.26 and 6.27 and the reports and drawings referred to in paragraphs 4.2.1.1 and 4.2.2.2 are not Contract Documents.

1.10 **CONTRACT PRICE:** The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.9.1 in the case of Unit Price Work).

1.11 **CONTRACT TIMES:** The numbers of days or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by ENGINEER'S written recommendation of final payment in accordance with paragraph 14.13.

1.12 **CONTRACTOR:** The person, firm or corporation with whom OWNER has entered into the Agreement.

1.13 **DEFECTIVE:** An adjective which when modifying the word Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER'S recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.8 or 14.10).

1.14 **DRAWINGS:** The drawings which show the scope, extent and character of the Work to be furnished and performed by CONTRACTOR and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents. Shop drawings are not Drawings as so defined.

1.15 **EFFECTIVE DATE OF THE AGREEMENT:** The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

1.16 **ENGINEER:** The person, firm or corporation named as such in the Agreement.

1.17 **ENGINEER'S CONSULTANT:** A person, firm or corporation having a contract with ENGINEER to furnish services as ENGINEER'S independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

1.18 **FIELD ORDER:** A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Times.

1.19 **GENERAL REQUIREMENTS:** Sections of Division 1 of the Specifications.

1.20 **HAZARDOUS WASTE:** The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

1.21 **LAWS AND REGULATIONS; LAWS OR REGULATIONS:** Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

1.22 **LIENS:** Liens, charges, security interests or encumbrances upon real property or personal property.

- 1.23 MILESTONE: A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 1.24 NOTICE OF AWARD: The written notice by OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.
- 1.25 NOTICE TO PROCEED: A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Times will commence to run and which CONTRACTOR shall start to perform CONTRACTOR'S obligations under the Contract Documents.
- 1.26 OWNER: The public body or authority, corporation, association, firm or person with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.
- 1.27 PARTIAL UTILIZATION: Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
- 1.28 PCBs: Polychlorinated biphenyls.
- 1.29 PETROLEUM: Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square in. absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.
- 1.30 PROJECT: The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.
- 1.31 RADIOACTIVE MATERIAL: Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 1.32 RESIDENT PROJECT REPRESENTATIVE: The authorized representative of ENGINEER who may be assigned to the site or any part thereof.
- 1.33 SAMPLES: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
- 1.34 SHOP DRAWINGS: All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.
- 1.35 SPECIFICATIONS: Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.
- 1.36 SUBCONTRACTOR: An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

1.37 **SUBSTANTIAL COMPLETION:** The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER'S definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by ENGINEER'S written recommendation of final payment in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.38 **SUPPLEMENTARY CONDITIONS:** The part of the Contract Documents which amends or supplements these General Conditions.

1.39 **SUPPLIER:** A manufacturer, fabricator, supplier, distributor, materialman or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

1.40 **UNDERGROUND FACILITIES:** All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

1.41 **UNIT PRICE WORK:** Work to be paid for on the basis of unit prices.

1.42 **WORK:** The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

1.43 **WORK CHANGE DIRECTIVE:** A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.23. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times as provided in paragraph 10.2.

1.44 **WRITTEN AMENDMENT:** A written amendment of the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

ARTICLE 2 - PRELIMINARY MATTERS

Delivery of Bonds:

2.1 When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall

also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.2 OWNER shall furnish to CONTRACTOR up to ten copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Times; Notice to Proceed:

2.3 The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

Starting the Work:

2.4 CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run, but no Work shall be done at the site prior to the date on which the Contract Times commence to run.

Before Starting Construction:

2.5 Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents, unless CONTRACTOR knew or reasonably should have known thereof.

2.6 Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for review:

2.6.1 a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents.

2.6.2 a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;

2.6.3 a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.7 Before any Work at the site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with paragraphs 5.4, 5.6 and 5.7.

Preconstruction Conference:

2.8 Within twenty days after the Contract Times start to run, but before any Work at the site is started, a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.6, procedures for handling Shop Drawings and other submittals, processing Applications for Payment and maintaining required records.

Initially Acceptable Schedules:

2.9 Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.6. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until the schedules are submitted to and acceptable to ENGINEER as provided below. The progress schedule will be acceptable to ENGINEER as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on ENGINEER responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR'S full responsibility therefor. CONTRACTOR'S schedule of Shop Drawing and Sample submissions will be acceptable to ENGINEER as providing a workable arrangement for reviewing and processing the required submittals. CONTRACTOR'S schedule of values will be acceptable to ENGINEER as to form and substance.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Intent:

3.1 The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

3.2 It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically call for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in paragraph 9.4.

3.3 Reference to Standards and Specifications of Technical Societies; Reporting and Resolving Discrepancies:

3.3.1 Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.3.2 If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier referred to in paragraph 6.5, CONTRACTOR shall report it to ENGINEER in writing at once, and, CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.23) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.5 or 3.6; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

3.3.3 Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in paragraph 3.5 or 3.6, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and:

The provisions of any such standard, specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

3.3.3.1 the provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

No provision of any such standard, specification, manual, code or instruction shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to OWNER, ENGINEER, or any of ENGINEER'S Consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of paragraph 9.13 or any other provision of the Contract Documents.

3.4 Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or

indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.13 or any other provision of the Contract Documents.

Amending and Supplementing Contract Documents:

3.5 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.5.1 a formal Written Amendment,

3.5.2 a Change Order (pursuant to paragraph 10.4), or

3.5.3 a Work Change Directive (pursuant to paragraph 10.1).

3.6 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

3.6.1 a Field Order (pursuant to paragraph 9.5),

3.6.2 ENGINEER'S approval of a Shop Drawing or Sample (pursuant to paragraphs 6.26 and 6.27), or

3.6.3 ENGINEER'S written interpretation or clarification (pursuant to paragraph 9.4).

Reuse of Documents:

3.7 CONTRACTOR, and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER'S Consultant, and (ii) shall not reuse any of such Drawing, Specifications, other documents or copies on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

Availability of Lands:

4.1 OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a correct statement of record legal title and legal description of the lands upon

which the Work is to be performed and OWNER'S interest therein as necessary for giving notice of or filing a mechanic's lien against such lands in accordance with applicable Laws and Regulations. OWNER shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. If CONTRACTOR and OWNER are unable to agree on entitlement to or the amount or extent of any adjustments in the Contract Price or the Contract Times as a result of any delay in OWNER'S furnishing these lands, rights-of-way or easements, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2 Subsurface and Physical Conditions:

4.2.1 Reports and Drawings: Reference is made to the Supplementary Conditions for identification of:

4.2.1.1 Subsurface Conditions: Those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by ENGINEER in preparing the Contract Documents; and

4.2.1.2 Physical Conditions: Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) that have been utilized by ENGINEER in preparing the Contract Documents.

4.2.2 Limited Reliance by CONTRACTOR Authorized; Technical Data: CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any claim against OWNER, ENGINEER or any of ENGINEER'S Consultants with respect to:

4.2.2.1 the completeness of such reports and drawings for CONTRACTOR'S purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto, or

4.2.2.2 other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings, or

4.2.2.3 any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.

4.2.3 Notice of Differing Subsurface or Physical Conditions: If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:

4.2.3.1 is of such a nature as to establish that any "technical data" on which

CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is materially inaccurate, or

4.2.3.2 is of such a nature as to require a change in the Contract Documents, or

4.2.3.3 differs materially from that shown or indicated in the Contract Documents,
or

4.2.3.4 is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then

CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.23), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

4.2.4 ENGINEER'S Review: ENGINEER will promptly review the pertinent conditions, determine the necessity of OWNER'S obtaining additional exploration or tests with respect thereto and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER'S findings and conclusions.

4.2.5 Possible Contract Documents Change: If ENGINEER concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in paragraph 4.2.3., a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

4.2.6 Possible Price and Times Adjustments: An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition causes an increase or decrease in CONTRACTOR'S cost of or time required for performance of the Work; subject, however, to the following:

4.2.6.1 such condition must meet any one or more of the categories described in paragraphs 4.2.3.1 through 4.2.3.4, inclusive;

4.2.6.2 a change in the Contract Documents pursuant to paragraph 4.2.5 will not be an automatic authorization of nor a condition precedent to entitlement to any such adjustment;

4.2.6.3 with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.10 and 11.9; and

4.2.6.4 CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Times if;

4.2.6.4.1 CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a bid or becoming bound under a negotiated contract; or

4.2.6.4.2 the existence of such condition could reasonably have been discovered

or revealed as a result of any examination, investigation, exploration, test or study of the site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR'S making such final commitment; or

4.2.6.4.3 CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.2.3.

If OWNER and CONTRACTOR are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Price or Contract Times, a claim may be made therefor as provided in Articles 11 and 12. However, OWNER, ENGINEER and ENGINEER'S Consultants shall not be liable to CONTRACTOR for any claims, costs, losses or damages sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.3 Physical Conditions—Underground Facilities:

4.3.1 Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

4.3.1.1 OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2 The cost of all of the following will be included in the Contract Price and CONTRACTOR shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work.

4.3.2 Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.23), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the Underground Facility. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or the amount or length of any such adjustment in Contract Price or Contract Times, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12. However, OWNER, ENGINEER and ENGINEER'S

Consultants shall not be liable to CONTRACTOR for any claims, costs, losses or damages incurred or sustained by CONTRACTOR on or in connection with any other project or anticipated project.

Reference Points:

4.3 OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER'S judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall not make changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

4.4 Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material:

4.5.1 OWNER shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. OWNER shall not be responsible for any such materials brought to the site by CONTRACTOR, Subcontractor, Suppliers or anyone else for whom CONTRACTOR is responsible.

4.5.2 CONTRACTOR shall immediately: (i) stop all Work in connection with such hazardous condition and in any area affected thereby (except in an emergency as required by paragraph 6.23), and (ii) notify OWNER and ENGINEER (and thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such hazardous condition or take corrective action, if any. CONTRACTOR shall not be required to resume Work in connection with such hazardous condition or in any such affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR special written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (ii) specifying any special conditions under which such Work may be resumed safely.

If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of such Work stoppage or such special conditions under which Work is agreed by CONTRACTOR to be resumed, either party may make a claim therefor as provided in Articles 11 and 12.

4.5.3 If after receipt of such special written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order such portion of the Work that is in connection with such hazardous condition or in such affected area to be deleted from the Work.

If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a claim therefor as provided in Articles 11 and 12. OWNER may have such deleted portion of the Work performed by OWNER'S own forces or others in accordance with Article 7.

4.5.4 To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and the officers, directors, employees, agents, other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from such hazardous condition, provided that: (i) any such claim, cost, loss or damage is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) nothing in this subparagraph 4.5.4 shall obligate OWNER to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.

4.5.5 The provisions of paragraphs 4.2 and 4.3 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site.

ARTICLE 5 - BONDS AND INSURANCE

Performance, Payment and Other Bonds:

5.1 CONTRACTOR shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR'S obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided by Laws or Regulations and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

5.2 If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1, CONTRACTOR shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to OWNER.

5.3 Licensed Sureties and Insurers; Certificates of Insurance:

5.3.1 All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.3.2 CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain in accordance with paragraph 5.4. OWNER shall deliver to

CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain in accordance with paragraphs 5.6 and 5.7 hereof.

CONTRACTOR'S Liability Insurance:

5.4 CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR'S performance and furnishing of the Work and CONTRACTOR'S other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

- 5.4.1 claims under workers' compensation, disability benefits and other similar employee benefit acts;
- 5.4.2 claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR'S employees;
- 5.4.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR'S employees;
- 5.4.4 claims for damages insured by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;
- 5.4.5 claims for damages, other than to the Work itself because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
- 5.4.6 claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The policies of insurance so required by this paragraph 5.4 to be purchased and maintained shall:

- 5.4.7 with respect to insurance required by paragraphs 5.4.3 through 5.4.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER'S Consultants and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers and employees of all such additional insureds;
- 5.4.8 include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
- 5.4.9 include completed operations insurance;
- 5.4.10 include contractual liability insurance covering CONTRACTOR'S indemnity obligations under paragraphs 6.12, 6.16, and 6.31 through 6.33;

- 5.4.11 contain a provision or endorsement that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.3.2 will so provide);
- 5.4.12 remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work in accordance with paragraph 13.12; and
- 5.4.13 with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

OWNER'S Liability Insurance:

- 5.5 In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.4, OWNER, at OWNER'S option, may purchase and maintain at OWNER'S expense OWNER'S own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

Property Insurance:

- 5.6 Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 5.6.1 Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 - 5.6.2 be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework and Work in transit and shall insure against at least the following perils: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils as may be specifically required by the Supplementary Conditions;
 - 5.6.3 include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 - 5.6.4 cover materials and equipment stored at the site or at another location that was agreed to

in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER; and

5.6.5 be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR and ENGINEER with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.

5.7 OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

5.8 All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained by OWNER in accordance with paragraphs 5.6 and 5.7 will contain a provision or endorsement that the coverage afforded will not be cancelled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.11.

5.9 OWNER shall not be responsible for purchasing and maintaining any property insurance to protect the interests of CONTRACTOR, Subcontractors or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount, will be borne by CONTRACTOR, Subcontractor or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.10 If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraphs 5.6 or 5.7, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

5.11 Waiver of Rights:

5.11.1 OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraphs 5.6 and 5.7 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have not rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against

Subcontractors, ENGINEER, ENGINEER'S Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

5.11.2 In addition, OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and the officers, directors, employees and agents of any of them, for:

5.11.2.1 loss due to business interruption, loss of use or other consequential loss extending beyond direct physical loss or damage to OWNER'S property or the Work caused by, arising out of or resulting from fire or other peril, whether or not insured by OWNER; and

5.11.2.2 loss or damage to the completed Project or part thereof caused by, arising out of or resulting from fire or other insured peril covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.10, after substantial completion pursuant to paragraph 14.8 or after final payment pursuant to paragraph 14.13.

Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in this paragraph 5.11.2 shall contain provisions to the effect that in the event of payment of any such loss, damage or consequential loss the insurers will have no rights of recovery against any of CONTRACTOR, Subcontractors, ENGINEER, ENGINEER'S Consultants and the officers, directors, employees and agents of any of them.

Receipt and Application of Insurance Proceeds

5.12 Any insured loss under the policies of insurance required by paragraphs 5.6 and 5.7 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.13. OWNER shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

5.13 OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to OWNER'S exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

Acceptance of Bonds and Insurance; Option to Replace:

5.14 If either party (OWNER or CONTRACTOR) has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with Contract Documents, the objecting party shall so notify the other party in writing within ten days after receipt of the certificates (or other evidence requested) required by paragraph 2.7. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

Partial Utilization—Property Insurance

5.15 If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6-CONTRACTOR'S RESPONSIBILITIES Supervision and Superintendence:

6.1 CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.2 CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR'S representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3 CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out and

construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without OWNER'S written consent given after prior written notice to ENGINEER.

6.4 Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.5 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

Progress Schedule:

6.6 CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.9 as it may be adjusted from time to time as provided below:

6.6.1 CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.9) proposed adjustments in the progress schedule that will not change the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

6.6.2 Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of paragraph 12.1 Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.7 Substitutes and "Or-Equal" Items:

6.7.1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by ENGINEER under the following circumstances:

6.7.1.1 "Or-Equal": If in ENGINEER'S sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so

that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER'S sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

6.7.1.2 Substitute Items: If in ENGINEER'S sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under subparagraph 6.7.1.1, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The procedure for review by the ENGINEER will include the following as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR'S achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute.

6.7.1.3 CONTRACTOR'S Expense: All data to be provided by CONTRACTOR in support of any proposed "or-equal" or substitute item will be at CONTRACTOR'S expense.

6.7.2 Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER'S sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.7.1.2.

6.7.3 Engineer's Evaluation: ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.7.1.2 and 6.7.2. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without ENGINEER'S prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. ENGINEER will record time required by ENGINEER and ENGINEER'S Consultants in evaluating

substitutes proposed or submitted by CONTRACTOR pursuant to paragraphs 6.7.1.2 and 6.7.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER accepts a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER'S Consultants for evaluating each such proposed substitute item.

Concerning Subcontractors, Suppliers and Others:

6.8.1 CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to OWNER and ENGINEER as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

6.8.2 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to OWNER in advance of the specified date prior to the Effective Date of the Agreement for acceptance by OWNER and ENGINEER, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER'S or ENGINEER'S acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER or ENGINEER of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

6.9.1 CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR'S own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.9.2 CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the ENGINEER through CONTRACTOR.

6.10 The divisions and sections of the Specifications and the identifications of any Drawings shall not

control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.11 All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.6 or 5.7, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER'S Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

Patent Fees and Royalties:

6.12 CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER'S Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents.

Permits:

6.13 Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. OWNER shall bear cost of securing required permits.

Laws and Regulations:

6.14.1 CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR'S compliance with any Laws or Regulations.

6.14.2 If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom; however, it shall not be CONTRACTOR'S primary responsibility

to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR'S obligations under paragraph 3.3.2.

Taxes:

6.15 CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

Use of Premises:

6.16 CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights- of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless OWNER, ENGINEER, ENGINEER'S Consultant and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR'S performance of the Work.

6.17 During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. CONTRACTOR shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

6.18 CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

6.19 CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER

for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to ENGINEER for OWNER. Final Payment will be withheld until record documents are presented to the ENGINEER.

Safety and Protection:

6.20 CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1 all persons on the Work site or who may be affected by the Work;

6.20.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

6.20.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER'S Consultant or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). CONTRACTOR'S duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

Safety Representative:

6.21 CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

Hazard Communication Programs:

6.22 CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.

Emergencies:

6.23 In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER or ENGINEER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.24 Shop Drawings and Samples:

6.24.1 CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see paragraph 2.9). All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show ENGINEER the materials and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.26.

6.24.2 CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.26. The numbers of each Sample to be submitted will be as specified in the Specifications.

6.25 Submittal Procedures:

6.25.1 Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

6.25.1.1 all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto,

6.25.1.2 all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and

6.25.1.3 all information relative to CONTRACTOR'S sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

6.25.2 Each submittal will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR'S obligations under the Contract with respect to CONTRACTOR'S review and approval of that submittal.

6.25.3 At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

6.26 ENGINEER will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by ENGINEER as required by paragraph 2.9. ENGINEER'S review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER'S review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.27 ENGINEER'S review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER'S attention to each such variation at the time of submission as required by paragraph 6.25.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with requirements of paragraph 6.25.1.

6.28 Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by ENGINEER as required by paragraph 2.9, any related Work performed prior to ENGINEER'S review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

Continuing the Work:

6.29 CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.3 CONTRACTOR'S General Warranty and Guarantee:

6.30.1 CONTRACTOR warrants and guarantees to OWNER, ENGINEER and ENGINEER'S Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR'S warranty and guarantee hereunder excludes defects or damage caused by:

6.30.1.1 abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors or Suppliers; or

6.30.1.2 normal wear and tear under normal usage.

6.30.2 CONTRACTOR'S obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR'S obligation to perform the Work in accordance with the Contract Documents:

6.30.2.1 observations by ENGINEER;

6.30.2.2 recommendation of any progress or final payment by ENGINEER;

6.30.2.3 the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;

6.30.2.4 use or occupancy of the Work or any part thereof by OWNER;

6.30.2.5 any acceptance by OWNER or any failure to do so;

6.30.2.6 any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13;

6.30.2.7 any inspection, test or approval by other; or

6.30.2.8 any correction of defective Work by OWNER

Indemnification:

6.31 To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER'S Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage: (i) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of

tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

6.32 In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.31 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under worker's compensation acts, disability benefit acts or other employee benefit acts.

6.33 The indemnification obligations of CONTRACTOR under paragraph 6.31 shall not extend to the liability of ENGINEER and ENGINEER'S Consultants, officers, directors, employees or agents caused by the professional negligence, errors or omissions of any of them.

Survival of Obligations:

6.34 All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

ARTICLE 7-OTHER WORK

Related Work at Site:

7.1 OWNER may perform other work related to the Project at the site by OWNER'S own forces, or let other direct contracts therefor which shall contain General Conditions similar to these, or have other work performed by utility owners. If the fact that such other work is to be performed was not noted in the Contract Documents, then: (i) written notice thereof will be given to CONTRACTOR prior to starting any such other work, and (ii) CONTRACTOR may make a claim therefor as provided in Articles 11 and 12 if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the amount or extent thereof.

7.2 CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the additional work with OWNER'S employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its

several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

7.3 If the proper execution or results of any part of CONTRACTOR'S Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR'S Work. CONTRACTOR'S failure so to report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR'S Work except for latent or nonapparent defects and deficiencies in such other work.

Coordination:

7.4 If OWNER contracts with others for the performance of other work on the Project at the site, the following will be set forth in Supplementary Conditions:

7.4.1 the person, firm or corporation who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified;

7.4.2 the specific matters to be covered by such authority and responsibility will be itemized; and

7.4.3 the extent of such authority and responsibilities will be provided.

Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility in respect of such coordination.

ARTICLE 8-OWNER'S RESPONSIBILITIES

8.1 Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.2 In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.3 OWNER shall furnish the data required of OWNER under the Contract Documents promptly and shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.4 and 14.13.

8.4 OWNER'S duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER'S

identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site and drawings of physical conditions in existing structures at or contiguous to the site that have been utilized by ENGINEER in preparing the Contract Documents.

8.5 OWNER'S responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.10.

8.6 OWNER is obligated to execute Change Orders as indicated in paragraph 10.4.

8.7 OWNER'S responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.

8.8 In connection with OWNER'S right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with OWNER'S right to terminate services of CONTRACTOR under certain circumstances.

8.9 The OWNER shall not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR'S means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. OWNER will not be responsible for CONTRACTOR'S failure to perform or furnish the Work in accordance with the Contract Documents.

8.10 OWNER'S responsibility in respect of undisclosed Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Materials uncovered or revealed at the site is set forth in paragraph 4.5.

8.11 If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER'S obligations under the Contract Documents, OWNER'S responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9-ENGINEER'S STATUS DURING CONSTRUCTION OWNER'S Representative:

9.1 ENGINEER will be OWNER'S representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction are set forth in the Contract Documents and shall not be extended without written consent of OWNER and ENGINEER.

Visits to Site:

9.2 ENGINEER will make visits to the site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR'S executed Work. Based on information obtained during such visits and observations,

ENGINEER will endeavor for the benefit of OWNER to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER'S efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work. ENGINEER'S visits and on-site-observations are subject to all the limitations on ENGINEER'S authority and responsibility set forth in paragraph 9.13, and particularly, but without limitation, during or as a result of ENGINEER'S on-site visits or observations of CONTRACTOR'S Work ENGINEER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work.

Project Representative:

9.3 If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more continuous observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.13 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the site who is not ENGINEER'S Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other person will be as provided in the Supplementary Conditions.

Clarifications and Interpretations:

9.4 ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER or CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree to the amount or extent thereof, if any, OWNER or CONTRACTOR may make a written claim therefor as provided in Article 11 or Article 12.

Authorized Variations in Work:

9.5 ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR who shall perform the Work involved promptly. If OWNER or CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree as to the amount or extent thereof, OWNER or CONTRACTOR may make a written claim therefor as provided in Article 11 or 12.

Rejecting Defective Work:

9.6 ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or the ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

Shop Drawings, Change Orders and Payments:

9.7 In connection with ENGINEER'S authority as to Shop Drawings and Samples, see paragraphs 6.24 through 6.28 inclusive.

9.8 In connection with ENGINEER'S authority as to Change Orders, see Articles 10, 11, 12.

9.9 In connection with ENGINEER'S authority as to Applications for Payment, see Article 14. Determinations for Unit Prices:

9.10 ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER'S preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER'S written decision thereon will be final and binding upon OWNER and CONTRACTOR, unless, within ten days after the date of any such decision, either OWNER or CONTRACTOR delivers to the other and to ENGINEER written notice of intention to appeal from ENGINEER'S decision and:

(i) an appeal from ENGINEER'S decision is taken within the time limits and in accordance with the procedures set forth in Exhibit GC-A, "Dispute Resolution Agreement," entered into between OWNER and CONTRACTOR pursuant to Article 16, or (ii) if no such Dispute Resolution Agreement has been entered into, a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to ENGINEER'S decision, unless otherwise agreed in writing by OWNER and CONTRACTOR. Such appeal will not be subject to the procedures of paragraph 9.11.

Decisions on Disputes:

9.11 ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and Claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to ENGINEER and the other party to the Agreement promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within sixty days after the start of such occurrence or event unless ENGINEER allows an

additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to ENGINEER and the claimant within thirty days after receipt of the claimant's last submittal (unless ENGINEER allows additional time). ENGINEER will render a formal decision in writing within thirty days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. ENGINEER'S written decision on such claim, dispute or other matter will be final and binding upon OWNER and CONTRACTOR unless: (i) an appeal from ENGINEER'S decision is taken within the time limits and in accordance with the procedures set forth in EXHIBIT GC-A, "Dispute Resolution Agreement," entered into between OWNER and CONTRACTOR pursuant to Article 16, or (ii) if no such Dispute Resolution Agreement has been entered into, a written notice of intention to appeal from ENGINEER'S written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within thirty days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty days of the date of such decision, unless otherwise agreed in writing by OWNER and CONTRACTOR.

9.12 When functioning as interpreter and judge under paragraphs 9.10 and 9.11, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to paragraphs 9.10 or 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter pursuant to Article 16.

9.13 Limitations on ENGINEER'S Authority and Responsibilities:

9.13.1 Neither ENGINEER'S authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by ENGINEER shall create, impose or give rise to any duty owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them.

9.13.2 ENGINEER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. ENGINEER will not be responsible for CONTRACTOR'S failure to perform or furnish the Work in accordance with the Contract Documents.

9.13.3 ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.13.4 ENGINEER'S review of the final Application for Payment and accompanying documentation

and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and Other documentation required to be delivered by paragraph 14.12 will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with, the Contract Documents.

9.13.5 The limitations upon authority and responsibility set forth in this paragraph 9.13 shall also apply to ENGINEER'S Consultants, Resident Project Representative and assistants.

ARTICLE 10--CHANGES IN THE WORK

10.1 Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work. Such additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

10.2 If OWNER and CONTRACTOR are unable to agree to the extent, if any, of an adjustment of the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a claim may be made therefor as provided in Article 11 or Article 12.

10.3 CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.5 and 3.6 except in the case of an emergency as provided in paragraph 6.23 or in the case of uncovering Work as provided in paragraph 13.9.

10.4 OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

10.4.1 changes in the Work which are (i) ordered by OWNER pursuant to paragraph 10.1, (ii) required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under paragraph 13.14, or (iii) agreed to by the parties;

10.4.2 changes in the Contract Price or Contract Times which are agreed to by the parties; and

10.4.3 changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 9.11; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.

10.5 If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR'S

responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11-CHANGE OF CONTRACT PRICE

11.1 The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at CONTRACTOR'S expense without change in the Contract Price.

11.2 The Contract Price may only be changed by a Change Order or by a Written Amendment. Any claim for an adjustment in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after the start of such occurrence or event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the adjustment claimed covers all known amounts to which the claimant is entitled as a result of said occurrence or event. All claims for adjustment in the Contract Price shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.

11.3 The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

11.3.1 where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1 through 11.9.3, inclusive);

11.3.2 where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2);

11.3.3 where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 11.3.2, on the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a CONTRACTOR'S fee for overhead and profit (determined as provided in paragraph 11.6)

Cost of the Work:

11.4 The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:

11.4.1 Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the

Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen and other personnel employed full-time at the site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by OWNER.

11.4.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

11.4.3 Payments made by CONTRACTOR to the Subcontractors for Work performed or furnished by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of ENGINEER, which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR'S Cost of the Work and fee as provided in paragraphs 11.4,

11.5,11.6, and 11.7. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4 Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.

11.4.5 Supplemental costs including the following:

11.4.5.1 The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR'S employees incurred in discharge of duties connected with the Work.

11.4.5.2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.

11.4.5.3 Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof—all in accordance with the terms of said rental

agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4 Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

11.4.5.5 Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6 Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER in accordance with paragraph 5.9), provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR'S fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7 The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8 Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9 Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.5 The term Cost of the Work shall not include any of the following:

11.5.1 Payroll costs and other compensation of CONTRACTOR'S officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR'S principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.4--all of which are to be considered administrative costs covered by the CONTRACTOR'S fee.

11.5.2 Expenses of CONTRACTOR'S principal and branch offices other than CONTRACTOR's office at the site.

11.5.3 Any part of CONTRACTOR'S capital expenses, including interest on CONTRACTOR'S capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.5.4 Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).

11.5.5 Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

11.6 The CONTRACTOR'S fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.6.1 a mutually acceptable fixed fee; or

11.6.2 if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1 for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR'S fee shall be fifteen percent;

11.6.2.2 for costs incurred under paragraph 11.4.3, the CONTRACTOR'S fee shall be five percent;

11.6.2.3 where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraphs 11.4.1, 11.4.2, 11.4.3 and 11.6.2 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be paid a fee of fifteen percent of the costs incurred by such Subcontractor under paragraphs 11.4.1 and 11.4.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

11.6.2.4 no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;

11.6.2.5 when both additions and credits are involved in any one change, the adjustment in CONTRACTOR'S fee shall be computed on the basis of the net change in accordance with paragraphs 11.6.2.1 through 11.6.2.4, inclusive.

11.7 Whenever the cost of any Work is to be determined pursuant to paragraphs 11.4 and 11.5, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

Cash Allowances:

11.8 It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

11.8.1 the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and

11.8.2 CONTRACTOR'S costs for unloading and handling on the site, labor installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.9 Unit Price Work:

11.9.1 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER in accordance with paragraph 9.10.

11.9.2 Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

11.9.3 OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:

11.9.3.1 the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

11.9.3.2 there is no corresponding adjustment with respect to any other item of Work; and

11.9.3.3 if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12-CHANGE OF CONTRACT TIMES

12.1 The Contract Times (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on

written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Times (or Milestones) shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

12.2 All time limits stated in the Contract Documents are of the essence of the Agreement.

12.3 Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a claim is made therefor as provided in paragraph 12.1. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.4 Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR'S sole and exclusive remedy for such delay. In no event shall OWNER be liable to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of CONTRACTOR, or (ii) delays beyond the control of both parties including

but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

ARTICLE 13-TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1 Notice of Defects: Prompt notice of all defective Work of which OWNER or ENGINEER have actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

13.2 OWNER, ENGINEER, ENGINEER'S Consultants, other representatives and personnel of

OWNER, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR'S site safety procedures and programs so that they may comply therewith as applicable.

Testing and Inspections:

13.3 CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.4 OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

13.4.1 for inspections, tests or approvals covered by paragraph 13.5 below;

13.4.2 that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.9 below shall be paid as provided in said paragraph 13.9; and

13.4.3 as otherwise specifically provided in the Contract Documents.

13.5 If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection, or approval. CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for OWNER'S and ENGINEER'S acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR'S purchase thereof for incorporation in the Work.

13.6 If any Work (or the work of others) that is to be inspected, tested or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

13.7 Uncovering Work as provided in paragraph 13.6 shall be at CONTRACTOR'S expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR'S intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

Uncovering Work:

13.8 If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER'S observation and replaced at CONTRACTOR'S expense.

13.9 If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER

or inspected or tested by others, CONTRACTOR, at ENGINEER'S request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefor as provided in Article 11. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

OWNER May Stop the Work:

13.10 If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any surety or other party.

Correction or Removal of Defective Work:

13.11 If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with Work that is not defective. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.12 Correction Period:

13.12.1 If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER'S written instructions: (i) correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

13.12.2 In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

13.12.3 Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph 13.12, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

Acceptance of Defective Work:

13.13 If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER'S recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all claims, costs, losses and damages attributable to OWNER'S evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness). If any such acceptance occurs prior to ENGINEER'S recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

OWNER May Correct Defective Work:

13.14 If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR'S services related thereto, take possession of CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER'S representatives, agents and employees, OWNER'S other contractors and ENGINEER and ENGINEER'S Consultants access to the site to enable OWNER to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by OWNER in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR'S defective Work. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER'S rights and remedies hereunder.

ARTICLE 14-PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

14.1 The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

Application for Progress Payment:

14.2 At least twenty days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect OWNER'S interest therein, all of which will be satisfactory to OWNER. The amount of retainage with respect to progress payments will be as follows:

The OWNER shall retain ten (10%) percent of the amount of each payment until final completion and acceptance of all WORK covered by the CONTRACT DOCUMENTS. The OWNER at any time, however, after fifty (50%) percent of the WORK has been completed, if he finds that satisfactory progress is being made, and has received a written request by the CONTRACTOR, shall reduce retainage to five (5%) percent on the current and remaining estimates. The OWNER may reinstate up to ten percent withholding if the OWNER determines, at its discretion, that the contractor is not making satisfactory progress or there is other specific cause for such withholding (such as work performed deteriorities).

CONTRACTOR'S Warranty of Title:

14.3 CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

Review of Applications for Progress Payment:

14.4 ENGINEER will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing ENGINEER'S reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. Ten days after presentation of the Application for Payment to OWNER with ENGINEER'S recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7) become due and when due will be paid by OWNER to CONTRACTOR.

14.5 ENGINEER'S recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER'S on-site observations of the executed Work as an experienced and qualified design professional and on ENGINEER'S review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER'S knowledge, information and belief:

14.5.1 the Work has progressed to the point indicated,

14.5.2 the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated in the recommendation), and

14.5.3 the conditions precedent to CONTRACTOR'S being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER'S responsibility to observe the Work. However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents or (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

14.6 ENGINEER'S recommendation of any payment, including final payment, shall not mean that ENGINEER is responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of Work, or for any failure of CONTRACTOR to perform or furnish Work in accordance with the Contract Documents.

14.7 The ENGINEER may refuse to approve the whole or any part of any payment if, in his opinion, he is unable to make such representations to the OWNER. He may also refuse to approve any such payment, or because of subsequent discovered evidence or the results of subsequent inspection or tests, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect the OWNER from loss because:

14.7.1 The Work is defective, or completed work has been damaged requiring correction or replacement,

14.7.2 The Contract Price has been reduced by Written Amendment or Change Order,

14.7.3 OWNER has been required to correct defective work or complete the Work in accordance with paragraph 13.14,

14.7.4 ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.4 inclusive, OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

14.7.5 claims have been made against OWNER on account of CONTRACTOR'S performance or furnishing of the Work.

14.7.6 Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens.

14.7.7 there are other items entitling OWNER to a set-off against the amount recommended, or

14.7.8 OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.7.1 through 14.7.3 or paragraphs 15.2.1 through 15.2.4 inclusive; but OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER'S satisfaction the reasons for such action.

Substantial Completion:

14.8 When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within fourteen days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER'S objections, ENGINEER considers the Work substantially complete, ENGINEER will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER'S issuing the definitive certificate of Substantial Completion, ENGINEER'S aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

14.9 OWNER shall have the right to exclude CONTRACTOR from the Work after the date of

Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.10 Use by OWNER at OWNER'S option of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) OWNER, ENGINEER and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR'S performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1 OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete the provisions of paragraphs 14.8 and 14.9 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.10.2 No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.15 in respect of property insurance.

Final Inspection:

14.11 Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

Final Application for Payment:

14.12 After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by paragraph 5.4, certificates of inspection, marked-up record documents (as provided in paragraph 6.19) and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously

delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.4.13, (ii) consent of the surety, if any, to final payment, and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of or filed in connection with the Work. In lieu of such releases or waivers of Liens and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills and other indebtedness connected with the Work for which OWNER or OWNER'S property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

Final Payment and Acceptance:

14.13 If, on the basis of ENGINEER'S observation of the Work during construction and final inspection, and ENGINEER'S review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR'S other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER'S recommendation of payment and present the Application to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. Thirty days after the presentation to OWNER of the Application and accompanying documentation, in appropriate form and substance and with ENGINEER'S recommendation and notice of acceptability, the amount recommended by ENGINEER will become due and will be paid by OWNER to CONTRACTOR.

14.14 If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR'S final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Waiver of Claims:

14.15 The making and acceptance of final payment will constitute:

14.15.1 a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR'S continuing obligations under the Contract Documents; and

14.15.2 a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15-SUSPENSION OF WORK AND TERMINATION

OWNER May Suspend Work:

15.1 At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes an approved claim therefor as provided in Articles 11 and 12.

OWNER May Terminate:

15.2 Upon the occurrence of any one or more of the following events:

15.2.1 if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.9 as adjusted from time to time pursuant to paragraph 6.6);

15.2.2 if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

15.2.3 if CONTRACTOR disregards the authority of ENGINEER; or

15.2.4 if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents; OWNER may, after giving CONTRACTOR (and the surety, if any,) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by OWNER arising out of or resulting from completing the Work such excess will be paid to CONTRACTOR. If such claims, costs, losses and damages exceed the unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and when so approved by ENGINEER incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

15.3 Where CONTRACTOR'S services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may

thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.4 Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

15.4.1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

15.4.2 for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

15.4.3 for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and

15.4.4 for reasonable expenses directly attributable to termination.

CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

CONTRACTOR May Stop Work or Terminate:

15.5 If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted or OWNER fails for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Agreement and recover from OWNER payment on the same terms as provided in paragraph 15.4. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application of Payment within thirty days after it is submitted, or OWNER has failed for thirty days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may upon seven day's written notice to OWNER and ENGINEER stop the Work until payment of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.5 are not intended to preclude CONTRACTOR from making claim under Articles 11 and 12 for an increase in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR'S stopping Work as permitted by this paragraph.

ARTICLE 16-DISPUTE RESOLUTION

If and to the extent that OWNER and CONTRACTOR have agreed on the method and procedure for resolving disputes between them that may arise under this Agreement, such dispute resolution method and procedure, if any, shall be as set forth in Exhibit GC-A, "Dispute Resolution Agreement," to be attached hereto and made a part hereof. If no such agreement on the method and procedure for

resolving such disputes has been reached, and subject to the provisions of paragraphs 9.10, 9.11, and 9.12, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17--MISCELLANEOUS

Giving Notice:

17.1 Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Times:

17.2.1 When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.2.2 A calendar day of twenty-four hours measured from midnight to the next midnight will constitute a day.

Notice of Claim:

17.3 Should OWNER and CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose

Cumulative Remedies:

17.4 The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.12, 6.16, 6.30, 6.31, 6.32, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

Professional Fees and Court Costs Included:

17.5 Whenever reference is made to "claims, costs, losses and damages," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs.

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the General Conditions and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

SC 1

The terms used in these Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

SC 5.4

The limits of liability for the insurance required by paragraph 5.4 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulations:

SC 5.4.1 and 5.4.2

Workers' Compensation, etc., under paragraphs 5.4.1. and 5.4.2. of the General Conditions.

- (1) State: Statutory.
- (2) Applicable Federal (e.g., Longshoreman's): Statutory.
- (3) Employer's Liability: \$500,000.

SC 5.4.3. 5.4.4. and 5.4.5

CONTRACTOR'S Liability Insurance under paragraphs 5.4.3. through 5.4.5. of the General Conditions, which shall also include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of CONTRACTOR:

- (1) General Aggregate (Except Products-Completed Operations) \$1,000,000.
- (2) Products-Completed Operations Aggregate \$1,000,000.
- (3) Personal and Advertising Injury (Per Person/Organization) \$1,000,000.
- (4) Each Occurrence (Bodily Injury and Property Damage) \$1,000,000.
- (5) Property Damage liability insurance will provide Explosion, Collapse and Underground coverages where applicable.
- (6) Excess Liability
General Aggregate \$1,000,000
Each Occurrence \$1,000,000

SC 5.4.6 Automobile Liability

- (1) Bodily Injury:
\$1,000,000 Each Person
\$1,000,000 Each Accident

Property Damage:
\$1,000,000 Each Accident

-or-

- (2) Combined Single Limit (Bodily Injury and Property Damage):
\$1,000,000 Each Accident

SC 5.4.10

The Contractual Liability coverage required by paragraph 5.4.10 of the General Conditions shall provide coverage for not less than the following amounts:

- (1) General Aggregate \$1,000,000.
- (2) Each Occurrence (Bodily Injury and Property Damage) \$1,000,000

SC 5.6 and 5.7

Amend the first sentence of paragraphs GC-5.6 and 5.7 by striking out "OWNER" and substituting "CONTRACTOR".

SC 5.8

Amend the first sentence of the General Conditions by deleting "by OWNER" and inserting "by CONTRACTOR".

SC 5.10

Delete paragraph 5.10 of the General Conditions in its entirety.

SC 5.11.2

Delete paragraph 5.11.2 of the General Conditions in its entirety.

SC 6.8.2

In section 6.8.2 of the General Conditions delete "Supplementary Conditions" where appearing, and substitute therefor "Contract Documents". Also, add to the end of this section the following:

CONTRACTOR shall not substitute any person as Subcontractor in the place of the Subcontractor listed in the original bid, except (i) if the listed Subcontractor's bid is later determined by the CONTRACTOR to be non-responsible or nonresponsive or the listed Subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the OWNER for good cause shown by the CONTRACTOR. The terms, conditions, and requirements of each contract between the CONTRACTOR and a Subcontractor performing work under a subdivision or branch of work listed above shall incorporate by reference the terms, conditions, and requirements of the contract between the CONTRACTOR and the OWNER.

SPECIAL PROVISIONS

TOWN OF SUMMERVILLE BEAR ISLAND ROAD TRAFFIC SIGNALS PROJECT

The Contractor's attention is directed to the following special provisions that are considered to be a part of this contract and that may be in addition to all other general and special requirements as may be contained within the bidding and contract requirements.

1. EQUIPMENT/MATERIALS: The contractor will purchase all equipment/materials for the project. The Contractor will be responsible for all offloading of delivered owner furnished equipment and materials, their storage, the designated delivery schedule, damage due to carelessness of offloading and the security of said deliveries.

Equipment/Materials being furnished by Owner and installed by Contractor:

A. Mast Arm Assemblies and all appurtenances

2. FOUNDATION DESIGN: Representatives from the mast arm supplier shall provide foundation designs for each pole. Contractor shall coordinate design services with the supplier's representatives. **Contractor is responsible for soil tests to aid in foundation design.**

3. COMPLETION TIME: Work will be commenced on the date stipulated on the Notice to Proceed and shall be complete within 180 consecutive days.

4. LIQUIDATED DAMAGES: Should the Contractor exceed any of the time limitations as set forth above, liquidated damages shall be assessed against the Vendor at a rate of \$500.00 per day.

5. EXISTING SITE CONDITIONS: The Contractor shall satisfy himself as to the existing site conditions prior to bidding the project. The Contractor shall be responsible for maintaining a workable site condition during the execution of this contract. The contractor shall be responsible for restoring all disturbed areas to original or satisfactory conditions as approved by the Owner. Reasonable care shall be taken during construction to avoid damage to vegetation.

6. UNDERCUT IN UNSUITABLE MATERIAL: Prior to performing any undercut in areas with unsuitable material, the Contractor shall obtain from the Engineer a field order to perform the work. Following the removal of material, the Contractor shall verify the Engineer and Owner (prior to backfill) the lines and depths to which the undercut was performed.

7. All testing associated with the specifications for construction of the project shall be at the expense of the Contractor.

8. AS-BUILTS: The Contractor is responsible for maintaining as-builts for all features. The as-builts will be reviewed in conjunction with processing the partial pay requests. Final as-builts including location of each utility feature, utilizing South Carolina grid coordinates, will be prepared by the Engineer based on accurate as-builts provided by the contractor. The contractor shall provide accurate as-builts including location of all foundations, poles, junction boxes, directional bores, etc. Final payment will not be processed until final as-builts have been submitted and accepted.

9. **STAKE OUT:** The Contractor shall be responsible for initial stake out associated with this project. All subsequent stake out shall be the responsibility of the Contractor. Control points are provided and are shown on the plans. Any questions shall be brought to the attention of the Engineer.

10. **SEEDING:** All areas disturbed during construction shall be seeded in accordance with the specifications. Any and all areas disturbed outside of the designated limits shall be seeded at the Contractor's expense.

11. **DISCREPANCIES, INCONSISTENCIES, AND AMBIGUITIES:** Any discrepancies found between the DRAWINGS, OWNER'S SPECIFICATIONS, ENGINEER'S SPECIFICATIONS, and site conditions or any inconsistencies or ambiguities in the DRAWINGS or OWNER'S SPECIFICATIONS or the ENGINEER'S SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies, or ambiguities shall be done at the CONTRACTOR'S risk.

12. **SUBMITTALS:** Project submittals shall be submitted to engineer at least (1) week prior to preconstruction meeting. Work shall not commence until after preconstruction meeting.

13. **NONRESIDENT TAXPAYERS:** If the bidder is a South Carolina nonresident taxpayer and the contract amount is \$10,000.00 or more, the bidder acknowledges and understands that in the event he is awarded a contract, bidder shall submit a Nonresident Taxpayer Registration Affidavit (State Form #1-312-6/99) to the Town of Summerville Purchasing Department before a contract can be signed. Affidavit must certify that the nonresident taxpayer is registered with the S.C. Department of Revenue or the S.C. Secretary of State's Office, in accordance with Section 12-8-550 (A)(B)(C) of S.C. Code of Laws (1976) as amended and referenced below.

SECTION 12-8-550. *Withholding for nonresident temporarily conducting business or performing personal services; exemption; revocation of exemption.*

(A) *A person hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within this State shall withhold two percent of each payment in which the South Carolina portion of the contract exceeds or could reasonably be expected to exceed ten thousand dollars. This section does not apply to a nonresident which registered with the Secretary of State or the Department of Revenue and by that registration agreed to be subject to the jurisdiction of the department and the courts of this State to determine its South Carolina tax liability, including withholding and estimated taxes, together with any related interest and penalties. Registering with the Secretary of State or the department is not an admission of tax liability nor does it require the filing of an income tax or franchise (license) tax return. If the person hiring, contracting, or having a contract with a nonresident obtains an affidavit from the nonresident stating that the nonresident is registered with the department or with the Secretary of State, the person is not responsible for the withholding.*

(B) *The department may revoke the exemption granted by registering with the Secretary of State or the department if it determines that the nonresident taxpayer is not cooperating with the department in the determination of the nonresident taxpayer's correct South Carolina tax liability. This revocation does not revive the duty of a person hiring, contracting, or having a contract with a nonresident to withhold, until the person receives notice of the revocation.*

(C) *This section does not apply to payments on purchase orders for tangible personal property when those payments are not accompanied by services to be performed in this State.*

TECHNICAL SPECIFICATIONS

TOWN OF SUMMERVILLE BEAR ISLAND ROAD TRAFFIC SIGNALS PROJECT

The “Standard Specifications for Highway Construction, Edition of 2007” as published by the South Carolina Department of Transportation (SCDOT) shall govern the material and workmanship on this project and is incorporated within this contract by reference, except where modified by the SCDOT Traffic Signals Supplemental Technical Specifications dated 5/16/2016 (Revised) and the Special Provisions included within this bid document. In addition, the “Standard Drawings for Road Construction” published by the South Carolina Department of Transportation are incorporated within this contract by reference.

SCDOT TRAFFIC SIGNALS

**SUPPLEMENTAL
TECHNICAL
SPECIFICATIONS**

Revised
5/16/2016

Traffic Signal Supplemental Technical Specifications

Table of Contents

		Revision Date
675.0	GENERAL PROVISIONS	1/15/2016
675.1	ELECTRICAL CONDUIT	5/16/2016
677.1	ELECTRICAL CABLE	1/15/2016
677.3	FIBER OPTIC CABLE	1/15/2016
677.4	FIBER INTERCONNECT CENTER	1/15/2016
677.6	FACTORY TERMINATED PATCH PANEL	1/15/2016
677.7	WIRELESS COMMUNICATIONS ASSEMBLY	3/14/2016
678.1	DETECTOR LOOP	5/16/2016
678.2	WIRELESS VEHICLE DETECTION SYSTEM	3/9/2016
680.1	ELECTRIC SERVICE	5/16/2016
680.2	SPLICE BOX/JUNCTION BOX	1/15/2016
682.1	WOOD POLE/BACK GUY ASSEMBLY	1/15/2016
682.3	STEEL CABLE	1/15/2016
682.4	PEDESTRIAN POLE AND BASE	1/15/2016
686.1	SIGNAL HEADS	1/15/2016
686.3	PEDESTRIAN SIGNAL HEAD	1/15/2016
686.4	PEDESTRIAN PUSH BUTTON STATION ASSEMBLY WITH SIGN	5/16/2016
686.5	LED BLANKOUT SIGN	1/15/2016
688.1	REMOVAL, SALVAGE AND DISPOSAL OF EQUIPMENT AND MATERIALS	1/15/2016
688.3	VIDEO DETECTION SYSTEM	1/15/2016
688.5	STEEL STRAIN POLE AND FOUNDATION	1/15/2016
688.6	CONCRETE STRAIN POLE	1/15/2016
688.7	CONTROLLER AND CABINET ASSEMBLY	1/15/2016
688.8	FLASHER CABINET	1/15/2016
688.9	SOLAR POWERED FLASHER ASSEMBLY	1/15/2016
690.1	STEEL POLE WITH MAST ARM	1/15/2016

TRAFFIC SIGNAL SUPPLEMENTAL SPECIFICATION REVISIONS

Date	Spec	Description	Details of Revision
5/16/2016	675.1	ELECTRICAL CONDUIT	Revised Trenchless requirements
5/16/2016	686.4	PEDESTRIAN PUSH BUTTON STATION ASSEMBLY WITH SIGN	Clarified requirements for installing dual push button station assemblies
5/16/2016	680.1	ELECTRIC SERVICE	Revised requirements for Disconnect Switch
5/16/2016	678.1	DETECTOR LOOP	Revised requirements for splices
3/22/2016	677.7	WIRELESS COMMUNICATIONS ASSEMBLY	updated
3/22/2016	678.2	WIRELESS VEHICLE DETECTION SYSTEM	updated
1/15/16	Various	Removed [103.1,103.2,676.1,676.2,677.2, 677.5, 677.7,682.2 686.2, 689.2, 689.3] Added 678.2 Wireless Vehicle Detection Renamed [677.7,682.1, 686.1, 686.5, 688.3, 688.7]	Removed specifications from Supplemental [103.1, 103.2, 676.1,676.2, 677.2, 677.5,677.7,682.2, 686.2, 689.2, 689.3]. Added 678.2 Wireless Vehicle Detection to Supplemental; Renamed specifications [677.7 , 682.1, 686.1, 686.5, 688.3, 688.7].
1/15/16	All	All	Revised passive to active wording
6/4/2015	675.0	GENERAL PROVISIONS	Added specification
6/4/2015	688.2	TEMPORARY ADJUSTMENT OF TRAFFIC SIGNAL EQUIPMENT & TIMINGS	Removed specification; merged pertinent requirements from this specification into 675.0 General Provisions
12/15/2014	686.3	PEDESTRIAN SIGNAL HEAD	Revised Pay Items. Mounting hardware is incidental.
12/15/2014	686.1	VEHICLE SIGNAL HEADS AND BACKPLATES	Consolidated Pay Items.
4/18/2014	677.1	ELECTRICAL CABLE	Added option to allow other products meeting SCDOT specifications
4/18/2014	103.2	MOBILIZATION OF MATERIAL	Clarified description
10/28/2013	675.1	ELECTRICAL CONDUIT	Revised Measurement section and added PI#675027Z
9/12/2013	686.1	LED MODULES AND/ORPOLYCARBONATE VEHICLE SIGNAL HEADS	Revised PI#6887898
9/12/2013	686.1	LED MODULES AND/ORPOLYCARBONATE VEHICLE SIGNAL HEADS	Added PI#6865723,6865733,6887903,6887899
9/12/2013	688.7	CONTROLLER AND 332/336 CABINETS	Revised Description for PI#6888225, 6888226
9/12/2013	688.7	CONTROLLER AND 332/336 CABINETS	Added PI#6845614
7/17/2013	103.1		Added Pay Item Notes
7/17/2013	103.2		Revised Pay Items , Added Pay Item Notes
7/17/2013	675.1		Revised Specification, Added Pay Item Notes, Added Pay Item
7/17/2013	676.1		Added Pay Item Notes
7/17/2013	676.2		Added Pay Item Notes
7/17/2013	677.1		Added Pay Item Notes
7/17/2013	677.2		Revised Pay Item Numbers , Added Pay Item Notes
7/17/2013	677.3		Revised Pay Item Number , Added Pay Item Notes
7/17/2013	677.4		Added Pay Item Notes
7/17/2013	677.5		Added Pay Item Notes
7/17/2013	677.6		Added Pay Item Notes
7/17/2013	677.7		Added Pay Item Notes
7/17/2013	678.1		Added Pay Item Notes
7/17/2013	680.1		Added Pay Item Notes
7/17/2013	680.2		Added Pay Item Notes
7/17/2013	682.1		Revised Ground Rod Dimensions , Added Pay Item Notes

7/17/2013	682.2		Added Pay Item Notes
7/17/2013	682.3		Added Pay Item Notes
7/17/2013	682.4		Added Pay Item Notes
7/17/2013	686.1		Added Pay Items, Added Pay Item Notes
7/17/2013	686.2		Added Pay Item Notes
7/17/2013	686.3		Revised Pay Item Numbers , Added Pay Item Notes
7/17/2013	686.4		Added Pay Item Notes
7/17/2013	686.8		Added Pay Item Notes
7/17/2013	688.1		Added Pay Item Notes
7/17/2013	688.2		Added Pay Item Notes
7/17/2013	688.3		Added Pay Item Notes
7/17/2013	688.5		Revised Class 5000 Concrete, Added Pay Items, Added Pay Item Notes
7/17/2013	688.6		Added Pay Item Notes
7/17/2013	688.7		Revised Class 3000 Concrete, Added Pay Items , Added Pay Item Notes
7/17/2013	688.8		Added Pay Item Notes
7/17/2013	688.9		Added Pay Item Notes
7/17/2013	689.1		New Specification
7/17/2013	689.2		Added Pay Item Notes
7/17/2013	689.3		Added Pay Item Notes
7/17/2013	690.1		Added Pay Items , Added Pay Item Notes

675.0 GENERAL PROVISIONS

1.0 Turn Key Project

Unless noted otherwise on the plans or in the Special Provisions this is a "turn-key" project, with the contractor furnishing and installing all equipment, complete and operational to the satisfaction of the Engineer. The CONTRACTOR will install the traffic signal(s) to provide a completely modern installation. At Project completion all traffic signals/equipment shall be complete and operational, to the satisfaction of the Engineer.

1.1 Plans

- The PLANS are schematic in nature, showing what is generally expected at each intersection. The CONTRACTOR must devise/refine the final details, working within the Specifications, the Standard Drawings, and with the Engineer.
- Deviations from the Plans must be approved by the Engineer.
- After the completion of the project, the CONTRACTOR shall furnish to the District Traffic Engineer, three (3) "red-lined" sets of Plans detailing deviations from the plans and showing the exact locations and sizes of all conduits, poles, pedestals, splice boxes, detectors, and the routing and destination of all wires leaving the control cabinets.

1.2 Temporary Items / Temporary Adjustments

If Plans or Engineer indicates temporary items or adjustments are necessary, the contractor shall perform as indicated below:

- Provide new equipment that is to be removed after all the signal work is completed,
- Relocate existing signs or equipment to another location,
- Shift existing signs or equipment slightly for work zone setups.
- Any new equipment will be paid using the appropriate furnish and install pay item based on the quantity installed. The items installed become the property of SCDOT. If Engineer indicates temporary items are to be removed at the end of the contract, Contractor shall deliver these items to the appropriate signal shop. Remove and Salvage of temporary items shall be included in Remove and Salvage pay item in accordance with **688.1 Removal, Salvage and Disposal**.
- Relocated items will be paid using the appropriate install pay items based on the quantity installed.
- Shifting signal heads and/or signs along the existing span wire or mast arm shall be incidental to the work required for continuity of operations.
- Use fully reliable, fully functional temporary equipment of good appearance.
- Install temporary signals in accordance with SCDOT specifications.
- Relocated or adjusted signal equipment are considered "temporary", unless specified otherwise on the Plans. The CONTRACTOR shall plan and stage the work so that the result is a traffic signal installation conforming to the plans and using all NEW equipment.
- Signal heads shall be shifted side-to-side to be over traffic lanes as the traffic lanes are opened or closed to traffic.
- The location of temporary and final signal poles will be approved by the ENGINEER. The CONTRACTOR shall furnish the temporary and final wood poles as necessary for Continuity of Operation. Provide back guys for wood poles, sufficient to keep the pole vertical.
- Contractor may re-use minor equipment in temporary adjusted configurations, but not in the final configuration. This includes steel cable, electrical cable, conduit, pedestrian buttons and signs, and splice boxes not utilized in the new signalization. The CONTRACTOR shall furnish sufficient steel cable and electrical cable to provide Continuity of Operation.
- Contractor shall coordinate and cooperate with any utility owning joint use poles in order to maintain signal continuity.
- Transfer highway signs on existing steel cable (span wires) to the adjusted spans, and place in the same physical alignment. (Ground mounted signs are covered in Section 107.11 of the STANDARD SPECIFICATIONS.)
- The CONTRACTOR shall install temporary electric service(s) as necessary to operate the signal(s). Coordinate with the local power company.
- Contractor shall obtain all necessary permits or licenses.

1.3 Transfer of Operations (Continuity of Operations from existing to temporary or from temporary to final)

- Provide Full Continuity of Operation; Transfer operation to the new or temporary controller, simultaneously turning off the old controller.
- The Maintenance of Traffic (as provided in the Traffic Control Plan), and the SAFETY OF TRAFFIC is of prime importance. Continuous Operation of traffic signals enhances safety. Contractor shall NOT arbitrarily turn off signals for convenience. Instead, construct the adjusted, temporary or new signal and smoothly transfer

operation to that signal. When the ENGINEER gives permission to briefly turn off a signal, provide complete intersection control using a flagger and/or Police traffic direction.

- Existing traffic signals shall REMAIN IN OPERATION until the new/modified installation has been satisfactorily tested, and placed in operation. Accomplish the testing without hazard to the traveling public and while the signal heads are suitably BAGGED WITH BURLAP.
- Covered all signal heads in place, but not in use, with BURLAP. NOTE: PLASTIC BAGS ARE NOT ACCEPTABLE.
- Adjustments in the existing equipment made necessary by the new installation are incidental to the signal construction.
- After approval is received from the Engineer, switch the new signal heads into service during that controller phase being displayed by the existing equipment; turn off the existing equipment simultaneously. After the new signal equipment has been made operational, immediately turn off the existing signal heads, and remove.
- The CONTRACTOR shall completely coordinate work between sub-contractors, and shall carefully stage the project to minimize the impact to traffic.

1.4 Operations during Construction

- The contractor shall be responsible for the operations of all existing and newly installed signals from the notice to proceed of the project until final acceptance of the project.
- There is no separate pay item for operations during construction; Operations is simply part of the construction process and is incidental to the construction.
- Fixed time operation of signals is not acceptable. Maintain detection for the life of the project. Install and operate the temporary actuation devices; transfer operation to the temporary devices prior to demolition of the existing loop detector systems.
- If detection is damaged and cannot be immediately repaired or temporary lane configurations are required, CONTRACTOR shall provide temporary equipment to provide operational detection during the life of the construction project, using video detection or other approved detection method.
- It is not permissible to adopt "uncoordinated" operation of adjacent signals; if damage to the existing interconnection cable has been broken, Contractor shall repair it immediately. If the installation of a new signal within or adjacent to an existing signal system occurs, provide interconnection to the new signal as soon as it is operational. Ensure appropriate communications is available to communicate with the signal system.
- The District Traffic ENGINEER will provide temporary controller time settings for changing traffic conditions during construction. These temporary time settings may occur throughout the project life; Contractor shall implement these timings as directed by the Engineer; this work is incidental to the contract.
- Plan the work to cause minimum interference with any existing signal operation.
- The CONTRACTOR shall not change the phasing or other operation of a signalized intersection without the approval of the District Traffic Engineer.
- Ensure the signal controller has the correct settings on the time clocks to local legal time, where needed.

1.5 Maintenance / Repairs

- The contractor shall be responsible for the daily maintenance and repairs and emergency repairs for all existing, temporary and any newly installed signals in the project from the notice to proceed until final acceptance of the project. The CONTRACTOR is responsible and liable for proper and safe operation of each signal. The CONTRACTOR shall perform EMERGENCY REPAIRS AND SERVICES as required, to ensure continuity of operation of listed traffic signals and associated equipment. This shall include replacement of malfunctioning LED modules.
- Contractor and District Electrical Supervisor shall perform a walk thru of all signals to determine if any repairs are needed prior to the contractor assuming maintenance responsibility. After the contractor assumes maintenance responsibility, the contractor also assumes financial responsibility for repairs until final acceptance.
- The Contractor shall retain ownership of the materials and equipment provided in the project until Final Acceptance (see Final Inspection & Final Acceptance) has been made by the Engineer, when it then becomes SCDOT property.
- There is no separate pay item for maintenance during construction; maintenance is simply part of the construction process and is incidental to the contract.
- The CONTRACTOR shall provide at least one (1) qualified LOCAL signal technician, subject to call at all times, to provide emergency services as required to assure continuous and efficient operation of signal installations and systems. This shall include non-business hours, weekends, and holidays. The Technician shall be fully qualified to trouble-shoot, service, repair and/or replace traffic controllers and components, both electro-mechanical and solid-state. At the PRE-CONSTRUCTION CONFERENCE, the CONTRACTOR shall

furnish the RCE with a LIST OF THE SIGNAL TECHNICIANS who will be responsible for performing the emergency service, and the LOCAL PHONE NUMBER(S) of the CONTRACTOR's agent(s) (answering service, etc.), who will receive emergency calls during and after the CONTRACTOR's normal business hours.

- The CONTRACTOR shall be ON-SITE of the malfunctioning signal for emergency service within the maximum time listed in the following schedule-

i. <u>Weekdays or Saturday</u>	<u>Maximum Time</u>
1. 6 AM to 6 PM	1 hour
2. 6 PM to 6 AM	4 hours
ii. <u>Sundays or Holidays</u>	
1. Day or Night	4 hours
- Once the CONTRACTOR has started repair work/emergency service the CONTRACTOR shall restore a malfunctioning signal to normal phase operations uninterrupted.
- The CONTRACTOR shall maintain a LOG of all trouble calls received, the response time, and the corrective action taken. The records and logs shall be available to Department personnel for review during normal working hours. All records and logs shall be turned over to the Department at FINAL ACCEPTANCE.
- In the event the CONTRACTOR fails to perform in accordance with requirements and schedules of this Specification, the Department reserves the right, without notice to the CONTRACTOR, to engage a Third Party to perform the maintenance and emergency service necessary to assure continuous traffic signal operation. Further, all expenses incurred by the Department in implementing this option, shall be deducted from the payment due the CONTRACTOR, plus a FIFTEEN HUNDRED (\$1500) DOLLAR PENALTY FOR EACH OCCASION, FOR EACH DAY (UNTIL CORRECTED). The penalty shall be forfeited as liquidated damages.

1.6 Utility Coordination

- The CONTRACTOR, prior to the beginning of any construction activity, shall coordinate as necessary with the Utility Company supplying the power for this project.

1.7 Contract Schedule

- Unless noted otherwise in the *Special Provisions*, the **CONTRACTOR** shall furnish the Engineer with a WEEKLY SCHEDULE for the **TRAFFIC SIGNAL CONSTRUCTION** work, each Friday, for the week to come, listing the location and date of each intended activity. This will permit scheduling signal inspection personnel. Deviation from this schedule may cause the Department to delay Inspection and Payments.
- Any work performed without notification of the proper parties in the Department, will be treated as unauthorized work (see Section 105.11 of the Standard Specifications), and could result in nonpayment to the CONTRACTOR for that work.

1.8 Permits, Codes, Licenses, & Abilities

- Perform all work in a safe and workmanlike manner, to meet the highest industry standards, all in accordance with the requirements of the latest editions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the Illuminating Engineering Society (IES), the American National Standards Institute (ANSI), the National Electrical Manufacturer's Association (NEMA), and the regulations and standards of the local power company.
- The prime contractor or subcontractor responsible for the performance of the work must be licensed by the SC Licensing Board For Contractors and possess a Journeyman Card issued by the South Carolina Municipal Association or as required by the city in which work occurs at the time work is performed.
- Further, at least one 'ON-SITE' field supervisor shall have LEVEL II or higher, Traffic Signal Certification by the International Municipal Signal Association (IMSA). Photo copies of the license and certificate (for both above) shall be submitted before work commences. The CONTRACTOR shall retain employee(s) holding the above certificate for the duration of the project; and the employee(s) shall be present DAILY and at the FINAL INSPECTION.
- The CONTRACTOR shall employ persons capable of programming traffic signal controllers of the type used by this project. The CONTRACTOR shall possess both a desktop and a portable (laptop) computer, and be capable of using them to upload and download signal operating parameters.
- In addition to the state requirements, all permits and licenses required by a City/County are the responsibility of the CONTRACTOR.
- The CONTRACTOR shall arrange with the utility company for hookup connections and attachment agreements.

1.9 Integration

- Integration will be performed by SCDOT or local government signal maintenance staff; contractor shall coordinate with SCDOT to determine project schedule and time frame for integration. Contractor shall not

expect SCDOT or local government signal maintenance staff to provide integration without 2 weeks' notice and mutually agreed upon schedule of completion, including time frame for cabinets/controllers/conflict monitors to be provided at the signal shop; if signal maintainers have any issues with equipment provided, they will contact contractor to inform them to replace said equipment within reasonable time frame and to meet project schedules.

1.10 Equipment

- SCDOT Supplied Equipment - The Department will not furnish signal equipment, unless noted otherwise in the Special Provisions or on the Plans.
- Contractor Supplied Equipment - The CONTRACTOR shall furnish all **new** equipment (submittal of invoices required), including incidental items; used, refurbished equipment or any equipment with less than 80% of the warranty remaining at installation will not be accepted.
- Compatibility
 - a. If additional equipment is required during the life of this contract due to a Change Order or Extra Work, CONTRACTOR shall purchase equipment from the same manufacturer as the original item, to ensure compatibility.
 - b. When installing equipment such as signal heads or pedestrian equipment, where some existing equipment is being retained, the contractor shall provide the same type of equipment, as is remaining, for visual compatibility.
- The CONTRACTOR shall submit for approval a list of equipment including make, model number, manufacturer serial numbers, warranty information, purchase invoice, and purchase date. Documentation only has to be submitted for the furnish items required for this contract. At the time of such submission, the CONTRACTOR shall provide a copy of the Transmittal Letter, to SCDOT.
- If equipment is on the SCDOT Equipment Contract or the SCDOT QPL, catalog cut sheets do not have to be provided. On all other equipment, the CONTRACTOR shall submit for approval, catalog descriptions and documentation--THREE (3) COPIES--for each class of signal equipment and materials furnished by the CONTRACTOR. They are to be submitted TWO WEEKS PRIOR TO INSTALLATION to the Construction Office FOR APPROVAL. At the time of such submission, the CONTRACTOR shall provide a copy of the Transmittal Letter, to SCDOT.
- Equipment substitutions in the life of the contract are only allowed if the contractor can show a valid hardship in remaining with the originally submitted equipment. A valid hardship may include drastic price increases, non-availability of type of equipment due to unforeseen delivery or material shortages (contractor ordering equipment late does not apply), vendor going out of business, etcetera. SCDOT may allow equipment substitutions if product is of better quality than originally submitted or if contractor is replacing non-QPL items with QPL or SCDOT Equipment Contract items, or if equipment is experimental in nature and SCDOT wants to test said equipment.
- SCDOT will not pay for furnish and/or installation costs of any materials installed without prior approval and acceptance.
Contractor shall provide letter from the manufacturer of the cabinet and from the manufacturer of the controller indicating the equipment provided is the SCDOT QPL qualified equipment; Contractor shall ensure all warranties, serial numbers, documentation, and receipts are provided with cabinet assembly and controller delivery.

1.11 Inspection

- INSPECTION is the responsibility of SCDOT. SCDOT will designate those individuals responsible for inspection. For signals located within a local government with which SCDOT has a signal maintenance agreement, the inspection personnel may include local government personnel.
- The CONTRACTOR is advised that in any dispute between the Contractor and the Manufacturer, concerning the operation/maintainability/reparability of any piece of equipment, THE DECISION OF THE DEPARTMENT SHALL BE FINAL.
- SCDOT's designated inspector will provide a punch list of outstanding items to be addressed prior to Final Inspection.

1.12 Final Inspection & Final Acceptance

- The contractor should not request a final inspection if the punch list items are not completed.
- The CONTRACTOR shall request Final Inspection one week prior to the desired day of inspection. Confirmation to the Resident Construction Engineer shall be provided forty-eight (48) hours prior to Final Inspection, that the project is on schedule and ready for inspection.
- Burn In Upon completion of the Final Inspection and correction of any deficiencies, the work will be subject to a **sixty (60) day operational test (burn in), during which the contractor remains responsible for any**

maintenance or repairs of any deficiencies. If during this period, a problem arises a **NEW sixty (60) day test** period shall begin. Prior to Final Acceptance, if the materials or equipment are damaged or are in disrepair, the Contractor shall be responsible for repair or replacement.

- Final acceptance occurs 60 days after all punch list items are completed and signal is accepted by SCDOT. During this 60 day period, contractor remains responsible for maintenance of signals and any emergencies which may arise.
- Final Acceptance Contractor will officially transfer all equipment, including warranties to SCDOT. SCDOT will become responsible for signal operations and maintenance after 60 days of trouble-free operation and official final acceptance of entire project.

1.13 Mobilization

- Section 103.10, 103.11 of the STANDARD SPECIFICATIONS is amended as indicated below:
- For traffic signal projects, payment for 1031000 (LS) Mobilization includes all the signals and signal related work in the contract.
- For traffic signal projects, payment for 1031010 (EA) Mobilization will be paid per traffic signal (Each) or per ¼ mile for fiber installation (Each).
- These prices shall include demobilization.

1031000	MOBILIZATION	LS
1031010	MOBILIZATION	EA

- For traffic signal projects, payment for Mobilization of Material pay item addresses payment for moving large items furnished by SCDOT, such as concrete poles, requiring special equipment like boom trucks, to the project site from a location designated by SCDOT.

9610021	MOBILIZATION OF MATERIAL PER WORK ORDER, 1-100 MILES FROM LOCATION TO WORKSITE	EA
9610022	MOBILIZATION OF MATERIAL PER WORK ORDER, 101-250 MILES FROM LOCATION TO WORKSITE	EA
9610023	MOBILIZATION OF MATERIAL PER WORK ORDER, 250+ MILES FROM LOCATION TO WORKSITE	EA

1.14 Payment for Materials on Hand

Section 109.7 of the STANDARD SPECIFICATIONS is amended to include the following paragraphs.

When permitted by the Engineer, partial payment will be made for major traffic signal items that are being furnished by the CONTRACTOR. Certain items such as wooden poles, and other very heavy units not readily movable or vandalized, may be stored in un-secured locations either ON- or OFF-SITE. Other items such as signal heads, detector amplifiers, controllers, cabinets, and certain other major items may be stored in a secured/protected location either ON- or OFF-SITE. The equipment shall be labeled stating SCDOT, and the Project Name. Other requirements of Paragraph 109.8 remain applicable. Payment shall be in accordance with the following criteria:

The Contractor may be paid at FIFTY (50%) PERCENT of the contract unit price of item, not to exceed the paid invoice amount.

1. Only items measured by 'EACH' shall be eligible.
2. Only items with a unit price exceeding \$500 shall be eligible.
3. The total invoice price of the items shall exceed \$10,000.

1.15 Maintenance of Traffic (Traffic Control)

- The Contractor shall execute the item of Traffic Control as required by the Standard Specifications, the plans, the Standard Drawings For Road Construction, these supplemental specifications, the MUTCD, and the Engineer.

675.1 ELECTRICAL CONDUIT

1.1 Description

This work shall consist of furnishing and installing Electrical Conduit and fittings of the types and sizes specified herein, at locations shown on the Plans, or as established by the ENGINEER in accordance with these Specifications.

1.2 Materials

- Use rigid, heavy-wall, galvanized steel conduit, meeting the requirements of Federal Specification WW-C-581, and American Standards Association Specifications USAS C-80.1-1966.
- Use sunlight resistant PVC (Polyvinyl chloride) Conduit SCHEDULE 80, meeting the requirements of National Electrical Manufacturing Association (NEMA) Specification TC-2 and Underwriter Laboratory (UL) standards UL-514; and/or ASTM D-1784. Fittings shall meet NEMA TC-3 and UL-514.
- Use SCHEDULE 80 HDPE (High Density Polyethylene) Rolled Conduit.
- Use Flexible Weather-Tight Steel Conduit consisting of flexible single strip, helically wound, interlocking galvanized steel. Ensure the steel conduit is made liquid-tight using an extruded polyvinyl chloride jacket and that it meets the requirements of UL-360.
- Use fittings that are made of the same material and quality as the conduit run, including conduit bodies, 90° bends, weatherheads, elbows, nipples, couplings, and other hardware.
- Use Conduit Junction Boxes that are non-metallic PVC molded junction box with a weather tight screw-down cover, of nominal size 6"W x 6"L x 4"D.
- Use threaded Grounding Bushings made of malleable iron, galvanized steel, or brass; and shall have an insulating plastic insert, and lay-in lugs to hold No. 6 AWG copper wire.
- Use a Pulling Line made of Polypropylene Rope, having a minimum tensile strength of 240 pounds.
- Use Underground Warning Tape that is Heavy duty B-720 polyethylene, 0.89 mm (3.5 mils) thick, by 76 mm (3 in) wide, with APWA color RED, for electric lines.
- Use minimum 14 Ga. Tracer Wire

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Electrical Conduit.
- Install conduit as Riser, or Underground.
- Install Underground Conduit as Trenched, Bored and Jack or Directional Bored in accordance with the plans and Standard Drawings.
- Concrete used for patching pavement shall be DOT STANDARD SPECIFICATION CLASS X according to Sections 701,702,703, and 704.
- Bituminous Concrete for patching pavement shall be DOT STANDARD SPECIFICATIONS, Section 400 and 403.
- All materials will be subject to inspection for condition by the ENGINEER, just prior to incorporation into the work.
- Use standard bends, elbows, or by bending the steel conduit to make changes in direction of conduit. Steel conduit, if bent, shall have a uniform radius which will fit the location, with a minimum radius of six (6) times the internal diameter of the pipe. Sharp kinks in the conduit or the substitution of unlike materials will not be permitted.
- Use standard manufactured conduit bodies, condulets, weatherheads, elbows, nipples, tees, reducers, bends, couplings, unions, etc., of the same materials and treatment as the straight conduit, as required throughout the conduit line. Tightly connect all fittings to the conduit. Use a SOLVENT-WELD CEMENT for fitting connections with PVC conduit. Where steel conduit mates PVC, use an adapter coupling and waterproof seal.

1.3.2 Riser

- Use nipples to eliminate cutting and threading where short lengths of conduit are required. Where it is necessary to cut and thread steel conduit, no exposed threads will be permitted. All conduit fittings shall be free from burrs and rough places; and all cut conduits shall be reamed before fittings and cables are installed. All conduit runs ending in a junction box, hand box, or

other approved junction point, shall be provided with a bushing to protect the cable from abrasion. Cap future use conduit.

- Attach conduit risers to wood poles; or where specified, to the outside of steel poles. Use stainless steel bands for steel poles. Use conduit clamps/straps and galvanized screws on wood poles. Attachment shall be in accordance with the plans or Standard Drawings. Furnish each Riser with a weatherhead, which shall not be measured.

1.3.3 *Trenched*

- Unless shown otherwise, place conduits at a minimum depth of 18 inches below surface grade, and slope at a minimum rate of 6 inches per 100 feet of length, to a splice box/junction box hole or drain. Clean and swab all conduit runs before installing cables. Use DUCT-SEAL in poles, cabinets, and buildings to seal the opening.
- Where conduit passes under a curb, cut an 'X' in the curb, over the conduit. Where there is no curb, drive a stake in the ground at the end of the conduit to mark its location. Cut an 'X' to indicate the side the conduit enters, where conduit is placed in a signal pole foundation for future use.
- Restore all cuts, trenches, and openings to the original condition. Replace grass surfaces with pre-grown, cut turf (sod), in existing lawns. Rake, seed and fertilize other dirt areas. Replace any damaged trees and shrubs.

1.3.3.1 Trenching (Non-Paved Surface)

- Excavate the trenches to such depth as necessary to provide 18 inches minimum cover over the conduit. Cinders, broken concrete, or other hard abrasive materials will not be permitted in the back-filling. Clear the trench of such materials before placing the conduit. No conduit shall be placed prior to inspection by the ENGINEER. Compact the back-fill and restore the surface.

1.3.3.2 Trenching (In Paved Surface)

- Cleanly saw cut trenches across driveways or streets about 6 inches wide. Place the conduit and compact the back-fill. Provide and install the patch of like material and thickness as was removed. NO additional payment shall be made for the bituminous or concrete patching material, unless a pay item has been established for such.

1.3.3.3 Bored and Jack (Pushing)

- If pay item is provided, place steel conduit under existing roadways, driveways, sidewalks or other paved surfaces by Bore and Jack method. Such conduit shall be placed by jacking, boring, pushing, or other means approved by the ENGINEER, without cutting or removing pavement.

1.3.3.4 Trenchless (Directional Bored)

- If pay item is provided, place Schedule 80 PVC or Schedule 80 HDPE conduit under existing roadways, driveways, sidewalks or other paved surfaces by directional bore method. Conduit shall be buried at a minimum of 36 inches. Payment will not be made for damaged or crumpled conduit. An acceptable alternative material can be **SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)**.

1.3.3.5 Placed Before Pouring

- Install PVC conduit w/ Flexible Weather Tight conduit firmly attached to the bottom reinforcement bar mat or to the bottom wire mat, using plastic tie-wraps every 2 feet, at locations where conduit is placed before concrete placement in a bridge deck. At expansion joints, use 4 feet (typical) of Flexible Weather Tight steel conduit to accommodate movement. Install to NEC standards for concrete structural installations and usage, including any recommended lubricants and sleeves. Plug all conduit ends to prevent concrete penetration. When used on a bridge, provide a splice-box(es) near the center line, and terminate the conduit in hand-boxes at each end.

1.3.3.6 Open Cuts in Roadway

- Open cuts are typically not allowed, and every effort to bore under roadways and driveways shall be attempted. If utility conflicts require open cuts for installation of conduit, and where approved by the Engineer, conduit may be placed in an open cut and open cuts shall be repaired in accordance with the SCDOT Utility Accommodations Policy.

1.4 Measurement

- Electrical Conduit will be measured by LINEAR FEET, for the type, size, and method of installation specified, along the center line of the conduit from end to end, including trenched, risers, and bored-and-jacked.
- Conduit bends, conduit bodies, (condulets), 90° bends, elbows, conduit junction boxes for detector loops, miscellaneous fittings, couplings, weatherheads, adapters, bushings, locknuts, and other items shall be incidental to conduit installation and shall NOT be measured.
- Unless otherwise specified, trenching, back-filling, and patching will NOT be measured for payment.
- If more than one conduit is installed within a directional bore, payment will be made for the directional bore from box to box. The additional runs of conduit will be paid per LF of additional conduit (pay item 675027Z) from box to box.
- F&I Encased Conduit work includes all equipment, manpower and materials to furnish and install conduit in an open cut paved area within a travel way; this work is paid by linear feet (LF):

1.5 Payment**For conduit either Trenched or Riser:**

6750005	FURNISH & INSTALL 1.0" GALVANIZED RIGID CONDUIT	LF
6750015	FURNISH & INSTALL 2.0" GALVANIZED RIGID CONDUIT	LF
6750025	FURNISH & INSTALL 3.0" GALVANIZED RIGID CONDUIT	LF
6750181	FURNISH & INSTALL 1.0" ALUMINUM CONDUIT	LF

For bored and jacked:

6750078	FURNISH & INSTALL 1.0" GALVANIZED RIGID CONDUIT (BORED AND JACKED)	LF
6750085	FURNISH & INSTALL 2.0" GALVANIZED RIGID CONDUIT (BORED AND JACKED)	LF
6750090	FURNISH & INSTALL 3.0" GALVANIZED RIGID CONDUIT (BORED AND JACKED)	LF

For high accuracy directional boring:

675027S	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT (DIRECTIONAL BORED)	LF
675027V	FURNISH & INSTALL 3.0" SCHEDULE 80 PVC CONDUIT(DIRECTIONAL BORED)	LF
675027Y	FURNISH & INSTALL 4.0" SCHEDULE 80 PVC CONDUIT(DIRECTIONAL BORED)	LF
675027Z	FURNISH ADDITIONAL CONDUIT WITHIN DIRECTIONAL BORE	LF
6760050	FURNISH & INSTALL 1" SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)	LF
6760060	FURNISH & INSTALL 2" SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)	LF
6760070	FURNISH & INSTALL 3" SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)	LF
6760080	FURNISH & INSTALL 4" SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)	LF

For flexibility:

6750175	FURNISH & INSTALL 1.0" FLEXIBLE GALVANIZED STEEL CONDUIT - WEATHER TIGHT	LF
6750179	FURNISH & INSTALL 2.0" FLEXIBLE GALVANIZED STEEL CONDUIT - WEATHER TIGHT	LF
675017D	FURNISH & INSTALL 3.0" FLEXIBLE GALVANIZED STEEL CONDUIT - WEATHER TIGHT	LF

Open Cut:

6750262	FURNISH & INSTALL ENCASED CONDUIT (2-2" PVC, SCHEDULE 40)	LF
6750263	FURNISH & INSTALL ENCASED CONDUIT (3-2" PVC, SCHEDULE 40)	LF

677.1 ELECTRICAL CABLE

1.1 Description

This work shall consist of furnishing and installing traffic signal, loop lead-in, pedestrian signal, and pedestrian push button Electrical Cable of the size and type shown on the Plans or detailed in the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Electrical Cable.

1.3.2 Field Wiring

- Install SPLICE-FREE cable runs. Make all connections at terminal blocks, or in the controller cabinet.
- Install all field wiring in accordance with applicable Electrical Codes--National, State, and Local. Where required, arranging for PERMITS and/or electrical INSPECTION is the responsibility of the Contractor.
- Provide at least 3 feet of cable slack at each splice box, strain pole base, and cabinet. Neatly coil and bind the slack with a nylon tie.
- At the cabinet end, label each cable, using nylon cable markers, and indelible pen, indicating the Phase and/or Approach (NB, EB, etc.).
- Cabinet connections shall correspond to the COLOR-CODE shown on the Standard Drawing 675-110-00 TYPICAL WIRE & CABLE USAGE sheet; (green wire to green signal circuit, etc.).
- Replace the entire length of cables damaged during installation, without further cost to the Department.
- All electrical cable installed in conduit shall be drawn in place, free from electrical and mechanical injury. When a lubricating agent is needed, use a wire pulling compound compatible with the cable insulation.
- Install in conduit any vertical cable runs mounted on the outside of poles as shown on the plans or in the Standard Drawings.
- Use weather service heads wherever electrical cable directly enters a strain pole or a vertical conduit run.
- Provide drip loops of at least 8 inches at all overhead entrance points such as signal heads, strain poles, or weather heads.
- If any splices in homerun cables are detected, all work will cease by the contractor in that district until new wire is pulled to replace the spliced joint.

1.3.3 Traffic Signal Wiring

- Install each cable run with the number of conductors indicated in the Standard Drawing 675-110-00 Typical Wire and Cable Usage. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.
- Run a separate cable for each phase or approach in accordance with Standard Drawing 675-110-00 Typical Wire and Cable Usage.
- The list below is a guide to general usage--

Signal: Jumpers	4 pair (8 conductor) BLACK
Signal: To Each Approach	4 pair (8 conductor) BLACK

1.3.4 Loop lead-in Wiring

- Install each cable run with the number of conductors indicated in the Standard Drawing 675-110-00 Typical Wire and Cable Usage. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.
- Run a separate cable to each corner of the intersection in accordance with Standard Drawing 675-110-00 Typical Wire and Cable Usage.
- The list below is a guide to general usage--

Loop: To Each Corner	4 pair (8 conductor) GRAY
Loop Lead-in	2 pair (4 conductor) GRAY

1.3.5 Pedestrian Signal Head Wiring

- Install each cable run with the number of conductors indicated in the Standard Drawing 675-110-00 Typical Wire and Cable Usage. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.
- Run a separate cable for each phase or approach in accordance with Standard Drawing 675-110-00 Typical Wire and Cable Usage.
- The list below is a guide to general usage--

Pedestrian Signal	2 pair (4 conductor) BLACK
Pedestrian Push Button	2 pair (4 conductor) GRAY
Loop Lead-in	2 pair (4 conductor) GRAY

1.3.6 Push Button Wiring

- Install each cable run with the number of conductors in accordance with Standard Drawing 675-110-00 Typical Wire and Cable Usage. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.
- A separate cable should be run for each phase or approach in accordance with Standard Drawing 675-110-00 Typical Wire and Cable Usage.
- The list below is a guide to general usage--

Pedestrian Push Button	2 pair (4 conductor) GRAY
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1.3.7 Electrical Conduit

All conduit and elbows shall be installed as described in the appropriate Specification.

See 675.1 ELECTRICAL CONDUIT.

See 688.7 CONTROLLERS AND 332/336 CABINETS.

See 688.5 STEEL STRAIN POLE AND FOUNDATION.

1.4 Measurement

- With the exception of the electrical service cable, electrical cable lengths of the size and numbers of conductors specified, shall be measured by LINEAR FEET as actually furnished and installed, completely in place and accepted, with each size cable being a separate pay item.

1.5 Payment

6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	LF
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	LF
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR - BLACK	LF
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR - GRAY	LF

677.3 FIBER OPTIC CABLE

1.1 Description

This work shall consist of furnishing and installing single-mode fiber optic (SMFO) cable in conduit and risers or overhead lashed to new messenger cable.

1.2 Materials

Acceptable single-mode fiber optic (SMFO) cable shall meet all requirements stated in RUS-90 and shall be an accepted product of the United States Department of Agriculture Rural Utility Service as meeting the requirements of RUS-PE-90. The cable shall be new, unused, and of current design and manufacture. More information concerning these industry standards can be found on the SCDOT website, *677.3 Fiber Optic Cable Industry Standards*, http://www.scdot.org/doing/publications_Traffic.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Fiber Optic Cable.
- The CONTRACTOR shall furnish all materials and attachment hardware and installation guides necessary to install the fiber optic cable in accordance with Standard Drawing 675-125-00 Interconnect. Install fiber optic cable where, and in the manner indicated on the Plans, or as needed to maintain communications in an existing fiber network, in accordance with the standard drawings.
- The CONTRACTOR shall order cable in reel lengths that are of sufficient length to require no intermediate splicing of the cable.
- Prior to installation, the CONTRACTOR SHALL PROVIDE certified TEST RESULTS from the manufacturer showing the cable furnished has been tested and meets Industry Standards, 677.3 Fiber Optic Cable.
- The CONTRACTOR shall take every precaution to ensure the fiber optic cable is not damaged during storage and installation. Do not step on the fiber optic cable or run over the fiber optic cable by any vehicle or equipment. Do not pull the fiber optic cable along the ground or over or around obstructions.
- Ensure the fiber optic cable is packaged on wooden reels. These reels shall not contain imperfections such as broken flanges or nails that may cause damage to the cable as it is unreeled.
- Each cable reel shall have a durable weatherproof label that shows the actual length of cable on the reel.
- The CONTRACTOR shall coordinate his overhead and underground construction activities on a continuing basis with each of the utility agencies which have facilities in the immediate vicinity.

1.3.2 Bends and Tensioning

- During installation, the CONTRACTOR shall provide cable blocks at least every 50 feet to guide the cable and reduce pulling tension. All pulling equipment and hardware that will contact the cable during installation must maintain the minimum bend radius of the fiber optic cable as listed in Table 1. Corner blocks, appropriately sized to ensure that the minimum bending radius of the cable is maintained, shall be provided whenever fiber optic cable must be pulled around a corner.

Table 1 Fiber Optic Minimum Bend Radius Chart

Nominal Cable Diameter		Minimum Bend Radius (No Tension) Installed		Minimum Bend Radius (Under Tension)	
		Centimeter s	Inches	Centimeter s	Inches
6.0 – 10.0	(1/4 – 3/8)	10.0	(4.0)	15.0	(6.0)
10.1 – 15.0	(4/10 – 6/10)	15.0	(6.0)	22.5	(9.0)
15.1 – 20.0	(10/16 – 8/10)	20.0	(8.0)	25.0	(10.0)
20.1 – 23.0	(13/16 – 9/10)	23.0	(9.0)	25.0	(10.0)
23.1 – 25.0	(15/16 – 1.0)	25.0	(10.0)	30.0	(12.0)

- Fiber optic cable shall not be pulled through any intermediate junction box, manhole, pull box, pole base or any other opening in the conduit unless specifically required by the ENGINEER in specific facilities. The necessary length of cable to be installed shall be pulled from one junction box,

manhole, pull box, pole base, or cabinet to the immediate next downstream manhole, box, pole base, or cabinet. The remaining length of cable to be installed in the next conduit shall be carefully stored in a manner that is not hazardous to pedestrian or vehicular traffic yet ensures that no damage to the cable shall occur. The cable shall be stored in a manner that shall allow that length of cable to be safely pulled into the next conduit. The ENGINEER shall approve the storing methods to be used.

- Cable reel lagging shall remain on the cable reels until they arrive at the pulling site. If the lagging has been removed, the CONTRACTOR shall securely fasten the cable ends to avoid damage during transit.
- If the cable must be unreeled during installation, use the “figure-eight” configuration to prevent kinking or twisting of the fiber optic cable. The preferred size of the “figure-eight” is 15 feet with each loop about eight (8) feet in diameter. The fiber optic cable shall not be coiled in a continuous direction except for lengths of 100 feet or less.
- The CONTRACTOR shall not increase the tension on the messenger cable to which the fiber optic cable has already been lashed.
- At the completion of a day’s installation, the CONTRACTOR shall protect the cable from moisture by placing a cable cap and/or several wraps of tape on the tip of the cable.
- The CONTRACTOR shall record the cable meter marks at every other pole location and at the fiber splice points on a set of as-built plans. Two (2) copies of the plans showing the meter marks shall be provided to the ENGINEER. The meter marks are most easily obtained while forming drip loops.
- The CONTRACTOR shall route the fiber optic cable on the inside of messenger intersections at dead ends and crossovers.

1.3.3 Aerial Installation

- Where the plans call for aerial installation, the CONTRACTOR shall furnish new messenger cable (see 682.3 Steel Cable) and shall lash the fiber optic cable to the new messenger.
- Install aerial cable either manually or by using the moving reel method. If the CONTRACTOR proposes to use the moving reel method, the CONTRACTOR shall submit to the ENGINEER the cable manufacturer’s recommended procedures for this installation technique at least seven (7) days prior to beginning the installation of the fiber optic cable.
- Maintain the required clearances between the fiber optic cable and the utility features as follows unless otherwise noted on the PLANS:
 - 4 inches minimum vertical clearance and 12 inches minimum total (diagonal) separation to the telephone and/or cable vision facilities.
 - 40 inches minimum vertical clearance to all electrical transformers.
 - 40 inches minimum vertical clearance to all electric lines (including street light circuits).
- Where called for on the PLANS or as directed by the ENGINEER, furnish fiberglass extension arms and utilize to install the new fiber optic cable. Provide MIF PH6-2 fiberglass extension arms or approved equal.
- Where called for on the PLANS, the CONTRACTOR shall install down guys, sidewalk guys, and aerial guys in accordance with 682.2 Back Guy and as shown in the standard drawings.
- The CONTRACTOR shall use a Kellems® (or approved equal) grip wire mesh pulling grip and swivel to prevent damage to the cable during cable pulls.
- The CONTRACTOR shall provide drip loops for the fiber optic cable at all utility poles to which the fiber optic cable is attached. The drip loops must be of the “smooth-curve” type and shall be at least of the recommended dimensions for a drip loop in the typical details. Form drip loops by hand or by using an expansion loop-forming tool. Support the cable with straps and spacers in the absence of lashing wire support and to hold the cable bundles together. Install the strap and spacer no closer than 4 inches to the first bend in the drip loop.
- Where called for on the PLANS, the CONTRACTOR shall install backlashes in the Fiber Optic cable as necessary. The CONTRACTOR shall utilize 16 inch Fiber Optic Strand Storage Bracket (Multilink model number 2116-SSPTB or approved equivalent) which are also known as “Fiber Optic Sno Shoes”. All hardware necessary for the installation of the backlash including the “Fiber Optic Sno Shoes”, and lashing of the additional cable shall be incidental to the cost of Furnishing and Installing the Fiber Optic cable.
- The straps and spacers used for drip loops and other fiber optic cable handling purposes shall be hand-tight only. The strap and spacer must be loose enough to allow longitudinal travel by the cable, but tight enough to prevent the strap and spacer from moving on the messenger cable.
- Over lash the fiber optic cable to the messenger cable (See 682.3 Steel Cable - 1/4” galvanized steel cable). Use aluminum wrapping tape spaced at intervals not exceeding 380 mm or with 1.5 mm (minimum) diameter galvanized steel spiral cable wrap for lashing. Wrapping tape, if used shall be 1.3 mm x 7.6 mm. Use at least 4 turns. Accomplish the lashing in the manner that results in the

wire and the cable appearing to be an integral part of the support cable. Install fiber optic cable without loose lashing, twisting or weaving along the messenger.

- The CONTRACTOR shall terminate the lashing wire with a lashing wire clamp as the cable run is lashed up, span-by-span. Terminate the lashing wires as follows:
 - 1) Place a cable spacer between the fiber optic cable and the messenger.
 - 2) Locate lashing wire clamp 2 inches from strap and spacer. Pull enough lashing wire out of lasher to terminate into the lashing wire clamp.
 - 3) Wrap the lashing wire 3 times around only the messenger between the lashing wire clamp and the planned location of the first wrap around both the strand and fiber optic cable.
 - 4) Secure the lashing wire as shown in the typical details.

1.3.4 Underground Installation

Where shown on the PLANS, install the fiber optic cable in new underground conduit and risers.

- Seven (7) days prior to the installation of fiber optic cable in conduit is performed, the CONTRACTOR shall provide the ENGINEER with 4 copies of the cable manufacturer's recommended and maximum pulling tensions and a list of the cable manufacturer's approved pulling lubricants. Only use those lubricants in the quantity recommended by the fiber optic cable manufacturer.
- When installing the cable in underground conduit, the maximum allowable pulling tension for the cable installation by the CONTRACTOR shall not exceed 70 percent of the manufacturer's maximum pulling tension. If the cable is pulled by mechanical means, use a dynamometer (clutch device) approved by the ENGINEER to ensure that a maximum allowable pulling tension is not exceeded at any time during installation.
- Fiber optic cable shall not be pulled over edges or corners, over or around obstructions or through unnecessary curves or bends. Use approved cable guides, feeders, shoes and bushings to prevent damage to the cable during installation.
- Use sealing bushings rather than weather heads on all risers containing fiber optic cable. The sealing bushings shall conform to the typical detail shown.
- Ensure conduit bends and cabinet entrance fittings used by the fiber optic cable network are designed to accommodate the bending radius limitations of the fiber optic cable used.

1.3.5 Splice

Splice the fiber optic cable only at those points shown in the PLANS. The designated splices proposed for installation in each controller cabinet consist of one of the following:

- Fibers Interconnect Centers – This splice in the cabinet shall be installed in accordance with 677.4 Fiber Interconnect Center
- The CONTRACTOR shall pull an adequate amount of fiber optic cable into the controller cabinet to perform splicing and to provide approximately 50 feet of slack cable (approximately 25 feet from the entering and 25 feet from the exiting cable). After the fiber optic cable has been spliced, the cable shall be neatly coiled (with tie-wraps placed on the cable) and placed on top of the fiber interconnect center or on the bottom of the cabinet. The cable shall be readily accessible to enable maintenance personnel to perform splicing of the cable in a vehicle located near the controller cabinet.
- Factory Terminated Patch Panel – This aerial splice and plug into cabinet shall be installed in accordance with 677.6 Factory Terminated Patch Panel
- Fiber optic cable runs shall be continuous between allowable splice points. The CONTRACTOR shall carefully determine the length of fiber optic cable necessary to reach from termination point to termination point. Splicing of fiber optic cable in conduit, pole bases, manholes, or pull boxes shall not be permitted.

1.3.6 Utilities

- Relocation of overhead utilities will be made by others and is not a part of this Contract.
- Where fiber optic cable is to be installed on overhead poles, the CONTRACTOR shall exercise care in temporary placement of installation equipment to provide safety to the public and to prevent damage to existing facilities. Should the CONTRACTOR cause damage to any existing cables and/or equipment, the CONTRACTOR shall immediately notify the ENGINEER and the affected owner and the CONTRACTOR shall repair or have the repair made at no additional cost.

1.3.7 Grounding and Bonding

- All metal conduits shall be grounded.
- All conduit, terminal cabinets, anchor bolts and reinforcing bar cages shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Use #6 AWG bare stranded copper wires for the grounding or bonding conductor.

- Bonding of metallic conduit in pull boxes and other installations, where the conduit is not coupled, shall be coupled with metallic conduit ground bushings having smoothly rounded molded insulated inserts and bonding jumpers.
- The CONTRACTOR shall furnish and install all grounding facilities.

1.3.8 **Fiber Optic Cable Tests**

- Continuity - Prior to the installation of any fiber optic cable, the CONTRACTOR shall test the continuity of each fiber using an Optical Time Domain Reflectometer (OTDR). The test shall be conducted while the fiber is still on the reel and the test results shall be provided to the ENGINEER.
- Contractor shall provide documentation indicating that all optic fibers have been proof tested by the fiber manufacturer at a minimum load of 50 kpsi.
- Contractor to provide documentation that all optical fibers have been 100% attenuation tested by the manufacturer. The attenuation of each fiber shall be provided with each cable reel.
- Splice Loss - After the installation of the fiber optic cable, the CONTRACTOR shall test the dB loss for every splice of the fiber optic cable in accordance with procedures established in the OTDR operator's manual. The testing may be done in conjunction with the splicing of the cable. Any splice that has a splice loss >0.09 dB shall be re-spliced.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the location of the splice (Intersection name, splice tray #), the fiber (by buffer tube and fiber color), and the splice loss in dB.
- Connector/End Splice Testing - The CONTRACTOR shall test each connector/end splice loss in one (1) direction using an OTDR in accordance with procedures established in the OTDR operator's manual. The average mated connector/end splice loss shall be <0.5 dB. Individual mated connector pair/end loss shall be <0.7 dB. Any connector/end splice with a loss greater than 0.7 dB shall be replaced, by the CONTRACTOR. Any replacement connectors/ends shall also be tested.
- End-to-End Attenuation Testing - The CONTRACTOR shall perform end-to-end testing of each fiber between each place point at 1310 nm and 1550 nm in one (1) direction in accordance with EIA/TIA 526-7.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the two (2) ends of the test site, the fiber tested, the wavelength tested, the reference power output, and the system attenuation in dB.
- The CONTRACTOR shall provide OTDR Signature traces of all fibers between all intersections for system documentation and restoration purposes.

1.4 **Measurement**

- Fiber optic cable, of the type and size specified will be measured by linear feet of cable actually furnished and installed, completely in place and accepted, using an "OTDR" (optical time-domain reflectometer). Such payment shall be full compensation for furnishing all material, labor, hardware, equipment and incidentals necessary for furnishing and installing communications cable and completing the work as specified.
- Note that electrical conduit, splice boxes, splice cabinets, and steel span wire are listed elsewhere as separate pay items.

1.5 **Payment**

6770470	FURNISH & INSTALL 12 STRAND FIBER OPTIC CABLE – SINGLE MODE	LF
677046D	FURNISH & INSTALL SELF SUPPORTING 12 STRAND FIBER OPTIC CABLE - SINGLE MODE	LF

677.4 FIBER INTERCONNECT CENTER

1.1 Description

This work shall consist of furnishing and installing a Fiber Interconnect Center, including splicing the fiber optic cable and all necessary material to accomplish this work in accordance with this specification and standard drawings.

1.2 Materials

The Fiber Interconnect Center shall include ST adapter panel, strain relief hardware, be rack mountable, have the capacity for 4 Fusion Splice Trays and termination/connection capacity for 24 fibers in 4 modules. The Center shall be a Systimax 600G2-1U-UP-SD or approved equivalent.

The interconnect center shall be equipped with 2 fiber optic modular connector panels with 24 factory-installed interconnection sleeves. The modular interconnection panels shall be clearly labeled (transmit/receive). The interconnection sleeves shall be types ST compatible, with ceramic insert, and composite housing for single-mode fiber optic cable. These shall be Systimax MODG2-6ST-SM-PT-A and MODG2-6ST-SM-PT-B or approved equivalent.

Each interconnect center shall be furnished with 3 Fusion Splice Trays. The trays shall be capable of accepting 12 fusion and 6 mechanical splices. The tray shall be a Systimax RS-2AF-16SS or approved equivalent.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Fiber Interconnect Center.
- Multiple splices may be required to connect all incoming fibers to traffic signal network.

1.3.2 Cabinet

- Install the Fiber Interconnect Center in the controller cabinet. Place the Fiber Interconnect Center in the cabinet such that the slack fiber optic cable stored on top of the fiber interconnect center (in accordance with 677.3 Fiber Optic Cable) can be easily removed (along with the fiber interconnect center) from the cabinet and taken to a maintenance vehicle for splicing.
- Provide all necessary materials and hardware including furnishing and installing splice trays, interconnection sleeves, jumpers, and connectors needed for connecting the fiber optic cable to the signal communications network.

1.3.3 Splicing Methods

- Use the fusion-splice technique to perform all splicing, which induces less than 0.3 dB attenuation, unless noted otherwise in the special provisions. Recoat bare fibers with a protective RTV gel or similar substance prior to application of the sleeve or housing to protect the fiber from scoring, dirt, or microbending. Package each spliced fiber in a heat shrink protective sleeve or housing. Perform all splices in accordance with the cable manufacturer's and the splice manufacturer's recommendations. During splicing, the CONTRACTOR shall maintain the continuity of the buffer tube and fiber color.
- Provide incoming fibers with 5 feet of coiled slack and splice to a pigtail of the same type fiber. Pigtails shall have a minimum length of 5 feet and shall have a factory-installed ST compatible connector. The pigtails shall have an attenuation of less than 0.3 dB. The ST connector shall mate with the connector panels installed in the fiber interconnect center.
- Protect unused optical fibers with sealed end caps.
- The CONTRACTOR shall record the meter marks on the cable sheath at each splice point. Provide these marks to the Engineer as part of the as-built system plans at the completion of the project.

1.3.4 Jumpers

- The CONTRACTOR shall furnish and install 2 single-mode fiber optic cable assemblies with connectors factory-installed on each end (jumpers). These assemblies will be used to connect the fiber optic

modem to the connector panel. These jumpers will not be paid for directly but shall be considered incidental to the item Furnish and Install Fiber Optic Modem.

1.3.5 Future Applications

- The fiber optic communications network shall accommodate future applications. As shown in the standard drawings, fusion splice all six fibers in one buffer tube of the entering cable through to the six fibers in one of the buffer tubes leaving the cabinet. Maintain the continuity of the buffer tube and fiber color. Splice these fibers in a separate splice tray. The cable entering and exiting the cabinet will contain another buffer tube that contains six fibers. Fusion-splice three of the incoming and three of the outgoing fibers to pigtail assemblies with factory-installed type ST compatible connectors. Place these six splices in a second splice tray. Fusion-splice the remaining three incoming and three outgoing fibers to pigtail assemblies with factory-installed type ST compatible connectors and placed in a third tray. Connect all pigtail assemblies to the connector panels installed in the Fiber Interconnect Center. Clearly label the Transmit and Receive designations of each fiber pair on the front of the connector panel. Test each fiber termination/connection for attenuation.

1.3.6 Fiber Optic Cable Tests

- Continuity - Prior to the installation of any fiber optic cable, the CONTRACTOR shall test the continuity of each fiber using an Optical Time Domain Reflectometer (OTDR). Conduct the test while the fiber is still on the reel and provide the test results to the ENGINEER.
- Splice Loss - After the installation of the fiber optic cable, the CONTRACTOR shall test the dB loss for every splice of the fiber optic cable in accordance with procedures established in the OTDR operator's manual. The testing may be done in conjunction with the splicing of the cable. Any splice that has a splice loss >0.09 dB shall be re-spliced.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the location of the splice (Intersection name, splice tray #), the fiber (by buffer tube and fiber color), and the splice loss in dB.
- Connector/End Splice Testing - The CONTRACTOR shall test each connector/end splice loss in one (1) direction using an OTDR in accordance with procedures established in the OTDR operator's manual. The average mated connector/end splice loss shall be <0.5 dB. Individual mated connector pair/end loss shall be <0.7 dB. Replace any connector/end splice with a loss greater than 0.7 dB. Test any replacement connectors/ends.
- End-to-End Attenuation Testing - The CONTRACTOR shall perform end-to-end testing of each fiber between each place point at 1310 nm and 1550 nm in one (1) direction in accordance with EIA/TIA 526-7.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the two (2) ends of the test site, the fiber tested, the wavelength tested, the reference power output, and the system attenuation in dB.
- The CONTRACTOR shall provide OTDR Signature traces of all fibers between all intersections for system documentation and restoration purposes.

1.4 Measurement

- This item shall include the labor, equipment, and materials necessary to furnish and install the fiber optic interconnect centers in accordance with the PLANS and Standard Drawings. This item shall be measured by the number of each installed, which shall be full compensation for furnishing and installing the fiber interconnect centers into the signal controller cabinets and making the necessary connections. The fusion splicing of the cable, furnishing and installing the splice trays, pigtail assemblies, connector panels and interconnection sleeves shall be considered incidental to this item and will not be paid directly.
- Pay item 6770486 may be used to pay for additional fiber splices required if more than one fiber trunk is to be interconnected at signal. This pay item includes all necessary items needed to provide this interconnection.

1.5 Payment

6770476	FURNISH & INSTALL FIBER OPTIC INTERCONNECT CENTER	EA
6888092	INSTALL FIBER OPTIC INTERCONNECT CENTER	EA
6770486	FIBER OPTIC REPAIR SPLICE OH/UG	EA

677.6 FACTORY TERMINATED PATCH PANEL

1.1 Description

This work shall consist of furnishing and installing a Factory Terminated Patch Panel, including splicing the fiber optic cable and all necessary material to accomplish this work in accordance with this specification and standard drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Factory Terminated Patch Panel.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- Multiple splices may be required to connect all incoming fibers to traffic signal network.

1.3.2 Cabinet

- The factory terminated patch panel shall be installed by the CONTRACTOR between the controller cabinet and the overhead fiber optic cable run. The factory terminated patch panel shall be located in the cabinet such that the slack fiber optic cable is safely stored (in accordance with 677.3 Fiber Optic Cable).
- Provide all necessary materials and hardware including furnishing and installing interconnection sleeves, jumpers, and connectors needed for connecting the fiber optic cable to the signal communications network.

1.3.3 Splicing Methods

- When using a preterminated, molded patch panel unit that serves as the drop cable and fiber interconnect center (patch panel/fusion splice containment) the free end shall be spliced to the trunk fiber optic cable in an approved aerial enclosure according to the splice plan. The overhead splice and enclosure and all necessary materials and hardware is incidental and should be included in pay item.
- Use the fusion- splice technique to perform all splicing, which induces less than 0.3 dB attenuation, unless noted otherwise in the special provisions. Recoat bare fibers with a protective RTV gel or similar substance prior to application of the sleeve or housing to protect the fiber from scoring, dirt, or microbending. Package each spliced fiber in a heat shrink protective sleeve or housing. Perform all splices in accordance with the cable manufacturer's and the splice manufacturer's recommendations. During splicing, the CONTRACTOR shall maintain the continuity of the buffer tube and fiber color.
- Protect unused optical fibers with sealed end caps.
- *The CONTRACTOR shall record the meter marks on the cable sheath at each splice point.* Provide these marks to the Engineer as part of the as-built system plans at the completion of the project.

1.3.4 Jumpers

- The CONTRACTOR shall furnish and install 2 single-mode fiber optic cable assemblies with connectors factory-installed on each end (jumpers). These assemblies will be used to connect the fiber optic modem to the Factory terminated patch panel. These jumpers will not be paid for directly but shall be considered incidental to the item Furnish and Install Factory terminated patch panel.

1.3.5 Future Applications

- Splice all fiber strands and connect to accommodate future applications.

1.3.6 Fiber Optic Cable Tests

- Continuity - Prior to the installation of any fiber optic cable, the CONTRACTOR shall test the continuity of each fiber using an Optical Time Domain Reflectometer (OTDR). Conduct the test while the fiber is still on the reel and provide the test results to the ENGINEER.
- Splice Loss - After the installation of the fiber optic cable, the CONTRACTOR shall test the dB loss for every splice of the fiber optic cable in accordance with procedures established in the OTDR operator's manual. The testing may be done in conjunction with the splicing of the cable. Any splice that has a splice loss >0.09 dB shall be re-spliced.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the location of the splice (Intersection name, splice tray #), the fiber (by buffer tube and fiber color), and the splice loss in dB.
- Connector/End Splice Testing - The CONTRACTOR shall test each connector/end splice loss in one (1) direction using an OTDR in accordance with procedures established in the OTDR operator's manual. The average mated connector/end splice loss shall be <0.5 dB. Individual mated connector pair/end loss shall be <0.7 dB. Replace any connector/end splice with a loss greater than 0.7 dB. Test any replacement connectors/ends.
- End-to-End Attenuation Testing - The CONTRACTOR shall perform end-to-end testing of each fiber between each place point at 1310 nm and 1550 nm in one (1) direction in accordance with EIA/TIA 526-7.
- The CONTRACTOR shall provide hardcopy test results to the ENGINEER that identify the two (2) ends of the test site, the fiber tested, the wavelength tested, the reference power output, and the system attenuation in dB.
- The CONTRACTOR shall provide OTDR Signature traces of all fibers between all intersections for system documentation and restoration purposes.

1.4 Measurement

- The bid for the Factory terminated patch panel shall include the cost of furnishing and installing the Factory terminated patch panel into the signal controller cabinets, splicing into fiber trunk overhead and making all the necessary connections.
- The fusion splicing of the cable, pigtail assemblies, connector panels and interconnection sleeves shall be considered incidental to this item and will not be paid directly.
- This item shall include the labor, equipment, and materials necessary to install the Factory terminated patch panel in accordance with the PLANS and Project Special Provisions. This item shall be measured by the number of each installed.
- Pay item 6770486 may be used to pay for additional fiber splices required if more than one fiber trunk is to be interconnected at signal. This pay item includes all necessary items needed to provide this interconnection.

1.5 Payment

6888082	FURNISH & INSTALL FACTORY TERMINATED PATCH PANEL	EA
6888093	INSTALL FACTORY TERMINATED PATCH PANEL	EA
6770486	FIBER OPTIC REPAIR SPLICE OH/UG	EA

677.7 WIRELESS NETWORK COMMUNICATIONS LINK

1.1 Description

This work shall consist of installing a Wireless Network Communications Link with all necessary hardware in accordance with the plans and standard drawings to provide a data link between field devices (i.e. Traffic Signal Controllers).

1.2 Materials

Wireless Communications Equipment provided by others (generally SCDOT). Cable shall be as follows or equal:

Superior Essex	Cabling	CAT 5e Ethernet cable
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1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Wireless Network Communications Link.
- The Contractor shall furnish the ENGINEER with any warranties on materials provided by the Manufacturer or Vendor as normal trade practice.
- A Wireless Network Communications Link is used to network two Traffic Signal Cabinets together. Each link consists of Master ODU (Out Door Unit, *Antenna*) connected to a data switch within one of the signal cabinets and a Slave ODU connected to a data switch within the other signal cabinet. Each ODU is aligned to face the opposing ODU. The cable length between the ODU and its associated data switch may not exceed 300 feet.
- Wireless Network Communications Link components at each of the linked traffic signal cabinets includes an ODU, a LPU (Lightning Protection Unit), power supply mounting hardware, and CAT 5e cabling. The ODU is pole mounted per manufacturer’s specifications. The LPU and power supply are mounted within the traffic signal cabinet. CAT 5e cable is installed between the ODU and LPU.

1.3.2 Site Survey

- **Perform a radio path Site Survey test before installing any equipment.** For the applicable frequency spectrum of the radios being deployed, perform a spectrum analysis to ensure no competing equipment in the area. Ensure the radio path site survey test is performed using the supplied brand of radio equipment to be deployed. Typically, if the ODUs can be mounted with clear line of sight between them, this is sufficient to ensure proper operation. If this is not possible, it may be determined that a repeater station is necessary to complete the intended link. Provide the test results to the ENGINEER for review and approval. Submit copies of the test results and colored copies of the frequency spectrum scan along with an electronic copy of this information. The ENGINEER will approve final locations of the ODUs and any necessary repeater stations.

1.3.3 Antenna

- Install each ODU in such a manner that avoids conflicts with other utilities (separation distances in accordance with the guidelines of the NESC) and as specified in the ODU manufacturer’s recommendations. Secure the ODU mounting hardware to the pole and route the CAT 5E cable such that no strain is placed on the RJ-45 connectors. Align each antenna/radio to be perpendicular to the ground (using bubble level) and to face the opposing radio

1.3.4 Cable

- Install Cat 5E cable between the ODU and the LPU. Terminate each end with compatible RJ-45 connector. Perform end-to-end continuity test and 1 GigaBit/sec transmission tests using Ethernet Twisted Pair test gear. Provide test results to ENGINEER.
- Lightning Protection Unit (LPU)- Install LPU in Signals cabinet per manufacturer’s instructions. Connect CAT 5e cable to LPU

1.4 Measurement

- Pay Item 677048B INSTALL WIRELESS NETWORK COMMUNICATIONS LINK BETWEEN TWO TRAFFIC SIGNALS is measured as EACH unit. This pay item includes furnishing mounting hardware and cable for ODU, installing ODU and cable, installing cabinet equipment, and adjusting ODU as needed for optimum communications for both ends of the link (Master ODU at one signal and Slave ODU at the other signal. Actual ODUs and associated equipment provided by others (generally SCDOT).

1.5 Payment

677048B	INSTALL WIRELESS NETWORK COMMUNICATIONS LINK BETWEEN TWO SIGNALS	EA
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678.1 DETECTOR LOOP

1.1 Description

This work shall consist of furnishing and installing a Detector Loop within and alongside the roadway, at the locations shown on the Plans, and in accordance with Standard Drawing 675-120-00. A Detector Loop installation shall consist of: installing the required conduit runs; making the pavement saw cut; placing the required number of turns of loop wire in the saw cut; creating a twisted pigtail; splicing the pigtail to the shielded, twisted pair lead-in cable; connecting the lead-in cable to the back-panel terminals at the controller cabinet; verifying proper detection of traffic; and sealing the saw cut. Several items used to create a complete detector installation are specified elsewhere. They are: FURNISH AND INSTALL ELECTRICAL CONDUIT; and FURNISH AND INSTALL SPLICE BOXES/ JUNCTION BOXES. The "junction point" referred to in the specifications below, is defined to be a splice box, or a conduit junction box as specified on the Plans.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Detector Loop.
- The LOCATION and SIZE of each loop shall conform to the Plans and to the Standard Drawings.
- The front of each loop shall typically located 12 to 36 inches in front of the Stop Line, however, the final location will be determined by the ENGINEER based on field conditions.
- Center loops in the traffic lane in accordance with the Standard Drawings and as shown on the Plans.
- Stage loop installation so that each entire loop installation (from saw cut to sealing) is completed within the same working day with minimum blockage of traffic.
- Cut all presence loops, left turn lanes and side streets, in a quadrupole design, in accordance with the standard drawings.
- Provide a 5-year workmanship warranty for the loops following Final Acceptance. The CONTRACTOR will return to repair or replace any loops rising up or pulling from the pavement or not functioning within warranty period at no additional cost.

1.3.2 Saw Cuts

- Prior to cutting, mark the intended saw cut using paint or chalk on the pavement and obtain approval from the ENGINEER.
- The Contractor shall slot the roadway using a diamond or abrasive rotary power-saw with a blade approximately 3/8 INCH IN WIDTH.
- Use a power-driven walk-along model saw , not a hand-tool.
- The MINIMUM DEPTH of each Saw cut shall be:
 - 2 INCHES DEEP in CONCRETE; and
 - 2-1/2 INCHES DEEP in BITUMINOUS pavement; and
 - 3 INCHES DEEP for any Quadrupole loop or loop with 4 turns.
- Cut the corners diagonally to prevent sharp edges in accordance with the standard drawings. Extend the saw cuts to provide full-depth.
- Wash out and blow dry saw cuts to ensure the cut is free from dust, grit, oil and moisture before the placement of wire. Use compressed air to blow dry.
- If the Engineer gives written approval, the curb and gutter may be saw cut. If saw cutting of curb and gutter is not permitted, drill a 1 ½-inch hole under the curb at a 45 degree angle.
- Avoid pavement seams or cracks. However, when it is necessary to traverse a crack, drill a 2-inch diameter hole at least 3 inches deep, and provide slack in the loop wire to allow for expansion and contraction.

1.3.3 Loop Wire

- Install each loop wire in a continuous and splice-free manner.
- Do not install provide any wire with cuts, breaks, or nicks in the insulation. The Engineer will not accept damaged loop wire.
- Wire all loops in one direction, counter-clockwise only.
- Each loop shall have the number of turns shown below, or as indicated on the Plans.
 - 6' x 6' , 6' x 10' – 4 turns
 - 6' x 15', 6' x 20', 6' x 30', 10' x 20', 10' x 30' – 3 turns
 - 6' x 40', 6' x 50', 10' x 40' – 2 turns
 - Quadrupole loops shall have twice the turns in the middle cut, and be wired in a figure eight pattern, counter-clockwise only
- Form each Detector Loop by installing one continuous length of single conductor (loop) wire in a separate saw cut, from the nearest approved "junction point", around the loop the specified number of turns, then back to the "junction point".
- Place the wire in the cut so that there are no kinks or curls, and no straining or stretching of the insulation around the corner of the slot, or at the junction.
- Press the wire to the bottom of the saw cut slot, using a roller or a blunt-stick (similar to a paint stirrer), to seat the loop wire at the bottom of the slot or channel. Do not use a screwdriver or similar sharp tool as this may damage the loop wire insulation.
- After placing the wire in the slot, recheck it for slack, raised portions, and tightness.
- Use 1 INCH LENGTHS of 1/2 inch closed-cell foam-plastic (BACKER-ROD) at 2 foot spacings, to hold the wire at the bottom of the slot. DO NOT use backer-rod around the entire perimeter!
- Form the "pigtail" by twisting together the two ends of the loop wire from the corner of the loop to the "junction point"; Twist the two ends with a pitch of 15 TURNS PER YARD;
- Enclose the loop wire pigtail in conduit from the roadway edge to the "junction point".
- TEST each loop BEFORE SEALING, to ensure inductance is in the range of 50 to 2500 micro-Henrys. Ensure the insulation resistance measured to earth ground is greater than 100 megohms at 500 volts DC. Provide MEGGER TEST and INDUCTANCE TEST before and after sealing, and provide a written record of the test to the ENGINEER on company letterhead.

1.3.4 Lead-In Cable

- Install the lead-in cable in a continuous run, splice-free, and free from cuts or nicks in the insulation.
- At the specified "junction point", splice the twisted "pigtail" from the loop wire to the shielded, (twisted-pair) lead-in cable that runs from the "junction point" to the controller cabinet (terminal).
- Provide an electrically permanent and waterproof seal at the "junction point" splice. Remove 1-1/2 inches of insulation from each wire. Use either a crimped-on or twisted and soldered splice. No wire nuts are allowed. Waterproof seal the entire splice using a method described below:
 - a. Normal Splice – Splice each individual pair (pair of twisted loop wires meeting pair of loop lead-in wires), by using either a crimp-on or a soldered joint. Seal the junctions in a low-voltage, waterproof splice kit. Install the splice kit per the manufacturer's instructions.
 - b. Underwater Splice - Where required on the Plans, install an underwater splice kit according to the manufacturer's instructions.
- The ENGINEER must be present to witness the splicing. Any splices made without the presence of the ENGINEER are unacceptable, and shall be re-spliced.
- Leave sufficient slack in both the lead-in cable and the loop wire, to allow movement of 3 feet from the front of the "junction point". Neatly coil and nylon-tie the slack after completion of the splice.
- In the controller cabinet, label the lead-in cable on an insulated, preprinted-sleeve, slipped over the wire before attachment of a spade-lug connector. Crimp on a spade-lug connector onto each loop lead-in wire.
- In the controller cabinet, do not connect the ground (drain) wire from each lead-in cable; instead, cut it off at the cable sheath, and leave it floating.
- Run the lead-in cable in conduit (in accordance with 675.1 Electrical Conduit) from the "junction point" to the nearest signal pole, or directly to the cabinet if in the same quadrant.
- Run the lead in cable inside a conduit (riser) or metal pole, across span wires, and then down inside a conduit (riser) or metal pole, to the cabinet.
- Install one of the following for the conduit for lead-in cable required to be installed under sidewalks and curbs
 - Rigid Galvanized Steel Conduit

- SCHEDULE 80 PVC Conduit
- SCHEDULE 80 HDPE Rolled Conduit
- Flexible Weather-Tight Steel Conduit

1.3.5 Sealant

- Use QPL approved Loop Sealant in all loops unless specified by the ENGINEER.
- Mix and apply Loop Sealant according to the manufacturer's directions.
- Do not pour Loop Sealant into saw cuts during precipitation of any kind, or at temperatures below 10° C (50° F).
- Completely fill the saw cut and drilled holes with Loop Sealant; do not allow bubbles below the surface; do not over fill the cut, ensuring only a minimum spillover along the joint. Use Duct-Seal to prevent sealant from flowing into conduit ends.
- When the sealant hardens, ensure there is neither a bulge nor depression, but rather a smooth road surface. Ensure the sealant is not over-poured, preventing bulges or bumps higher than the surrounding surface of the roadway. Wipe the area smooth with a squeegee.
- Ensure the sealant has hardened before allowing traffic to move over the area.

1.4 Measurement

- Detector loops shall be measured by LINEAR FEET of: loop wire, lead-in cable, and saw cut as actually placed, including sealant, electrical connections, testing, and incidental hardware. Note that conduit and splice boxes are measured elsewhere as separate items.

1.5 Payment

Loop Wire:

6770413	FURNISH & INSTALL NO. 14 COPPER WIRE, 1-CONDUCTOR FOR LOOP WIRE	LF
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Loop Lead-in cable:

See 677.1 Electrical Cable

6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	LF
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR - GRAY	LF

Saw Cut:

6780495	SAWCUT FOR LOOP DETECTOR	LF
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678.2 WIRELESS VEHICLE DETECTION SYSTEM

1.1 Description

This work shall consist of furnishing a Wireless Vehicle Detection System to detect vehicles on a roadway by using battery-powered magnetometer-type SENSORS that communicate their detection data by RADIO RECEIVER &/OR REPEATERS to a CABINET INTERFACE before the data is relayed to a local traffic controller and, optionally, a central software system or a data server, or interface to such, as may be desired.

1.2 Materials

1.2.1 Overview

- The Wireless Battery-Powered Magnetometer Vehicle Detection System shall consist of one or more SENSORS installed in each traffic lane where presence detection is required, avoiding sources of magnetic noise such as underground power cables, overhead high tension power cables, light rail or subway tracks, and power generation stations and sub-stations. The SENSORS shall be located as specified by the intersection plans, with each SENSOR'S supporting CABINET INTERFACE or REPEATER installed as necessary to provide communications. Each SENSOR in an installation shall be capable of being individually configured with its own sensitivity level. A single SENSOR shall be capable of being configured with a sensitivity level that approximates the detection zone of a standard 6' x 6' inductive loop. Each SENSOR shall be capable of being configured with relatively higher or lower sensitivity levels as may be required to detect bicycles, motorcycles, or light rail. As an option as directed by the plans, up to two SENSORS properly configured shall be capable of detecting motorcycles in a standard traffic lane and bicycles in a designated bicycle lane. A CABINET INTERFACE shall support the relay of SENSOR detection data through several interfaces as required by the application.
- Communications between a SENSOR and RADIO RECEIVER can be direct, via a single REPEATER, or via two REPEATERS operating in tandem. Communications between the SENSORS and the RADIO RECEIVER or REPEATER and between the REPEATER and RADIO RECIEVER or another REPEATER shall be via radio. Detection data shall be relayed from each CABINET INTERFACE to a local traffic controller for real- time vehicle presence detection using contact closure signals or serial communication interface.
- As an option, data shall be capable of being relayed from each CABINET INTERFACE to a central software system or central server over standard IP (Internet Protocol) networks. An option to provide data via a web page interface may be required.

1.2.2 Radio Link

The radio links between each SENSOR and RADIO RECEIVER or REPEATER and between each REPEATER and RADIO RECIEVER or each REPEATER and REPEATER shall conform to the following requirements.

- The physical layer of the radio links (i.e., the over-the-air data rate(s), modulation type(s), forward error correction, bit interleaving, channel coding, and other aspects of the transmitted signal) shall conform to published standards (e.g., IEEE, ITU-T, etc.).
- The center frequencies, bandwidths, and transmit power levels of the radio links shall allow operation in an unlicensed frequency band.
- Frequency channels shall be employed by the SENSORS, CABINET INTERFACE, and REPEATERS to avoid interference with other devices operating in the unlicensed band.
- Either user-configurable frequency assignments or frequency hopping technology shall be provided. If frequency channels are user-configurable, at least 16 frequency channels shall be supported. If spread-spectrum/frequency hopping technology is provided ensure technology can address potentially interfering radio transmissions in the unlicensed band.
- The link budget (i.e., transmit power plus transmit antenna gain plus receive antenna gain minus receive sensitivity, where receive sensitivity shall assume a 1% packet error rate) for all radio links shall be 93 dB or greater.

1.2.3 Components

The Wireless Vehicle Detection System shall consist of one or more of the following:

- **SENSORS** - installed in-pavement in each traffic lane.
- **RADIO RECEIVER** - mounted on the side of the roadway.

- **CABINET INTERFACE**- CABINET INTERFACE located in traffic signal cabinet will provide SENSOR information processing and support the interface between a RADIO RECEIVER and a standard traffic controller using contact closure signals or standard serial communication interface such as NEMA TS2 Port 1.
- **EXTENSION MODULE** - to provide additional detector outputs to a traffic controller.
- **REPEATER** - Wireless REPEATERS mounted on the side of the roadway, serving to extend the radio range of a RADIO RECEIVER.
- EPOXY, CAT5 / ETHERNET CABLE, ELECTRIC CABLE , SOFTWARE (Incidentals)

1.2.4 SENSOR

- Each SENSOR shall detect a vehicle by measuring changes in the earth's magnetic field near the SENSOR as caused by a stopped or passing vehicle (i.e., magnetometer-type detection). The SENSOR shall sample the earth's magnetic field at a rate of 128 Hz. The SENSOR shall communicate time-stamped ON and OFF vehicle detection events. Each SENSOR shall automatically recalibrate in the event of a detector lock. Each SENSOR shall communicate by radio to a nearby RADIO RECEIVER or REPEATER RADIO. Each SENSOR shall transmit its detection data within 150 ms of a detected event. Each SENSOR shall automatically re-transmit a detected event if no acknowledgement is received from the access point. Each SENSOR may stop retransmission after 8 attempts. Each SENSOR shall transmit a unique identifying code. Each SENSOR shall respond within 100 seconds when the access point is powered on and transmitting. When no RADIO RECEIVER or REPEATER is present or powered on and transmitting, the SENSORS are not required to detect vehicles.
- All SENSOR components shall be contained within a single housing. The SENSOR housing shall conform to NEMA Type 6P and IEC IP68 standard. The SENSOR components shall be fully encapsulated within the housing to prevent moisture from degrading the components. The SENSOR housing shall be capable of being installed in a 4 to 4.5 inch diameter hole with a minimum 2.25 inches. A SENSOR shall operate at temperatures from -37°F /-38.3°C to +176°F / +80°C. A SENSOR shall be battery-powered with an average lifetime of ten (10) years when the SENSOR is configured for and operating under normal traffic conditions.

1.2.5 RADIO RECEIVER (AT INTERSECTION)

- A RADIO RECEIVER shall support at least 48 SENSORs with a 0.125 second latency. A RADIO RECEIVER shall meet the temperature and humidity requirements of section 2.1.5 of NEMA Standard TS2-2003. All RADIO RECEIVER components (not including antennas) shall be contained within a single housing. The RADIO RECEIVER housing shall conform to NEMA Type 4X and IEC IP67 standards. A RADIO RECEIVER shall be no larger than 12"H x 8"W x 7"D.
- The RADIO RECEIVER shall communicate to the CABINET INTERFACE utilizing a standard CAT5e or higher Ethernet cable. The RADIO RECEIVER shall have a weatherproof Ethernet connector on the bottom. The Ethernet connector shall be shipped with a cover firmly attached to provide protection form the elements prior to cable connection. The weatherproof connector shall not require any specialized tools for installation.
- A means shall be provided for surge suppression and isolation between the radio receiver and the cabinet interface for a wired connection. Electrical isolation of 1000V or greater and transient / surge protection shall be provided for the interface between the Cabinet Interface and Radio Receiver. This may be provided integral to the devices or as a separate unit, or combination thereof.

1.2.6 CABINET INTERFACE

- Detection data shall be communicated to a standard roadside traffic controller via a CABINET INTERFACE capable of being installed in a standard 170 cabinet. Type 170, Type 2070 and ATC controller types shall be supported. As an option, detection data shall be communicated over TCP/IP via an integrated 10Base-T Ethernet interface or a NEMA TS2-2003 Port 1 serial interface. The CABINET INTERFACE shall be capable of simultaneously communicating detection data via the contact closure interface and other interfaces.
- Each CABINET INTERFACE shall be capable of communicating with at least 2 RADIO RECEIVERS. EXTENSION MODULES shall provide additional contact closures (user configurable form 1 to 4 outputs each). The CABINET INTERFACE shall provide all the higher level processing and interface functions of the system. Each CABINET INTERFACE shall provide detector data as contact closure signals to the traffic controller or via a serial communications interface. A CABINET INTERFACE shall connect to standard 170/2070 input files or NEMA detector racks. One or more EXTENTION MODULEs shall provide

up to 64 channels of detection data from a single CABINET INTERFACE's supported SENSORS, where each channel comprises an optically isolated contact closure relay and, if configured for TS2 operation, an additional output meeting TS2 requirements, to indicate the channel status. Each CABINET INTERFACE and EXTENTION MODULE shall be configurable. A CCI card shall provide contact closure signals in either presence or pulse mode. A CCI card shall provide up to 31 seconds of delay timing. A CCI card shall provide up to 7.5 seconds of extension (carryover) timing. The CCI and EXTENTION MODULE front panel shall provide status LEDs to monitor Detection channel status, and Faults. The CCI and EXTENTION MODULE front panel shall be either software or via front panel switches configurable to provide Presence or pulse mode, Delay timing and Extension timing.

- A CABINET INTERFACE or EXTENTION MODULE shall be powered by the input file/detector rack backplane via an 11- 26 VDC input. Power Consumption for a CABINET INTERFACE (without optional cellular interfaces) shall be under 5 watts. An EXTENTION MODULE shall be surge protected to GR-1089 standards. A CABINET INTERFACE and EXTENTION MODULE shall meet the requirements of NEMA TS2-2003, section 2.1.5 Temperature and Humidity, and section 2.1.7 Transients, Input-Output Terminals.

1.2.7 EXTENTION MODULE

- An EXTENTION MODULE shall be available to allow additional detector outputs to be interfaced to the traffic controller. When interfacing through the detector card rack, the extension module shall allow up to four detector outputs to be interfaced to detector card slot(s).

1.2.8 REPEATER

- A REPEATER radio communicating directly to a CABINET INTERFACE shall support at least 10 SENSORS. A REPEATER communicating to a CABINET INTERFACE via an intermediate REPEATER (i.e., tandem operation) shall support at least 6 SENSORS. A REPEATER shall be battery-powered, solar powered or a combination of the two. The REPEATER battery shall be field replaceable. A REPEATER shall meet the requirements of NEMA TS2-2003, section 2.1.5 Temperature and Humidity. All REPEATER components shall be contained within a single housing.

1.2.9 Epoxy

- The epoxy shall be a two part poly-urea based joint sealant. It shall have self-leveling characteristics. The surface the epoxy will be bonding to shall be free of debris, moisture and anything else which might interfere with the bonding process. The epoxy shall be approved by the manufacturer of the detection system. Epoxy is an incidental item to be included in installation of SENSORS.

1.2.10 Software

- Each SENSOR, access point contact closure, RADIO RECEIVER and REPEATER shall be capable of accepting software and firmware upgrades. The Wireless Battery-Powered Magnetometer Vehicle Detection System shall provide software operating on conventional notebook/portable PCs or utilize a standard web browser program to support configuration of a SENSOR, to support configuration of an access point, to support configuration of a REPEATER, to store and retrieve detection data.

1.2.11 Certification

- The Contractor SHALL FURNISH, the design details and drawings prior to installation in sufficient detail for complete evaluation and comparison with these Specifications.

1.2.12 Warranty

- Performance shall be warranted for a period of **60 months** of the date of purchase and shall include repair or replacement of any component of the Wireless Vehicle Detection System. Failure due to workmanship, materials, and manufacturing defects shall be warranted for repair or replacement of the first 60 months of the date of purchase. The vendor shall replace any failed components within 30 calendar days of notification.
- During the warranty period, technical support shall be available from the supplier via telephone within 2 business days of the time a call is made by a user, where this support shall be provided by factory-authorized personnel or factory-authorized installers.
- During the warranty period, standard updates to the software shall be available from the supplier without charge.

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1.3 Construction

- Install wireless detection system in accordance with manufacturer’s instructions.
- Install wireless detectors using coring and fill hole with epoxy to obtain flush mounted installation
- Install overhead receivers/ repeaters to ensure proper communications with detectors
- Coordinate with manufacturer or their representative to ensure proper system installation
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1.4 Measurement

Pay Item 677049A includes furnishing and installing all necessary hardware, software, mounting hardware, equipment and components required to obtain detection zones complying with this specification and as shown on the plans or listed in the special provisions. Such payment shall be full compensation for installing all equipment, labor, and incidentals necessary to complete the work as specified. The other pay items listed below are specifically for furnishing and installing that item, and include any necessary mounting hardware, cable and other incidental items necessary for installation of that item.

1.5 Payment

677049A	FURNISH & INSTALL WIRELESS DETECTION SYSTEM PER SIGNAL	EA
6770494	F&I FLUSH MOUNTED WIRELESS SENSOR	EA
6770496	RADIO RECEIVER AT INTERSECTION W/ ANTENNA/MOUNTING KIT	EA
6770497	CABINET INTERFACE / SYSTEM CONTROLLER	EA
6770498	EXTENTION MODULE (FOR ADDITIONAL DETECTOR OUTPUTS)	EA
6770495	REPEATERS W/ ANTENNA/MOUNTING KIT	EA
6770501	FURNISH & INSTALL EPOXY TUBES	EA
6770505	FURNISH EPOXY APPLICATOR	EA

680.1 ELECTRIC SERVICE

1.1 Description

This work shall consist of furnishing and installing an Electric Service to provide electric power to traffic signals, at locations shown on the Plans, and in accordance with the Standard Drawings and Power Company procedures.

1.2 Materials

- All materials shall be NEC compliant.
- Meter, Meter Box (Pan type), Hub Access.
- Power Connection – Single-phase, 120/240 Volt, 3-Wire, 60-Hertz alternating current supply.
- Cable - 3-Wire (W, BL, RD), THHN/THWN, No.6 AWG
- Disconnect Switch - NEMA Standard Type 3R, weatherproof, Circuit Breaker Type, with a tab for pad-locking the cover closed, 3-Wire Design (2-circuit), with solid neutral. The panel shall be completely enclosed; there shall be no gaps in the panel with the door shut.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Electric Service.
- Perform all work in accordance with the Plans, the Standard Drawings and the REQUIREMENTS OF THE LOCAL POWER COMPANY. All work shall be in accordance with the National Electric Code (NEC), and applicable local Codes.
- Coordinate with the ENGINEER and the Power Company Representative as necessary to arrange the schedule for power connection.
- The Engineer will provide contact information for the Power Company.
- Make all necessary arrangements with the Power Company to insure having the needed power available at the TIME OF SIGNAL TURN-ON. Immediately report any difficulties in securing the service of the Power Company to the Engineer.
- Coordinate with the Engineer and the Power Company to determine the exact location of the electric service. The Electric Service is generally located as indicated below:
 - a) Overhead service drop to controller pole;
 - b) Overhead service drop to service pole, then underground to controller cabinet (isolated);
 - c) Underground Power Company feed, to service on the back of controller cabinet.
- The CONTRACTOR shall obtain all ELECTRIC PERMITS required; and shall arrange for INSPECTION at completion.
- Use 1-inch diameter SCHEDULE 80 PVC Conduit and Fittings or Rigid Metallic Conduit for the Electric Service; install it to extend from the point of Power Company attachment, through the meter and disconnect assembly, to the controller cabinet, in accordance with 675.1 ELECTRICAL CONDUIT.
- Install a weather head to the above conduit for overhead service connections. Install a strain Clevis, to create a 1 feet minimum drip loop.
- Use rustproof hardware; use stainless steel or galvanized steel parts; use STAINLESS STEEL BANDS for attachment to steel poles.
- Space the bands a maximum of 3 feet and at the top and bottom of the pole.
- When specifically required by the Utility Company or on wood poles, substitute Conduit Clamps/strap, fastened with galvanized screws, for the bands.

1.3.2 Meter

- Provide a Meter for the electric service, unless otherwise directed by the Engineer. Provide the necessary hardware accordingly.
- The CONTRACTOR shall furnish and install the METER BOX (PAN), and the HUB.
- Provide power connection that is a SINGLE-PHASE, 120/240 VOLT, 3-WIRE, 60-Hertz alternating current supply.

Disconnect Switch

- Provide disconnect switch that is NEMA STANDARD TYPE 3R, weatherproof. It shall be CIRCUIT BREAKER TYPE, and have a tab for pad-locking the cover closed. It shall be of 3-WIRE DESIGN (2-circuit), with solid neutral.
- The CONTRACTOR shall twist a No. 6 AWG wire through the padlock tab, to prevent unauthorized entry and until SCDOT installs a padlock.

1.3.3 Electric Service

- Provide electrical service with components having the ratings stated in the following table, to provide a maximum of future flexibility and a minimum of voltage-drop to the lamps:

<u>ITEM</u>		<u>USAGE</u>	
		<i>Flashing Beacons</i>	<i>Traffic Signal</i>
Disconnect Breaker			
	Box Rating (for uniformity):	60 AMP	60 AMP
	Circuit Breaker (one side):	20 AMP	50 AMP
Cable			
	3-Wire (W, BL, RD), THHN/THWN	No.6 AWG	No.6 AWG
Conduit			
	Schedule 80 PVC (Wood Poles)	1 inch	1 inch
	Rigid metallic (galvanized or aluminum) for steel or concrete poles	1 inch	1 inch

- Install Electrical Service Cable (Type THHN/THWN, sized per above table, 3-WIRE, (White, Black, red) 600 Volt, Copper only, stranded, with cable lugs) from the point of Power Company attachment to the Meter. From the meter to the cabinet install white, (black or red) and green. Install Electrical Service Cable in separate conduit from all other Electric Cable that connects to signal heads, pedestrian head or detection. At no place shall the service cable be in the same conduit as signal cables or loop lead-ins.

1.3.4 Ground System

- Ensure the resistivity of the electrical system EARTH GROUND shall be 15 OHMS OR LESS, as measured with an appropriate instrument which was calibrated not more than 60 days prior to the date of performing such tests.
- Ensure the poles, ground rods, ground wires, span wires, etc. forming the traffic signal, form a "GROUNDING ELECTRODE SYSTEM" as defined by Article 250 of the NATIONAL ELECTRIC CODE.
- Provide a 16 mm by 5/8 inch by 8 feet (minimum) ground rod, copper-clad, with brass or bronze ground rod clamp. EXOTHERMICALLY WELD the service ground rod; Connect all other ground rods with clamps.
- Provide grounding wire for the service that is No. 6 AWG, Bare, solid or stranded copper wire Exothermically Welded. (Note that this is in addition to the solid grounding wire running down each wooden pole.)

1.4 Measurement

- Complete Electrical Service shall be measured by EACH service installed in place, as shown on the Plans. It shall include all necessary conduit (trenched and/or riser), cable, conduit fittings, hardware, ground rod, banding, clamps, lugs, and all other materials and equipment specified or directed by the ENGINEER or Power Company. (Usually, there shall be no additional measurement of electrical cable used; there shall be no additional measurement of conduit used.) When an "Isolated electric service" is required by the Plans, an item and quantity will have been provided for wooden pole, as required.

1.5 Payment

6800499	FURNISH & INSTALL ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	EA
6800500	MODIFY EXISTING ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	EA

680.2 SPLICE BOX / JUNCTION BOX

1.1 Description

This work shall consist of furnishing and installing a Splice Box or Junction Box at the locations shown on the Plans in accordance with these specifications and Standard Drawings 675-130-01, 675-130-03.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Electrical Conduit.
- Provide a Splice Box including a Box and Cover, installed over aggregate, in accordance with the Standard Drawings.
- Install the Splice Box for use as a signal cable electrical enclosure.
- Install the Junction Box, where indicated on plans, for use as a loop detector "junction point". Unless shown mounted on a pole, install the junction box in the dirt, at the depth of the conduit run, and covered with earth.

1.3.2 Splice Box

- Construct the Splice Box in accordance with the Standard Drawings, at locations shown on the Plans.
- Construct the Splice Box such that when the Box and Cover are in place, they are flush with the adjacent pavement, ground, or sidewalk, as shown in the Standard Drawings.
- Place patching Concrete around any Box installed in pavement.
- Place boxes at least 1 foot behind the curb-line or edge of roadway or as shown on the plans.

1.3.3 Placed Before Pouring.

- Where shown on the Plans, place Custom Splice Boxes in roadways or structures, prior to pouring the concrete. Typical usage would be in a bridge deck. Firmly attach the incoming conduit to the bottom reinforcement bar mat, or to the bottom wire-mat, using plastic tie-wraps every 2 feet. CAUTION: COMPLETELY PLUGG/BLOCK/SEAL THE BOTTOM OF THE SPLICE BOX AND THE CONDUIT ENDS TO PREVENT CONCRETE PENETRATION. When used on a bridge, install the Splice Boxes near the center line, and terminate the conduit in Splice Boxes at each end.

1.3.4 Conduit

- Install conduit (in accordance with 675.1 ELECTRICAL CONDUIT) to enter the Box at the bottom and to extend at least 2 inches beyond the inside wall.
- Install conduit to enter from the direction of the run unless otherwise permitted by the ENGINEER.
- Ensure all metallic conduit ends within the Box have grounding bushings with plastic inserts; and ensure they are bonded using #6 AWG bare copper ground wire. Provide end bushings to prevent chaffing in plastic conduits.
- After placing the electrical cable, pack the completed conduit ends with "duct-seal" or other equivalent material to prevent water from entering the conduit. Insert steel wool at conduit ends to prevent rodent/pest intrusion. Cap spare conduit.

1.4 Measurement

- Furnishing and installing Splice Boxes will be measured by EACH Box placed complete, including Box, Cover, aggregate, patching concrete, ground wire, ground bushings, sealing, and all miscellaneous hardware and incidentals required.
- Furnishing and installing Junction Boxes will be measured incidental to the conduit to which it is used with.

1.5 Payment

6800518	FURNISH & INSTALL 13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOSURE-(STR.POLY.CONC.) HD	EA
680052C	FURNISH & INSTALL 17"X30"X24"D.ELEC.FLUSH UNDGRD.ENCLOSURE-(STR.POLY.CONC.) HD	EA
6800508	FURNISH & INSTALL 12"X12"X12"D.ELEC.FLUSH UNDGRD.ENCLOSURE-(STR.POLY.CONC.) HD	EA
6888100	INSTALL ELECTRICAL FLUSH UNDERGROUND ENCLOSURE	EA

682.1 WOOD POLE / BACK GUY ASSEMBLY

1.1 Description

This work shall consist of furnishing and installing CCA treated Wood Poles and Back-Guy cable assemblies, of the types and sizes shown on the Plans, in accordance with these Specifications, and in close conformity with the lines shown on the Plans and in accordance with the Standard Drawings, 675-115-01, 675-115-02. Each wood pole installation shall include all related overhead and underground hardware, and back guy assemblies as provided elsewhere.

1.2 Materials

Furnish a wood pole meeting the following requirements:

- Southern Yellow Pine that is cut, stored, seasoned, and manufactured in accordance with specification ANSI 05, 1-19-79.
- Prohibited defects include:
 - Red heart
 - Shakes in the tops of poles
 - Short crooks
 - Double-sweep
 - Splits or through-checks
 - Nails or spikes
 - Excessive knots
 - Scars deeper than 1 inch or longer than 3 feet
 - Excessive butt-swell
 - More than one twist per pole length
 - Sweep in two planes
- All poles shall be straight to the extent that a line drawn from the center of the butt end, to the center of the tip end shall lie within the middle two-thirds of the body of the pole at all points.
- Poles shall also be free from short crooks, in which the surface deviation from straightness in any 5 feet of length exceeds 1.5 inches at any location, as determined by a straight edge.
- Each pole shall be prepared and pressure-treated in accordance with American Wood Preservers Association (AWPA) Standards C1, C3, C4, and M1. Treatment shall be "SALT TREATED", CCA-CHROMATED COPPER ARSENATE, and shall conform to AWPA Standard P5. The retention of the treatment shall be tested in accordance with AWPA Standard M2. The minimum penetration shall be 3 inches, or 90 percent of the sap-wood. The retention shall be at least 0.60 POUNDS PER CUBIC FOOT, as determined by AWPA Standards.
- Provide Class II pole in the length specified in pay item.
- Each pole shall have a "brand" 12 feet above the butt-end, showing the Manufacturer, Plant-location with month and year of treatment, "Southern Pine CCA", and the Pole Class and Length. A Metal Tag showing Pole Length and Class shall be fixed to the butt-end; and the Length and Class shall be stamped on the top-end.
- Each pole shall have the "Brand Mark" of an inspection-company that has been approved by the Department.

Furnish Back-Guy Assembly as follows:

- From the top-down, a Back-Guy Assembly shall consist of: eye-type thru-bolt, guy-hook, strandvise (or 3-bolt clamp), jumper-bonding clamp, the steel cable (3/8-inch guy-cable stranded), another strandvise (or 3-bolt clamp), and a Screw-type guy anchor.
- All parts shall be as shown on the Installation Details or the Standards. All hardware shall be hot-dip galvanized in accordance with ASTM Standard A-153 to ensure rust proof.
- Acceptable parts are:
 - a) Guy Anchors - One piece screw type guy-anchors, shall conform to EEI-TD-2, 1 inch diameter, 8- FEET LONG, thimble eye type. (Joslyn No. J-6550-WCA or approved equal)
 - b) Guy Guards shall conform to REA Item "AT" yellow plastic (PVC) sunlight resistant, 8 feet long.

- c) Spool Insulators shall conform to REA Item "CM".
- d) Insulators shall conform to REA Item "W".
- e) Machine Bolts shall conform to REA Item "C".
- f) `J' hooks - Reliable No. 5552 (or approved equal).
- g) Guy and Messenger Cable Dead Ends - Reliable Universal Strandvise (or approved equal)
- h) Thimbleye Bolts shall conform to EEI-TD-4.
- i) Thimble Nuts shall conform to EEI-TDJ-5.
- j) Washers shall conform to EEI-TDJ-10.
- k) Angle Thimbleye shall conform to REA Item 5.
- l) Cable- 3/8 INCH DIAMETER CABLE (682.3 STEEL CABLE)
- m) Cable Clamps: 3-bolt clamps shall conform to EEI-TDJ-23, (4 inch and 6 inch sizes)
- n) Clevises shall conform to EEI-TD-20.
- o) Side-walk Bridge-over shall be a stress supporting spreader-type, bolting to the wood pole.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Wood Poles and/or Back-Guy Assemblies.

1.3.2 Utility Poles

- Install poles used for joint-use UTILITIES, in accordance with all local codes, and with the requirements of the Utility Company. Provide Cross Arms if required by the Utility Company.

1.3.3 Location

- Install the pole in the general location shown on the Plans.
- Coordinate with the Engineer to stake the field location of the pole, considering the property lines, underground utilities, and overhead clearances (including the guy anchor assembly).
- Engineer will approve staked locations, however contractor is responsible for locating utilities.
- If utility conflicts are discovered, relocate pole in coordination with the Engineer's approval.
- The pole location may have to be moved based on unmarked utilities.

1.3.4 Hole

- Drill a 6-foot DEEP hole, unless indicated otherwise in standard drawings.
- The diameter of the hole shall be larger than the pole by approximately 4 inches all around.
- Ensure the hole is a uniform diameter, and cleanly augured.

1.3.5 Installation

- Install poles to be vertical; if poles are corner signal poles, RAKE the pole away from the strain, 2 to 4 inches per 10 feet length.
- Install back guy assembly in line with the strain of each span wire.
- After installing, back-fill the hole with clean earth or sand (no rocks or debris), placed in 1 foot layers; moisten and compact each layer.
- Remove excess earth from the site; A 2-inch mound around the pole base is acceptable.

1.3.6 Sidewalk

- When installing the pole in a sidewalk, cleanly cut out the sidewalk 6 inches larger than the pole on all sides.
- Install conduit runs in the cut.
- Install as indicated in 1.3.5 Installation, leaving 4 inches for concrete placement.
- Install expansion joint material around the pole and tack in place, after installation of the pole and back filling the hole.
- Pour concrete around the pole to a depth of 4 inches; neatly troweled level. This work is incidental to pole installation.

1.3.7 Grounding

- Ground each pole in accordance with the Standard Drawings.
- Install a No. 6 AWG, SOLID, bare-copper ground wire (ASTM B2) to run the entire length of wooden poles, and extend 6 inches above the top end.
- Securely attach and bond the ground wire to the pole while it is lying on the ground.

- Ensure the ground wire extends 6 inches above the top end with a 2-foot coil (slack) at the top end, and extends down to the bottom with another 2-foot coil on the bottom end.
- Attach the ground wire (and the coils) using galvanized 1-1/2 inch wire staples, on (2 foot) centers above 14 feet, and on 1 foot centers below 14 feet. (The spacing change will be at 8 feet above grade.)
- Provide Ground Rods that are copper-clad, conforming to EEI-TDJ-30, having a minimum size of 5/8 inch by 8 feet in length.
- Use a ground rod clamp that is heavy-duty bronze or brass.
- Provide a GROUND ROD on one wood pole at each intersection, typically on the pole having the electrical service from the Power Company.
- Drive the ground rod vertically into the earth, until it extends about 2 inches above local grade.
- Use a separate No. 6 AWG bare, STRANDED/SOLID copper wire to bond the electrical service and the overhead cable (and pole ground wire) system to the ground rod, using a grounding clamp.

1.3.8 Back-Guy Assembly

- Back Guy each wood pole used to support signal span wires.
- Install Back-Guy Assemblies on wood poles used to support messenger cables especially at turns, and as directed by the ENGINEER.
- Install sufficient numbers of back-guy assemblies to ensure the stability of wood pole installations. This may include:
 - Double-guying
 - Extra-large anchors
 - Re-guying Utility Company poles.
- Install a Back-Guy Assembly:
 - a) Where shown on the plans;
 - b) In conjunction with installation of Steel Cable as span wire;
 - c) In conjunction with the installation of a wooden pole;
 - d) Where required by the Utility Company to "dress" pole to which signal equipment is attached; or,
 - e) At corner/turning wood poles that are used for messenger cable runs.
- A separate pay item is provided for Back Guy installation
- Inform the ENGINEER when additional back guy assemblies are required.
- Ensure the number and size of Back-Guy assemblies is fully sufficient to anchor every wood signal pole, corner messenger cable pole, and Utility Company pole (where required).
- Stage the installation of the wood pole, Back-Guy Assembly, and the span wire, for the safety of the motorist, pedestrian, and signal construction worker.
- Stretch, adjust, and then RE-ADJUST the span wire and Back-Guy Assembly to produce the specified amount of span wire sag, the proper signal head road-clearance, and still create a nearly vertical wood pole.
- Ensure the Back-Guy Assembly is sufficiently strong to handle the pull of all span wires, considering the earth/soil type into which the ground anchor is buried. Provide EXTRA LARGE ANCHORS and/or MULTIPLE-ANCHOR ASSEMBLIES if needed. Use special anchors for solid rock.
- Where a pedestrian sidewalk is adjacent to a wood pole, furnish a sidewalk "bridge-over" assembly.
- Ensure the compass angle of the Back-Guy is reasonably IN LINE with the strain of the overhead cable: that is, in line with each span wire. For corner signal wood poles, install two (2) Back-Guys, installed at right angles to each other. Using a single diagonal Back-Guy is generally unacceptable, unless approved by the ENGINEER.
- Install the Back-Guy (wherever possible) to provide as a minimum: rise=2 / run=1 (i.e. 2/1). For example, if the Back-Guy is attached at 26 feet, the anchor should be at a minimum of 13 feet from the pole. This corresponds to an angle with the earth of about 60 degrees.
- Perform all work within the public Right of Way, and take particular to assure that the Back-Guy does not extend into private property.
- Install the Back-Guy where it will not interfere with traffic, giving particular attention to private driveways. Where damage is likely (e.g. edge of driveway) install a STEEL GUY GUARD to protect the cable. When shown on the Plans, place a CONCRETE TIRE/WHEEL STOP (curb) at the base of the Back-Guy, anchored/pinned with 2 feet pieces of reinforcement bar.
- Do not splice the steel cable used in the Back-Guy assembly.

1.3.9 Inspection

- The ENGINEER will inspect each installation of wood pole, span wire, signal heads, and Back-Guy, for proper clearance, dress, and tension. At the direction of the ENGINEER, the CONTRACTOR shall re-install or replace improper installations, without further compensation.

1.3.10 Acceptance

- Acceptance of each wood pole shall include checking for the pressure-treatment inspection company Brand Mark, plus visual inspection by the ENGINEER.
- The visual inspection shall be made of the pole, overhead cables, grounding, and back guy assembly.
- The complete installation shall be structurally sound, and the final pole placement shall be vertical, or raked as specified.
- Contractor shall replace any poles NOT meeting this inspection, without further cost to the project.

1.4 Measurement

- Furnishing and installing wood poles, will be measured by EACH, of the Size specified, erected in place as shown on the Plans, including grounding, and all miscellaneous hardware and related work activity as required.
- Furnishing and installing Back-Guy Assemblies, will be measured by EACH, erected in place in accordance with the Specifications and as shown on the Plans, including all miscellaneous hardware as required.
- Additional Back-Guy Assemblies that are installed for reason of situations or conditions that arise during construction, will be paid, and shall be measured by EACH.

1.5 Payment

Wood Pole

6825020	FURNISH & INSTALL 35' WOOD POLE - CLASS II - CCA TREATED(0.60)	EA
6825021	FURNISH & INSTALL 40' WOOD POLE - CLASS II - CCA TREATED(0.60)	EA
6825023	FURNISH & INSTALL 50' WOOD POLE - CLASS II - CCA TREATED(0.60)	EA
6825025	FURNISH & INSTALL 60' WOOD POLE - CLASS II - CCA TREATED(0.60)	EA

Back-Guy Assembly

6825045	FURNISH & INSTALL 3/8" BACK GUY FOR WOOD POLE	EA
6825046	FURNISH & INSTALL 3/8" SIDEWALK GUY	EA
6825047	FURNISH & INSTALL 3/8" AERIAL GUY	EA

682.3 STEEL CABLE

1.1 Description

This work shall consist of furnishing and installing splice-free lengths of Steel Cable with cable supports, for mounting signal heads, signs, interconnect runs at locations shown on the Plans and in accordance with the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Steel Cable.

1.3.2 Span Wire

- Install all Span Wire as shown on the plans and in accordance with the Standard Drawings. Note that different methods and materials are required for Wood Poles and Steel Poles.
- Before erecting the Span Wire, the Contractor shall determine the length of cable required to span the distance indicated on the Plans. Allow sufficient additional length to compensate for sag, pole connections, and adjustments, to make the whole assembly consistent with the plans and the Standard Drawings. NO MID-SPAN SPLICES SHALL BE PERMITTED.
- Set the Span Wire so that the height of the installed signal heads, including all hardware, shall conform to the clearances shown on the Standard Drawings.
- Do not permanently "tied-off" the Span Wire until all signal heads, signs, and cables are in place.
- Do not erect any Span Wire which lays on, or is likely to rub a Utility Company's cable. Protect any Span Wire erected within 6 inches of any other cable, wire, or structure with plastic wire-guards.
- When required by the Utility Company, or by the applicable electrical Code, install strain-type fiberglass insulators.
- **Cables from STEEL POLES**
 - a) Steel Poles are essentially electrical conductors.
 - b) Use a Roller Type Pole Clamp attached at the proper height.
 - c) Secure the free-end of the cable with a 6 inch galvanized steel clamp, with 5/8 inch galvanized bolts. Place the clamp approximately 1 foot from the pole. Cable-grips are not permitted.
 - d) Cover the ends of the cable with "servisleeves" to prevent unraveling.
 - e) The SAG shall be 3%, TO 5%, fully loaded.
- **Cables from WOODEN POLES**
 - a) Wooden poles are essentially electrical insulators, and thus require extensive GROUNDING and BONDING procedures, in accordance with the Standard Drawings.
 - b) The SAG shall be typically 5%, fully loaded.
 - c) The height of attachment shall be sufficient to provide the required road-clearance, including sag.
 - d) Shall be installed in accordance with the requirements of the Utility Company.
 - e) May require the installation of a back guy assembly as required in 682.1 WOOD POLE/BACK GUY ASSEMBLY.
 - f) Shall be electrically bonded.

1.3.3 Messenger Wire

- Where Messenger Wire is attached to traffic signal poles, install it in the same manner as specified for span wire, but with relatively little sag.
- Where Messenger Wire is attached to utility poles, install it in accordance with the UTILITY COMPANY'S SPECIFICATIONS.

1.3.4 Tether Wire

- Where Steel Cable is specified to tether signal heads and/or traffic signs, install it in accordance with the Standard Drawings. Galvanized S-hooks should be used at the pole ends to permit "break-away" action.

1.3.5 Cable Supports

- Use Cable Supports to support electrical cables from span wire and messenger wire. Place Cable Supports at 10 INCH INTERVALS.

- When Aluminum Tie-Wraps are used, install by wrapping 3-full turns TIGHTLY around the bundle formed by the steel cable and all electrical cables then cutting off from the tape coil.

1.4 Measurement

- Measure Steel Cable of the SIZE specified by the LINEAR FEET of material as actually placed, which shall include cable supports, clamps, insulators, and all other miscellaneous hardware and fittings. (or other sizes as shown on the plans), and such payment shall be full compensation for furnishing and placing the cable, support rings, clamps, S-hooks, turnbuckles, and other incidentals required to complete the work as specified.

1.5 Payment

6825092	FURNISH AND INSTALL 3/8" GALVANIZED STEEL CABLE (Span Wire)	LF
6825090	FURNISH AND INSTALL 1/4" GALVANIZED STEEL CABLE (Messenger Wire)	LF

682.4 PEDESTRIAN POLE AND BASE

1.1 Description

This work shall consist of furnishing and installing a Pedestrian Pedestal Pole and Base in accordance with these Specifications and the Standard Drawings (675-105-02, 675-105-03).

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Pedestrian Pole and Base.
- Install Pedestrian Pedestal Poles where shown on the Plans and as needed to accommodate pedestrian movements.
- Mount Pedestrian Pedestal Poles so that no portion of the assembly (including the pedestrian head) is closer than 24" inches to the face of the curb.
- Powder-coating may be required if pay item is provided or if specified in the special provisions or on the signal plans. Perform the powder-coating over the aluminum poles at the factory or during the manufacturing process.

1.3.2 Installation

- Construct the foundation to the dimensions shown on Standard Drawings.
- Capp two 1- inch conduit elbows at both ends and secured in place in the excavation before pouring any concrete. The size and number of elbows shall be that necessary to mate with the incoming runs.
- Ensure all conduit elbows shall extend beyond the side of the finished foundation by approximately twelve inches, in the direction of, and at a depth matching the incoming conduit.
- Set 4 Anchor Bolts using pre-formed templates (wood or metal), to provide a "bolt-circle" in accordance with the Dimension Chart, or with recommendations of the base manufacturer. Leave the templates in place for two days (48 hours) or until the forms are removed.
- Mix, place and test concrete in accordance with applicable portions of SCDOT STANDARD SPECIFICATIONS Sections 701, 702, 703, and 704.
- Fasten the pedestrian pole base to the concrete foundation using appropriate hardware.
- Erect and tightly screw the aluminum pole into the base.
- Tighten the setscrew to prevent counter rotation of the aluminum pole.

1.4 Measurement

- Furnishing and installing pay items include pedestrian pedestal pole, base, and foundation installation by EACH including all required incidental hardware and work to install.

1.5 Payment

6825480	FURNISH & INSTALL 4' BREAK-AWAY ALUMINUM PEDESTAL POLE AND BASE	EA
6825482	FURNISH & INSTALL 8' BREAK-AWAY ALUMINUM PEDESTAL POLE AND BASE	EA
6825484	FURNISH AND INSTALL 10' BREAK-AWAY ALUMINUM PEDESTAL POLE AND BASE	EA

Powder-coating Option:

6888192	POWDERCOATING OPTION FOR 4' ALUMINUM PEDESTAL POLE	EA
6888193	POWDERCOATING OPTION FOR 8' ALUMINUM PEDESTAL POLE	EA
6888194	POWDERCOATING OPTION FOR 10' ALUMINUM PEDESTAL POLE	EA

Foundation Only:

Only for use where pedestrian pole and base is provided by others.

6825486	INSTALL CONCRETE FOUNDATION FOR ALUMINUM PEDESTAL POLE	EA
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686.1 SIGNAL HEADS

1.1 Description

This work shall consist of furnishing and installing Signal Heads, LED Modules or Backplates of the types, sizes, and mounting specified, in accordance with these Specifications, the plans and in accordance with the Standard Drawings (675-105-01, 675-105-02).

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Signal Heads.
- The Contractor shall furnish the ENGINEER with any warranties on materials provided by the Manufacturer or Vendor as normal trade practice, including a minimum 5-year warranty for the LED modules.
- In addition, the Contractor shall provide a EIGHTEEN (18) MONTHS workmanship warranty following the FINAL ACCEPTANCE. If any signal head fails by reason of defective material or workmanship, including cracking, falling, peeling or fading, the Contractor shall furnish and install replacement signal heads at no expense to the Department.
- Signal LED modules shall have the incandescent look. Pixelated LED modules shall be supplied as replacement modules only as directed by the ENGINEER.
- The red section in the five section head shall be powder coated.
- Provide fully assembled Signal Heads with LED Modules and the appropriate mounting hardware
- Install Signal Heads where shown on the plans and positioned in accordance with the Standard Drawings.
- Ensure the top section of all vehicle signal heads mounted on the same pole or pedestal is within 6 inches of being the same height unless otherwise specified.
- Install all multi-section/ combination signal heads with their top sections at the same elevation as other signal heads.

1.3.2 Wiring

- Connect electrical cable to the terminals in each signal head to provide the proper display indication.
- Do not externally splice the cable.
- Run electrical cable in accordance with the Standard Drawings.

1.3.3 Mounting

- Provide mounting hardware that is from one manufacturer. The DEPARTMENT will not accept mix-matched mounting assembly parts.
- Tighten mounting assembly to manufacturer standards prior to installing.
- If overhead adjustments are required for aiming, contractor shall field tighten using spanner wrench; Contractor shall ensure that signal heads are securely mounted on span wire or mast arms.
- Mount all traffic signal heads as shown on the plans and in accordance with the Standard Drawings.
- Aim signal faces to ensure good visibility, and to the satisfaction of the ENGINEER.

1.3.4 Signal Backplate

- Fasten Signal Backplates using appropriate hardware recommended by the signal head manufacturer.
- Provide a Signal Backplate that matches signal head without cutting, bending, or breaking. Drilling holes to match screw patterns is acceptable.
- Provide a Signal Backplate in accordance with Standard Drawing.

1.4 Measurement

- The pay items for furnish and install Signal Heads will be measured using the EACH unit and includes furnishing and installing Signal Heads with LED modules as specified on the plans and including ALL mounting hardware, internal electrical connections and ALL required incidental hardware.

1.5 Payment

6865710	Furnish and Install 12" 5 Section Signal Head	EA
6865720	Furnish and Install 12" 4 Section Signal Head	EA
6865723	Furnish and Install 12" 3 Section Signal Head	EA

6865834	FURNISH & INSTALL BACKPLATE W/ RETROREFL.BORDERS FOR TRAFFIC SIGNAL	EA
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686.3 PEDESTRIAN SIGNAL HEAD

1.1 Description

This work shall consist of furnishing and installing Pedestrian Signal Heads, Pedestrian LED Modules of the types, sizes, and mounting specified, in accordance with these Specifications, the plans and in accordance with the Standard Drawings. (675-105-02, 675-105-03, 675-110-00).

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.1 Construction

1.1.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Pedestrian Signal Heads.
- The Contractor shall furnish the ENGINEER with any warranties on materials provided by the Manufacturer or Vendor as normal trade practice, including a minimum 5-year warranty for the LED modules.
- In addition, the Contractor shall provide a EIGHTEEN (18) MONTHS workmanship warranty following the FINAL ACCEPTANCE. If any pedestrian signal head fails by reason of defective material or workmanship, including cracking, falling, peeling or fading, the Contractor shall furnish and install replacement pedestrian signal heads at no expense to the Department.
- Pedestrian Signal LED modules shall have the incandescent look. Supply pixelated LED modules as replacement modules only as directed by the ENGINEER.
- The pedestrian head and the mounting hardware are stated as one item.
- Install pedestrian signal heads where shown on the Plans or as needed to accommodate pedestrian movements.
- If multiple Pedestrian Signal Heads are required on the same pole or pedestal, mount within 6 INCHES of being the same height unless otherwise specified on the Plans.
- Mount Pedestrian Signal Heads so that no portion of the assembly is closer than 24 INCHES to the face of the curb.
- Mount Pedestrian Signal Heads to provide a clearance of 9 to 10 feet from the surface grade.

1.1.2 Wiring

- Connect electrical cable to the terminals in each Pedestrian Signal Head to provide the proper display indication when energized by the signal controller.
- Do not externally splice the cable.
- Run electrical cable in accordance with the Standard Drawings.

1.1.3 Mounting

- Use non-corrosive material in all hardware.
- Use FEDERAL YELLOW painted brackets, arms, and other hardware, unless noted otherwise in the plans or special provisions.
- Mount all pedestrian signal heads as shown on the Plans and Standard Drawings.
- See Standard Drawings for mounting information on Clamshell Mount, Side of Pole Mount, Single Post Top Mount, and Dual Post Top Mount.

1.2 Measurement

- The pay items for furnish and install Pedestrian Signal Heads will be measured using the EACH unit and includes furnishing and installing Pedestrian Signal Heads with LED modules as specified on the plans and including ALL mounting hardware, internal electrical connections and ALL required incidental hardware.
- There are separate pay items for furnishing and installing Pedestrian LED modules in existing pedestrian signal heads using the EACH unit.

1.3 Payment

6865782	FURNISH & INSTALL PEDESTRIAN SIGNAL HEAD	EA
6865783	FURNISH & INSTALL COUNTDOWN PEDESTRIAN SIGNAL HEAD	EA

686.4 PEDESTRIAN PUSH BUTTON STATION ASSEMBLY WITH SIGN

1.1 Description

This work shall consist of furnishing and installing a PEDESTRIAN PUSH BUTTON STATION ASSEMBLY AND PUSH BUTTON SIGN, of the types, sizes, and mountings specified in accordance with these Specifications, at locations shown on the Plans and in accordance with the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Pedestrian Push Button Assembly.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- Install Push Button Station Assemblies where shown on the Plans, or as necessary to accommodate pedestrian movements.

1.3.2 Installation

- Install Push Button Station Assemblies on poles in a height of 3-1/2 to 4 feet ABOVE GRADE.
- Orient and wire the Push Button Station Assembly in such a manner to clearly indicate to the pedestrian, the crosswalk with which it is associated.
- Attach Push Button Station Assemblies to poles using 1 inch stainless steel bands or galvanized screwed directly to pole.
- If dual push button station assemblies are required, a single dual mounting bracket shall be used to allow for two push button station assemblies to be mounted with the buttons positioned below the sign.
- Firmly secure the finished assembly to the pole.
- Connect each Push Button Station Assembly with the appropriate electrical cable, and wire to actuate the proper phase of the controller. The necessary cable is specified as a separate item, in accordance with 677.1 ELECTRICAL CABLE.
- Do not splice the cable.
On metal poles, bring the cable for the push buttons through the rear of the assembly directly into the pole or controller cabinet. On wooden poles, use electrical conduit to bring the cable to the assembly.

1.3.3 Push Button Signs

- Install each push button sign on the station assembly to reflect the proper intention of the pedestrian movement.

1.4 Measurement

- The pay items for furnish and install Push Button Station Assembly with Sign will be measured using the EACH unit and includes furnishing and installing the Push Button, Push Button Assembly and Sign as specified on the plans and including ALL mounting hardware, internal electrical connections and ALL required incidental hardware.

1.5 Payment

6865793	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON MICROSWITCH TYPE STATION ASSEMBLY (9"x12") AND SIGN (R-10-3E)	EA
6865794	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON MICROSWITCH TYPE STATION ASSEMBLY (9"x15") AND SIGN (R-10-3E)	EA
6865795	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON MICROSWITCH TYPE	EA
6865796	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON SOLID STATE WITH LIGHT AND TONE STATION ASSEMBLY (9"x12") AND SIGN (R-10-3E)	EA
6865797	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON SOLID STATE WITH LIGHT AND TONE STATION ASSEMBLY (9"x15") AND SIGN (R-10-3E)	EA
6865798	FURNISH & INSTALL PEDESTRIAN PUSH BUTTON SOLID STATE WITH LIGHT AND TONE	EA

686.5 LED BLANKOUT SIGN

1.1 Description

This work shall consist of furnishing and installing a LED Blankout Sign of Clam-Shell configuration, with Sun Visor and designated mounting hardware. of the types, sizes, and mounting specified, in accordance with these Specifications, the plans and in accordance with the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.1 Construction

1.1.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to LED Blankout Sign.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- The Blankout Sign and the mounting hardware are stated as one item.
- Install the Blankout Signs where shown on the Plans, positioned according to the Standard Drawings.
- Hang Blankout Sign to ensure good visibility, to the satisfaction of the Engineer.

1.1.2 Wiring

- Connect electrical cable to the terminals in each Blankout sign to provide the proper display indication.
- Do not externally splice the cable.
- Run electrical cable in accordance with the Standard Drawings.
- Electrical cable shall be splice-free lengths of, NO. 14 COPPER WIRE, 4 CONDUCTOR, BLACK, see 677.1 Electric Cable

1.1.3 Mounting

- Use hardware that is non-corrosive material, or chemically compatible with the item being used.
- Use adjustable signal brackets to rigidly mount Blankout Signs.
- Use brackets and suspensions that are painted Federal YELLOW unless directed otherwise by the Engineer (Except mast arm mounts).
- Mount all Blankout Signs as shown on the Standards Drawings.

1.2 Measurement

- The pay items for furnish and install Blankout Signs will be measured using the EACH unit and includes furnishing and installing Blankout Sign housing, with appropriate LED module as specified on the plans and including ALL mounting hardware, internal electrical connections and ALL required incidental hardware.
- There are separate pay items for furnishing and installing Blankout LED modules in existing Blankout sign housing using the EACH unit and includes weather tight neoprene gasket and any other hardware or material necessary to complete installation.

1.3 Payment

6865820	FURNISH & INSTALL NO RIGHT/LEFT TURN SYMBOLIC LED BLANKOUT SIGN W/ SPAN WIRE MOUNTING	EA
6865821	FURNISH & INSTALL NO RIGHT/LEFT TURN SYMBOLIC LED MODULE	EA

688.1 REMOVAL SALVAGE AND DISPOSAL OF EQUIPMENT AND MATERIALS

1.1 Description

This work consists of the removal and salvage or removal and disposal of equipment, materials or refuse that are not designated or permitted to remain. The engineer will instruct the contractor of what equipment or materials will be salvaged and where the contractor should deliver salvaged equipment/materials. The engineer will instruct the contractor of what equipment, materials and refuse to be disposed of. Contractor will dispose of these items in a manner that complies with all state and federal regulations governing disposal.

1.2 Materials

n/a

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Removal, Salvage and Disposal of Equipment and Materials.
- Carefully remove the items to be salvaged from the job site and return to the Department. The Contractor shall deliver, and obtain a RECEIPT for, the salvaged equipment, to one of the SCDOT District Signal Shops or one of the Local Government Signal Shops ([see link](#))
- Remove equipment or material to be Disposed and properly dispose at an APPROVED LAND FILL (or material reclamation yard). Any materials designated as HAZARDOUS WASTE shall be disposed in accordance with regulations enforced by the SC Department of Health and Environmental Control (DHEC).
- Any equipment or material to be Disposed shall not be re-sold by contractor as anything other than scrap material.
- Fill every hole caused by removing old equipment on THE SAME DAY. Back-fill, compact, and reseed/sod, to the satisfaction of the ENGINEER. Cleanly side-trim holes in PAVEMENT then bring to grade and finish with the same paving material as the adjacent pavement. Completely replace sidewalk "squares" (complete square), using forms and expansion material.
- Underground conduit and detector loops not utilized, shall be abandoned in place.
- FINAL ACCEPTANCE and Final Payment will be withheld, if the Contractor has not removed unneeded equipment from the job site, and if the Contractor cannot present RECEIPTS from SCDOT or Local Government showing that the salvaged equipment has been delivered to SCDOT.

1.3.2 Items that are generally Removed and Disposed of:

1.3.2.1 Concrete foundations

- Remove the foundations of ground-mounted cabinets completely. The Engineer may direct the contractor to clear the foundation to a minimum depth of 18 inches below surface grade.
- Remove the foundations of signal support poles completely. The Engineer may direct the contractor to clear the foundation to a minimum depth of 18 inches below surface grade.

1.3.2.2 Damaged Equipment

- Remove and Dispose any signal equipment/material that is deemed by the Engineer as damaged beyond salvaging.

1.3.2.3 Miscellaneous Equipment

- Remove minor equipment from the site and dispose.
- This includes steel cable, electrical cable, conduit, concrete pads, back guys and pullboxes / handboxes not utilized in the new signalization.

1.3.3 Items that are determined whether to Salvage or Disposed of in the field by the Engineer

1.3.3.1 Wood Poles

- Remove Wood Poles that are not utilized in the new signalization and are not required by other utilities
- The ENGINEER shall make the determination whether each wooden pole shall be salvaged or disposed.
- If wood pole is to be salvaged, tag it with information concerning what location it was removed from.

Items that are generally Removed and Salvaged**1.3.3.2 Cabinet Assembly**

- Prior to removal, clearly tag every cabinet, controller, conflict monitor, and any other major cabinet equipment item with the intersection name from which it is being removed. (*Fiber interconnect center, video detection cabinet equipment, Ethernet switch, fiber modem, radio cabinet equipment*)
- Record serial numbers for each cabinet, controller, and conflict monitor serial numbers and transmit to the Department

1.3.3.3 Signal Heads

- Prior to removal, clearly tag each signal head with the intersection name from which it is being removed.
- Carefully dismount signal heads keeping as much of the mounting hardware intact as possible.
- During the removal and delivery, take special care to prevent damage to the lenses and visors.

1.3.3.4 Pedestrian Equipment

- Prior to removal, clearly tag each pedestrian head, pedestrian pole and pedestrian button assembly with the intersection name from which it is being removed.
- Carefully dismount pedestrian heads and button assemblies keeping as much of the mounting hardware intact as possible.
- Ensure removal of pedestal pole includes related hardware (nuts, base).
- During the removal and delivery, take special care to prevent damage to the lenses and visors.

1.3.3.5 Metal Poles

- Prior to removal, clearly tag each steel strain pole with the intersection name from which it is being removed.
- Ensure removal of strain poles includes their related hardware (pole caps, bolt covers, hand hole covers, nuts, transformer bases, etc.).
- Bag related hardware and attach to steel strain pole and pedestrian pole to ensure materials remain together.

1.3.3.6 Splice Boxes

- Prior to removal, clearly tag each splice box with the intersection name from which it is being removed.

1.3.3.7 Signs

- Remove and salvage highway signs on existing span wires after the replacement signs have been installed.

1.4 Measurement

This item shall be paid as a lump sum per contract or as an each, which relates to remove, salvage, disposal items per signal. The lump sum pay item includes all signals named in the contract. Costs relating to transportation, disposal, pavement and grading repairs should be included in pay item. The cost for removing foundations for steel strain poles is either provided as lump sum (which is all removals needed per contract) or each, which is all removals needed per steel strain pole foundation removal. The related costs of transportation, disposal, concrete, pavement repair, etc., will not be measured for payment, but shall be included in the bid price of Removal, Salvage, and Disposal.

1.5 Payment

6885990	REMOVAL, SALVAGE,& DISP.OF EXISTING TRAF. SIGNAL EQUIPMENT	LS
6885991	REMOVAL, SALVAGE,& DISP.OF EXISTING TRAF. SIGNAL EQUIPMENT	EA
6885982	REMOVE FOUNDATION OF STEEL STRAIN POLE - 18" BELOW GRADE	LS
6887941	REMOVE FOUNDATION OF STEEL STRAIN POLE - 18" BELOW GRADE	EA

688.3 VIDEO DETECTION SYSTEM

1.1 Description

This work consists of furnishing and installing video detection systems with all necessary hardware and software in accordance with the plans and Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Video Detection System.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- Arrange and conduct site surveys with SCDOT personnel to determine proper camera sensor unit selection and placement.
- Provide SCDOT at least 3 working days notice before conducting site surveys.
- Upon completion of the site surveys, provide SCDOT with revised plans reflecting the findings of the site survey.
- As determined during the site survey, install sensor junction boxes with nominal 6 x 10 x 6 inches dimensions at each sensor location. Provide terminal blocks and tie points for power cable
- Place into operation loop emulator detection systems. Configure loop emulator detection systems to achieve required detection in designated zones. Have a certified manufacturer's representative on site to supervise and assist with installation, set up, and testing of the system.
- Perform modifications to camera sensor unit for gain, sensitivity, and iris limits necessary to complete the installation.
- Do not install camera sensor units on signal poles unless approved by the ENGINEER
- Install a power cable appropriately sized to meet the power requirements of the sensors. At a minimum, provide three conductor 120 VAC field power cable.
- Install the necessary cables from each sensor to the signal controller cabinet along signal cabling routes.
- Install surge protection where coaxial video cables and other cables are required between the camera sensor and other components located in the controller cabinet. Terminate all cable conductors.
- Relocate camera sensor units and reconfigure detection zones as necessary according to the plans for construction phases.

1.4 Measurement

- Furnishing and Install Video Detection System shall be measured as EACH unit and shall include one camera, the cabinet equipment, and all mounting hardware and necessary cable to connect camera to cabinet equipment.
- Furnish and Install Add'l Camera with Hardware & Lead In shall be measured as EACH unit and includes furnishing and installing 1 camera and all mounting hardware and necessary cables to connect to cabinet equipment.

1.5 Payment

6886039	FURNISH & INSTALL VIDEO DETECTION CAMERA MOUNTING HARDWARE	EA
6886040	FURNISH & INSTALL VIDEO DETECTION SYSTEM W/HARDWARE & LEAD-IN	EA
6886041	INSTALL VIDEO DETECTION SYSTEM	EA
6886042	FURNISH & INSTALL VIDEO DETECTION CAMERA W/ HARDWARE & LEAD-IN	EA

688.5 STEEL STRAIN POLE AND FOUNDATION

1.1 Description

This work shall consist of furnishing and installing Steel Strain Poles for traffic signal supports at the locations shown on the Plans and in accordance with the Standard Drawings, with anchor bolts and all miscellaneous hardware. This work shall also consist of installing a foundation for the steel strain pole in accordance with the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Steel Strain Pole.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- Repair galvanized surfaces (poles) which have been scratched or abraded so that bare metal is exposed, by applying 2 coats of 90% (minimum) Zinc-rich, cold-galvanizing compound; to the satisfaction of the ENGINEER.

1.3.2 Location

- Install the pole in the general location shown on the Plans.
- Coordinate with the Engineer to stake the field location of the pole, considering the property lines, underground utilities, and overhead clearances.
- ENGINEER will approve staked locations, however contractor is responsible for locating utilities.
- If utility conflicts are discovered, relocate pole in coordination with the Engineer's approval.
- The pole location may have to be moved based on unmarked utilities.

1.3.3 Foundation

- Drill a hole, as indicated in the Standard Drawings.
- The hole shall be augured (earth-auger), and the concrete poured in UN-disturbed earth.
- Ensure the hole is a uniform diameter, and cleanly augured.
- If foundation cannot be constructed to meet Standard Drawings, provide an alternative foundation design signed and sealed by a SC PE.
- It may be necessary to use a jack-hammer in BED-ROCK; it may be necessary to use a heavy walled CAISSON to line the hole and to pump it dry in high water table areas or areas where springs are encountered. These materials, tools and additional labor are incidental to the project.
- Where shown on the Plans, or as determined by the location of underground utilities, it may be necessary to excavate a hole BY HAND. NO additional payment shall be made UNLESS an item has been established in the BID or Proposal for UNCLASSIFIED EXCAVATION (hand excavation of hole) - CUBIC YARDS.
- Construct the foundation as shown in Standard Drawing 675-115-02 including the rebar cage and conduit.
- Mix, place, pour and test the concrete in accordance with SCDOT Standard Specifications, Sections 701, 702, 703, and 704.
- Provide CLASS 5000 for the foundation. Place the concrete in one continuous pour with vibration.
- Set the Anchor Bolts using pre-formed templates (wood or metal), to provide a "bolt-circle" in accordance with the Standard Drawings or with recommendations of the pole Manufacturer. Leave the templates in place for 2 days (48 hours).
- Capp conduit elbows at both ends, and secure in place in the excavated hole before pouring any concrete.
- Each foundation shall have a minimum of 1-3", 3-2" and 2-1" conduits placed in accordance with the Standard Drawings. Provide additional conduits if shown on the plans. These conduits are incidental to the work.
- Terminate all conduit provided in foundation in a 13"X24"X18"splice box; the splice box shall be installed in accordance with 680.2 Splice Boxes / Junction Boxes. The splice box shall be paid separately.
- Ensure all conduit elbows extend beyond the side of the finished foundation by a minimum of 12 inches, in the direction of, and at a depth matching the incoming conduit. Where a conduit elbow is placed for

future use, scribe an "X" in the foundation to indicate the side where such conduit enters. Ensure the conduit protrudes a minimum of 6 inches above the top of the finished concrete foundation.

1.3.4 Grounding

- Furnish and install ground rods and grounding wire with each foundation.
- Configure the ground rod with the foundation, as shown on the Standard Drawings.
- Use grounding clamps of brass or bronze to secure the grounding wire to the ground rod.
- Use a continuous ground wire to bond all metal parts together--pole ground stud; pedestal pole nut; pole-mounted controller cabinet ground; metal conduits; etc.

1.3.5 Installation

- Do not place the steel pole on the foundation for a minimum of 2 days (48 hours after individual pour)
- Do not place strain on the steel pole for a minimum of 7 days (168 hours after individual pour) or as otherwise directed by the ENGINEER.
- Rake each pole away from the line of span wire pull, by adjusting the nuts on the Anchor Bolts.
- When final load is applied, ensure there is a 6 inch (plus or minus one inch) rake at the top of the pole, opposing the direction of the stress.
- Restore the site to prime condition after the pole installation, back filling the area surrounding the pole with topsoil, raking it level and seeding. If the area is sloped, then use landscape turf.

1.3.6 Sidewalk/Island Installation

- When installing the pole in a sidewalk, cleanly cut out the entire "square" of the sidewalk and install the foundation as indicated above.
- Replace the sidewalk using expansion joint material to separate different "pours" and old/new concrete. This work is incidental, unless an item has been established for CONCRETE PATCH or for SIDEWALK.
- In concrete islands, saw-cut out a square opening 4 feet x 4 feet for the pole base and repair as stated above.
- When installed in SIDEWALKS or CONCRETE ISLANDS, contour the entire area and hand-finish to produce a neat visual line. Sharp edges or pedestrian hazards shall not be allowed.

1.3.7 Acceptance

- Acceptance of each pole shall include foundation strength testing plus visual inspection by the ENGINEER.
- The visual inspection shall be made of the pole, overhead cables, and grounding.
- The complete installation shall be structurally sound, and the final pole placement shall be vertical, or raked as specified.
- Contractor shall replace any poles NOT meeting this inspection, without further cost to the project.

1.4 Measurement

- Furnishing and installing 13" Diameter Steel Strain Poles and Foundations, will be measured by EACH, of the size(s) specified, and erected in place as shown on the plans. This shall include foundation, anchor bolts, nut covers, pole cap, reinforcing steel, ground rod, ground wire, and all miscellaneous hardware as required.
- Installing Concrete Foundation for Steel Strain Pole, will be measured by each, shall include reinforcing steel, ground rod, ground wire, and all miscellaneous hardware as required.

1.5 Payment

682505A	FURNISH & INSTALL 26' STEEL STRAIN POLE AND FOUNDATION	EA
6825050	FURNISH & INSTALL 26' STEEL STRAIN POLE (POWDER COATED) AND FOUNDATION	EA
6825056	FURNISH & INSTALL 26' STEEL STRAIN POLE (POWDER COATED OVER GALVANIZED) & FOUNDATION	EA
682505B	FURNISH & INSTALL 28' STEEL STRAIN POLE AND FOUNDATION	EA
6825051	FURNISH & INSTALL 28' STEEL STRAIN POLE (POWDER COATED) AND FOUNDATION	EA
6825057	FURNISH & INSTALL 28' STEEL STRAIN POLE (POWDER COATED OVER GALVANIZED) AND FOUNDATION	EA
682505D	FURNISH & INSTALL 32' STEEL STRAIN POLE AND FOUNDATION	EA
6825052	FURNISH & INSTALL 32' STEEL STRAIN POLE (POWDER COATED) AND FOUNDATION	EA
6825058	FURNISH & INSTALL 32' STEEL STRAIN POLE (POWDER COATED OVER GALVANIZED) AND FOUNDATION	EA

688.6 CONCRETE STRAIN POLE

1.1 Description

This work shall consist of furnishing and installing pre-stressed Concrete Strain Poles for traffic signal supports at the locations shown on the Plans and in accordance with the Standard Drawings, with all miscellaneous hardware. These poles shall be of the type intended for direct embedding, with the hole back filled with concrete.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Concrete Strain Pole.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice.
- Patch any concrete surfaces which have been chipped, chunked or damaged to the satisfaction of the ENGINEER with a commercial grade vinyl or epoxy based on concrete patching compound, according to manufacturer's instructions.
- CAUTION – Concrete poles are very heavy, quite long and are difficult to handle. Perform transportation, site handling and erection with acceptable equipment and methods and by qualified personnel. The Contractor is cautioned to have cranes, pole trailers and sufficient manpower to perform this work with total safety to the crew and to the motoring public. The Contractor shall review the manufacturer's shop drawings to identify proper pick-up points for lifting.

1.3.2 Location

- Install the pole in the general location shown on the Plans.
- Coordinate with the Engineer to stake the field location of the pole, considering the property lines, underground utilities, and overhead clearances.
- ENGINEER will approve staked locations, however contractor is responsible for locating utilities.
- If utility conflicts are discovered, relocate pole in coordination with the Engineer's approval.
- The pole location may have to be moved based on unmarked utilities.

1.3.3 Hole

- Auger the hole in undisturbed earth of the diameter and to the depth (at least) listed in the standard drawings or as recommended by the manufacturer (whichever is larger). Construct the embedding foundation as shown in Standard Drawing 675-115-02.
- Measure the depth and diameter of the hole with a tape measure to ensure it meets the required dimensions.
- If hole dimensions and backfill foundation cannot be constructed to meet Standard Drawings, provide an alternative foundation design signed and sealed by a SC PE.
- It may be necessary to use a jack-hammer in BED-ROCK; it may be necessary to use a heavy walled CAISSON to line the hole and to pump it dry in high water table areas or areas where springs are encountered. In Wet-lands or loose-sand, it may also be necessary to auger a larger hole. These materials, tools and additional labor are incidental to the project.
- Where shown on the Plans, or as determined by the location of underground utilities, it may be necessary to excavate a hole BY HAND. NO additional payment shall be made UNLESS an item has been established in the BID or Proposal for UNCLASSIFIED EXCAVATION (hand excavation of hole) - CUBIC YARDS.
- In bed-rock, a hole shall be jack-hammered out and be of sufficient depth to hold the design embedded length and a diameter to provide 3 inch clearance all around the concrete pole.

1.3.4 Grounding

- Furnish and install ground rods and grounding wire with each concrete pole.
- Drive the ground rod adjacent to the poured concrete embedding as shown on the Standard Drawing.
- Use grounding clamps of brass or bronze to secure the grounding wire to the ground rod.
- Use a continuous ground wire to bond all metal parts together--pole ground stud; pedestal pole nut; pole-mounted controller cabinet ground; metal conduits; etc.

1.3.5 Installation

- Place the concrete pole in the hole.
- Lift the pole into place, using a sling. A single point lift shall NEVER be used and such misuse could result in the ENGINEER rejecting that pole.
- Next, to lower the pole into the hole, insert a bar into the chocker hole (1/3 down the pole)(to prevent the strap from slipping) and use a single strap to raise one end of the pole vertically and jostle the butt end into the hole.
- Lower the pole into the hole and hold vertically by the crane.
- Using a pry bar through the "CANT" hole, rotate the pole so that all holes are at the proper compass orientation angle with the street and incoming conduit runs.
- Rake each pole slightly away (leaned away) from the direction of the span wire pull. For a concrete pole this will typically mean that the back side of the pole is vertically plumb.
- Backfill the hole back with concrete while supporting the concrete pole vertically with a pole or boom truck until the poured embedding concrete begins to set. This will typically be 15 to 20 minutes.
- Mix, place, pour and test the concrete in accordance with SCDOT Standard Specifications, Sections 701, 702, 703, and 704.
- Provide CLASS 3000 for the foundation; Place the concrete in one continuous pour.
- Plug/cover the underground cable entrance hole and any conduit openings to prevent concrete intrusion.
- After installation, the Contractor shall plug or cap all unused openings and couplings on the concrete pole using a threaded plug or a cemented PVC cap.
- Cap at both ends and secure in place any conduit elbows in the excavation before pouring any concrete.
- Each foundation shall have a minimum of 1-3", 3-2" and 2-1" conduits placed in accordance with the Standard Drawings. Provide additional conduits if shown on the plans. These conduits are incidental to the work.
- Terminate all conduit provided in foundation in a 13"X24"X18"splice box; the splice box shall be installed in accordance with 680.2 Splice Boxes / Junction Boxes. The splice box shall be paid separately.
- Ensure all conduit elbows shall extend beyond the side of the finished foundation by a minimum of 12 inches in the direction of and at a depth matching the incoming conduit.
- Do not place stress (steel cables) on the pole until the poured embedding concrete has hardened (typically 72 hours).
- Restore the site to prime condition after the pole installation, back filling the area surrounding the pole with topsoil, raking it level and seeding. If the area is sloped, then use landscape turf.

1.3.6 Sidewalk/Island Installation

- When installing the pole in a sidewalk, cleanly cut out the entire "square" of the sidewalk and install the concrete pole embedded in poured concrete; back fill with tamped dirt to 4 inches below the ground line foundation as indicated above.
- Replace the sidewalk using expansion joint material to separate different "pours" and old/new concrete. This work is incidental, unless an item has been established for CONCRETE PATCH or for SIDEWALK.
- In concrete islands, saw-cut out a square opening 4 feet x 4 feet for the pole base and repair as stated above.
- When installed in SIDEWALKS or CONCRETE ISLANDS, contour the entire area and hand-finish to produce a neat visual line. Sharp edges or pedestrian hazards shall not be allowed.

1.3.7 Acceptance

- Acceptance of each pole shall include foundation strength testing plus visual inspection by the ENGINEER.
- The visual inspection shall be made of the pole, overhead cables, and grounding.
- The complete installation shall be structurally sound, and the final pole placement shall be vertical, or raked as specified.
- Contractor shall replace any poles NOT meeting this inspection, without further cost to the project.

1.4 Measurement

- Furnishing and installing concrete strain poles will be measured by EACH of the length specified. This shall include pole cap and all miscellaneous hardware as required.
- Conduit elbows shall be considered to be incidental to the installation of the concrete pole.

1.5 Payment

6825061	FURNISH & INSTALL 35' CONCRETE STRAIN POLE	EA
6825062	FURNISH & INSTALL 40' CONCRETE STRAIN POLE	EA
6825064	FURNISH & INSTALL 45' CONCRETE STRAIN POLE	EA

688.7 CONTROLLER AND CABINET ASSEMBLY

1.1 Description

This work shall consist of furnishing and installing Cabinet Assembly, Cabinet Foundation and Controller in accordance with these Specifications, at the locations shown on the Plans, and in accordance with the Standard Drawings. This item shall include all electrical accessories and other items specified.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Controller and Cabinet Assembly.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice or to match warranty on existing state contract items.

1.3.2 Concrete Foundation

- Construct the foundation to the dimensions shown on the Standard Drawing 675-130-02.
- Set bolt pattern in accordance with the recommendations of the Cabinet Manufacturer.
- Set templates for setting anchor bolts and leave in place until the forms are removed.
- Concrete lag bolts drilled into pad are allowed.
- Mix, place and test concrete in accordance with applicable portions of SCDOT STANDARD SPECIFICATIONS Sections 701, 702, 703, and 704. Provide CLASS 3000 concrete.
- Set base mounted cabinets on a bead of silicone caulk.

1.3.3 Ground Rod and Ground Wire

- Furnish and install a ground rod and ground wire with each Cabinet.
- Place the 5/8 INCH by 8 feet (minimum) Copper-clad ground rods near the cabinet's concrete foundation, external to the cabinet pad in a splice box. If additional ground rods are required, place nearby and EXOTHERMICALLY WELD together.
- Place a 1-INCH PVC conduit and elbow in foundation prior to pouring as shown in the Standard Drawing.
- Run ground wires (No. 6 AWG bare, stranded copper wire) continuously from the ground rod to the Controller Cabinet (chassis ground on the AC ground bar) through this conduit; and run ground wires continuously from the ground rod to the foundation anchor bolts, to the conduit bends, etc.
- EXOTHERMICALLY WELD ground wires TO THE GROUND ROD.
- Use grounding bushings on metal conduit.
- For Cabinets mounted on strain poles, connect the grounding stud on the pole.
- The entire ground rod shall be driven below the grade or place in a junction box.

1.3.4 Conduit Elbows

- Do not encase the conduit entering the cabinet in concrete. (See Standard Drawings)
- Set Conduit Elbows in the footing excavation before the concrete is poured.
- The size and number of elbows shall be that necessary to mate with the incoming runs and in accordance with the plans and the Standard Drawings. Run conduit in accordance with Standard Drawing 675-130-02 from pole to splice box and from pole to cabinet where the steel pole is adjacent to a base mounted cabinet.
- Conduit shall extend beyond the side of the finished foundation by a minimum of 12 inches, in the direction of, and at a depth matching the incoming conduit.
- The conduit shall extend beyond the top of the finished foundation into the pole or Cabinet, in accordance with Standard Drawings.
- Cover and protect the open-ends and threads on the conduit bends during construction activities.

1.3.5 Electrical Wiring

- Install all required equipment in the Cabinet, and neatly wire with tied or wrapped harnesses. Force-fitted or mutually interfering equipment is not acceptable.
- Label cable harnesses and terminals legibly.

- Terminate all bare wires in a "spade-lug" prior to connection to a terminal strip. 'Crimp-on' the "spade-lug" using a ratchet-type crimping tool.
- Tie wires not facilitating equipment movement to the back or side-panel.
- Install and position equipment for easy access.
- Ensure opening and closing the Cabinet door shall not chaff the wiring.
- Ensure the field (lamp) wiring shall have 3 feet of slack cable in each cabinet.
- Coil the slack and tie neatly in the bottom of the Cabinet.
- Separate signal cables from detector lead-in cables as much as possible, to reduce interference.

1.4 Measurement

- Local Controller and Cabinet furnished and/or installed will be measured by EACH TYPE Controller and Cabinet (mounting specified); and erected in place as shown on the Plans including miscellaneous electronics, load switches, wiring, electrical connection, ground rod, ground wire, and all related hardware. This includes a concrete cabinet foundation, anchor bolts and all necessary hardware.
- Furnishing and/or Installing a Concrete Cabinet Foundation will be measured by EACH and will include anchor bolts and all necessary hardware.

1.5 Payment

6845510	FURNISH AND INSTALL CONTROLLER AND 336 CABINET ASSEMBLY - POLE MOUNTED	EA
6845511	FURNISH AND INSTALL CONTROLLER AND 332/336 CABINET ASSEMBLY - BASE MOUNTED	EA
6888220	INSTALL CONTROLLER AND 336 CABINET - POLE MOUNTED	EA
6888225	INSTALL CONTROLLER AND 332/336 CABINET - BASE MOUNTED-INCLUDING FOUNDATION	EA
6888226	INSTALL CONTROLLER AND 332/336 CABINET ASSEMBLY-BASE MOUNTED CABINET ON EXISTING FOUNDATION	EA
6845520	FURNISH AND INSTALL 2070 CONTROLLER UNIT IN EXISTING CABINET	EA
6845614	INSTALL 2070 CONTROLLER UNIT &/OR CONFLICT MONITOR IN EXISTING CABINET	EA
6887951	FURNISH AND INSTALL CONCRETE CABINET FOUNDATION	EA

688.8 FLASHER CABINET ASSEMBLY

1.1 Description

This work shall consist of furnishing and installing Splice/Flasher Cabinet as indicated on the plans and in accordance with these Specifications and the Standard Drawings.

1.2 Materials

Acceptable materials for Flasher Cabinet Assembly includes an aluminum flasher box, complete with mounting brackets, police lock and key, minimum dimensions of 14" x 14" x 11". Flasher Cabinet Assembly shall have terminal lugs included. Flasher Cabinet Assembly shall be Pre-wired for Time Switch and include a back panel pre-wired for

- 8 position terminal block
- 10 amp circuit breaker
- SPA-100T lightning surge protector
- Toggle switch for a variety of operation times
- 30 amp isolation relay
- NEMA flasher.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Flasher Cabinet.
- The Contractor shall furnish the ENGINEER with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice or to match warranty on existing state contract items.
- Provide all components or hardware made of corrosion-resistant material, or be of the same materials as the item being installed.
- Provide a cabinet designed for pole or pedestal-pole mounting. It shall be furnished with all related corrosion resistant hardware, including top and bottom mounting brackets, or pole-hub. Straps used shall be stainless steel.
- Install a Flasher Cabinet Assembly to operate overhead or shoulder mounted flashers that are powered with electricity.

1.3.2 Mounting/ Foundation

Mount the Cabinet as shown in the Standards Drawings.

1.3.3 Grounding

- GROUNDING AND SURGE/LIGHTNING PROTECTION SHALL BE PROVIDED in every Flasher Cabinet Assembly (unless specifically forbidden by the Manufacturer).
- The Protector shall be Telephone Company grade, and be conformable with the Terminal Block
- Ground the cable shield.
- Run a No. 6 AWG bare stranded copper Ground Wire continuously from the Cabinet to the ground rod at the pole base. Where design requires, drive a new ground rod; and install a ground wire from the Cabinet to the ground rod.

1.3.4 Electrical Wiring

- Connect electrical cables to the terminals in accordance with the signal equipment Manufacturer recommendations.

1.4 Measurement

- Furnishing and/or Installing Flasher Cabinet Assembly, shall be measured by EACH housing, erected and placed as shown on the Plans, including miscellaneous electronics, electrical connections, etc. NOTE: The furnishing, installation, and payment of the conduit, poles, electrical service, and other major items are specified elsewhere.

1.5 Payment

6845655	FURNISH & INSTALL FLASHER CABINET ASSEMBLY	EA
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688.9 SOLAR POWERED FLASHER ASSEMBLY

1.1 Description

This work shall consist of installing and/or furnishing a Solar Powered Flasher Assembly and performing all related wiring necessary, in accordance with these Specifications and the Standard Drawings.

1.2 Materials

Acceptable materials can be found on the current SCDOT Qualified Products List http://info.scdot.org/Construction_D/sitePages/qualifiedProducts3.aspx.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Solar Powered Flasher Assembly.
- The Contractor shall furnish the ENGINEER with any warranties on materials provided by the Manufacturer or Vendor as normal trade practice, including a minimum 5-year warranty for the LED modules.
- The types of Solar Flasher Assembly is listed below:
 - 24/7 Single Solar 24 Hour Flashing Beacon
 - 24/7 Single Compact Solar 24 Hour Flashing Beacon
 - Dual 24 Hour Solar Powered Flashing Beacon
 - Dual Solar Powered School Flashing Beacon
 - Dual Compact Solar School Zone Flasher

1.3.2 Installation

- Install the entire assembly, including solar engine, signal housing and LED modules with all necessary hardware for mounting to one of the following pole types:
 - Pedestrian Pole
 - Side-of-pole arm
- If the sign is larger than 36 inches, install the assembly using two poles.
- Install Pedestrian Pole in accordance with 682.4 Pedestrian Pole and Base and the Standard Drawings.
- The entire assembly shall mount at one point. Separate mounting for the signal head or any other component shall not be required.

1.4 Measurement

Furnishing and Installing a Solar Powered Flasher Assembly, shall be measured by EACH, erected and placed as shown on the Plans, which shall include all electrical connections and all required incidental hardware and all necessary bases and foundations for poles.

Separate pay items for Pedestrian Poles are in accordance with 682.4 Pedestrian Pole and Base.

1.5 Payment

6865700	FURNISH & INSTALL SOLAR POWERED FLASHER ASSEMBLY - SINGLE BEACON	EA
6865701	FURNISH & INSTALL SOLAR POWERED FLASHER ASSEMBLY - DUAL BEACON	EA
6865702	FURNISH & INSTALL SOLAR POWERED FLASHER ASSEMBLY	EA

690.1 STEEL POLE WITH MAST-ARM

1.1 Description

This work shall consist of designing (foundations, lengths of arms, size of support arms), furnishing and installing Steel Traffic Signal Poles with Mast-Arm(s). Concrete footings with reinforcing steel, anchor bolts, ground rods, conduit elbows, and miscellaneous hardware shall be designed and installed with each pole as required. **Steel mast-arm poles, its components, adapter plates and foundations shall be stamped and sealed by a licensed South Carolina Professional Engineer.**

1.2 Materials

Material Specifications are located at http://www.scdot.org/doing/technicalPDFs/publicationsManuals/trafficEngineering/TrafficSignal_MaterialSpecs.pdf.

1.3 Construction

1.3.1 General

- The requirements detailed in this specification cover any other pay item not listed in Payment but pertaining to Mast Arms.
- The CONTRACTOR shall furnish the Engineer with all warranties on equipment and material offered by the Manufacturer as normal trade practice.
- Repair poles, which have been scratched or abraded so that bare metal is exposed, to the satisfaction of the Engineer. Repair holes drilled in poles or Mast-Arms
- Use hardware or components made of a non-corrosive material, or be of the same material as the item being installed.
- Install signal head using rigid signal head mount brackets. The bracket shall consist of a top- and bottom-arm, an extruded aluminum vertical tube, a vertical tube clamp, and a mast-arm clamp, with all hardware. The Bracket shall be COMPLETELY RUST PROOF, and shall be fully adjustable in all dimensions and angles.
- Where required by the Plans, install signs using a rust proof mounting bracket.
- Powdercoating Color and type will be specified on the plans or in the Special Provisions.
- Decorative options will be specified on the plans or in the Special Provisions.
- Luminaires generally require a taller pole, per Standard Drawing or as noted in Special Provisions or Signal Plans.
- Luminaire to be furnished and/or installed must be provided by the same manufacturer as the mast arm, unless noted otherwise. Luminaire design and/or color should match mast arm design and/or color unless noted otherwise in Special Provisions or on Plans.
- Luminaires are metered separately from traffic signal, unless noted otherwise on the plans or in the special provisions.

1.2 Location

- Install the pole in the general location shown on the Plans.
- Coordinate with the Engineer to stake the field location of the pole, considering the property lines, underground utilities, and overhead clearances.
- ENGINEER will approve staked locations, however contractor is responsible for locating utilities.
- If utility conflicts are discovered, relocate pole in coordination with the Engineer's approval.
- The pole location may have to be moved based on unmarked utilities.
- The design of the mast arm is based on the location, length and soil type. Contractor shall not order mast arm poles until final pole location is determined free of utilities and is approved by the Engineer.
- Provide soil boring at each signal location to the satisfaction of the Engineer of Record designing the mast arm assembly and foundation. A minimum of one soil boring per signal to a 15' depth is required.

1.3 Foundation

- Contractor to provide foundation design (see 1.3.9), including depth and diameter of foundation, reinforcing cage design, strength of concrete;
- Drill a hole, as indicated in the foundation design.
- The hole shall be augured (earth-auger), and the concrete poured in UN-disturbed earth.
- Ensure the hole is a uniform diameter, and cleanly augured.
- The foundation shall be constructed with a circular reinforcing cage (**either tied together, or tack welded**) installed, in accordance with foundation design.
- Steel reinforcement shall conform to the requirements of DOT STANDARD SPECIFICATIONS, Section 703.2.1. The bars shall be of the size and type shown on the foundation design.
- The finished square surface above ground shall be as shown on the Standard Drawings.

- It may be necessary to use a jack-hammer in BED-ROCK; it may be necessary to use a heavy walled CAISSON to line the hole and to pump it dry in high water table areas or areas where springs are encountered. These materials, tools and additional labor are incidental to the project.
- Where shown on the Plans, or as determined by the location of underground utilities, it may be necessary to excavate a hole BY HAND. NO additional payment shall be made UNLESS an item has been established in the BID or Proposal for UNCLASSIFIED EXCAVATION (hand excavation of hole) - CUBIC YARDS.
- Mix, place, pour and test the concrete in accordance with SCDOT Standard Specifications, Sections 701, 702, 703, and 704.
- Use design concrete strength, minimum of CLASS 5000 for the foundation. Place the concrete in one continuous pour with vibration.
- Set the Anchor Bolts using pre-formed templates (wood or metal), to provide a "bolt-circle" in accordance with the Standard Drawings or with recommendations of the pole Manufacturer. Leave the templates in place for 2 days (48 hours).
- Capp conduit elbows at both ends, and secure in place in the excavated hole before pouring any concrete.
- Each foundation shall have a minimum of 1-3", 3-2" and 2-1" conduits placed in accordance with the Standard Drawings. Provide additional conduits if shown on the plans. These conduits are incidental to the work.
- Terminate all conduit provided in foundation in a 13"X24"X18"splice box; the splice box shall be installed in accordance with 680.2 Splice Boxes / Junction Boxes. The splice box shall be paid separately.
- Ensure all conduit elbows extend beyond the side of the finished foundation by a minimum of 12 inches, in the direction of, and at a depth matching the incoming conduit. Where a conduit elbow is placed for future use, scribe an "X" in the foundation to indicate the side where such conduit enters. Ensure the conduit protrudes a minimum of 6 inches above the top of the finished concrete foundation.

1.4 Grounding

- Furnish and install ground rods and grounding wire with each foundation.
- Configure the ground rod with the foundation, as shown on the Standard Drawings.
- Use grounding clamps of brass or bronze to secure the grounding wire to the ground rod.
- Use a continuous ground wire to bond all metal parts together--pole ground stud; pedestal pole nut; pole-mounted controller cabinet ground; metal conduits; etc.

1.5 Anchor Bolts

- Provide hooked anchor bolts at least 90 inches long with each steel pole with mast arms.
- Thread and hot dip galvanize the top 12 inches of the anchor bolt.
- Provide two hot dipped galvanized nuts and two washers per anchor bolt.

1.6 Adapter Plate

- Provide adapter plate with each mast arm that has a different anchor bolt pattern from SCDOT's standard steel pole pattern.
- **Note: Adapter plate(s), bolts, nuts, and washers not required if steel pole with mast arm is designed to be supported by current SCDOT signal foundation (concrete foundation with (4) 2" dia. anchor bolts on a 18-inch dia. bolt circle), and the design meets the design criteria requirements of this specification.**
- With each steel pole with mast arms, provide a 2" thick, hot dipped galvanized steel adapter to allow a pole with a 19" square base plate and 18" dia. bolt circle to be installed. Plate shall be pre-drilled with (4) 2 3/8" dia. bolt holes on the 18" dia. bolt circle. A 10" dia. minimum hole shall be provided in the center of the adapter plate.
- Provide (4) hot dipped galvanized 2" x 10" hex head cap screws, (12) nuts, and (8) washers in a **BURLAP** bag for each adapter plate. Bolts and nuts shall be of sufficient strength to support a 32-foot tall steel pole with steel strain wire supporting signal heads and signs for the intersection in case the steel pole with mast arms is damaged and has to be removed and replaced.
- Adapter plate(s), bolt, and nut selection and design shall be stamped and sealed by a licensed South Carolina Professional Engineer.
- Provide a **BURLAP** bag containing the adapter plate nuts, bolts, and washers inside each steel pole with mast arms.
- Place the adapter plate, if required, between the leveling nuts and the steel pole with mast arms base.

1.8 Installation

- Do not place the mast arm pole on the foundation for a minimum of 2 days (48 hours after individual pour)
- Do not place a load on the mast arm poles for a minimum of 7 days (168 hours after individual pour) or as otherwise directed by the ENGINEER.
- Each Pole shall be raked away from the line of the Mast-Arm pull, by adjusting the nuts on the anchor bolts.
- When final load is applied, there shall be an essentially vertical appearance as determined by the Engineer.
- Provide 22' minimum vertical clearance between the bottom of the overhead traffic signal mast arm and the pavement and shoulders, unless otherwise shown on the plans.

- Restore the site to prime condition after the pole installation, back filling the area surrounding the pole with topsoil, raking it level and seeding. If the area is sloped, then use landscape turf.

1.8.1 Sidewalk/Island Installation

- When installing the pole in a sidewalk, cleanly cut out the entire "square" of the sidewalk and install the foundation as indicated above.
- Replace the sidewalk using expansion joint material to separate different "pours" and old/new concrete. This work is incidental, unless an item has been established for CONCRETE PATCH or for SIDEWALK.
- In concrete islands, saw-cut out a square opening 4 feet x 4 feet for the pole base and repair as stated above.
- When installed in SIDEWALKS or CONCRETE ISLANDS, contour the entire area and hand-finish to produce a neat visual line. Sharp edges or pedestrian hazards shall not be allowed.

1.9 Acceptance

- Acceptance of each pole shall include foundation strength testing plus visual inspection by the ENGINEER.
- The visual inspection shall be made of the pole, overhead cables, and grounding.
- The complete installation shall be structurally sound, and the final pole placement shall be vertical, or raked as specified.
- Contractor shall replace any poles NOT meeting this inspection, without further cost to the project.

1.10 Design Criteria

1.10.1 AASHTO Standards

- Ensure the Mast-Arm traffic signal Pole is designed to meet the requirements of the "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals"; American Association of State Highway And Transportation Officials (AASHTO), latest edition.
- Design all components of the Mast-Arm Pole assemblies to include and to address the following:
 - Mast Arm Length
 - Soil type
 - Design Life – minimum 25-year mean recurrence interval
 - Basic wind speed in accordance with AASHTO Wind Speed map (latest edition)
 - Ice loading
 - Fatigue category II (2)
 - Natural wind gust pressure loads
 - Truck-induced gust pressure loads
 - Mast arm loading as follows in 1.10.2.

1.10.2 Minimum Loading Assumptions

- For design, minimum loading assume there is a 4-section polycarbonate, rigidly mounted signal head with backplate centered per lane including auxiliary lanes, an 24" x 8' illuminated street name sign on each arm, and additional 24" x 36" signs adjacent to each signal head. See plans to determine if additional loading is required. Design mast arms for the most stringent loading.

1.10.3 Design And Drawings

- The CONTRACTOR SHALL FURNISH pole design details, calculations, and shop-drawings in sufficient detail for complete evaluation and comparison with these Specifications.
- Any exceptions to these Specifications must be stated in writing.
- The design, calculations, and shop drawings shall be stamped and sealed by a licensed South Carolina Professional Engineer.
- The CONTRACTOR SHALL FURNISH a concrete foundation design details and calculations adequate for local soil type and steel pole with mast arm loading.
- Mast arm loading shall be the greater of the Minimum Loading Assumptions or the loading shown on the Plans.
- The design and calculations shall be stamped and sealed by a licensed South Carolina Professional Engineer.
- **Provide CATALOG CUTS ARE REQUIRED FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.**

1.10.4 Miscellaneous Items

Steel pole with mast arms design drawing shall include the following:

- 4" x 6" minimum reinforced handhole,
- ½" coarse thread grounding stud located on interior of pole handhole,
- strain relief j-hook at top of pole, rain cap,
- holes in steel poles and mast arms for wiring to be routed to traffic signals,
- holes for wiring to be protected with full circumference grommets,
- nut covers to be provided to cover anchor bolt nuts,
- tapered poles and mast arms shall taper uniformly along their length

- additional requirements as shown on the signal plans for the intersections

2.1 Measurement

The following pay items will be measured by Each (EA) erected in place as shown on the plans:

- Design shall include all necessary services to completely design mast arm installation, including necessary geotechnical work, utility research, foundation design, mast arm upright and arm structural design and determining length of mast arms.
- Furnish includes delivery costs and all necessary components necessary to provide and install a fully functional mast arm, including all hardware Adapter Plates (if applicable), Anchor Bolts, Nut Covers, Pole Cap, reinforcing steel, ground rod, ground wire, and all miscellaneous hardware as required.
- Install pay items including foundation include all materials and work necessary to completely install mast arm structure, including rebar, concrete, conduit, and forms.
- Install pay item without foundation includes all work necessary to install mast arm on existing foundation.
- Powdercoating pay items include providing a color option for mast arms, either over the base mast arm material or over the galvanized mast arm material
- Decorative option per mast arm includes providing decorative features such as ornamental pole bases (skirts), fluted options, banner arms or curved options, in accordance with the special provisions or plans.
- Luminaire option for mast arm includes the additional cost for a taller pole (27'), if luminaire is to be mounted above the signal heads.
- Furnish and install mounting assembly pay items include installing the mounting hardware for signs and for signal heads on the mast arm, including all necessary hardware.
- Furnish and install Luminaire includes all necessary materials, equipment and labor for full operational luminaire assembly, including electrical cable, conduit and meter pan if metered separately from traffic signal.
- Pay items for mast arms designating the height and length of the mast arms will only be used when the Engineer has designed full mast arm plans; payment and will be paid for at the contract unit price Each (EA), and include all materials, hardware, manpower and equipment to fully install a functional mast arm assembly.

The following pay item will be measured by cubic yard (CY):

- Install Foundation for Mast Arm includes all materials and work necessary to completely install mast arm foundation, including rebar, concrete, conduit, and forms.

Payment

6888179	DESIGN, FURNISH & INSTALL STEEL POLE WITH MAST ARM INCLUDING FOUNDATION	EA
6888172	DESIGN, FURNISH & INSTALL STEEL POLE WITH MAST ARM WITHOUT FOUNDATION	EA
6888177	DESIGN, FURNISH & INSTALL STEEL POLE WITH TWIN MAST ARMS INCLUDING FOUNDATION	EA
6888178	DESIGN, FURNISH & INSTALL STEEL POLE WITH TWIN MAST ARMS WITHOUT FOUNDATION	EA
6888166	POWDERCOATING PER MAST ARM OVER BASE	EA
6888167	POWDERCOATING PER MAST ARM OVER GALVANIZED	EA
6888168	DECORATIVE OPTION PER MAST ARM	EA
6888169	LUMINAIRE OPTION FOR MAST ARM - TO ACCOUNT FOR TALLER POLE	EA
6513020	FURNISH & INSTALL MOUNTING ASSEMBLY FOR FLAT SHEET SIGN ERCTD ON MAST ARM	EA
6865831	FURNISH & INSTALL VEHICLE TRAFFIC SIGNAL HEAD MOUNTING ASSEMBLY FOR MAST ARM	EA
6888164	FURNISH & INSTALL DUAL LUMINAIRE INCLUDING LUMINAIRE ARMS AND ALL ASSOCIATED HARDWARE	EA
6888165	FURNISH & INSTALL SINGLE LUMINAIRE INCLUDING LUMINAIRE ARMS AND ALL ASSOCIATED HARDWARE	EA
6888174	INSTALL FOUNDATION FOR MAST ARM INCLUDING CONCRETE AND REBAR	CY
	FURNISH & INSTALL ___' STEEL POLE WITH ___' MAST ARM INCLUDING FOUNDATION	EA
	FURNISH & INSTALL ___' STEEL POLE WITH TWIN MAST ARMS (___'X___')AT ___ DEG. INCLUDING FOUNDATION	EA