Project Manual
For

Pennies for Progress 3

SC Hwy. 557 Improvements (Kingsburry Road to SC 49)

August 22, 2023

County Management
David Hudspeth, County Manager
Michael Moore, Assistant County Manager
Kevin Madden, Assistant County Manager

County Council
District 1: Tom Audette
District 2: Allison Love
District 3: Tommy Adkins
District 4: William “Bump” Roddey
District 5: Christi Cox, Chairwoman
District 6: Watts Huckabee
District 7: Debi Cloninger

York County Engineering Reference No. 11149-009

Prepared for:
York County Engineering Department
PO Box 148
6 South Congress Street
York, South Carolina 29745
803-684-8571

Prepared by:
NV5 ENGINEERS & CONSULTANTS, INC.
7500 INDEPENDENCE BLVD. SUITE 100, CHARLOTTE, NC 28227
704-566-4319

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BID PROPOSAL FORM AND SCHEDULE

BID FORM

SC Highway 557 Improvement Project

Submitted: _____, 2023

York County Government
6 South Congress Street
York, SC 29745

Sir or Madam:

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Bid, as principal or principals, is or are named herein and that no other person than herein mentioned has any interest in the Bid of the Contract to which the work pertains; that this Bid is made without connection or arrangement with any other person, company, or parties making a bid or proposal and that the Bid is in all respects fair and made in good faith without collusion or fraud.

The Bidder further declares that he has examined the site of the Work and, through personal knowledge and experience and/or subsurface investigations, has fully satisfied himself in regard to all conditions pertaining to such site and he assumes full responsibility therefore; that he has examined the Drawings and Specifications for the Work and from his own experience or from professional advice that the Drawings and Specifications are sufficient for the Work to be done; that he has examined the other Contract Documents and all addenda relating thereto, and that he has satisfied himself fully, relative to all matters and conditions with respect to the Work to which this Bid pertains.

The Bidder proposes and agrees, if this Proposal is accepted, to contract with York County Government (OWNER) in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, transportation and labor and to perform all work necessary to complete the Work specified in the Bid and other Contract Documents.

The Bidder further proposes and agrees to commence substantial work on this project within 15 days of a Notice to Proceed and agrees that the Work will be completed and ready for final payment **within 900 days** of the Notice to Proceed.

The Bidder further agrees that the deductions for liquidated damages, as stated in the Agreement and General Conditions, constitute fixed, agreed, and liquidated damages to reimburse the OWNER for additional costs to the OWNER resulting from the Work not being completed within the time limit stated in the Contract Form. The liquidated damages shall be **$2,200.00** for each consecutive calendar day thereafter.

The Bidder further agrees to execute a Contract and furnish satisfactory Performance and Indemnity and Payment Bonds, and the required Certificates of Insurance, within ten consecutive calendar days after receipt of Notice of Award of the Contract, and the undersigned agrees that in case of failure on his part to execute the said Contract and Performance and Indemnity and Payment Bonds within the ten (10) consecutive calendar days after the award of the Contract, the Bid guarantee accompanying his Bid and the money payable thereon shall be paid to the OWNER as liquidation of damages sustained by the OWNER; otherwise, the Bid guarantee shall be returned to the undersigned after the Contract is signed and the Performance and Indemnity and Payment Bonds are filed.

ACKNOWLEDGEMENT OF ADDENDA

Acknowledgement is hereby made of the following Addenda received since issuance of the Bid Documents:

Addendum No._____	Dated:_____
Addendum No._____	Dated:_____
Addendum No._____	Dated:_____
Addendum No._____	Dated:_____
Addendum No._____	Dated:_____
Addendum No._____	Dated:_____
Addendum No._____	Dated:_____

Company _____

Authorized Signature _____

Print Name _____

Email Address _____
(*Please print clearly)*

Note:

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. The undersigned proposes the following unit prices to be utilized on the Work or Extra Work should modifications or variations incorporate these items of work into the Work.

SC Highway 557 Improvements Project
BID SCHEDULE - ROADWAY

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
1031000	MOBILIZATION	1.000	LS		$0.00
1031100	MOBILIZATION - SUBCONTRACTOR	1.000	LS		$0.00
1031200	BRIDGE CONSTRUCTION ACCESS	1.000	LS		$0.00
1032010	BONDS AND INSURANCE	1.000	LS		$0.00
1050800	CONST. STAKES, LINES & GRADES	1.000	EA		$0.00
1052000	UTILITY RELOCATION NO. 001	1.000	EA		$0.00
1052000	UTILITY RELOCATION NO. 002	1.000	EA		$0.00
1052001	UTILITY STAKING	1.000	LS		$0.00
1071000	TRAFFIC CONTROL	1.000	LS		$0.00
1080300	CPM PROGRESS SCHEDULE	1.000	LS		$0.00
1090200	AS-BUILT CONSTRUCTION PLANS	1.000	LS		$0.00
2011000	CLEAR. & GRUB. WITHIN R/W	1.000	LS		$0.00
2013050	CLEAR. & GRUB. DITCHES	0.500	ACRE		$0.00
2021000	REM. OF STRUCT. & OBSTRUCT.	1.000	LS		$0.00
2021005	REM.&DISP.OF EXIST.CATCH BASIN	2.000	EA		$0.00
2021015	REM.& DISP.OF EXISTING MANHOLE	3.000	EA		$0.00
2021210	REM&DISP.OF HI-LEV.CONTAM.SOIL	100.000	TON		$0.00
2025000	REM. & DISP.OF EXIST. ASPHALT PAVEMENT	24,000.000	SY		$0.00
2027801	REMOVAL OF EXIST. GUARDRAIL	790.000	LF		$0.00
2028500	REM. & DISP.OF EXIST. CULVERT (7)'X(7)'	1.000	EA		$0.00
2031000	UNCLASSIFIED EXCAVATION	78,680.000	CY		$0.00
2033000	BORROW EXCAVATION	220,926.000	CY		$0.00
2033100	BORROW PIT SET-UP	1.000	LS		$0.00
2036020	GEOTEXTILE, SEPARATION	1,074.000	SY		$0.00
2037000	GEOGRID REINFORCEMENT (UNIAXIAL)	4,261.000	SY		$0.00
2037030	GEOGRID STABILIZATION	1,074.000	SY		$0.00
2041000	STRUCTURE EXCAVATION FOR CULVERTS	379.700	CY		$0.00

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
2052020	GRANULAR BRIDGE LIFT MATERIAL	1,874.000	CY		$0.00
2081001	FINE GRADING	77,000.000	SY		$0.00
2103000	FLOWABLE FILL	30.000	CY		$0.00
3050112	GRADED AGGR.BASE COURSE-12"UNIF	30,900.000	SY		$0.00
3069900	MAINTENANCE STONE	5,000.000	TON		$0.00
3100310	H/M ASPH. BASE CR.-TYPE A	12,350.000	TON		$0.00
4010005	PRIME COAT	8,535.000	GAL		$0.00
4011004	LIQUID ASPHALT BINDER PG64-22	2,322.000	TON		$0.00
4012080	FULL DEPTH ASPH. PAV. PATCHING 8" UNIF	500.000	SY		$0.00
4013990	MILL.EXIST.ASPH.PVMT.-VARIABLE	4,720.000	SY		$0.00
4019000	MILLED-IN RUMBLE STRIP	1.391	MI		$0.00
4020320	H/M ASPH.INTERMEDIATE CR.TYPE B	19,000.000	TON		$0.00
4030320	H/M ASPH.SURF.CR. TYPE B	13,100.000	TON		$0.00
4037221	DRIVEWAY PAVING-SURF. TYPE C NON-RESURFACING PROJECT	300.000	TON		$0.00
5010108	ROLLER COMPACTED CONCRETE PAVEMENT - 8" UNIFORM	31,800.000	SY		$0.00
6021120	PERM.CONST.SIGNS(GRND.MNTD)	1,322.000	SF		$0.00
6021125	PERM.CONST.SIGNS(BARR.MOUNTED)	245.000	SF		$0.00
6041200	BARRICADE - TYPE 3	552.000	LF		$0.00
6052121	PORT.TERM.IMP.ATTEN-(TL-2)	4.000	EA		$0.00
605212A	ANCHOR KIT - PORT. ATTENUATOR(TEST LEVEL 2)	4.000	EA		$0.00
6053110	TEMPORARY CONCRETE BARRIER	2,500.000	LF		$0.00
608100B	TYPE B - FLASHING LIGHT	8.000	EA		$0.00
6092100	TEMPORARY CLEAR PAVEMENT MARKERS MONO-DIR.- 4"X4"	24.000	EA		$0.00
6092150	TEMPORARY YELLOW PAVEMENT MARKERS MONO-DIR.- 4"X4"	24.000	EA		$0.00
6092155	TEMPORARY YELLOW PAVEMENT MARKERS BI-DIR.- 4"X4"	630.000	EA		$0.00
609115G	PREF.FLEX.WET RETRO.PVMT.MARK(T-2)TEMP.REMOVABLE 4"WH.SOLID PREF.	350.000	LF		$0.00

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
609115H	PREF.FLEX.WET RETRO.PVMT.MARK(T-2)TEMP.REMOVABLE4"YEL.SOLID PREF.	700.000	LF		$0.00
6250005	4" WHITE BROKEN LINES -(GAPS EXCLUDED)-FAST DRY PAINT	28,620.000	LF		$0.00
6250010	4" WHITE SOLID LINES (PVT. EDGE LINES)-FAST DRY PAINT	95,532.000	LF		$0.00
6250025	24" WHITE SOLID LINES (STOP/DIAGONAL LINES)-FAST DRY PAINT	670.000	LF		$0.00
6250030	WHITE SINGLE ARROW (LEFT, STRAIGHT, RIGHT)-FAST DRY PAINT	59.000	EA		$0.00
6250035	WHITE WORD MESSAGE "ONLY"-FAST DRY PAINT	26.000	EA		$0.00
6250040	WHITE COMBINATION ARROW(STR.& RT.OR STR.& LT.)FAST DRY PAINT	2.000	EA		$0.00
6250043	WHITE LANE DROP ARROW (LEFT OR RIGHT)-FAST DRY PAINT	2.000	EA		$0.00
6250105	4" YELLOW BROKEN LINES(GAPS EXC) - FAST DRY PAINT	18,000.000	LF		$0.00
6250110	4" YELLOW SOLID LINE(PVT.EDGE&NO PASSING ZONE)-FAST DRY PAINT	134,280.000	LF		$0.00
6250115	24" YELLOW DIAGONAL LINES - FAST DRY PAINT	200.000	LF		$0.00
6271005	4" WHITE BROKEN LINES(GAPS EXCL.)THERMOPLASTIC- 90 MIL.	28,970.000	LF		$0.00
6271010	4" WHITE SOLID LINES (PVT. EDGE LINES) THERMO.- 90 MIL.	13,581.000	LF		$0.00
6271025	24" WHITE SOLID LINES (STOP/DIAG LINES)-THERMO.-125 MIL	510.000	LF		$0.00
6271030	WHITE SINGLE ARROWS (LT, STRGHT, RT) THERMO.-125 MIL.	47.000	EA		$0.00
6271035	WHITE WORD MESSAGE "ONLY" -THERMO - 125 MIL.	26.000	EA		$0.00
6271040	WHITE COMBO ARROWS(STR&RT.OR STR&LT)THERMO-125MIL	2.000	EA		$0.00
6271043	WHITE LANE DROP ARROW(LT.OR RT.)THERMO-125MIL	2.000	EA		$0.00
6271064	4" YELLOW BROKEN LINES(GAPS EXC)THERMO - 90 MIL.	18,000.000	LF		$0.00
6271074	4" YELLOW SOLID LINES(PVT.EDGE LINES) THERMO-90 MIL.	44,360.000	LF		$0.00
6271080	24" YELLOW SOLID LINES - THERMO - 125 MIL.	200.000	LF		$0.00
6300005	PERMANENT CLEAR PAVEMENT MARKERS-MONO-DIR.- 4"X4"	325.000	EA		$0.00
6301005	PERMANENT YELLOW PAVEMENT MARKERS MONO-DIR.- 4"X 4" PERM. YEL.	400.000	EA		$0.00
6301100	PERMANENT YELLOW PAVEMENT MARKERS BI-DIR.- 4"X4"	660.000	EA		$0.00
6351100	PREF.FLEX.RETRO.PVMT.MARK(T-1)PERM.60MIL4"WH.BROKEN	700.000	LF		$0.00
6351400	PREF.FLEX.RETRO.PVMT.MARK(T-1)PERM.(60MIL)4"YEL.BROKEN	700.000	LF		$0.00
6351450	PREF.FLEX.RETRO.PVMT.MARK(T-1)PERM.(60MIL)4"YEL.SOL.	700.000	LF		$0.00
6510105	FLAT SHEET, TYPE III, FIXED SZ. & MSG. SIGN	440.000	SF		$0.00
6510108	FLAT SHEET, TYPE XI, SIZE DETERMINED BY MSG, OVERHEAD	30.000	SF		$0.00
6513015	MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON SPAN WIRE	8.000	EA		$0.00

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
6531210	U-SECTION POST FOR SIGN SUPPORTS - 3P	442.000	LF		$0.00
6531500	REFLECTIVE SIGN POST PANELS	50.000	LF		$0.00
6750275	FURNISH & INSTALL 1.0" SCHEDULE 80 PVC CONDUIT	135.000	LF		$0.00
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	1,546.000	LF		$0.00
675027C	FURNISH & INSTALL 3.0" SCHEDULE 80 PVC CONDUIT	135.000	LF		$0.00
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	450.000	LF		$0.00
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	1,880.000	LF		$0.00
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	5,067.000	LF		$0.00
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	1,615.000	LF		$0.00
6770413	FURNISH & INSTL NO. 14 COPPER WIRE,1-CONDUCTOR FOR LOOP WIRE	4,100.000	LF		$0.00
6780495	SAWCUT FOR LOOP DETECTOR	1,800.000	LF		$0.00
6800499	FURNISH & INSTALL ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	2.000	EA		$0.00
6800500	MOD. EXIST ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	1.000	EA		$0.00
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	19.000	EA		$0.00
680052C	F&I-17"X30"X24"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	2.000	EA		$0.00
6825020	FURNISH & INSTALL - 35' WOOD POLE-CLASS II-CCA TR(0.60)	11.000	EA		$0.00
682505B	FURNISH & INSTALL 13" X 28' STEEL STRAIN POLE AND FOUNDATION	8.000	EA		$0.00
6825092	FURNISH & INSTALL 3/8" GALVANIZED STEEL CABLE	1,075.000	LF		$0.00
6825484	FURNISH & INSTALL 10' BREAK-AWAY ALUM PEDESTAL POLE AND BASE	1.000	EA		$0.00
6845511	F&I - CONTR 332/336 CABINET ASSEMBLY - BASE MOUNTED	3.000	EA		$0.00
6865710	FURNISH & INSTALL - 12" 5 SECTION SIGNAL HEAD	1.000	EA		$0.00
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	1.000	EA		$0.00
6865722	F&I - 12" 1-WAY-4 SECT(RA.YA.YAF.GA) VEH TRAFFIC SIGNAL	4.000	EA		$0.00
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	15.000	EA		$0.00
6865731	F&I - 12" 1-WAY-3 SECTION(R.Y.G.)VEHICLE TRAFFIC SIGNAL	15.000	EA		$0.00
6865733	F&I - 12" 1-WAY-3 SECT(RA.YA.GA.) VEHICLE TRAFFIC SIGNAL	1.000	EA		$0.00
6865782	F&I - 1-WAY-1SECT.HAND/MAN COUNTDOWN PEDESTRIAN SIGNAL HEAD	4.000	EA		$0.00
6865791	F&I -PEDESTRIAN PUSH BUTTON STATION ASSEM AND SIGN (R-10-3E)	4.000	EA		$0.00
6865830	VEHICLE TRAFFIC SIGNAL HEAD MOUNTING ASSEMBLY FOR SPAN WIRE	21.000	EA		$0.00
6865834	F&I BACKPLATE W/ RETROREFL.BORDERS FOR TRAFF. SIG.	37.000	EA		$0.00

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
6865840	F&I-PEDESTRIAN TRAF. SIGNAL HEAD MOUNTING ASSEM FOR POST TOP	1.000	EA		$0.00
6865841	F&I - PED TRAF. SIGNAL HEAD MOUNTING ASSEMBLY FOR SIDE POLE	3.000	EA		$0.00
6885992	TEMPORARY ADJUSTMENT OF TRAFFIC SIGNAL EQUIPMENT	3.000	LS		$0.00
6887951	FURNISH & INSTALL CONCRETE CABINET FOUNDATION	2.000	EA		$0.00
7011400	CONC. FOR STRUCTURES - CLASS 4000	267.600	CY		$0.00
7031100	REINF. STEEL FOR STRUCTURES (ROADWAY)	35,119.000	LB		$0.00
7055000	IRON PIPE HANDRAILING	205.000	LF		$0.00
7137400	DESIGN,DETAIL AND CONSTRUCT RETAINING WALL	650.000	SF		$0.00
7143618	18" SMOOTH WALL PIPE	9,920.000	LF		$0.00
7143624	24" SMOOTH WALL PIPE	4,196.000	LF		$0.00
7143630	30" SMOOTH WALL PIPE	2,104.000	LF		$0.00
7143636	36" SMOOTH WALL PIPE	732.000	LF		$0.00
7149999	CLEANING EXISTING PIPE	800.000	LF		$0.00
7191250	CATCH BASIN -TYPE 9 MH	16.000	EA		$0.00
7191605	CATCH BASIN -TYPE 16	111.000	EA		$0.00
7191625	CATCH BASIN -TYPE 17	1.000	EA		$0.00
7191650	CATCH BASIN -TYPE 18	5.000	EA		$0.00
7192020	DROP INLET (24"X36")	7.000	EA		$0.00
7192105	MANHOLE	12.000	EA		$0.00
7193005	PRECAST CONCRETE RISER - 48" DIAM.	2.000	LF		$0.00
7193105	PRECAST CONCRETE DRAINAGE BASE - 48" DIAM.	1.000	EA		$0.00
7196000	EXTRA DEPTH OF BOX	130.000	LF		$0.00
7199100	BEVELING OF PIPE END	12.000	EA		$0.00
7203210	CONC.CURB & GUTTER(2'-0")VERTICAL	22,100.000	LF		$0.00
7204100	CONCRETE SIDEWALK(4" UNIFORM)	4,650.000	SY		$0.00
7204900	DETECTABLE WARNING MATERIAL	165.000	SF		$0.00
7205000	CONCRETE DRIVEWAY(6" UNIFORM)	751.000	SY		$0.00
7206000	CONCRETE MEDIAN	160.000	SY		$0.00
7209000	PEDESTRIAN RAMP CONSTRUCTION	330.000	SY		$0.00

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
8041010	RIP-RAP (CLASS A)	1,900.000	TON		$0.00
8041020	RIP-RAP (CLASS B)	2,454.000	TON		$0.00
8041030	RIP-RAP (CLASS C)	1,646.000	TON		$0.00
8048210	GEOTEX/EROS.CONTROL(CLASS2)TYPE C	5,270.000	SY		$0.00
8051050	PREMASH W-BEAM STRONG POST SYSTEM WSP3	1075.000	LF		$0.00
8051151	MT3 LEADING END TREATMENT TL3	9.000	EA		$0.00
8051710	MB TRAILING END TREATMENT	1.000	EA		$0.00
8052200	MGS2C GR BEHIND CURB	3050.000	LF		$0.00
8053253	MTBBC3 MASH THRIE-BEAM BARRIER CONNECTOR TL3	4.000	EA		$0.00
8055300	SACRIFICIAL FLEXIBLE WARNING MARKER POST (FWMP) 48Y/Y	4.000	EA		$0.00
8055800	PREMASH W-BEAM TIGHT CURVED SYSTEM	65.200	LF		$0.00
8057100	PREMASH TYPE T TL3 LEADING 50'	2.000	EA		$0.00
8068301	TEMPORARY BARRIER FENCE	6,080.000	LF		$0.00
8071000	RESET FENCE	155.000	LF		$0.00
8091010	RIGHT OF WAY MARKER(REBAR&CAP)	264.000	EA		$0.00
8091050	RIGHT OF WAY PLAT	1.000	LS		$0.00
8100100	PERMANENT COVER	23.000	ACRE		$0.00
8100200	TEMPORARY COVER	12.000	ACRE		$0.00
8101105	COMPOST	6,200.000	CY		$0.00
8101110	STRAW OR HAY MULCH WITH TACKIFIER	35.000	ACRE		$0.00
8104005	FERTILIZER (NITROGEN)	2,300.000	LB		$0.00
8104010	FERTILIZER (PHOSPHORIC ACID)	2,300.000	LB		$0.00
8104015	FERTILIZER (POTASH)	2,300.000	LB		$0.00
8105005	AGRICULTURAL GRANULAR LIME	46,000.000	LB		$0.00
8109050	SELECTIVE WATERING	271,500.000	GAL		$0.00
8109901	MOWING	70.000	ACRE		$0.00
8151110	TEMP. EROSION CONTROL BLANKET	31.422	MSY		$0.00
8151203	H.E.C.P. - TYPE 3	70.000	ACRE		$0.00
8152004	INLET STRUCT.FILT.-TYPE-F(WEIGHTED)	1,760.000	LF		$0.00

SC Highway 557 Improvements Project
BID SCHEDULE - ROADWAY

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
8152006	INLET STRUCT.FILT.-TYPE-F(NON-WEIGHTED)	1,370.000	LF		$0.00
8153000	SILT FENCE	26,300.000	LF		$0.00
8153090	REPLACE/REPAIR SILT FENCE	7,890.000	LF		$0.00
8154010	CLEANING SILT BASINS	5,550.000	CY		$0.00
8154050	REM/SILT RETAIN BY SILT FENCE	6,575.000	LF		$0.00
8154155	CLEANING INLET STRUCTURE FILTERS	152.000	EA		$0.00
8156205	INLET STRUCTURE FILTER - TYPE D1	23.000	EA		$0.00
8156207	FILTER MATERIAL FOR INLET STRUCTURE FILTER - TYPE D1	23.000	EA		$0.00
8156212	INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 16)	109.000	EA		$0.00
8156214	INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 18)	5.000	EA		$0.00
8156410	AGGREGATE NO.5 OR 57 FOR EROSION CONTROL	3,620.000	TON		$0.00
8156490	STABILIZED CONSTRUCTION ENTRANCE	1,375.000	SY		$0.00
8157012	TEMPORARY FLEXIBLE PIPE SLOPE DRAIN - 12"	300.000	LF		$0.00

Roadway Base Bid Subtotal **$0.00**

SC Highway 557 Improvements Project
BID SCHEDULE - BRIDGE

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
2028100	REMOVE & DISPOSE OF EXISTING BRIDGE	1.000	LS		$0.00
6750278	2.0" SCHEDULE 80 PVC CONDUIT	1,565.000	LF		$0.00
7011400	CONCRETE FOR STRUCTURES - CLASS 4000	1,549.200	CY		$0.00
7020300	COMPRESSION SEAL JOINT	159.800	LF		$0.00
7023200	GROOVED SURFACE FINISH	2,449.000	SY		$0.00
7031200	REINFORCING STEEL FOR STRUCTURES (BRIDGE)	392,313.000	LBS		$0.00
7031220	HOOP REINFORCING STEEL FOR STRUCTURES (BRIDGE)	18,289.000	LBS		$0.00
7044000	P.S. CONCRETE BEAM (TYPE IV)	3,120.000	LF		$0.00
7054000	CONCRETE BRIDGE RAILING WALL (3'-6" HT.)	780.500	LF		$0.00
7110010	PILE DRIVING SET-UP	34.000	EA		$0.00
7111565	REINFORCED PILE TIPS (HP 14 X 89)	34.000	EA		$0.00
7112230	STEEL H-BEARING PILING (HP 14 X 89)	1,228.000	LF		$0.00
7120006	DRILLED SHAFT SET-UP	15.000	EA		$0.00
7120152	DRILLED SHAFT WITH ROCK EXCAVATION - 42" DIAMETER	82.500	LF		$0.00
7120161	DRILLED SHAFT WITH WET & DRY EXCAVATION - 48" DIAMETER	391.700	LF		$0.00
7120165	CONSTRUCTION CASING-48" DIAMETER	391.700	LF		$0.00
7243100	ELASTOMERIC BEARING	72.000	EA		$0.00
7270010	CROSSHOLE SONIC LOGGING SETUP	15.000	EA		$0.00
8011210	AGGREGATE UNDERDRAIN #789 W/4" PERF. PIPE FOR STRUCTURES	312.000	TON		$0.00
8142100	WATERPROOFING (SUBSTRUCTURE - SECOND METHOD)	45.500	SY		$0.00

Bridge (SC 557 over Crowder's Creek) Base Bid Subtotal **$0.00**

SC Highway 557 Improvements Project
BID SCHEDULE - WATER AND SEWER ITEMS for TOWN OF CLOVER

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
W1	MOBILIZATION	1.000	LS		$0.00
W2	TRAFFIC CONTROL	1.000	LS		$0.00
W3	REMOVE & DISPOSE EXISTING WATER LINES	1.000	LS		$0.00
W4	REMOVE & DISPOSE EXISTING SEWER FORCEMAIN	1.000	LS		$0.00
W5	PAVEMENT PATCH	250.000	LF		$0.00
W6	8" DUCTILE IRON PIPE & FITTINGS	410.000	LF		$0.00
W7	12" DIP WATERLINE & FITTINGS	4,475.000	LF		$0.00
W8	12" DIP SEWER FORCEMAIN & FITTINGS	3,175.000	LF		$0.00
W9	2" AIR RELEASE VALVE	4.000	EA		$0.00
W10	FIRE HYDRANT ASSEMBLY ON 8" WATERLINE	1.000	EA		$0.00
W11	FIRE HYDRANT ASSEMBLY ON 12" WATERLINE	4.000	EA		$0.00
W12	8" BUTTERFLY VALVE	2.000	EA		$0.00
W13	12" BUTTERFLY VALVE	6.000	EA		$0.00
W14	24" STEEL CASED BORE UNDER HWY 557	78.000	LF		$0.00
W15	CONNECT TO EXISTING WATER SYSTEM	5.000	EA		$0.00
W16	CONNECT TO EXISTING SEWER SYSTEM	2.000	EA		$0.00
W17	RECONNECT TO EXISTING WATER METER	1.000	EA		$0.00
W18	TESTING DISINFECTION - WATER LINES	1.000	LS		$0.00
W19	RECORD DRAWINGS	1.000	LS		$0.00
W20	GRASSING	1.500	AC		$0.00

Enter Subtotal into ROADWAY Bid item "UTILITY RELOCATION NO. 001" **$0.00**

SC Highway 557 Improvements Project
BID SCHEDULE - WATER AND SEWER ITEMS for BLUE GRANITE WATER COMPANY

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
W1	MOBILIZATION	1.000	LS		$0.00
W2	TRAFFIC CONTROL	1.000	LS		$0.00
W3	REMOVE & DISPOSE EXISTING WATER LINES	1.000	LS		$0.00
W4	PAVEMENT PATCH	120.000	LF		$0.00
W5	12" DUCTILE IRON PIPE & FITTINGS	4,715.000	LF		$0.00
W6	6" PVC PIPE & FITTINGS	1,919.000	LF		$0.00
W7	2" AIR RELEASE VALVE	3.000	EA		$0.00
W8	FIRE HYDRANT ASSEMBLY ON 12" WATERLINE	6.000	EA		$0.00
W9	12" BUTTERFLY VALVE	9.000	EA		$0.00
W10	20" STEEL CASING PIPE (OPEN-CUT)	80.000	LF		$0.00
W11	20" STEEL CASED BORE UNDER HWY 557	110.000	LF		$0.00
W12	CONNECT TO EXISTING WATER SYSTEM	4.000	EA		$0.00
W13	CONNECT TO EXISTING SEWER SYSTEM	2.000	EA		$0.00
W14	RECONNECT TO EXISTING WATER METER	10.000	EA		$0.00
W15	TESTING DISINFECTION - WATER LINES	1.000	LS		$0.00
W16	RECORD DRAWINGS	1.000	LS		$0.00
W17	GRASSING	1.500	AC		$0.00

Enter Subtotal into ROADWAY Bid item "UTILITY RELOCATION NO. 002" **$0.00**

BID FORM

SC Highway 557 Improvements Project

Base Bid List

(The base bid of this bid document shall include all costs to provide each line item described to the roads contained within this bid and as outlined in this bid document.)

Roadway Base Bid Subtotal **$** _____

Bridge Base Bid Subtotal **$** _____

Water and Sewer Base Bid Subtotal **$ See Note Below**

*Note: Included in Roadway Bid Items – Utility Relocation No. 001 & 002

Total Cost (Roadway Items + Bridge Items + Water & Sewer Items)

$ _____

10% for Allowance (Total Cost X 10%) **$** _____

Total Project Bid: $_____

Attached hereto is a cashier's check on the _____

Bank of _____

or Bid Bond for the sum _____Dollars (_____

_____ L.S.
(Name of Bidder) (Affix Seal)

_____ L.S.
(Signature of Officer)

_____ L.S.
(Title of Officer)

Address:

P.O. Box_____ Street:_____

City:_____ State, Zip Code:_____

Telephone:_____ Fax:_____

Federal ID#:_____

Email address: _____

Contractor License type: _____ Contractor License number: _____

License status: _____ Expiration: _____

Classification: _____

The full names and residences of persons and firms interested in the foregoing bid, as principals, are as follows:

_____

_____

Name of the executive who will give personal attention to the work:

_____

_____

Attach list of subcontractors as required by Article 13.4 of Information to Bidders.

END OF SECTION

DIVISION I - SECTION 3B

BID BOND FORM

SAMPLE

BID BOND
(EXAMPLE FORMAT)

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS, that _____

as Principal, and _____, as Surety, a Corporation chartered and existing under the laws of the State of _____, with its principal offices in the City of_____, and authorized to do business in the State of South Carolina are held and firmly bound unto the OWNER, _____

_____ in the penal Sum of _____

_____Dollars ($_____) lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted to the OWNER the accompanying bid, dated _____***, 2023***, for:

SC Highway 557 Improvements Project

NOW, THEREFORE,

A. If said Bid shall be rejected, or

B. If the principal shall not withdraw said Bid within twenty-four (24) hours after date of opening of the same, and shall within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the OWNER in accordance with the Bid as accepted, and give bonds with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract, then the above obligations shall be void and of no effect, otherwise to remain in full force and effect.

C. In the event of the withdrawal of said Bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the principal shall pay the OWNER the difference between the amount specified in said bid and the amount for which the OWNER may procure the required work and supplies, if the latter amount be in excess of the former, then the above obligations shall be void and of no effect, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under their several seals, this ____ day of _____, A.D., *2023,* the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

WITNESSES: PRINCIPAL:

_____ _____
Name of Firm

_____ _____
Signature of Authorized Officer
(Affix Seal)

_____
Title

_____
Business Address

_____
City State

WITNESS: SURETY:

_____ _____
Corporate Surety

_____
(Affix Attorney-in-Fact Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____who signed the said bond on behalf of the principal, was then _____ of said corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

_____
(Corporate Secretary Seal)

STATE OF SOUTH CAROLINA
COUNTY OF YORK

Before me, a Notary Public duly commissioned, qualified and acting, personally appeared _____to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of the OWNER, the _____.

Subscribed and sworn to before me this ____ day of_____, *2023*, A.D.

(Attach Power of Attorney
to original Bid Bond)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires:_____

END OF SECTION

DIVISION I - SECTION 4

CONTRACT DOCUMENTS

DIVISION I - SECTION 4A

AGREEMENT BETWEEN CONTRACTOR AND OWNER

AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, *2023* A.D., by and between the York County Government, party of the first part (hereinafter sometimes called the "OWNER"), and _____, party of the second part (hereinafter sometimes called the "CONTRACTOR").

WITNESSETH: That the parties hereto, for the consideration hereinafter set forth, mutually agree as follows:

1. SCOPE OF THE WORK

   1.1. The CONTRACTOR shall furnish all labor, materials, equipment, machinery, tools, apparatus, and transportation and perform all of the Work shown on the Drawings and described in the Specifications entitled:

   Pennies for Progress Project
   SC Highway 557 Improvements

   as prepared by York County Engineering Department acting as, and in the Contract Documents entitled the ENGINEER, and shall do everything required by this Contract and the other Contract Documents.

2. THE CONTRACT SUM

   2.1. The OWNER shall pay to the CONTRACTOR for the faithful performance of the Contract, in lawful money of the United States, and subject to addition and deductions as provided in the Contract Documents, a total sum as follows:

   Based upon the prices shown in the Bid heretofore submitted to the OWNER by the CONTRACTOR, a copy of said Proposal being a part of these Contract Documents, the aggregate amount of this Contract (obtained from either the lump sum price, the application of unit prices to the quantities shown in the Bid, or the combination of both) being the sum of

   _____

   ($_____).

3. COMMENCEMENT AND COMPLETION OF WORK

   3.1. The CONTRACTOR shall commence Work and the Contract Time will commence to run on the date fixed in the Notice to Proceed.

   3.2. The CONTRACTOR shall prosecute the Work with faithfulness and diligence and shall be completed and ready for final payment within ***900 calendar* days** after commencement date fixed in the Notice to Proceed.

4. CONTRACTOR'S ACCEPTANCE OF CONDITIONS

   4.1. The CONTRACTOR hereby agrees that, by virtue of submitting a completed Bid including his declarations therein of full satisfaction, knowledge and understanding of the Contract Documents, site conditions (surface and subsurface) and all other conditions affecting the Work, he assumes full responsibility for performance of the Work as required under this Contract. It is expressly agreed that under no circumstances, conditions or situations shall this Contract be more strongly construed against the OWNER than against the CONTRACTOR and his Surety.

4.2. It is understood and agreed that the passing, approval and/or acceptance of any part of the Work or material by the OWNER, ENGINEER, or by any agent or representative, as being in compliance with the terms of this Contract and/or of the Contract Documents, shall not operate as a waiver by the OWNER of strict compliance with the terms of this Contract, and/or the Contract Documents covering said Work; and the OWNER may require the CONTRACTOR and/or his surety to repair, replace, restore and/or make to comply strictly and in all things with this Contract and the Contract Documents any and all of said Work and/or materials which within a period of two years from and after the date of the acceptance of any such Work or material, are found to be defective or to fail in any way to comply with this Contract or with the Contract Documents. This provision shall not apply to materials or equipment normally expected to deteriorate or wear out and become subject to normal repair and replacement before their condition is discovered. Failure on the part of the CONTRACTOR and/or his Surety, immediately after notice to either, to repair or replace any such defective materials and workmanship shall entitle the OWNER, if it sees fit, to replace or repair the same and recover the reasonable cost of such replacement and/or repair from the CONTRACTOR and/or his surety, who shall in any event be jointly and severally liable to the OWNER for all damage, loss and expense caused to the OWNER by reason of the CONTRACTOR's breach of this Contract and/or his failure to comply strictly and in all things with this Contract.

5. LIQUIDATED DAMAGES

5.1. It is mutually agreed that time is of the essence of this Contract and should the CONTRACTOR fail to complete the work within the specified time, or any authorized extension thereof, there shall be deducted from the compensation otherwise to be paid to the CONTRACTOR, and the OWNER will retain the amount of *Two Thousand, Two Hundred Dollars ($2,200.00)* per calendar day as fixed, agreed, and liquidated damages for each calendar day elapsing beyond the specified time for substantial completion or any authorized extension thereof, which sum shall represent the actual damages which the OWNER will have sustained by failure of the CONTRACTOR to complete the work within the specified time. After substantial completion, if the CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, Contractor shall pay OWNER *Two Thousand, Two Hundred Dollars ($2,200.00)* per for each calendar day that expires after the date specified for Final Completion and readiness for final payment until the work is complete and ready for final payment. It being further agreed that said sum is not a penalty, but is the stipulated amount of damages sustained by the OWNER in the event of such default by the CONTRACTOR.

5.2. For the purposes of this Article, the day of final acceptance of the Work shall be considered a day of delay, and the scheduled day of completion of the work shall be considered a day scheduled for production.

6. PARTIAL AND FINAL PAYMENTS

6.1. In accordance with the provisions fully set forth in the General Conditions, and subject to additions and deductions as provided, the OWNER shall pay the CONTRACTOR as follows:

6.1.1. Within 30 days after receipt by the OWNER of the CONTRACTOR's request for partial payment, the OWNER shall make partial payments to the CONTRACTOR, on the basis of the estimate of Work as approved by the ENGINEER, for work performed during the preceding calendar month, less five percent (5%) of the amount of such estimate which is to be retained by the OWNER until all Work has been performed strictly in accordance with this Agreement and until such Work has been accepted by the OWNER.

6.1.2. Upon submission by the CONTRACTOR of evidence satisfactory to the OWNER that all payrolls, material bills and other costs incurred by the CONTRACTOR in connection with

the construction of the Work have been paid in full, including all retainage to subcontractors on the project, and also after all guarantees that may be required in the specifications have been furnished and are found acceptable by the OWNER, final payment on account of this Agreement shall be made within sixty (60) days after completion by the CONTRACTOR of all Work covered by this Agreement and acceptance of such Work by the OWNER.

6.1.3. Retainage will be released in full at Final Completion.

7. ADDITIONAL BOND

7.1. It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Performance and Payment Bonds hereto attached for its faithful performance, the OWNER shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bond(s) ceases to be adequate to cover the performance of the Work, the CONTRACTOR shall, at his expense, and within three days after the receipt of notice from the OWNER to do so, furnish an additional bond or bonds, in such form and amount, and with such sureties as shall be satisfactory to the OWNER. In such event, no further payment to the CONTRACTOR shall be deemed due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the OWNER.

8. CONTRACT DOCUMENTS

8.1. The Contract Documents, as stated in the Instructions to Bidders, including this Project Manual and General Conditions, and the accompanying Contract Drawings, shall form the Contract and are as fully a part of this Contract as if herein repeated.

IN WITNESS WHEREOF the parties hereto have executed this Agreement on the day and date first above written in three (3) counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original Contract.*

Owner	Contractor
By:_____	By:_____
[Corporate Seal]	[Corporate Seal]
Attest:_____	Attest:_____
Address for giving notices:	Address for giving notices:
	License No._____
	Agent for service of process:_____

(*) In the event that the CONTRACTOR is a Corporation, a certificate of resolution of the Board of Directors of the Corporation, authorizing the officer who signs the Contract to do so in its behalf shall be completed and submitted with this form.

END OF SECTION

DIVISION I - SECTION 4B

GENERAL CONDITIONS OF THE CONTRACT

GENERAL CONDITIONS

1. DEFINITIONS

1.1. Whenever used in any of the Contract Documents, the following meanings shall be given to the terms herein defined:

1.1.1. *Addendum* or *Addenda* - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents.

1.1.2. *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.

1.1.3. *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.

1.1.4. *Bid* - The offer or proposal of the bidder on the prescribed Bid Form setting forth the prices for the Work to be performed.

1.1.5. *Bidder* - One who submits a Bid directly to OWNER, as distinct from sub-bidder, who submits a Bid to a Bidder.

1.1.6. *Bidding Documents* - The Invitation for Bids, Instruction to Bidders, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

1.1.7. *Bonds* - Performance and Indemnity and Payment Bonds and other instruments of security.

1.1.8. *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.

1.1.9. *Contract Documents* - Executed Agreement, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, Bid Guarantee, Statement of Bidder's Qualifications, Performance and Indemnity Bond, Payment Bond, Certification of Insurance, General Conditions, Supplemental Conditions (if any), Special Conditions (if any), Technical Specifications, and Drawings (as listed in the Index of Drawings).

1.1.10. *Contract Price* - The moneys payable by OWNER for completion of the Work in accordance with the Contract Documents.

1.1.11. *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 records.

1.1.12. *CONTRACTOR* - The person, firm, or corporation entering into Contract with the OWNER to construct and install the improvements embraced in this Contract.

1.1.13. *Defective* - An adjective which when modifying the word Work refers to 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 had been damaged prior to ENGINEER's recommendation or final payment.

1.1.14. *Drawings* - The construction drawings which graphically show the scope, extent, and character of the Work to be furnished and performed by the CONTRACTOR and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents. These Drawings are listed in the Index of Drawings.

1.1.15. *ENGINEER* – The person, firm or corporation serving the OWNER with Engineering services, his successors, or any other person or persons, employed by said OWNER for the purpose of directing or having charge of the work embraced in this Contract.

1.1.16. *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.

1.1.17. *Liens* - Liens, charges, security interests or encumbrances upon project funds, real property or personal property.

1.1.18. *Local Government* - York County, South Carolina, within which the Project Areas are situated.

1.1.19. *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.

1.1.20. *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.

1.1.21. *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 on which CONTRACTOR shall start to perform, CONTRACTOR's obligations under the Contract Documents.

1.1.22. O*WNER* - The York County Government, which is authorized to undertake this Contract.

1.1.23. *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.

1.1.24. *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.

1.1.25. *Project Area* - The area within which are the specified limits of the improvements to be constructed in whole or in part under this Contract.

1.1.26. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

1.1.27. *Resident Project Representative* – The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

1.1.28. *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.

1.1.29. *Site* – Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of the CONTRACTOR.

1.1.30. *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.

1.1.31. S*pecial Conditions* - The part of the Contract Documents that amends or supplements the Technical Specifications.

1.1.32. *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.

1.1.33. *Substantial Completion* - The Work (or specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER's definitive certification 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. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.1.34. *Successful Bidder* - The lowest, qualified, responsible and responsive Bidder to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

1.1.35. *Supplier* – A manufacturer, fabricator, supplier, distributor, material man 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.

1.1.36. *Supplemental Conditions* - The part of the Contract Documents that amends or supplements these General Conditions.

1.1.37. *Technical Specifications* - The part of the Contract Documents that describes, outlines, and stipulates: the quality of materials, equipment and systems to be furnished; the quality of workmanship required; and the methods to be used in carrying out the construction work to be performed under this Contract.

1.1.38. *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.

1.1.39. *Unit Price Work* - Work to be paid for on the basis of unit prices.

1.1.40. *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 and incorporating materials and equipment into the construction, and furnishing, installing and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

1.2 Other technical terms not specifically defined within the Contract Documents shall have the meanings given in AIA Document "Glossary of Construction Industry Terms," current edition. Technical terms not

defined as above and used to describe items of the Work, and which so applied have a well-known technical or trade meaning, shall be deemed to have such recognized meaning.

2. CONTRACTOR'S OBLIGATIONS

2.1. All work shall be done in strict accordance with the Contract Documents. Observations, construction reviews, tests, recommendations or approvals by the ENGINEER or persons other than the CONTRACTOR, shall in no way relieve the CONTRACTOR of his obligations to complete all work in accordance with the Contract Documents. All work shall be done under the direct supervision of the CONTRACTOR. The CONTRACTOR shall be responsible for construction means, methods, techniques, and procedures, and for providing a safe place for the performance of the work by the CONTRACTOR, Subcontractors, suppliers, and their employees and for access, use, work, or occupancy by all authorized persons.

3. LANDS BY CONTRACTOR

3.1. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application, but specifically related to the use of the Site with which the CONTRACTOR must comply in performing work.

3.2. Any land and access thereto not specifically shown to be furnished by the OWNER that may be required for temporary construction facilities or for storage of materials and equipment shall be provided by the CONTRACTOR with no liability to the OWNER. The CONTRACTOR shall confine his apparatus and storage to such additional areas as he may provide at his expense.

3.3. The CONTRACTOR shall not enter upon private property for any purpose without obtaining permission, and he shall be responsible for the preservation of all public property, trees, monuments, structures and improvements, along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits, and other underground structures, and shall protect carefully from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed.

4. SURVEYS BY CONTRACTOR

4.1. Based upon the Construction Documents and any additional information provided by the OWNER, the CONTRACTOR shall develop and make all detailed surveys necessary for construction, including working points, lines and elevations.

5. PUBLIC UTILITIES

5.1. The elevation and location of all public utilities shown on the Drawings were taken from existing public records. It shall be the duty of the CONTRACTOR to make final and exact determination of the location and extent of all utilities and he will be liable for any expense resulting from damage to them.

6. SUPERINTENDENT

6.1. A qualified superintendent, who is acceptable to the OWNER, shall be maintained on the Work and shall give efficient supervision to the Work until its completion. The superintendent shall have full authority to act in behalf of the CONTRACTOR, and all instruction given to the superintendent shall be considered as given to the CONTRACTOR. It shall be the responsibility of this CONTRACTOR's superintendent to coordinate the Work of all the Subcontractors. The superintendent shall be present on the site at all times required to perform adequate supervision and coordination.

7. SUBCONTRACTORS

7.1. At the time set forth in the Contract Documents or when requested by the OWNER, the CONTRACTOR shall submit in writing for review of the OWNER the names of the Subcontractors proposed for the work. Subcontractors may not be changed except at the request or with the approval of the OWNER. The CONTRACTOR is responsible to the OWNER for the acts and deficiencies of his Subcontractors, and of their direct and indirect employees, to the same extent as he is responsible for the acts and deficiencies of his employees. The Contract Documents shall not be construed as creating any contractual relation between any Subcontractor and the OWNER. The CONTRACTOR shall bind every Subcontractor by the terms of the Contract Documents.

8. ASSIGNMENTS

8.1. The CONTRACTOR shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder without written consent of the OWNER. In case the CONTRACTOR assigns all or any part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

9. MUTUAL RESPONSIBILITY OF CONTRACTORS

9.1. If through acts of neglect on the part of the CONTRACTOR, any other CONTRACTOR or any Subcontractor shall suffer loss or damage on the work, the CONTRACTOR agrees to settle with such other CONTRACTOR or Subcontractor by agreement or arbitration if such other CONTRACTOR or Subcontractor will so settle. If such other CONTRACTOR or Subcontractor shall assert any claim against the OWNER on account of any damage alleged to have been sustained, the OWNER shall notify the CONTRACTOR, who shall indemnify and save harmless the OWNER against any such claim.

10. ORAL AGREEMENTS

10.1. No oral order, objection, claim or notice by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

11. MATERIALS, SERVICE AND FACILITIES

11.1. It is understood that except as otherwise specifically stated in the Contract Documents, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, gas, light, power, transportation, superintendence, taxes, insurance, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

11.2. Any work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the OWNER.

12. MATERIALS AND EQUIPMENT

The materials and equipment installed in the work shall meet the requirements of the Contract Documents and no materials or equipment shall be ordered until reviewed by the ENGINEER. The CONTRACTOR shall furnish all materials and equipment not otherwise specifically indicated or provided by the OWNER.

The CONTRACTOR shall guarantee all materials and equipment he provides in accordance with Section 16 of these GENERAL CONDITIONS.

12.1. Substitutions: In order to establish standards of Quality, the ENGINEER has, in the detailed Specifications, referred to certain products by name and catalog number without consideration of possible substitute or “or equal” items. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design.

12.1.1. Whenever it is indicated in the Drawings or specified in the specifications that a substitute or “or-equal” item of material or equipment may be furnished or used by the CONTRACTOR, application for such acceptance will not be considered by the ENGINEER until after the Effective Date of the agreement. The CONTRACTOR shall furnish the complete list of proposed desired substitutions, together with such engineering and catalog data as the ENGINEER may require. All proposals for substitutions shall be submitted in writing by the General Contractor and not by individual trades or material suppliers. The ENGINEER will review proposed substitutions and make his recommendations in writing within reasonable time.

12.1.2. The CONTRACTOR shall abide by the ENGINEER's recommendation when proposed substitute materials or items of equipment are not recommended for installation and shall furnish the specified material or item of equipment in such case.

12.2. Space Requirements: It shall be the responsibility of the CONTRACTOR to insure that materials and equipment to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall order such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Contract Documents.

12.3. Arrangement: Where equipment requiring different arrangement of connections from those shown is approved, it shall be the responsibility of the CONTRACTOR to install the equipment to operate properly, and in harmony with the intent of the work required by such arrangement.

12.4. Unacceptable Materials and Equipment: Materials and equipment which do not conform to the requirements of the Contract Documents, or are not equal to samples reviewed by the ENGINEER, or are in any way unsatisfactory or unsuited to the purpose for which they are intended, shall not be furnished nor installed.

12.5. Storage: Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground and/or they shall be placed under cover. Stored materials and equipment shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the property owner or leasee. Materials, equipment, construction machinery, fuel, and oils shall not be stored or parked within the drip-line of any trees in or adjacent to the project site or additional off-site easements and right-of-ways.

12.6. Manufacturer's Directions: Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

13. INSPECTION AND TESTING OF MATERIALS

13.1. Unless otherwise specifically provided for in the specifications, the inspection and testing of material and finished articles to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the OWNER. The cost of such inspection and testing shall be paid by the CONTRACTOR. The CONTRACTOR shall furnish evidence satisfactory to the OWNER that the material and finished articles have passed the required tests prior to the incorporation of such materials

and finished articles in the work. The CONTRACTOR shall promptly segregate and remove rejected material and finished articles from the site of the work.

14. SAMPLES

14.1. All samples called for in the Specifications or required by the ENGINEER shall be furnished by the CONTRACTOR and shall be submitted to the ENGINEER for his review. Samples shall be furnished so as not to delay fabrication, allowing the ENGINEER reasonable time for the consideration of the samples submitted.

14.1.1. Samples for Tests: CONTRACTOR shall furnish such samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to standard methods or as provided in the Contract Documents.

14.1.2. CONTRACTOR's Guaranty: All samples shall be submitted by the CONTRACTOR with a covering letter indicating that such samples are recommended by the CONTRACTOR for the service intended and that the CONTRACTOR's Guaranty will fully apply.

14.1.3. All materials, equipment and workmanship shall be in accordance with samples guaranteed by the CONTRACTOR and reviewed by the ENGINEER.

15. SHOP DRAWINGS

15.1. The CONTRACTOR shall provide shop drawings, setting schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or the ENGINEER's instructions. Deviations from the Drawings and Specifications shall be called to the attention of the ENGINEER at the time of the first submission of shop drawings and other drawings for consideration. The ENGINEER's review of any drawings shall not release the CONTRACTOR from responsibility for such deviations. Shop drawings shall be submitted according to a schedule prepared jointly by the CONTRACTOR and the ENGINEER.

15.1.1. CONTRACTOR's Certification: When submitted for the ENGINEER's review, shop drawings shall bear the CONTRACTOR's certification that he has reviewed, checked and approved the shop drawings, that they are in harmony with the requirements of the Project and with the provisions of the Contract Documents, and that he has verified all field measurements and construction criteria, materials, catalog numbers and similar data. CONTRACTOR shall also certify that the work represented by the shop drawings is recommended by the CONTRACTOR and the CONTRACTOR's Guaranty will fully apply.

16. GUARANTY

16.1. The CONTRACTOR shall guarantee all materials and equipment furnished and work performed for a period of one years from the date of final payment of the work.

16.1.1. The Performance and Indemnity Bond shall remain in full force and effect during the guaranty period.

16.1.2. Correction of faulty work after final payment shall be as provided in Paragraph 41.

17. INSURANCE

17.1. The CONTRACTOR shall not commence any work until he obtains, at his own expense, all required insurance. Such insurance must have the approval of the OWNER as to the limit, form, and amount. The CONTRACTOR will not permit any Subcontractor to commence work on this project until such Subcontractor has complied with the same insurance requirements.

Types: The types of insurance the CONTRACTOR is required to obtain
and maintain for the full period of the Contract will be: Workmen's Compensation Insurance, Automobile and Comprehensive General Liability Insurance as detailed in the following portions of this specification.

17.1.2. Evidence: As evidence of specified insurance coverage, the OWNER may, in lieu of actual policies, accept certificates issued by the insurance carrier showing such policies in force for the specified period. Each policy or certificate will bear an endorsement or statement waiving right of cancellation or reduction in coverage within ten days' notice in writing to be delivered by registered mail to the OWNER. Should any policy be cancelled before final payment by the OWNER to the CONTRACTOR and the CONTRACTOR fails immediately to procure other insurance as specified, the OWNER reserves the right to procure such insurance and to deduct the cost thereof from any sum due the CONTRACTOR under this Contract.

17.1.3. Adequacy of Performance: Any insurance bearing on adequacy of performance shall be maintained after completion of the project for the full guaranty period. Should such insurance be cancelled before the end of the guaranty period and the CONTRACTOR fails immediately to procure other insurance as specified, the OWNER reserves the right to procure such insurance and to charge the cost thereof to the CONTRACTOR.

17.1.4. Payment of Damages: Nothing contained in these insurance requirements is to be construed as limiting the extent of the CONTRACTOR's responsibility for payment of damages resulting from his operations under this Contract.

18. WORKMEN'S COMPENSATION INSURANCE

18.1. Before the Agreement between the OWNER and the CONTRACTOR is entered into, the CONTRACTOR shall submit written evidence that he and all Subcontractors have obtained, for the period of the Contract, full Workman's Compensation Insurance coverage for all persons whom they employ or may employ in carrying out the work under this Contract. This insurance shall be in strict accordance with the requirements and statutory limits of the most current and applicable South Carolina Workman's Compensation Insurance Laws.

19. COMPREHENSIVE GENERAL LIABILITY AND AUTOMOBILE INSURANCE

19.1. Before commencement of the work, the CONTRACTOR shall submit written evidence that he and all his Subcontractors have obtained for the period of the Contract, full Comprehensive General Liability Insurance and automobile coverage. This coverage shall provide for both bodily injury and property damage.

19.1.1. Comprehensive General Liability Insurance shall include coverage for bodily injury, sickness or disease, death, or property damage arising directly or indirectly out of or in connection with the performance of work under this Contract, and shall provide for a combined single limit of not less than one million ($1,000,000) dollars for all damages arising out of bodily injury, sickness or disease, death, or property damage for each occurrence.

19.1.2. Automobile insurance shall include coverage for bodily injury and property damage arising directly or indirectly out of or in connection with the performance of work under this Contract, and shall provide for a combined single limit of not less than one million ($1,000,000) dollars for all damages arising out of bodily injury or property damage for each occurrence.

19.1.3. Indemnity: Included in such insurance will be contractual coverage sufficiently broad to insure the provisions of Paragraph 20.

20. INDEMNITY

20.1. The CONTRACTOR shall hold harmless, indemnify and defend the OWNER, it's successors and assigns, the ENGINEER, their consultants, and each of their officers and employees and agents, from any and all liability claims, losses or damage arising or alleged to arise from the performance of the work described herein, but not including the sole negligence of the OWNER or the ENGINEER.

21. PATENTS AND ROYALTIES

21.1. If any design, device, material or process covered by letters, patent or copyright is used by the CONTRACTOR, he shall provide for such use by legal agreement with the OWNER of the patent or a duly authorized licensee of such OWNER, and shall save harmless the OWNER, and the ENGINEER, from any and all loss or expense on account thereof, including its use by the OWNER.

22. PERMITS

22.1. All permits and licenses necessary for the prosecution of the work shall be secured and paid for by the CONTRACTOR. This shall include all Business Licenses required by the Local Government.

23. LAWS TO BE OBSERVED

23.1. The CONTRACTOR shall give all notices and comply with all Federal, State and local laws, ordinances and regulations in any manner affecting the conduct of the work, and all such orders and decrees as exist, or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the OWNER its successors and assigns, the ENGINEER, their consultants, and each of their officers and employees and agents against any claim or liability arising from, or based on, the violation of any such law, ordinance, regulation, order or decree, whether by himself or his employees.

24. WARNING SIGNS AND BARRICADES

24.1. The CONTRACTOR shall provide adequate signs, barricades, red lights and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be placed and illuminated at night as to show in advance where construction, barricades, or detours exist.

25. PUBLIC CONVENIENCE

25.1. The CONTRACTOR shall at all times so conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property. No road or street shall be closed to the public except with permission of the proper authorities. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed.

26. SAFETY

26.1. The CONTRACTOR shall be solely and completely responsible for the conditions of the job site, including safety of all persons and property affected directly or indirectly by his operation during the performance of the work. This requirement will not be limited to normal working hours but will only apply continuously 24 hours per day until written acceptance of the work by the OWNER and shall not be limited to normal working hours.

26.2. The ENGINEER's construction reviews of the CONTRACTOR's performance is not intended to include review of the adequacy of the CONTRACTOR's safety measures in, on, or near the construction site.

27. NOTICE TO PROCEED

27.1. Following the execution of the Contract by the OWNER and the CONTRACTOR, written Notice to Proceed with the work shall be given by the OWNER to the CONTRACTOR. The CONTRACTOR shall begin and shall prosecute the work regularly and uninterruptedly thereafter (except as provided for herein) with such force as to secure the completion of the work within the Contract Time.

28. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

28.1. It is hereby understood and mutually agreed, by and between the CONTRACTOR and the OWNER, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the Notice to Proceed.

28.2. The CONTRACTOR agrees that said work shall proceed regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

28.3. If said CONTRACTOR shall neglect, fail, or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the CONTRACTOR shall be in default after the time stipulated in the Contract for completing the work.

28.4. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

28.5. It is further agreed that time is of the essence of each and every portion of this Contract and of the Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. PROVIDED, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following:

28.5.1. Any preference, priority or allocation order duly issued by the Federal or State Government.

28.5.2. Unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, flood, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; and

28.5.3. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsection 28.5.1. and 28.5.2. of this article:

> PROVIDED, FURTHER, that the CONTRACTOR shall, within 10 days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter, and grant such extension of time as the OWNER shall deem equitable and just.

29. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

29.1. Immediately after execution and delivery of the contract, and before the first partial payment is made, the CONTRACTOR shall deliver to the OWNER an estimated construction progress schedule in a form satisfactory to the OWNER, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents.

30. EXTENSION OF CONTRACT TIME

30.1. A delay beyond the CONTRACTOR's control occasioned by an Act of God, by act or omission on the part of the OWNER or by strikes, lockouts, fire, etc., may entitle the CONTRACTOR to any extension of time in which to complete the work as agreed by the OWNER, provided, however, that the CONTRACTOR shall immediately give written notice to the OWNER of the cause of such delay.

30.2. Act of God shall mean an earthquake, flood, cyclone, or other cataclysmic phenomenon. Storms of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the CONTRACTOR for damages to the work resulting there from.

31. EXTRA WORK

31.1. New and unforeseen items of work found to be necessary, and which cannot be covered by any item or combination of items for which there is a Contract price, shall be classed as Extra Work. It shall be the responsibility of the CONTRACTOR to identify necessary work items classed as Extra Work and for which no previous contract price has been arranged and advise the ENGINEER and the OWNER of the need for the aforesaid necessary Extra Work. The CONTRACTOR shall do such Extra Work and furnish such materials as may be required for the proper completion or construction of the whole work contemplated, upon written order from the OWNER as approved by the ENGINEER. In the absence of such written order, no claim for Extra Work shall be considered.

31.2. Extra Work shall be performed in accordance with these Contract Documents where applicable and work not covered by such shall be done in accordance with the best construction practice and in a workmanlike manner.

31.3. Extra Work required in an emergency to protect life and property shall be performed by the CONTRACTOR as required.

32. CLEANING UP

32.1. The CONTRACTOR shall at all times, keep the premises clean and shall remove from the OWNER's property, and from all public and private property, temporary structures, rubbish, waste materials resulting from his operation or caused by his employees, and all surplus materials, leaving the site smooth, clean and true to line and grade and in the same condition as existed prior to the work performed by the CONTRACTOR or his Subcontractors and as approved by the OWNER. Failure to maintain a clean project site or to complete clean-up of the project site at the completion of the work shall

be cause for the OWNER to perform the necessary clean-up and the costs thereof shall be charged to the CONTRACTOR.

33. REQUEST FOR PAYMENT

33.1. The CONTRACTOR may submit to the OWNER periodically, but not more than once each month, a Request for Payment for work done and materials delivered to and stored on the site. The CONTRACTOR shall furnish the OWNER all reasonable information required for obtaining the necessary data relative to the progress and execution of the work. Payment for materials stored on the site will be conditioned upon evidence submitted to establish the OWNER's title to such materials. Each Request for Payment shall be computed on the basis of work completed on all items listed in the Detailed Breakdown of Contract (or on unit prices, as the case may be), less retainage as stated in Special Provisions until final completion and acceptance of the work and less previous payments.

34. ENGINEER'S ACTION ON REQUEST FOR PAYMENT

34.1. All CONTRACTOR's Requests for Payment shall be referred to the ENGINEER for his review and, within a reasonable period, the ENGINEER shall:

34.1.1. Recommend payment by the OWNER of the Request for Payment as submitted.

34.1.2. Recommend payment by the OWNER of such other amount as the ENGINEER shall consider as due the CONTRACTOR, informing the OWNER and the CONTRACTOR in writing of his reasons for recommending the amended amount.

34.1.3. Recommend to the OWNER that payment of the Request for Payment be withheld, informing the CONTRACTOR and the OWNER in writing of his reasons, for so recommending.

35. OWNER'S ACTION ON REQUEST FOR PAYMENT

35.1. Within thirty days after receipt of a Request for Payment from the CONTRACTOR, the OWNER shall:

35.1.1. Pay the Request for Payment as recommended by the ENGINEER.

35.1.2. Pay such other amount, in accordance with Paragraph 36, as he shall decide is due the CONTRACTOR, informing the CONTRACTOR and the ENGINEER in writing of this reasons for paying the amended amount.

35.1.3. Withhold payment in accordance with Paragraph 36, informing the CONTRACTOR and the ENGINEER of his reasons for withholding payment.

36. OWNER'S RIGHT TO WITHHOLD PAYMENT OF A REQUEST FOR PAYMENT

36.1. The OWNER may withhold payment, in whole or in part, of a Request for Payment to the extent necessary to protect himself from loss on account of any of the following:

36.1.1. Defective work.

36.1.2. Evidence indicating the probable filing of claims by other parties against the CONTRACTOR that may adversely affect the OWNER.

36.1.3. Failure of the CONTRACTOR to make payments due to Subcontractors, material suppliers, or employees.

36.1.4. Damage to another CONTRACTOR.

37. PAYMENT FOR EXTRA WORK

37.1. Written notice of claims for payment for Extra Work shall be given by the CONTRACTOR within ten days after receipt of instructions from the OWNER to proceed with the Extra Work and also before any work is commenced, except in emergency endangering life or property. No claim shall be valid unless so made. In all cases, the CONTRACTOR's itemized estimate sheets showing all labor and material shall be submitted to the OWNER. The OWNER's order for Extra Work shall specify any extension of the Contract Time and one of the following methods of payment:

37.1.1. Unit prices or combination of unit prices which formed the basis of the original Contract.

37.1.2. A lump sum based on the CONTRACTOR's estimate and accepted by the OWNER.

37.1.3. Actual cost plus 15 percent for overhead and profit. Actual costs are defined as follows:

37.1.3.1. Labor costs, including time of foreman while engaged directly upon extra work.

37.1.3.2. Labor insurance and taxes.

37.1.3.3. Materials and supplies actually used on the work.

37.1.3.4. Associated General Contractors of America standard rental rates on each piece of equipment having a value in excess of $50.00. Equipment and tools of lesser value are considered "small tools" and, as such, are considered to be part of overhead.

38. ACCEPTANCE AND FINAL PAYMENT

38.1. When the CONTRACTOR has completed the work in accordance with the terms of the Contract Documents, he shall certify completion of the work to the OWNER and submit a final Request for Payment, which shall be the Contract Amount plus all approved additions, less all approved deductions and less previous payments made. The CONTRACTOR shall furnish evidence that he has fully paid all debts for labor, materials, and equipment incurred in connection with the work, and upon acceptance by the OWNER, the OWNER will release the CONTRACTOR except as to the conditions of the Performance and Indemnity Bond and the Labor and Material Payment Bond, any legal rights of the OWNER, required guaranties, and Correction of Faulty Work after Final Payment, and will pay the CONTRACTOR's final Request of Payment. The CONTRACTOR shall allow sufficient time between the time of completion of the work and approval of the final Request for Payment for the ENGINEER to assemble and check the necessary data.

38.1.1. Release of Liens: The CONTRACTOR shall deliver to the OWNER a complete release of all liens arising out of this Contract before the retained percentage or before the final Request for Payment is paid. If any liens remains unsatisfied after all payments are made, the CONTRACTOR shall refund to the OWNER such amounts as the OWNER may have been compelled to pay in discharging such liens including all costs and a reasonable attorney's fees.

39. OWNER'S RIGHT TO TERMINATE AGREEMENT

39.1. The OWNER shall have the right to terminate his agreement with the CONTRACTOR after giving ten days' written notice of termination to the CONTRACTOR in the event of any default by the CONTRACTOR.

39.1.1 Default by CONTRACTOR: It shall be considered a default by the CONTRACTOR whenever he shall:

39.1.1.1. Declare bankruptcy, become insolvent, or assign his assets for the benefit of his creditors.

39.1.1.2. Disregard or violate provisions of the Contract Documents or fail to prosecute the work according to the agreed Schedule of Completion, including extensions thereof.

39.1.1.3. Fail to provide a qualified superintendent, competent workmen or Subcontractors, or proper materials, or fail to make prompt payment thereof.

39.1.2. Completion by the OWNER: In the event of termination of the Agreement by the OWNER because of default by the CONTRACTOR, the OWNER may take possession of the work and of all materials and equipment thereon and may finish the work by whatever method and means he may select.

40. TERMINATION OF CONTRACTOR'S RESPONSIBILITY

40.1. The Contract will be considered complete when all work has been finished and the project accepted in writing by the OWNER. The CONTRACTOR's responsibility shall then cease, except as set forth in his Performance and Indemnity Bond, as provided in Paragraph 16, Guaranty, and as provided in Paragraph 41, Correction of Faulty Work After Final Payment.

41 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT

41.1. The making of the final payment by the OWNER to the CONTRACTOR shall not relieve the CONTRACTOR of responsibility for faulty materials or workmanship. The CONTRACTOR shall promptly replace any such defects, as determined by the ENGINEER, discovered within two years from the date of final payment of the work.

42. INSPECTION

42.1. The authorized representatives of the ENGINEER and OWNER shall be permitted to inspect all materials, workmanship, and other relevant project records and data. Materials and workmanship will be subject to the approval of the OWNER and/or his representative.

43. CORRECTION OF WORK

43.1. All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be, at all times and places, subject to the inspection of the ENGINEER who shall be the final judge of the quality and suitability of the work, materials, process of manufacturer, and methods of construction for the purposes for which they are used. Should they fail to meet his approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the CONTRACTOR at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the ENGINEER, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract hereunder shall be reduced by such amount as in the judgment of the ENGINEER shall be equitable.

44. SUBSURFACE CONDITIONS FOUND DIFFERENT

44.1. Should the CONTRACTOR encounter subsurface and/or latent conditions at the site materially differing from those shown on the Plans or indicated in the Specifications, he shall immediately give notice to the ENGINEER of such conditions before they are disturbed. The ENGINEER will thereupon promptly investigate the conditions, and if he finds and so determines that they materially differ from those

shown on the Plans or indicated in the Specifications, he will at once make such changes in the Plans and/or Specifications, as he may find necessary. Any increase or decrease of cost resulting from such changes are to be adjusted in the manner provided in Paragraph 37 of the General Conditions.

45. CONTRACT SECURITY

45.1. The CONTRACTOR shall furnish a Performance Indemnity Bond and Payment Bond (forms attached) in an amount at least equal to 100% of the contract prices as security for the faithful performance of this Contract, as the security for the payment of all persons performing labor on the project under this Contract, and furnishing materials in connection with this Contract. The Performance and Indemnity Bond and the Payment Bond may be in one or in separate instruments in accordance with local law. Before final acceptance, each bond must be approved by the OWNER.

46. DISPUTE RESOLUTION

46.1 OWNER and CONTRACTOR agree to negotiate all disputes between them in good faith prior to exercising their rights under law.

46.2 Any claim, dispute or other matter in question arising from or related to this Agreement or the performance or breach thereof, which cannot be resolved through direct discussions between parties shall be subject to mediation as a condition precedent to the institution of legal or equitable proceedings by either party, and only after both parties have completed the mediation process.

46.3 Through mediation, CONTRACTOR and OWNER shall endeavor to resolve claims, disputes, or other matters in question between them by mediation in an informal process in which a third-party mediator facilitates discussion between the parties. The parties may designate a mediator mutually agreeable to both CONTRACTOR and OWNER to conduct the mediation. If the parties are unable to agree upon a mediator, mediation shall be conducted in accordance with the mediation provision of the South Carolina Circuit Court Alternative Dispute Resolution Rules. The mediation shall be conducted in York County, South Carolina. A request for mediation shall be filed in writing with the other party to this Agreement, and legal or equitable proceedings shall be stayed pending mediation for a period of sixty (60) days from the date of the request for mediation is filed, unless stayed for a longer period of time by agreement of the parties or court order. The cost of a third-party mediator will be shared equally by the parties.

46.4 If the parties reach an agreement during the mediation process, they shall reduce the agreement to writing and sign it with their attorneys, if any. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

46.5 In any action or proceedings to enforce or interpret any provision of this Agreement, or where any provision herein is validity asserted as a defense, each Party shall bear its own attorney fees, costs, and expenses.

47. CONTRACTOR'S/SUBCONTRACTOR'S PERSONNEL

47.1 Contractor warrants that all Contractor/Subcontractor personnel engaged in the performance of Work under this Contract shall possess sufficient experience and/education to perform the services requested by the County. County expressly retains the right to have any of the Contractor/Subcontractor personnel removed from performing services under this Contract. Contractor shall effectuate the removal of the specified Contractor/Subcontractor personnel from providing any services to the County under this Contract within one business day of notification by County. County shall submit the request in writing to

the Contractor's Project Manager. The County is not required to provide any reason, rationale or additional factual information if it elects to request any specific Contractor personnel be removed from performing services under this Contract.

END OF SECTION

DIVISION I - SECTION 4C

SPECIAL CONDITIONS

SPECIAL CONDITIONS

1. All work performed by the Contractor must be in accordance with the South Carolina Department of Transportation (SCDOT) 2007 Standard Specification for Highway Construction and SCDOT Traffic Signals Material Specifications (Revised 11/1/2021), unless directed otherwise in the plans or by the Engineer. A full version of the 2007 Edition SCDOT Standard Specifications For Highway Construction may be viewed or downloaded on SCDOT's website at www.scdot.org.

2. All work performed by the Contractor shall be constructed using the SCDOT'S Current Standard Drawings with all updates effective at the time of the letting, unless directed otherwise in the plans or by the Engineer. The Standard Drawings are available for download on SCDOT's website www.scdot.org. All drawings that are updated are labeled with their effective letting date in red.

3. There are no known underground storage tanks within the right-of-way. A Phase I Environmental Site Assessment was conducted for the project and is attached in the Appendix. One LUST site is located adjacent to the subject project. However, it is the Contractor's responsibility to investigate the project site prior to bidding to determine all structures and obstructions requiring removal. In accordance with Section 202 of SCDOT Specifications, payment for the removal and satisfactory disposal of all underground storage tanks shall be included in the lump sum bid item of "Removal of Structures and Obstructions." Pay Item No. 2021210 "Removal and Disposal of High-Level Contaminated Soil" is included in Division I, Section 3A as a contingency item and shall be used as directed by the Engineer.

   Any additional items including tanks encountered within the construction limits will be removed and payment shall be included in the lump sum price.

   All work shall be performed in accordance with the Department of Health and Environmental Control (DHEC) requirements by contracting personnel certified by DHEC. The Contractor will be required to obtain all permits and provide the required closure reports for all tank removals.

4. The Contractor shall be liable and responsible for payment of fines assessed by any regulatory agency due to non-compliance with applicable permit requirements and/or regulations by the Contractor. In the event that Owner is fined due to non-compliance with permit requirements, the Owner will charge the Contractor the cost of the fine by deducting an equal amount from the next progress pay estimate.

5. In the Bid Proposal Form and Schedule, Division I-Section 3, contract items given a unique seven (7) digit Item Number shall be constructed in accordance with SCDOT Standard Specifications. The first three (3) digits correspond to sections of the SCDOT Standard Specifications. The remaining four (4) digits are for individual identification of each contract item. Contract items that are identified with Item Numbers beginning with W, S, F, and SP shall be constructed in accordance with specifications contained within this document.

6. Construction conditions requiring minor vertical adjustments (0-2 ft.) to existing water line valve boxes, sanitary sewer manholes, and other minor appurtenances shall be the responsibility of the Contractor. The costs for the adjustments shall be the Contractor's responsibility and shall be included in Bid Item, Mobilization. Other utilities requiring relocation or adjustment for construction activities will be the responsibility of the utility owner.

7. Reconstruction of driveways and other special provisions on properties, included in the right-of-way acquisition, shall be coordinated with the Engineer. Contractor shall notify Engineer prior to construction of driveways.

8. The Owner will obtain the South Carolina Department of Health and Environmental Control (DHEC) Notice of Intent (NOI) for the project. The Contractor's signature is required on several documents necessary for obtaining the permit including, but not limited to, the NOI application, weekly inspection reports and Co-Permittee Agreements. The Contractor shall cooperate with the Owner in providing the required signatures. The Contractor shall be responsible for posting at the project site and keeping on file, permit approvals and other notices as required by permits for the project. The NOI also requires that on-site preconstruction conferences be held for the Prime Contractor and all subcontractors. The Contractor shall participate in these meetings as required by the NOI.

9. Testing shall be conducted by the Owner/Engineer in accordance with the procedures defined in the SCDOT Standard Specifications, and applicable Supplemental Specifications.

10. The Contractor shall provide all record drawing information to the Engineer prior to final approval.

11. Commercial advertising signs (realtor signs) within the construction limits should be removed and left on adjacent property - Do not reinstall. No direct payment will be made for removing these signs as the work is considered incidental to the item of clearing and grubbing.

12. Mailboxes are to be relocated at the direction of the Engineer. No direct payment will be made for the relocation of mailboxes.

13. The removal or relocation of billboards is not the Contractor's responsibility.

14. Non-conforming signs that are not to be relocated shall be removed and placed on the property beyond the construction limits.

15. In the interest of closing out this project in a prompt and timely manner, the Contractor shall complete item 1090200 (as-built construction plans) within 30 days of the substantial completion or final acceptance of the project. The final pay request as required in Section 4.37 of the General Conditions shall be submitted within 120 calendar days of the Owner's final acceptance of the project. The Owner shall impose a $200 per calendar day penalty for failure on the Contractor's part to complete and submit final closeout documents including the final pay request within the required 120 days. This late penalty shall be deducted from the project retainage for each calendar day beyond the allowed 120 days.

16. Temporary lane closure shall be conducted in accordance with SCDOT standard details and as directed by the Engineer. The Contractor shall submit a lane closure plan to the Engineer seven (7) calendar days prior to a lane closure. The Contractor shall notify all agencies responsible for emergency services of the lane closure schedule seven (7) calendar days prior to closure.

17. Partial Payments – The following retainage will be withheld pending final completion and final payment. A percentage based on the amount of the contract completed, shall be retained on each estimate until payment of the final estimate. The retainage shall be 5 percent until the project is 75 percent complete, at which time the retainage will be reduced to 2.5 percent. However, when the Contractor has completed at least 99 percent of the work, the Owner may, at his discretion, further reduce the retainage to an amount which will be adequate to complete the remaining work plus any anticipated liquidated damage. The Contractor may be required to furnish consent of surety before the retained amount is reduced to less than 2.5 percent.

18. The Geotechnical Reports included as part of this manual were prepared to assist the Owner in preparing the project design. The reports have been included for general information and are not intended to be used to determine the nature of the unclassified materials on the project. The Owner, NV5 Engineers and Consultants, nor F&ME guarantee the accuracy or accept liability for information contained there-in. Any use of the geotechnical reports shall be at the Contractor's own risk as it is the Contractor's responsibility to make his own investigations and determinations.

19. The Contractor shall develop and submit prior to beginning construction, a schedule of work which will allow construction of the project while maintaining vehicular access to all adjacent parcels during the construction period.

20. The Contractor shall be responsible for abandoning wells, septic tanks and drain fields in accordance with DHEC and other applicable requirements. Payment for all work associated with the abandonment removal and capping of wells and septic tanks and drain fields shall be included in the clearing and grubbing pay item.

21. The Contractor shall be aware of the following special conditions related to right-of-way settlements with property owners adjacent to the project limits. The Contractor shall be responsible for coordinating with property owners to meet the conditions stipulated below:

Tract	OWNER/CONTACT INFO	CONDITIONS
20	Grace D. Alexander 5520 Hwy 557 Clover, SC 29710; (704)309-5062	308+95, Lt., SC 557 and 310+54, Lt., SC 557 Existing pecan trees shall be protected by installing temporary barrier fence. Contractor shall avoid work in these areas unless approved by the Engineer.
27	Duke Power Company	Ensure that access remains unrestricted at all times on a "24/7" basis during construction.
26, 28, 29	Journey Fellowship f/k/a Pine Grove Baptist Church 5415 Hwy 557 Lake Wylie, SC 29710	321+28, Rt., Sign Landowner shall be responsible for moving its sign and replace parking spaces taken by construction of the project.
31	Harpers Green Owners Association, Inc. 437 Battery Circle Lake Wylie, SC 29710	326+92 to 330+02, Rt., SC 557 Any portion of the existing sprinkler system within the new right of way will be relocated, clear of the new r/w, by the property owner.

22. A summary of the known utilities within the project limits of the project is included in Section 4D: Utilities Special Conditions. While the Owner has coordinated utility relocation work with the utilities prior to the letting of this contract, it will be the successful low bidder's responsibility to coordinate the construction work with the utilities work during construction.

23. For this project, the following will be eligible for adjustments:

    - A.C. Binder Adjustments for Liquid Asphalt Binder (PG 64-22)

    Base date for adjustment will be determined at the Preconstruction meeting dependent on the bid date for this project.

24. Contractor shall comply with all general and regional conditions identified in the nationwide permit.

25. The Contractor shall maintain ingress and egress at all times to the Bethel Volunteer Fire Department driveways.

26. The Contractor shall be liable and responsible for payment of fines assessed by any regulatory agency due to non-compliance with applicable permit requirements and/or regulations by the Contractor. In the event the Owner is fined due to non-compliance with permit requirements, the Owner will charge the Contractor the cost of the fine by deducting the fine amount from the next month's progress pay estimate.

27. A summary of the known utilities within the limits of the project is included in the attached Utility Report of this Project Manual. While the Owner has coordinated utility relocation work with the utilities prior to the letting of this contract, it will be the successful low bidder's responsibility to coordinate the construction work with the utilities work during construction.

28. The Roadway Boring Logs included as part of the attached Geotechnical Report were prepared to assist the Owner with preparing the project design. They have been included for general information and are not intended to be used to determine the nature of the unclassified materials on the project. The Owner, NV5 Engineers and Consultants, and F&ME, Inc. do not guarantee the accuracy or accept liability for information contained there-in. This information shall be used at the Contractor's own risk as it is the Contractor's responsibility to make his own investigation and determination of unclassified excavation material.

29. Moving Items – Certain items will need to be moved from within the project limits to allow for the construction of the project. It is the Contractor's responsibility to investigate the various project sites prior to bidding to determine the items requiring removal.

30. The Contractor shall take special care to not disturb the pecan trees on Tract 20 at approximate SC 557 Reloc. Sta. 308+95 Left and 310+54 Left. Contractor shall take care not to disturb roots of the trees during any construction operations, including any operations necessary to grade proposed slopes, construct proposed storm drainage structures and pipe culverts.

31. Mobilization shall be paid in accordance with Section 103.11 of the SCDOT 2007 Standard Specifications For Highway Construction.

32. The Contractor shall be responsible for abandoning wells, septic tanks and drain fields in accordance with DHEC and other applicable requirements. Payment for all work associated with the abandonment, removal and capping of wells, septic tanks and drain fields shall be included in the Clearing and Grubbing pay item, unless it is provided by other pay items included in this contract.

33. The contractor shall read the Section 404 General Permit included in this Project Manual and comply with all appropriate conditions during construction.

34. The typical pavement section used for the construction of temporary pavement during construction operations shall include the following assumptions:

    H/M ASPHALT SURFACE COURSE TYPE B (200 LB/SY)
    H/M ASPHALT INTERMEDIATE COURSE TYPE B (200 LB/SY)
    H/M ASPHALT BASE COURSE TYPE A (400 LB/SY)

    Quantities for temporary pavement are shown on the general construction note sheet 5 in the plans.

35. PAYMENT FOR MATERIAL TO BE USED IN THE WORK

Material Delivered on the Project
When so authorized by York County/SCDOT, partial payments will be made up to 95% of the delivered cost of materials on hand that are to be incorporated in the work, provided that such materials have been delivered on or in close proximity to the project and stored in an acceptable manner. Material payments will be allowed when 95% of the accumulated costs of unpaid invoices are equal to or greater than $10,000, materials have been inspected and approved by York County/SCDOT

Material Stored at Fabricator's Facilities or Contractor's Facilities
When so authorized by York County/SCDOT, partial payments will be made up to 95% of the invoiced cost, exclusive of delivery cost, for bulky materials requiring fabrication at an offsite location that are durable in nature and represent a significant portion of the project cost, if it has been determined by York County/SCDOT, that the material cannot be reasonably stockpiled in the vicinity of the work. Material payments will be allowed when the materials have been inspected and approved by York County/SCDOT

Materials with Delayed Delivery to the Project
When so authorized by York County/SCDOT, partial payments will be made up to 95% of the invoiced cost of materials that have been ordered by the contractor but will be more than 45 days before being delivered to the project.

Required Documents

(1) Written consent of surety to make such partial payments,
(2) Bill of Sale from the Contractor to the Department, and
(3) Copy of invoice from material supplier verifying the cost of the material.

General Requirements

The partial payments will be made on the conditional basis that the material meets the requirements of the contract and will be incorporated into the project. The Contractor shall reimburse the Department for all partial payments for material paid, but not incorporated into the project.

Partial payments for materials on hand or already ordered but not yet delivered to the project will not constitute acceptance, and any faulty material will be rejected even though previous payment may have been made for same in the estimates.

Partial payment will not be made for fuel, supplies, form lumber, falsework, or used materials.

Partial payments will not be made on seed or any living or perishable plant materials except that when such materials have been planted or otherwise incorporated in the work, payment may be made, not as materials, but as work done as part of a contract item for which a contract unit or lump sum price has been established.

Partial payments will not exceed 95% of the contract unit or lump sum prices for the work.

DIVISION I - SECTION 4D

UTILITIES SPECIAL PROVISIONS/CONDITIONS

UTILITY SPECIAL PROVISIONS/CONDITIONS
COORDINATION OF RELOCATION WORK WITH HIGHWAY CONSTRUCTION

SC HIGHWAY 557 IMPROVEMENTS YORK COUNTY, SC
YORK COUNTY PROJECT – 11149-09 SCDOT PROJECT ID 0041800

There is a need to establish small Utility Windows, during construction:

The following Utility Companies may need help defining the locations for the clearing and time constraints needed to complete their work:

- **AT&T**
- **Carolina Water Service/Blue Granite Water Company**
- **Comporium**
- **Duke Energy**
- **Town of Clover**
- **York County Natural Gas**
- **Verizon**

The utilities anticipate that the areas within the NPDES limits will be cleared by the time they begin their work. In some cases the contractor will be expected to locate where a proposed drainage facility will occur or define the NPDES line as well as the right of way.

Prior to any foundation excavation or pile driving occurring in the area of the bridge, the Contractor shall perform the following:

- Provide minimum 72-hour notice to SCDOT, prior to any excavation:
  District 4 Utility Coordinator - Mr. Jake Gaston 803-374-6312 (mobile)
  And call
  District 4 Resident Construction Engineer - Mr. Jared Bragg 803-324-3545;
- Provide minimum 72-hour notice to the Utility Contacts noted in this report;
- Locate underground lines, by SC811 or Utility Company and reference U-Sheets.

In Contract Services:

Town of Clover Water and Sewer, and Carolina Water Service/Blue Granite Water Company have requested in contract services for this project. Specifications and Design Drawings for this effort are included.

Town of Clover requests that all old water and sewer material removed from project site be kept in good condition and returned to the Town of Clover. These materials include fire hydrants, valves

and all other fittings that could be used in other parts of the town's water and sewer systems. Return these materials to:

Town of Clover
Maintenance Shop
300 Smith Street
Clover, SC 29710

DIVISION I - SECTION 4E

PERFORMANCE AND INDEMNITY BOND

PERFORMANCE AND INDEMNITY BOND

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS that _____ _____ as Principal, hereinafter called Contractor, and _____ _____as Surety, hereinafter called Surety, are held and firmly bound unto the York County Government, as Obligee, hereinafter called owner, in the amount of _____ _____Dollars ($_____) for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated_____, *2023*, entered into a Contract with Owner for:

Pennies for Progress Project
SC Highway 557 Improvements

in accordance with Drawings and Specifications prepared by York County Engineering Department, ENGINEER, which Contract is by reference made a part hereof and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that, if the Principal shall in all respects promptly and faithfully perform and comply with the terms and conditions of said Contract and his obligations thereunder and shall indemnify the OWNER and the ENGINEER and save either or all of them harmless against and from all costs, expenses and damages arising from the performance of said Contract or the repair of any work thereunder, then this obligation shall be void; otherwise, this Bond shall remain in full force and effect, in accordance with the following terms and conditions:

A. The Principal and Surety jointly and severally agree to pay the OWNER any difference between the sum to which the said Principal would be entitled on the completion of the Contract, and that sum which the OWNER may be obliged to pay for the completion of said work by Contract or otherwise, and any damages, direct or indirect or consequential, which the said OWNER may sustain on account of such work, or on account of the failure of said CONTRACTOR to properly and in all things, keep and execute all of the provisions of said Contract.

B. And this Bond shall remain in full force and effect for a period of two (2) years from the date of final payment of the project by the OWNER and shall provide that the CONTRACTOR guarantees to repair or replace for said period of one (1) years all work performed and materials and equipment furnished that were not performed or furnished according to the terms of the Contract, and shall make good, defects thereof which have become apparent before the expiration of said period of two (2) years. If any part of the project, in the judgment of the OWNER, for the reasons above stated needs to be replaced, repaired or made good during that time, the OWNER shall so notify the CONTRACTOR in writing. If the CONTRACTOR refuses or neglects to do such work within five (5) days from the date of service of such Notice, the OWNER shall have the work done by others and the cost thereof shall be paid by the CONTRACTOR or his Surety. After the one year warranty period and after all warranty work has been completed satisfactorily to the Owner, the Contractor may request that this Bond be terminated.

C. And the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the 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 change, extension of time, alteration or addition to the terms of the Contract or to the Work or to the Specifications.

D. The surety represents and warrants to the OWNER that they have a minimum Best's Key Rating Guide General Policyholder's Rating of "A –" and Financial Category of "Class VIII".

IN WITNESS WHEREOF, the above bounded parties executed this instrument under their several seals, this ____ day of _____ *2023*, A.D., the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

PRINCIPAL:

_____

_____
Signature of Authorized Officer
(Affix Seal)

WITNESSES:

_____ _____
Title

_____ _____
Business Address

_____
City State

SURETY:

WITNESS:

_____
Corporate Surety

_____ _____
Attorney-in-Fact (Affix Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the said bond on behalf of the Principal, was then _____ of said Corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

_____
Secretary

Corporate
Seal

STATE OF SOUTH CAROLINA

COUNTY OF YORK

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of the_____.

Subscribed and sworn to before me this____ day of _____, *2023* A.D.

(Attach Power of Attorney)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires:

END OF SECTION

DIVISION I - SECTION 4F

PAYMENT BOND

PAYMENT BOND

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS that _____ _____ as Principal, hereinafter called CONTRACTOR, and _____ as Surety, hereinafter called Surety, are held and firmly bound unto the York County Government, as Obligee, hereinafter called OWNER, in the amount of _____ _____Dollars($_____) for the payment whereof CONTRACTOR and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, CONTRACTOR has by written agreement dated_____, *2023*, entered into a Contract with OWNER for:

Pennies for Progress Project
SC Highway 557 Improvements

in accordance with Drawings and Specifications prepared by York County Engineering Department, ENGINEER, which Contract is by reference made a part hereof and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that, if the Principal shall promptly make payments to all claimants, as herein below defined, then this obligation shall be void; otherwise, this Bond shall remain in full force and effect, subject to the following terms and conditions:

A. A claimant is defined as any person supplying the Principal with labor, material and supplies, used directly or indirectly by the said Principal or any subcontractor in the prosecution of the work provided for in said Contract.

B. The above named Principal and Surety hereby jointly and severally agree with the OWNER that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after performance of the labor or after complete delivery of materials and supplies by such claimant, may sue on this Bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The OWNER shall not be liable for the payment of any costs or expenses of any such suit.

C. No suit or action shall be commenced hereunder by any claimant:

   1. Unless claimant, other than one having a direct contract with the Principal, shall within forty-five (45) days after beginning to furnish labor, materials or supplies for the prosecution of the work, furnish the Principal with a notice that he intends to look to this bond for protection.

   2. Unless claimant, other than one having a direct contract with the Principal, shall within ninety (90) days after such claimant's performance of the labor or complete

delivery of materials and supplies, deliver to the Principal written notice of the performance of such labor or delivery of such material and supplies and the nonpayment therefore.

3. After the expiration of one (1) year from the performance of the labor or completion of delivery of the materials and supplies; it being understood, however, that if any limitation embodied in this Bond is prohibited by any law controlling the construction hereof such limitations shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

4. Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.

D. The Principal and the Surety jointly and severally, shall repay the OWNER any sum which the OWNER may be compelled to pay because of any lien for labor or materials furnished for any work included in or provided by said Contract.

E. The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration of or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications applicable thereto shall in any way affect its obligations on this Bond, and the Surety hereby waives notice of any such change, extension of time, alterations of or addition to the terms of the Contract, or to the work or to the Specifications.

F. The Surety represents and warrants to the Owner that they have a minimum Best's Key Rating Guide General Policyholder's rating of "___A -___" and Financial Category of "Class __VIII___".

IN WITNESS WHEREOF, the above bounded parties executed this instrument under their several seals, this _____ day of _____ *2023*, A.D., the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

PRINCIPAL:

_____

_____
Signature of Authorized Officer
(Affix Seal)

WITNESSES:

_____ _____
Title

_____ _____
Business Address

_____
City State

SURETY:

WITNESS:

_____
Corporate Surety

_____ _____
Attorney-in-Fact
(Affix Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the said bond on behalf of the Principal, was then _____ of said Corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

_____

Secretary

Corporate
Seal

STATE OF SOUTH CAROLINA

COUNTY OF YORK

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the CONTRACTOR named therein in favor of the_____.

Subscribed and sworn to before me this ____ day of _____, *2023*, A.D.

(Attach Power of Attorney)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires: _____

END OF SECTION

DIVISION I - SECTION 4G

NOTICE OF AWARD

NOTICE OF AWARD

TO: _____

_____

_____

FROM: York County Engineering

P.O. Box 148

York, SC 29745

PROJECT TITLE: Pennies for Progress Project – SC Highway 557 Improvements

PROJECT DESCRIPTION: ***SC Highway 557 Improvements from west of Kingsburry Road to Harper Green Drive. The total estimated length of roadway is 2.480 miles, including 350.26 linear feet of bridge replacement.***

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 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 _____, *2023*.

On behalf of the York County Council

By:_____

Title:_____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged

By:_____

Title:_____

This _____day of _____,*2023*

DIVISION I - SECTION 4H

NOTICE TO PROCEED

NOTICE TO PROCEED

Date: _____

To: _____

_____

_____

Project:

Pennies for Progress Project
SC Highway 557 Improvements

You are hereby notified to commence work in accordance with the Agreement dated _____ on or before _____, and you are to complete the work within **900** consecutive calendar days thereafter. The date of completion of all work is therefore _____.

On behalf of the

YORK COUNTY GOVERNMENT

By: _____

Title: York County Engineer

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by _____, this the _____day of _____, ***2023***.

By: _____

Title: _____

DIVISION I - SECTION 4I

NON-COLLUSION AFFIDAVIT

NON-COLLUSION AFFIDAVIT

State of _____

County of _____

_____, being first duly sworn, deposes and says that:

(1) He is _____ of _____, the Bidder
Title Company Name
that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, conveyance or unlawful agreement any advantage against the OWNER or any person interested in the proposed contract;

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affidavit.

(Signed)_____

_____
(Title)

Subscribed and sworn to before me

this ____ day of _____, 20_____

_____

(Title)

My commission expires _____

DIVISION I - SECTION 4J

CERTIFICATE OF INSURANCE

CERTIFICATE OF INSURANCE
(May also use applicable Accord form)

THIS IS TO CERTIFY THAT THE _____
Insurance Company

Address _____

Of _____
has issued policies of insurance, as described below and identified by a policy number, to the insured named below; and to certify that such policies are in full force and effect at this time. It is agreed that none of these policies will be cancelled or changed so as to affect the interest(s) of the York County Government (hereinafter sometimes called the OWNER) until thirty (30) days after written notice of such cancellation or change has been delivered to the ENGINEER.

Insured: _____

Address: _____

Status of Insured
_____ Corporation _____ Partnership _____ Individual

Insured: _____

Description of Work: _____

_____

_____

INSURANCE POLICIES IN FORCE

Forms of Coverage	Policy Number	Expiration Date
*Worker's Comp./Employers' Liability	_____	_____
**Comprehensive Auto Liability	_____	_____
***Excess Liability	_____	_____
Other (Please specify type)	_____	_____

POLICY INCLUDES COVERAGE FOR:		YES	NO
1.	Additional Insured: OWNER and ENGINEER	_____	_____
2.	*Liability under the United States Longshore-men's and Harbor Workers' Compensation Act.	_____	_____
3.	**All owned, hired, or non-owned automotive equipment used in connection with work done for the Owner.	_____	_____
4.	Contractual Liability	_____	_____
5.	Damage caused by explosion, collapse or structural injury, and damage to underground utilities.	_____	_____
6.	Products/Completed Operations	_____	_____
7.	Owners and Contractors Protective Liability	_____	_____
8.	Personal Injury Liability	_____	_____
9.	***Excess Liability applies excess of:		
	(a) Employers' Liability	_____	_____
	(b) Comprehensive General Liability	_____	_____
	(c) Comprehensive Automobile Liability	_____	_____

Types of Coverage	Forms of Coverage	Minimum Limits of Liability	
Workers' Compensation	Bodily Injury	$ 1,000,000	Statutory
Employers' Liability	Bodily Injury	$ 500,000	Each Accident
	Disease	$ 500,000	Each Person
	Disease	$ 500,000	Policy Limit
Comprehensive Auto Liability	Combined Single Limit BI/PD	$ 1,000,000	Each Accident
Comprehensive General Liability	Bodily Injury	$ 1,000,000	Each Occurrence
		$ 5,000,000	Aggregate

The Insurance Company hereby agrees to deliver, within ten (10) days, two (2) copies of the above policies to the Engineer when so requested.

NOTE: Entries on this certificate are limited to the Authorized Agent or Insurance Company Representative.

Date_____ (SEAL) _____
Insurance Company

Issued at_____
Authorized Representative

Insurance Agent or Company

- Send original and one copy to:

York County Engineering
Post Office Box 148
6 South Congress Street
York, South Carolina 29745

END OF SECTION

DIVISION I - SECTION 4K

APPLICATION FOR PAYMENT

APPLICATION FOR PAYMENT No. _____

Date: _____ Contractor: _____

Project: _____ Project Number: _____

Purchase Order Number: _____ For Period _____ To _____

Total value of work completed to date (see attached sheet) $ _____

Total value of materials stored for project (see attached sheet) $ _____

SUB TOTAL $ _____

LESS _____ %RETAINED $ _____

TOTAL $ _____

LESS PREVIOUS PAYMENTS $ _____

Other Changes, additions, or deductions (see attached sheet) $ _____

TOTAL AMOUNT DUE THIS PAYMENT **$** _____

Previous Payments:							
1		6		11		16	
2		7		12		17	
3		8		13		18	
4		9		14		19	
5		10		15		20	

Submitted By:
I hereby certify to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, and that all amounts have been paid by the Contractor for Work which previous Applications for Payment were issued and payments received from the Owner, that current payment shown herein is now due.

Contractor: _____ Notarized: _____

Signed By: _____ My Commission expires: _____

Date: _____ Affix seal:

Recommended By:
Architect/Engineer: _____ Date: _____

Certified Amount: $ _____

The Certified amount is payable only to the Contractor named herein. Issuance, payment, and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Accepted By:
Owner: _____ Date: _____

DIVISION I - SECTION 4L

CHANGE ORDER FORM

CONTRACT CHANGE ORDER

CHANGE ORDER NO:_____

PROJECT: _____

DATE OF ISSUANCE: _____

DESCRIPTION OF CHANGE: _____

_____

_____

_____

CONTRACT AMOUNT		CONTRACT TIME (Calendar Days)	
Original	$ _____	Original Durations	_____ Days
Previous Change Orders (Add/Deduct)	$ _____	Previous Change Order (Add/Deduct)	_____ Days
This Change Order (Add/Deduct)	$ _____	This Change Order (Add/Deduct)	_____ Days
Revised Contract Amount	$ _____	Revised Contract Time	_____ Days
REVISED CONTRACT COMPLETION DATE IS: _____, *20*___			

	OWNER	CONTRACTOR	ENGINEER
SIGNATURE			
PRINT NAME			
COMPANY			
DATE			

DIVISION I - SECTION 4M

RELEASE AND WAVER OF CLAIM BY PRIME CONTRACTOR

RELEASE AND WAIVER OF CLAIM
BY PRIME CONTRACTOR

Know all men by these presents that the undersigned, _____of _____20 __ first being duly sworn, states that all payrolls, materials bills, sales tax, privilege tax or license, old age benefits tax, state and federal unemployment insurance, and other liabilities incurred for use in the performance of the contract for the ***Pennies for Progress Project: SC Highway 557 Improvements*** located in York County, South Carolina have been paid in full and waives any and all claims and releases York County Government (York County, South Carolina) from any rights or claims for debts due and owing by virtue of the furnishing of any material or supplies or any lien thereon.

_____
(Name of Company)

By: _____

Its: _____

Sworn to before me
this _____day of _____, 20 _____ .

_____

Notary Public for _____

My Commission expires: _____

DIVISION I - SECTION 4N

VALUE ENGINEERING INCENTIVE

VALUE ENGINEERING INCENTIVE

INTENT AND OBJECTIVE

(1) This Subarticle applies to any cost reduction proposal (hereinafter referred to as a Value Engineering Change Proposal or VECP) initiated and developed by the Contractor for the purpose of refining the contract documents so as to contribute to design cost effectiveness or significantly improve the quality of the end result. This Subarticle does not, however, apply to any such proposal unless it is identified by the Contractor, at the time of its submission to the County, as a proposal submitted pursuant to this Subarticle.

(2) VECPs contemplated are those that would result in net savings to the County by providing either: (A) a decrease in the cost of performance of the Contract, or; (B) a reduction in cost of ownership (hereinafter referred to as collateral costs) of the work provided by this Contract, regardless of acquisition costs. VECPs must result in savings without impairing essential functions and characteristics such as safety, service, life, reliability, economy of operation, ease of maintenance, aesthetics and necessary standard design features. However, nothing herein prohibits the submittal of VECPs where the required functions and characteristics could be combined, reduced or eliminated as being nonessential or excessive. Plan errors which are identified by the Contractor and which result in a cost reduction, will not qualify for submittal as a VECP.

(3) The County reserves the right to reject at its discretion any VECP submitted which proposes a change in the design of the pavement system or which would require additional right-of- way. Substitution of another design alternate, which is detailed in the plans, for the one on which the Contractor bid, will not be allowed under this Subarticle. Pending execution of a formal supplemental agreement, implementing an approved VECP, the Contractor shall remain obligated to perform in accordance with the terms of the existing contract. No time extensions will be granted due to the time required to review a VECP.

SUBCONTRACTORS

(1) The Contractor is encouraged to include the provisions of this Subarticle in contracts with subcontractors. The Contractor shall encourage submission of VECPs from subcontractors, however, it is not mandatory that VECPs be submitted nor is it mandatory that the Contractor accept or transmit to the County VECPs proposed by his subcontractors.

DATA REQUIREMENTS

(1) A description of the difference between the existing contract requirement and the proposed change, and the comparative advantages and disadvantages.

(2) Separate detailed cost estimates for both the existing contract requirement and the proposed change. The cost estimates shall be broken down by contract item numbers indicating quantity increases or decreases and deleted pay items. Additional proposed work, not covered by contract items, shall be identified by current County pay item numbers. In preparing the estimate, the Contractor shall include overhead, profit, and bond. No separate

pay item(s) for these costs will be allowed.

(3) An itemization of plan details, plan sheets, design standards and Specifications that must be changed or added if the VECP is adopted. Preliminary plan drawings must be sufficient to describe the proposed changes.

(4) An estimate of the effects the VECP would have on collateral costs to the County.

(5) Engineering or other analysis in sufficient detail to identify and describe specific features of the contract which must be changed if the VECP is accepted, with a proposal as to how these changes can be accomplished and an assessment of their effect on other project elements. The County may require that engineering analyses be performed by a prequalified consultant in the applicable class of work. Any design changes which result from the VECP must be supported by computations sealed by a Professional Engineer registered in the State of South Carolina.

(6) A statement of the time by which approval of the VECP must be issued by the County to obtain the total estimated cost reduction during the remainder of this Contract, noting any effect on the contract completion time or delivery schedule.

PROCESSING PROCEDURES

(1) Two copies of each VECP shall be submitted, one to the Engineer, or his duly authorized representative, and one to the County's Value Engineering Office. VECPs will be processed expeditiously; however, the County will not be liable for any delay in acting upon a VECP submitted pursuant to this Subarticle. The Contractor may withdraw, in whole or in part, a VECP not accepted by the County within the period specified in the VECP. The County shall not be liable for any VECP development cost in the case where a VECP is rejected or withdrawn.

The Engineer shall be the sole judge of the acceptability of a VECP and of the estimated net savings in construction and/or collateral costs from the adoption of all or any part of such proposal. In determining the estimated net savings, the right is reserved to disregard the contract bid prices if, in the judgment of the Engineer, such prices do not represent a fair measure of the value of work to be performed or to be deleted.

Prior to approval, the Engineer may modify a VECP, with the concurrence of the Contractor, to make it acceptable. If any modification increases or decreases the net savings resulting from the VECP as modified and upon determination of final quantities, the new savings shall be computed by subtracting the revised total cost of all bid items affected by the VECP design from the total cost of the same bid items as represented in the original contract.

Prior to approval of the VECP, which initiates the supplemental agreement, the Contractor shall provide acceptable contract quality plan sheets revised to show all details consistent with the VECP design.

COMPUTATIONS FOR CHANGE IN CONTRACT COST OF PERFORMANCE

Contractor development and implementation costs for the VECP will not be recoverable. If the VECP is adopted, the Contractor's share of the net savings as defined hereinafter shall be considered full compensation to the Contractor for the VECP.

County costs of processing or implementation of a VECP will not normally be considered in the estimate. However, the County reserves the right, where it deems such action appropriate, to require the Contractor to pay the County's cost of investigating and implementing a VECP submitted by the Contractor as a condition of considering such proposal. Where such a condition is imposed, the Contractor shall indicate his acceptance thereof in writing, and such acceptance shall constitute full authority for the County to deduct amounts payable to the County from any monies due or that may become due to the Contractor under the contract.

COMPUTATIONS FOR COLLATERAL COSTS

When collateral cost savings are sought by the Contractor, separate estimates must be prepared for collateral costs of both the existing contract requirement and the proposed change. Each estimate shall consist of an itemized breakdown of all costs and the basis for the data used in the estimate. Cost benefits to the County include, but are not limited to: reduced costs of operation, maintenance or repair, and extended useful service life. Increased collateral costs include the converse of such factors.

Computations shall be as follows:

(1) Costs shall be calculated over a 20-year period on a uniform basis for each estimate.

(2) If the difference in the estimates as approved by the County indicates a savings, the Contractor shall divide the resultant amount by 20 to arrive at the average annual net collateral savings. The resultant savings shall be shared as stipulated in Sharing Arrangements.

SHARING ARRANGEMENTS

If a VECP is approved by the County, the Contractor may be entitled to share in both construction savings and collateral savings to the full extent provided for in this Subarticle.

Except for innovative ideas, the Contractor and County shall each receive 50 percent of net reduction in the cost of performance of this Contract. For innovative ideas, the reduction in the cost of performance shall be shared as follows:

Accrued Net Savings	Contractor's Share %	County's Share %
Less than $25,000	100	0
$25,000 to $50,000	75	25
Over $50,000	50	50

If an approved change is identical or similar to a previously submitted VECP or an idea previously utilized by the County it will not be considered an innovative idea, thus will only qualify for a 50 percent sharing of savings.

When collateral savings occur, the Contractor shall receive 20 percent of the average one year's net collateral savings.

The Contractor shall not receive construction savings or collateral savings on optional work listed in this Contract, until the County exercises its option to obtain that work.

DIVISION I - SECTION 4O

TRAFFIC CONTROL SPECIAL CONDITION

TRAFFIC CONTROL SPECIAL CONDITIONS

1. The Contractor is advised that all work involving design or installation of traffic control devices, including but not limited to signs, pavement markings, elements of work zone traffic control, signals, etc., shall be in compliance with the FHWA's Manual on Uniform Traffic Control Devices (MUTCD), latest edition. The latest edition is defined as the edition that the Traffic Engineering Division of SCDOT recognizes as having been officially adopted (Engineering Directive, Memorandum 19) at the time the project is let, unless stated otherwise in the Special Provisions. The MUTCD may be downloaded from FHWA's website at https://mutcd.fhwa.dot.gov/ (https://mutcd.fhwa.dot.gov/kno_2009r1r2.htm)

2. This project will include detours as listed below:

    a. **S-114 Stage 4 Phase 1 Detour** will close S-114 between the intersections of SC 557/S-114 and S-114/S-649 for no longer than 7 calendar days to construct the tie-in and temporary driveway connection for Tract 4. The penalty for violating this closure is $1,500/day, or any part thereof.
    b. **S-114 Stage 4 Phase 2 Detour** will close S-114 between the intersections of SC 557/S-114 and S-114/S-649 for no longer than 7 calendar days to complete the tie-in within the areas shown in the traffic control plans. The penalty for violating this closure is $1,500/day, or any part thereof.

3. During Stage 2, Phase 1, temporary closure of S-1916 Pharr Yarns shall not exceed 14 calendar days.

4. Temporary Lane closures shall be conducted in accordance with SCDOT standard details and as directed by the Engineer. The Contractor shall submit a lane closure plan to the Engineer seven (7) calendar days prior to a lane closure. The Contractor shall notify all agencies responsible for emergency services of the road closure schedule seven (7) calendar days prior to closure. The penalty for violating the lane closure restrictions is **$500** per hour, or any part thereof. See Traffic Control Special Provisions.

DIVISION II

TECHNICAL SPECIFICATIONS

DIVISION II - SECTION 1

SCDOT TECHNICAL SPECIFICATIONS REFERENCE

SCDOT Technical Specifications Reference

SC Highway 557 Improvements
York County, SC

The Contractor shall execute all work on this project in accordance with The South Carolina Department of Transportation Supplemental Technical Specifications located here, in effect at the time of letting:

https://www.scdot.org/business/road-technical-specs.aspx

https://www.scdot.org/business/geotech.aspx

DIVISION II - SECTION 2

TRAFFIC CONTROL SPECIAL PROVISIONS

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 special provisions, all supplemental specifications, the MUTCD, and the Engineer. This is an amendment to the Standard Specifications to require the following:

GENERAL REGULATIONS -

These special provisions shall have priority to the plans and comply with the requirements of the MUTCD and the standard specifications. Revisions to the traffic control plan through modifications of the special provisions and the plans shall require approval by the County. **Final approval of any revisions to the traffic control plan shall be pending upon review by the SCDOT Director of Traffic Engineering.**

Install and utilize changeable message signs in all lane closures installed on high volume high-speed multilane roadways. Use of changeable message signs in lane closures installed on low volume low speed multilane roadways is optional unless otherwise directed by the plans and the Engineer. Install and use a changeable message sign within a lane closure set-up as directed by the *Standard Drawings For Road Construction*. When a lane closure is not present for any time to exceed 24 hours, remove the changeable message sign from the roadway. Place the sign in a predetermined area on the project site, as approved by the Engineer, where the sign is not visible to passing motorists. Utilize preprogrammed messages in accordance with the *Standard Drawings For Road Construction* when using the changeable message sign as part of the traffic control set-up for lane closures. Only those messages pertinent to the requirements of the traffic control situation and the traffic conditions are permitted for display on a changeable message sign at all times. At no time will the messages displayed on a changeable message sign duplicate the legends on the permanent construction signs.

During operation of changeable message signs, place the changeable message sign on the shoulder of the roadway no closer than 6 feet between the sign and the near edge of the adjacent travel lane. When the sign location is within 30' of the near edge of a travel lane open to traffic, supplement the sign location with no less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. Install and maintain the drums no closer than 3 feet from the near edge of the adjacent travel lane. This requirement for delineation of the sign location shall apply during all times the sign location is within 30' of the near edge of a travel lane open to traffic, including times of operation and non-operation. Oversized cones are prohibited as a substitute for the portable plastic drums during this application.

When mounting signs on multiple ground mounted sign supports, ensure that each post is of the same type. Combining and installing both ground mounted u-section and square steel tube posts within the same sign assembly is prohibited.

When mounting signs on ground mounted u-section or square steel tube posts, utilize either a sign support / ground support post combination with an approved breakaway assembly or a single direct driven post for each individual sign support of a sign assembly installation. Do not combine a sign support / ground support post combination and a direct driven post on the same sign assembly installation that contains two or more sign supports. Regarding sign support / ground support post combination installations, ensure that post lengths, stub heights and breakaway assemblies comply with the manufacturer's requirements and specifications. Use approved breakaway assemblies found on the *Approved Products List For Traffic Control Devices in Work Zones*.

When covering signs with opaque materials, the Department prohibits attaching a covering material to the face of the sign with tape or a similar product or any method that will leave a residue on the retroreflective sheeting. Residue from tape or similar products, as well as many methods utilized to remove such residue, damages the effective reflectivity of the sign. Therefore, contact of tape or a similar product with the retroreflective sheeting will require replacement of the sign. Cost for replacement of a sign damaged by improper covering methods will be considered incidental to providing and maintaining the sign; no additional payment will be made.

Overlays are prohibited on all rigid construction signs. The legends and borders on all rigid construction signs shall be either reversed screened or direct applied.

Signs not illustrated on the typical traffic control standard drawings designated for permanent construction signs shall be considered temporary and shall be included in the lump sum price bid item for "Traffic Control" unless otherwise specified.

Install "Grooved Pavement" signs (W8-15-48) supplemented with the "Motorcycle" plaque (W8-15P-30) in advance of milled or surface planed pavement surfaces. On primary routes, install these signs no further than 500 feet in advance of the beginning of the pavement condition. On interstate routes, install these signs no less than 500 feet in advance of the beginning of the pavement condition. Install two sign assemblies at each sign location, one on each side of the roadway, on multilane roadways when the pavement condition is present. Install these signs immediately upon creation of this pavement condition and maintain these signs until this pavement condition is eliminated.

Install "Steel Plate Ahead" signs (W8-24-48) in advance of an area of roadway where temporary steel plates are present. Install these signs no further than 300 feet in advance of locations where steel plates are present. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon installation of a temporary steel plate and maintain the signs until the temporary steel plates are removed.

Install and maintain any necessary detour signing as specified by the typical traffic control standard drawings designated for detour signing, Part VI of the MUTCD, these Special Provisions, and the Engineer. The lump sum price bid item for "Traffic Control" includes payment for installation and maintenance of the detour signing.

The Contractor shall maintain the travel patterns as directed by the traffic control plans and shall execute construction schedules expeditiously. The Contractor shall provide the Resident Engineer with no less than a two-week prior notification of changes in traffic patterns.

During nighttime flagging operations, flaggers shall wear a safety vest and safety pants that comply with the requirements of ANSI / ISEA 107 standard performance for Class 3 risk exposure, latest revision, and a fluorescent hard hat. The safety vest and the safety pants shall be retroreflectorized and the color of the background material of the safety vest and safety pants shall be fluorescent orange-red or fluorescent yellow-green.

During nighttime flagging operations, the contractor shall illuminate each flagger station with any combination of portable lights, standard electric lights, existing street lights, etc., that will provide a minimum illumination level of 108 Lx or 10 fc.

During nighttime flagging operations, supplement the array of advance warning signs with a changeable message sign for each approach. These changeable message signs are not required during daytime flagging operations. Install the changeable message signs 500' in advance of the advance warning sign arrays. Messages should be "Flagger Ahead" and "Prepare To Stop".

During surface planing and milling operations, grade elevation differences greater than 1 inch in areas with pavements composed of hot mixed asphalt (HMA) base courses, intermediate courses or surface courses and Portland cement concrete are PROHIBITED unless otherwise directed by the Department. However, during surface planing and milling operations for removal of Open-Graded Friction courses ONLY, a grade elevation difference of 1½ inches between adjacent travel lanes opened to traffic may exist unless otherwise directed by the Department.

During surface planing and milling operations, lane closures are required at all times where grade elevation differences and drop-offs greater than the acceptable measurements specified heretofore exist adjacent to or between travel lanes open to traffic unless otherwise specified by the department. If a grade elevation difference in excess of the specified acceptable ranges exist, either mill the adjacent travel lane or pave the milled travel lane as necessary to eliminate the grade elevation difference prior to opening the travel lane to traffic at these locations. Maintain the lane closure restrictions at all times unless otherwise directed by these special provisions.

During surface planing and milling operations, the length of roadway with an acceptable grade elevation difference less than or equal to 1" shall not exceed 2 miles.

During paving operations, the Department requires lane closures at all times where grade elevation differences and drop-offs greater than 2" exist adjacent to or between the travel lanes of a roadway opened to traffic, unless otherwise specified by these special provisions. Maintain lane closure restrictions at all times unless otherwise directed by these special provisions.

During paving operations, the length of roadway with an acceptable grade elevation difference less than or equal to 2" shall not exceed 2 miles.

Upon completion of the final riding surface on each road, the Contractor will be allowed up to 3 working days to begin eliminating shoulder drop-offs greater than 2" and work continuously until these drop-offs are eliminated.

Supplement and delineate the shoulder edges of travel lanes through work zones with traffic control devices to provide motorists with a clear and positive travel path. Utilize portable plastic drums unless otherwise directed by the Department. Vertical panels may be used where specified by the plans and directed by the RCE. The installation of traffic control devices are required in all areas where those areas immediately adjacent to a travel lane open to traffic have been altered in any manner by work activities, including but not limited to activities such as grading, milling, etc. Install the traffic control devices immediately upon initiating any alterations to the areas immediately adjacent to or within 15 feet of the near edge line of the adjacent travel lane. When sufficient space is available, place the traffic control devices no closer than 3 feet from the near edge of the traffic control device to the near edge line on the adjacent travel lane. When sufficient space is unavailable, place the traffic control device at the maximum distance from the near edge of the adjacent travel lane available.

LANE CLOSURE RESTRICTIONS -

The lane closure restrictions stated below are project specific. For all other restrictions see supplemental specification "Closure Restrictions" dated July 1, 2019.

The Contractor shall install all lane closures as directed by the Standard Specifications For Highway Construction (latest edition), the Standard Drawings For Road Construction, these special provisions, the MUTCD, and the Engineer. The Contractor shall close the travel lanes of two-lane two-way roadways by installing flagging operations. The Contractor shall close the travel lanes of multilane primary and secondary routes as directed by the typical traffic control standard drawings designated for lane closures on primary routes.

The County prohibits lane closures on SC 557 on Monday through Friday from 7:00am to 9:00am and from 4:00pm to 6:00pm and during any time of the day that traffic volumes in the travel lanes remaining open to traffic exceed 800 vehicles per hour per lane. The County reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the plans, these special provisions, and the Engineer. These restrictions will be in effect for all roadways associated with construction of the project. The penalty for violating the lane closure restrictions is $500/hour, or any part thereof.

Flagging operations are considered to be lane closures for two-lane two-way operations and shall be subject to all restrictions for lane closures as specified by this contract.

Lane closures, including flagging operations, are restricted to maximum distances of 2 miles. Install all lane closures according to the typical traffic control standard drawings. On occasions when daytime lane closures must be extended into the nighttime hours, substitute the nighttime lane closure standards for the daytime lane closure standards.

Installation and maintenance of a lane closure is PROHIBITED when the Contractor is not actively engaged in work activities specific to the location of the lane closure unless otherwise specified and approved by the Engineer. The length of the lane closure shall not exceed the length of

roadway anticipated to be subjected to the proposed work activities within the work shift time frame or the maximum lane closure length specified unless otherwise approved by the Engineer. Also, the maximum lane closure length specified does not warrant installation of the specified lane closure length when the length of the lane closure necessary for conducting the work activity is less. The length and duration of each lane closure, within the specified parameters, shall require approval by the Engineer prior to installation. The length and duration of each lane closure may be reduced by the Engineer if the work zone impacts generated by a lane closure are deemed excessive or unnecessary.

The presence of temporary signs, portable sign supports, traffic control devices, trailer mounted equipment, truck mounted equipment, vehicles and vehicles with trailers relative to the installation or removal of a closure and personnel are prohibited within the 15 to 30 foot clear zone based upon the roadway speed limit during the prohibitive hours for lane closures specified by these special provisions.

SHOULDER CLOSURE RESTRICTIONS -

The County prohibits the Contractor from conducting work within 15' of the near edge of the adjacent travel lane on primary routes during the hours when lane closures are prohibited. The hourly restrictions for lane closures shall also apply to work activities conducted under a shoulder closure within 15' of the near edge of an adjacent travel lane or a median area. The County reserves the right to suspend work conducted under a shoulder closure if any traffic backups develop and are deemed excessive by the Engineer. Maintain all shoulder closure restrictions as directed by the plans, these special provisions, and the Engineer.

On primary and secondary roadways, the County prohibits the Contractor from conducting work within 1' or less of the near edge of an adjacent travel lane under a shoulder closure. All work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within 1' of the near edge of an adjacent travel lane shall be conducted under a lane closure.

The Contractor shall install all shoulder closures as directed by the typical traffic control standard drawings designated for shoulder closures, and the Engineer. Substitution of the portable plastic drums with oversized cones during nighttime shoulder closures is PROHIBITED.

MOBILE OPERATIONS -

A mobile operation moves continuously at all times at speeds 3 mph or greater without any stops. The minimal traffic flow impacts generated by these operations involve brief traffic flow speed reductions and travel path diversions. Conduct work operations that cannot be performed at speeds of 3 mph or greater under standard stationary lane closures.

The Department prohibits the Contractor from conducting mobile operations during the hours when lane closures are prohibited. The hourly restrictions for lane closures shall also apply to work activities conducted under mobile operations. The Department reserves the right to suspend work conducted under mobile operations if any traffic backups develop and are deemed excessive by the Engineer. Maintain all mobile operation restrictions as directed by the plans, these special provisions, and the Engineer.

The distance intervals between the vehicles, as indicated in the *Standard Drawings For Road Construction*, may require adjustments to compensate for sight distance obstructions created by hills and curves and any other conditions that may obstruct the sight distance between the vehicles. However, adjustments to the distance intervals between the vehicles should be maintained within the range of variable distance intervals indicated in the standard drawings unless otherwise directed by the Engineer.

Maintain two-way radio communication between all vehicles in the vehicle train operating in a mobile operation.

Supplement the work vehicles and the shadow vehicles with amber colored flashing dome lights. The vehicles may also be supplemented with advance warning arrow panels and truck mounted attenuators as directed in the *Standard Drawings For Road Construction* and the Standard Specifications.

The Contractor shall install, operate and maintain all advance warning arrow panels, truck mounted attenuators and truck mounted changeable message signs as required by these special provisions, the manufacturer's specifications, the *Standard Drawings For Road Construction*, the Standard Specifications, the plans and the Engineer.

TYPICAL TRAFFIC CONTROL STANDARD DRAWINGS -

The typical traffic control standard drawings of the "Standard Drawings For Road Construction", although compliant with the MUTCD, shall take precedence over the MUTCD. The typical traffic control standard drawings of the "Standard Drawings For Road Construction" shall apply to all projects let to contract.

Install the permanent construction signs as shown on the typical traffic control standard drawings designated for permanent construction signing.

605-010-01 Scheme A	**E.B. SC 557**	**118 Square Feet**
	W.B. SC 557	**118 Square Feet**
605-010-01 Scheme C	**Kingsburry Road**	**92 Square Feet**
	Ridge Road	**92 Square Feet**
	Riddle Mill Road	**92 Square Feet**
	Bethel School Road	**92 Square Feet**
	Oakridge Road	**92 Square Feet**
605-010-01 Scheme E	**Davis Mill Road**	**24 Square Feet**
	Glenn Brandon Road	**24 Square Feet**
	Thatcher Crossing	**24 Square Feet**
	Harper Green Drive	**24 Square Feet**
Total		**792 Square Feet**

ADDENDUMS

(Addendums to the "2007 Standard Specifications for Highway Construction")

(A) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles (paragraph 2) -

When working within the rights-of-way of access-controlled roadways such as Interstate highways, the Contractor's vehicles may only change direction of travel at interchanges. These vehicles are prohibited from crossing the roadway from right side to the median or vice versa. Use a flagger to control the Contractor's vehicles when these vehicles attempt to enter the roadway from a closed lane or the median area. Ensure the flagger does not stop roadway traffic, cause roadway traffic to change lanes, or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

The Contractor shall have flaggers available to control all construction vehicles entering or crossing the travel lanes of secondary and primary routes. The RCE shall determine the necessity of these flaggers for control of these construction vehicles. The RCE shall consider sight distance, vertical and horizontal curves of the roadway, prevailing speeds of roadway traffic, frequency of construction vehicles entering or crossing the roadway and other site conditions that may impact the safety of the workers and motorists when determining the necessity of these flaggers. Ensure these flaggers do not stop roadway traffic, cause roadway traffic to change lanes or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways with posted regulatory speed limits of 55 MPH or greater and average daily traffic volumes {ADT} of 10,000 vehicles per day or greater, i.e. Interstate highways, all construction and work vehicles possessing any one or more of the vehicular characteristics listed below are only permitted to enter and exit a right or left shoulder work area during the presence of active lane closures unless otherwise directed by the RCE. These vehicles are not permitted to enter or exit these work areas without the presence of active lane closures unless otherwise directed by the RCE. Shoulder closures are unacceptable and insufficient methods for control of traffic at ingress / egress areas for these vehicles. The restrictive vehicular characteristics include the following:

- Over six (6) tires
- Tandem rear axles
- A base curb weight greater than 8000 lbs.
- A gross vehicular weight greater than 12000 lbs. unless performing duties as a shadow vehicle while supporting a truck mounted attenuator
- A trailer in tow except under the following conditions:
  - Trailers transporting traffic control devices (including but not limited to standard and 42" oversized traffic cones, portable plastic drums, signs, portable sign supports, u-channel and square steel tube sign posts) relative to the installation of lane closures, shoulder closures or other traffic control operations approved by the RCE
  - Trailer mounted traffic control devices (including but not limited to advance warning arrow panels, changeable message signs, temporary traffic signals, highway advisory radios, work zone intelligent transportation systems and trailer towed truck mounted attenuators)

(B) <u>Construction</u> (Sub-section 601.4) –

<u>Sub-section 601.4.2 Construction Vehicles</u> -

<u>Auxiliary Warning Lights for Vehicles and Equipment</u> -

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

All auxiliary warning light models shall meet *Society of Automotive Engineers* (SAE) Class I standards and SAE Standard J575 relative to *Tests for Motor Vehicle Lighting Devices and Components* and these specifications.

The amber/yellow color of the dome/lens of an auxiliary warning light device shall meet SAE Standard J578 for amber/yellow color specifications.

Auxiliary warning lights with parabolic reflectors that rotate shall rotate around a halogen lamp at a rate to produce approximately 175 flashes per minute. The parabolic reflector shall produce a minimum 80,000 candle power and a minimum 54,000 candela through an SAE Standard J846 approved amber dome.

Equip strobe type flashing auxiliary warning light devices with photosensitive circuit controls to adjust the lighting intensity in response to changes in ambient light conditions such as from day to night. These lights shall have a double-flash capability rated at approximately 80 double flashes per minute and produce a minimum 24 joules of flash energy at the highest power level setting.

Acceptable auxiliary warning light models shall provide sufficient light output to be clearly recognizable at a minimum distance of 1750 feet.

Mount all auxiliary warning light devices intended to function as the auxiliary warning light system or as an element thereof on vehicles and equipment at locations no less than 3 feet above the ground and in conspicuous locations to provide visibility to approaching motorists.

Auxiliary warning light devices and/or models that mount in the locations of the standard vehicle lighting system are unacceptable as the specified auxiliary warning light system due to restrictive simultaneous visibility capabilities from multiple sight angles. However, auxiliary warning light devices that mount in the standard vehicle lighting system locations are acceptable as supplements to the specified lighting devices mounted in locations that do meet the minimum height requirements and provide simultaneous visibility capabilities from multiple sight angles.

Standard vehicle hazard warning lights are only permitted as supplements to the specified auxiliary warning light devices.

(C) General Requirements for Providing and Maintaining Traffic Control Devices in the Work Zone (Section 602) –

Sub-section 602.4 Construction (paragraph 8) -

Mount flat sheet signs straight and level and with the face of the signs perpendicular to the surface of the roadway. This requirement applies to flat sheet signs whether they are portable or have the embedded supports. Mount advance construction signs 2 feet from the edge of a paved shoulder or the face of a curb, or if no paved shoulder exists, 6 feet to 12 feet from the edge of an adjacent travel lane to the nearest edge of the signs. The mounting height of single signs mounted on ground embedded sign supports is no less than 7 feet or no greater than 8 feet from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. Any secondary sign on the same assembly has a minimum mounting height of 6 feet from the ground to the bottom edge of the secondary sign. Ensure that signs mounted on portable sign supports, including advance construction signs, regulatory signs, warning signs, etc., have a minimum mounting height of 5 feet from the ground to the bottom edge of the sign. Provide special sign mounting assemblies, when necessary, in areas of double-layered guardrail, concrete median barrier, or bridge parapet walls.

(D) Category I Traffic Control Devices (Section 603) –

Sub-section 603.2.2 Oversized Traffic Cones (paragraph 6) -

Reflectorize each oversized traffic cone with 4 retroreflective bands: 2 orange and 2 white retroreflective bands. Alternate the orange and white retroreflective bands, with the top band always being orange. Make each retroreflective band not less than 6 inches wide. Utilize Type III – Microprismatic retroreflective sheeting for retroreflectorization on all projects let to contract after May 1, 2010 unless otherwise specified. Separate each retroreflective band with not more than a 2-inch non-reflectorized area. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the cone surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

Sub-section 603.2.3 Portable Plastic Drums (paragraph 3) -

Reflectorize each drum with Type III – Microprismatic retroreflective sheeting: 2 orange and 2 white retroreflective bands, 6 inches wide on all projects let to contract after May 1, 2010 unless otherwise specified. Alternate the orange and white retroreflective bands with the top band always being orange. Ensure that any non-reflectorized area between the orange and white retroreflective bands does not exceed 2 inches. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

(E) Category II Traffic Control Devices (Section 604) –

Sub-section 604.2.1 Type I and Type II Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle in the direction of passing traffic. The stripes shall be 6 inches wide.

Sub-section 604.2.2 Type III Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle. Apply the sloping orange and white stripes in accordance with the requirements of the Plans, SCDOT Standard Drawings and the MUTCD. The stripes shall be 6 inches wide.

(F) Temporary Concrete Barrier (Sub-section 605.2.3.2) –

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 6) -

Previously used temporary concrete barrier walls are subject to inspection and approval by the RCE before use. Ensure that previously used temporary concrete barrier walls are in good condition. Defects to a temporary concrete barrier wall that may disqualify a section of wall for use include gouges, cracks, chipped, or spalled areas. A defect that exposes reinforcing steel warrants immediate disqualification. A disqualification grade type defect shall consist of measurements in excess of 1 inch, entirely or partially within the boundaries of the end connection areas and the drainage slot areas as illustrated in the "Standard Drawings for Road Construction", and/or in excess of 4 inches for all areas beyond the end connection areas. To warrant disqualification, these measurements shall exceed the specified dimensions in all three directions, width, height, and depth. A defect that exceeds the specified dimensions in only one or two of the three directions does not warrant disqualification.

Temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel may be repaired in accordance with the following requirements. Repair is prohibited on temporary concrete barrier walls with defects 6 inches or greater in all three directions, width, height and depth.

For repair of temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel, repair the defect with a premanufactured patching material specifically fabricated for patching structural concrete. The strength of the patch must meet or exceed the design strength of the class 3000 concrete of the temporary concrete barrier wall. Perform the repair procedures in accordance with all requirements and instructions from the manufacturer of the patch material. Use a bonding compound between the patch material and the concrete unless specifically stated by the manufacturer that a bonding compound is not required. If the manufacturer states that application of a bonding compound is optional, SCDOT requires application of a bonding compound compatible with the patch material. If cracking occurs within the patched area, remove the patch material completely and repeat the repair process. The contractor shall submit documentation stating all repairs have been conducted in accordance with these requirements prior to installing any temporary concrete barrier walls with repairs. Utilization of temporary concrete barrier walls with repairs shall require approval by the RCE prior to installation.

The Contractor shall submit certification documents for the patch material utilized for repairs to the Engineer prior to placing temporary concrete barrier walls that have been repaired on the project site.

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 5) -

In regard to projects let to contract after January 1, 2017, ALL *NCHRP Report 350* compliant temporary concrete barrier walls placed on a project site SHALL comply with the requirements for the recessed approval stamp as directed by the *SCDOT Standard Drawings*. Those *NCHRP Report 350* compliant temporary concrete barrier walls with the original recessed approval stamp that reads "SCDOT 350" will continue to be acceptable on projects let to contract after January 1, 2017. However, those temporary concrete barriers with the "SCDOT 350" identification plate attached to the side of the barrier walls with mechanical anchors previously grandfathered will no longer be acceptable on projects let to contract after January 1, 2017.

(G) Construction Signs (Sub-section 605.4.1.1) –

On all projects relative to **interstate highways** let to contract after January 1, 2016, all signs attached to portable sign supports on and/or adjacent to **interstate highways** shall be rigid. Fabricate each of these rigid signs from an approved aluminum laminate composite rigid sign substrate approved by the Department. Utilization of signs fabricated from roll-up fabric substrates attached to portable sign supports installed on and/or adjacent to **interstate highways** will no longer be acceptable on projects let to contract after January 1, 2016.

ONLY those portable sign supports specified and approved for support of rigid signs fabricated from approved aluminum laminated composite rigid sign substrates and included on the *Approved Products List for Traffic Control Devices in Work Zones*, latest edition, are acceptable. To facilitate location of acceptable portable sign supports, the listing of portable sign supports is now separated into two (2) sections; "Portable Sign Supports for Use with Roll-Up Signs ONLY" and "Portable Sign Supports for Use with Roll-Up Sign Substrates and Rigid Sign Substrates".

The trade names of the approved aluminum laminate composite rigid sign substrates are "Acopan", "Alpolic", "Dibond" and "Reynolite". These rigid sign substrates are restricted to thicknesses no greater than 2 millimeters.

Rigid signs fabricated from standard aluminum sign blanks or any other rigid material other than Acopan, Alpolic, Dibond or Reynolite are PROHIBITED for attachment to portable sign supports. However, rigid signs fabricated from standard 0.080 and 0.100 inches thick aluminum sign blanks will continue to be acceptable for mounting on ground mounted sign supports.

Signs fabricated from roll-up fabric substrates approved by the Department will continue to be acceptable for use on and/or adjacent to secondary and primary roadways unless otherwise directed by the Department.

The minimum mounting height of signs mounted on these portable sign supports shall continue to be 5 feet from the ground to the bottom edge of the sign except where a minimum 7 foot mounting height is required in accordance with the standard specifications, the standard drawings, these special provisions and the MUTCD, latest edition.

(H) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.2.2.2.3.3 Color (paragraph 1) -

Use industrial grade enamel paint for cover of the metal aspects of the unit. Provide and attach supplemental striping to the rear face of the unit with a minimum Type III high intensity retroreflective sheeting unless otherwise directed by the Department. Utilize an alternating 4 to 8 inch black and 4 to 8 inch yellow 45-degree striping pattern that forms an inverted "V" at the center of the unit that slopes down and to the sides of the unit in both directions from the center.

(I) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.4.2.2 Truck-Mounted Attenuators (paragraph 6) -

A direct truck mounted truck mounted attenuator is mounted and attached to brackets or similar devices connected to the frame of a truck with a minimum gross vehicular weight (GVW) of 15,000 pounds (actual weight) unless otherwise directed. A trailer towed truck mounted attenuator is towed from behind and attached via a standard pintle hook / hitch to the frame of a truck with a minimum gross vehicular weight (GVW) of 10,000 pounds (actual weight) unless otherwise directed.

Each truck utilized with a truck mounted attenuator shall comply with the manufacturer's requirements to ensure proper operation of the attenuator. The minimum gross vehicular weight (GVW) (actual weight) for each truck shall comply with these specifications unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to specific requirements for the device in question.

If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a

bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure in its entirety and shall not protrude from the steel structure in any manner.

(J) Trailer-Mounted Changeable Message Signs (Sub-section 606.3.2) -

Sub-section 606.3.2.7 Controller (paragraphs 1-4) -

The controller shall be an electronic unit housed in a weatherproof, rust resistant box with a keyed lock and a light for night operation. Provide the unit with a jack that allows direct communications between the on-board controller and a compatible personal computer. The unit shall have a LCD display screen that allows the operator to review messages prior to displaying the message on the sign.

The controller shall have the capability to store 199 factory preprogrammed messages and up to 199 additional messages created by the user in a manner that does not require a battery to recall the messages. Also, the controller shall allow the operator the capability to program the system to display multiple messages in sequence.

Provide the controller with a selector switch to allow the operator to control the brightness or intensity level of the light source of the sign panel. The selector switch shall include "bright," "dim" and "automatic" modes; inclusion of additional modes is permissible. When the selector switch is in the "automatic" mode, a photosensitive circuit shall control the brightness or intensity level of the light source in response to changes in ambient light such as from day to night and other various sources of ambient light.

Equip each sign with remote communications capabilities, such as utilization of cellular telephone or internet browser technology, to allow the operator to revise or modify the message selection from the office or other remote location. Also, provide protection to prohibit unauthorized access to the controller, (i.e. password protection).

Sub-section 606.5 Measurement (paragraph 2) -

Trailer-mounted changeable message signs are included in the lump sum item for Traffic Control in accordance with **Subsections 107.12** and **601.5** of the “2007 Standard Specifications for Highway Construction”. No separate measurement will be made for trailer-mounted changeable message signs unless the contract includes a specific pay item for trailer-mounted changeable message signs.

The Contractor shall provide, install, operate, and maintain the trailer-mounted changeable message sign per traffic control set-up as directed by the Plans, the “Standard Drawings for Road Construction”, these Special Provisions, the Specifications, and the Engineer.

Sub-section 606.6 Payment (paragraph 2) -

In addition to **Subsections 107.12** and **601.6**, the payment for Traffic Control is full compensation for providing, installing, removing, relocating, operating, and maintaining trailer-mounted advance warning arrow panels and trailer-mounted changeable message signs as specified or directed and includes providing the units’ primary power source; repairing or replacing damaged or malfunctioning units within the specified time; providing traffic control necessary for installing, operating, and maintaining the units; and all other materials, labor, hardware, equipment, tools, supplies, transportation, incidentals, and any miscellaneous items necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other items of the Contract.

Sub-section 606.6 Payment (paragraph 3) -

Disregard this paragraph unless the Contract includes a specific pay item for trailer-mounted changeable message signs.

(K) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (in addition to paragraph 3) -

On two-lane two-way roadways, apply and place temporary or permanent pavement markings, as specified hereupon, prior to the end of each day's work or shift or reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines on edge lines and solid center lines and 4-inch wide by 10 feet long broken lines with a 30-foot gap for broken center lines and lane lines unless otherwise specified. The center line pavement markings shall be either double yellow solid lines, yellow broken lines or an appropriate combination of a yellow solid line and yellow broken lines for passing / no passing zones. Placement of a singular yellow solid line for a center line pavement marking is unacceptable. The edge line pavement markings shall be a white solid line.

On multilane primary and secondary roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines, utilized for edge lines and solid center lines, and 4-inch wide by 10 feet long broken lines with a 30-foot gap, utilized for lane lines and turn lanes, unless otherwise specified. The center line pavement markings shall be either double yellow solid lines or an appropriate combination of a yellow solid line and 4-inch wide by 10 feet long yellow broken lines for two-way left turn median areas. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas. The lane lines between travel lanes and turn lanes shall be 4-inch wide by 10 feet long white broken lines with a 30-foot gap.

However, on two-lane two-way and multilane primary and secondary roadways, application of a 4-inch wide solid line utilized for an edge line adjacent to an earth shoulder, white or yellow, may be delayed up to 72 hours after eradication of the original line when the length of eradicated line at a single location is no longer than 250 feet. In the event of multiple locations along the same line, each location must be separated from the adjacent location by no less than 250 feet with a cumulative total distance of eradicated line of no more than 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location. If the length of eradicated line exceeds 250 feet at any single location, the distance interval between multiple adjacent locations is less than 250 feet or a cumulative total distance of multiple locations of eradicated line exceeds 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location, replace the eradicated line(s) prior to reopening the adjacent travel lane to traffic.

On interstate roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 6-inch wide solid lines, utilized for edge lines, and 6-inch wide by 10 feet long white broken lines with a 30-foot gap, utilized for lane lines between travel lanes and auxiliary lanes, unless otherwise specified. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas.

On all roadways, apply and place white stop bars and white triangle yield bars in all locations where previous stop bars and triangle yield bars have been eradicated by the work. Apply and place white stop bars and white triangle yield bars at intersections controlled by stop and yield signs within 72 hours of the eradication of the original pavement marking. Apply and place white stop bars at signalized intersections controlled by traffic control signals and at railroad crossings prior to reopening a closed travel lane to traffic.

Within the limits of existing turn lanes on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work unless otherwise directed by the RCE. Apply and place white arrows within 72 hours of the eradication of the original pavement markings. However, in regard to newly constructed turn lanes, apply and place white arrows the within turn lanes as directed by the RCE.

Within the limits of existing lane-drop sites on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work prior to the end of each day's work or shift or reopening the closed travel lane to traffic. In regard to newly constructed lane-drop sites, apply and place white arrows within the travel lane to be terminated prior to opening the travel lane to traffic and as directed by the RCE.

(L) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (Revision to paragraph 8) -

On two-lane, two-way roadways, passing zones may be eliminated within the work zone through application of 4-inch double yellow centerline pavement markings if determined feasible and directed to do so by the Plans and/or the RCE. Apply no passing zone markings as specified by the Plans, the Specifications, the *MUTCD* and the RCE.

(M) Flagging Operations (Sub-section 610.4.1) –

Sub-section 610.4.1.1 Flagging Operations (paragraph 1) -

Use a flagging operation to control the flow of traffic when two opposing directions of traffic must share a common travel lane. A flagging operation may be necessary during a lane closure on a two-lane two-way roadway, an intermittent ramp closure or an intermittent encroachment of equipment onto a portion of the roadway. Utilize flagging operations to direct traffic around work activities and maintain continuous traffic flow at reduced speeds when determined to be appropriate by the RCE. As stated above, flagging operations shall direct traffic around the work activities and maintain continuous traffic flow, therefore, stopped traffic shall not be required to stop for time durations greater than those listed below unless otherwise directed by the RCE. Begin measurement of the time interval immediately upon the moment the Flagger rotates the Stop/Slow paddle to display the "Stop" condition to the approaching motorists.

LENGTH OF CLOSURE	MAXIMUM TIME DURATION FOR STOPPED TRAFFIC
1 MILE or LESS	5 Minutes
1 to 2 MILES	7 ½ Minutes

If the work activities require traffic to be stopped for periods greater than 5 to 7 ½ minutes as stated above, consider alternate work methods, conducting work activities during times of lowest traffic volumes such as during the hours of darkness or complete road closure with detour installation.

(N) Paving and Resurfacing (Sub-section 611.4.1) –

Sub-section 611.4.1.2 Requirements (paragraph 8) -

Whenever travel lanes with acceptable grade elevation differences are open to traffic, provide "Uneven Lanes" signs (W8-11-48) or "Uneven Pavement" signs (W8-11A-48). Reflectorize these signs with a fluorescent orange colored prismatic retroreflective sheeting unless otherwise specified. Install these signs adjacent to roadways with uneven pavement surfaces between travel lanes or between travel lanes and the adjacent paved shoulders. Install these signs at intervals no greater than 2600 feet.

STAGING

STAGE 1
(TC1 – TC5)

Install permanent construction signing schemes as indicated above in accordance with the standard drawings. Install temporary erosion control devices within the work area. Conduct clearing and grubbing operations within the work area.

Maintain all existing traffic patterns during Stage 1 unless otherwise specified in the traffic control plans or by the Engineer.

Construct the following areas up to, but not including the final layer of surface course:

S-27 Ridge Road from Station 20+00 to 27+57.

S-114 Kingsburry Road from Station 30+50 to 27+94.

SC 557 Relocated from Station 251+50 to 262+50, including the new bridge over Crowder's Creek.

Temporary driveways right of Relocated SC 557 Station 263+00 to 270+50. Maintain access along existing Davis Mill Road. Construct proposed driveway at Relocated SC 557 Station 268+75 LT and temporarily connect to existing driveway right of existing survey SC 557 Station 269+00.

SC 557 Relocated from Station 268+50 to 270+00 and 272+50 to 287+30, including the proposed 7'X8' box culvert.

Apply all temporary pavement markings and raised pavement markers as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

Install and maintain all traffic control devices, including pavement markings and raised pavement markers, in accordance with the plans, the standard drawings, the standard specifications, these special provisions, and the Engineer.

STAGE 2
(TC6 – TC18, and TC38)

Upon entering Stage 2 ensure permanent construction signs are in place and in working order.

Apply all temporary pavement markings and raised pavement markers as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer. Eradicate all conflicting pavement markings in accordance with the standard specifications, these special provisions, and the Engineer.

During Phase 1, utilizing Standard Drawing 601-005-00 and drums perform widening and build up to, but not including the final surface course for SC 557 from Station 203+05 to 244+50. Construct widening and build up to, but not including the final surface course for Riddle Mill Road and Bethel School Road.

During Phase 1, under a temporary closure complete construction and tie-in of S-1916 Pharr Yarns to the proposed SC 557 widening. Maintain access to existing Pharr Yarns facility via existing driveways along Kingsburry Road. Temporary closure shall not exceed 14 calendar days.

During Phase 1, install and utilize temporary traffic signal equipment for existing Ridge Road in accordance with sheet TTS1.1.

Conduct bridge construction operations as illustrated in the bridge plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

During Phase 1, while maintaining access using temporary drives previously constructed in Stage 1, construct tie-ins for permanent driveway on TC10 right of Relocated SC 557 Station 263+00 and Davis Mill Road. Remove existing pavement for old driveway alignments no longer used on sheet TC10.

During Phase 1, construct Relocated SC 557 up to, but not including the final surface course for SC 557 from Station 262+50 to 268+50 and 270+00 to 272+50.

During Phase 2 or within 14 calendar days of closure, remove temporary closure of S-1916 Pharr Yarns to the proposed SC 557 widening.

During Phase 2, maintain temporary traffic signal for Ridge Road installed during previous Phase.

During Phase 2, construct temporary widening left of existing SC 557 Station 244+50 to 249+67.

During Phase 3, install portable terminal impact attenuators and temporary concrete barrier along right shoulder of existing SC 557 Station 287+63 to 295+90. The approach ends of the temporary concrete barrier shall be tapered at a rate of 10:1 as illustrated in the plans. Construct new SC 557 and widening up to, but not including the final layer surface course from Station 287+30 to 330+02. Construct widening and build up for tie-in of Glenn Brandon Road.

During Phase 3, install and utilize temporary traffic signal equipment for Oakridge Road in accordance with sheet TTS2.1.

Maintain drainage between the existing alignment and the construction area in accordance with the plans, the standard drawings, the standard specifications, these special provisions, and the Engineer. Eradicate all conflicting pavement markings in accordance with the standard specifications, these special provisions, and the Engineer.

Install and maintain all traffic control devices, including pavement markings and raised pavement markers, in accordance with the plans, the standard drawings, the standard specifications, these special provisions, and the Engineer.

STAGE 3
(TC19 – TC31, and TC39 – TC41)

Upon entering Stage 3 and prior to shifting traffic into temporary pattern, apply all temporary pavement markings and raised pavement markers for the Stage 3 alignment as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer. Use tape on the new concrete surfaces as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

Shift traffic to the Stage 3 alignment as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer. Eradicate all conflicting pavement markings in accordance with the standard specifications, these special provisions, and the Engineer.

Maintain temporary traffic signal for Ridge Road installed during previous Stage.

During Phase 1, utilizing temporary widening constructed during Stage 2, Phase 2 from Station 244+50 to 249+67, shift traffic north and install portable terminal impact attenuators and temporary concrete barrier along right shoulder of SC 557 Station 244+60 to 251+40. The approach ends of the temporary concrete barrier shall be tapered at a rate of 10:1 as illustrated in the plans. Construct new SC 557 and widening up to, but not including the final layer surface course from Station 244+50 to 251+50. Remove the temporary barrier and attenuators when construction of this phase is complete.

Prior to entering Phase 2, complete the bridge construction operations as illustrated in the bridge plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

Install proposed guardrail along the new SC 557 roadway and complete bridge connections as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

During Phase 2, shift SC 557 traffic south and install portable terminal impact attenuators and temporary concrete barrier along left shoulder of SC 557 Station 244+60 to 247+40. The approach ends of the temporary concrete barrier shall be tapered at a rate of 10:1 as illustrated in the plans. Construct the tie-in of Relocated SC 557 and Driveway 1 up to, but not including the final layer surface course from Station 244+50 to 249+50. Remove the temporary barrier and attenuators when construction of this phase is complete.

Remove barricades for Davis Mill Road and new driveways constructed in Stage 2, Phase 1 Station 263+00 RT and 268+75 LT. Remove the temporary driveways.

While maintaining access for Thatcher Crossing via driveway Station 274+05 LT, complete the Driveway 2 tie-in.

During Phase 2 as shown on sheets TC28 and TC29, install portable terminal impact attenuators and temporary concrete barrier along left shoulder of Relocated SC 557 from Station 289+10 to 296+20. The approach ends of the temporary concrete barrier shall be tapered at a rate of 10:1 as illustrated in the plans. Complete the tie-in of new SC 557 up to, but not including the final layer surface course from Station 290+00 to 295+79. Remove the temporary barrier and attenuators when construction of this phase is complete.

With traffic in a temporary pattern, construct the north side of SC 557 from Station 301+05.90 to 333+97 and the west side of Oakridge Road from Station 10+80 to 15+41, including all curb and gutter, sidewalk and drainage.

Adjust temporary traffic signal for Oakridge Road installed in previous Stage in accordance with temporary traffic signal plan sheet TTS2.2. Disconnect and remove existing signal equipment.

Install and maintain all traffic control devices, including pavement markings and raised pavement markers, in accordance with the plans, the standard drawings, the standard specifications, these special provisions, and the Engineer.

STAGE 4
(TC32 – TC37)

Upon entering Stage 4 begin removal of the existing bridge over Crowder's Creek.

Complete construction of the tie-in for Ridge Road and associated driveways from Station 15+45 to 20+00.

Complete the tie-in for S-114 Kingsburry Road. Install all applicable detour signs, barricades, and other traffic control devices as directed in the plans and per SCDOT Standard Drawings and the Engineer. Remove or cover any conflicting signs of detour. Close S-114 Kingsburry Road from Station 33+00 to 35+85. Maximum closure duration is 7 calendar days. Penalties for violating this closure is $1,500/day, or any part thereof. Detour traffic in accordance with the detour plan on sheet TC33. Complete the Kingsburry Road tie-in from Sta 33+00 to 35+85 and temporary driveway as shown on the plans.

Open S-114 Kingsburry Road from Station 33+00 to 35+85 and the temporary driveway to traffic. Adjust the above previous detour signing in accordance with the detour plan on sheet TC34. Detour traffic in accordance with the detour plan on sheet TC34. Construct the Kingsburry Road tie-in from Sta 30+50 to 33+00 as shown on the plans. Maximum closure duration is 7 calendar days. Penalties for violating this closure is $1,500/day, or any part thereof.

Open Kingsburry Road to traffic once the tie-in is complete. Remove all applicable detour signs and barricades used in conjunction with the Kingsburry Road off-site detour.

Construct remaining work along Oakridge Road as shown on the plans.

Disconnect and remove all temporary signal devices and install permanent signal equipment in accordance with the plans, standard drawings, the standard specifications, these special provisions, and the Engineer.

Shift traffic to the final alignment and apply temporary pavement markings in accordance with the final pavement marking scheme as illustrated in the plans and in accordance with the standard drawings, the standard specifications, these special provisions, and the Engineer.

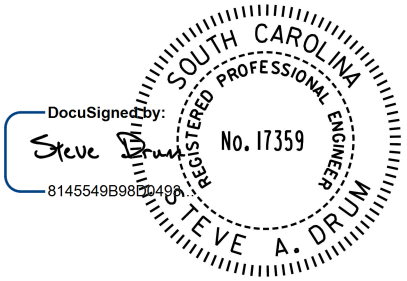
Install and maintain all traffic control devices, including pavement markings and raised pavement markers, in accordance with the plans, the standard drawings, the standard specifications, these special provisions, and the Engineer.

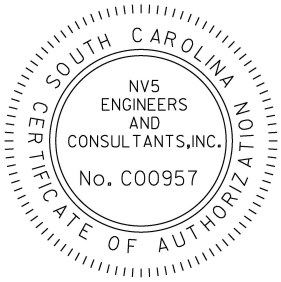
STAGE 5

Apply the asphalt surface course as directed by the Standard Specifications, these special provisions, and the Engineer. Apply temporary pavement markings as directed by the permanent pavement marking scheme and the typical traffic control standard drawings designated for mobile operations as the paving operations progress.

Apply the permanent pavement markings.

Install and maintain the traffic control for the application of the permanent pavement markings as directed by the typical traffic control standard drawings designated for mobile operations, the standard specifications, the special provisions, and the Engineer.





DIVISION II - SECTION 3

TRAFFIC SIGNALS - SIGNAL INSTALLATION GUIDELINES

INSTALLATION OF TRAFFIC SIGNALS

In order to provide uniformity in the manner in which signals are installed and placed in operation, all District Electrical Personnel should use the following procedure for the installation or replacement of new traffic signals.

1. Install poles, guys, overhead cable including signal head connections, but do not install signal heads until ready to place in flashing mode.

2. Install controller cabinet, cut loops and complete incidental work necessary to place signal in flashing mode.

3. Install heads and "bag" if necessary until the head can be placed in flashing mode and flash for at least 3 and not more than 7 days. Bag signal heads only in the event where all of the heads can not be installed within the same work day or if the intersection is a replacement of a closed loop system where the entire system is to be placed in operation at one time and the existing system will remain in operation until the switch over is initiated. **In the event where signalized intersections are replaced with new equipment, there is no mandatory flash period required.**

4. On the day the signal is to be placed in stop and go operation, erect "Signal Ahead" signs (**MUTCD** W3-3) on all approaches with a "NEW" plaque above the signs. When the signal is placed into operation, remove the "Stop" signs from the side street and "Stop Ahead" signs if applicable. Supplement the "Signal Ahead" signs with portable flashers and/or orange flags to draw attention to the signs.

5. The signal should be placed into operation on a normal workday, after the morning peak hour and prior to the afternoon peak hour.

6. The flags or flashers and the "NEW" plaques should be removed approximately two months after the signal is placed in operation.

DIVISION II - SECTION 4

SCDOT TRAFFIC SIGNAL SPECIAL PROVISIONS

PROJECT ID: 0041800 **COUNTY** York

1. **LIST OF TRAFFIC SIGNALS WITHIN PROJECT**

#	Intersection Name	Description of Signal Work
1	SC 557 (Hwy 557) and S-27 (Ridge Road)/S-114 (Kingsburry Road)	Install New Signal with Steel Strain Poles
2	SC 557 (Hwy 557) and S-435 (Oakridge Road)	Signal Modification with Steel Strain Poles

2. **PROJECT DESCRIPTION**

This Project is a ROAD WIDENING **construction project and involves the signal construction of** 2 **intersections along** SC 557 (Highway 557) **in and around** York County, **South Carolina. The intersections involved are shown on the above "List of Traffic Signals within Project or listed on the plans.**

Specific Description of the signal work: New signal, Rebuild, new steel poles, temporary adjustments of equipment, timing adjustments

3. **PAY ITEM ADDITIONAL INFORMATION** (if no changes, this can be eliminated)

Below is more information concerning any changes, revisions, or clarifications to the SCDOT Traffic Signal Supplemental Specifications and/or pay items for this particular contract:

Mobilization:

Wiring:

Communications:

Detection:

Signal Supports:

Signal Heads, Pedestrian Treatments, Illuminated signs, solar flashing assemblies:

Cabinet Items:

Service Items:

4. **EQUIPMENT (***Only needed if SCDOT is providing equipment to be installed by contractor.)*

6.1 SCDOT Provided Equipment *(Provide a list of equipment, location of equipment, details concerning equipment & installation)*

6.2 Faulty Equipment

- When SCDOT supplied equipment is designated faulty by the Engineer, the Contractor shall return it to the Manufacturer for replacement if it is under warranty, The Manufacturer shall furnish a replacement unit.
- When SCDOT supplied equipment is designated faulty by the Engineer and it is not under warranty, SCDOT shall replace the equipment.

5. **SIGNAL INTEGRATION** *(Only needed if different than the default. The default wording in the Supplemental Specifications (675.0 General Provisions 1.10) indicates SCDOT or local government signal maintenance staff will perform integration. If different than that, list what entity will perform integration.)*

- The _____ will perform integration in accordance with the Supplemental Specifications, 675.0 General Provisions.

6. **MAINTENANCE DURING CONSTRUCTION –** (*Only needed if different than the default. The default wording in the Supplemental Specifications (675.0 General Provisions 1.5) indicates that this begins at the contract NTP (notice to proceed) for all signals in the contract. If different than that, list whether maintenance begins at:*
   a. *When a work order is assigned by construction office*
   b. *When the contractor begins work at a signal*
   c. *Other option*

7. **CONTRACT SCHEDULE –** (*Only needed if different than the default.* The default wording in the *Supplemental Specifications indicates that contractor will to provide weekly schedule for all signal work. If SCDOT determines a need to set the schedule, indicate such below:)*

Example wording:

This is a "TURN-KEY" project where work is assigned using a work order system. Once work orders have been assigned to the ***CONTRACTOR, he*** *shall furnish the Engineer with a* ***WEEKLY SCHEDULE*** *for all active traffic signal construction work orders, 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.*

SCDOT TRAFFIC SIGNAL SPECIAL PROVISIONS – TRAFFIC CONTROL
FOR TRAFFIC SIGNAL PROJECTS

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 special provisions, all supplemental specifications, the MUTCD, and the Engineer. This is an amendment to the Standard Specifications to require the following:

GENERAL REGULATIONS -

These special provisions shall have priority to the plans and comply with the requirements of the MUTCD and the standard specifications. Revisions to the traffic control plan through modifications of the special provisions and the plans shall require approval by the department. **Final approval of any revisions to the traffic control plan shall be pending upon review by the Director of Traffic Engineering.**

Install and utilize changeable message signs in all lane closures installed on high volume high-speed multilane roadways. Use of changeable message signs in lane closures installed on low volume low speed multilane roadways is optional unless otherwise directed by the plans and the Engineer. Install and use a changeable message sign within a lane closure set-up as directed by the *Standard Drawings For Road Construction*. When a lane closures is not present for any time to exceed 24 hours, remove the changeable message sign from the roadway. Place the sign in a predetermined area on the project site, as approved by the Engineer, where the sign is not visible to passing motorists. The preprogrammed messages utilized shall be in accordance with the *Standard Drawings For Road Construction* when used as part of the traffic control set-up for lane closures. Only those messages pertinent to the requirements of the traffic control situation and the traffic conditions are permitted for display on a changeable message sign at all times. At no time will the messages displayed on a changeable message sign duplicate the legends on the permanent construction signs.

During operation of changeable message signs, place the changeable message sign on the shoulder of the roadway no closer than 6 feet between the sign and the near edge of the adjacent travel lane. When the sign location is within 30' of the near edge of a travel lane open to traffic, supplement the sign location with no less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. Install and maintain the drums no closer than 3 feet from the near edge of the adjacent travel lane. This requirement for delineation of the sign location shall apply during all times the sign location is within 30' of the near edge of a travel lane open to traffic, including times of operation and non-operation. Oversized cones are prohibited as a substitute for the portable plastic drums during this application.

All signs mounted on portable sign supports shall have a minimum mounting height of 5' from the bottom of the sign to the ground. All signs mounted on ground mounted u-channel posts or square steel tube posts shall have a minimum mounting height of 7' from the bottom of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present.

On multilane primary routes, avoid placement of signs mounted on portable sign supports within paved median areas utilized for two-way left turns unless otherwise directed by the RCE.

When mounting signs on multiple ground mounted sign supports, ensure that each post is of the same type. Combining and installing both ground mounted u-section and square steel tube posts within the same sign assembly is prohibited.

When mounting signs on ground mounted u-section or square steel tube posts, utilize either a sign support / ground support post combination with an approved breakaway assembly or a single direct driven post for each individual sign support of a sign assembly installation. Do not combine a sign support / ground support post combination and a direct driven post on the same sign assembly installation that contains two or more sign supports. Regarding sign support / ground support post combination installations, ensure that post lengths, stub heights and breakaway assemblies comply

with the manufacturer's requirements and specifications. Use approved breakaway assemblies found on the *Approved Products List For Traffic Control Devices in Work Zones*.

Temporary "Exit" signs (M1025-00) shall be located within each temporary gore during lane closures on multilane roadways. Mount these signs a minimum of 7' from the pavement surface to the bottom of the sign in accordance with the requirements of the MUTCD.

When covering signs with opaque materials, the Department prohibits attaching a covering material to the face of the sign with tape or a similar product or any method that will leave a residue on the retroreflective sheeting. Residue from tape or similar products, as well as many methods utilized to remove such residue, damages the effective reflectivity of the sign. Therefore, contact of tape or a similar product with the retroreflective sheeting will require replacement of the sign. Cost for replacement of a sign damaged by improper covering methods will be considered incidental to providing and maintaining the sign; no additional payment will be made.

Overlays are prohibited on all rigid construction signs. The legends and borders on all rigid construction signs shall be either reversed screened or direct applied.

Signs not illustrated on the typical traffic control standard drawings designated for permanent construction signs shall be considered temporary and shall be included in the lump sum price bid item for "Traffic Control" unless otherwise specified.

Install "Grooved Pavement" signs (W8-15-48) supplemented with the "Motorcycle" plaque (W8-15P-30) in advance of milled or surface planed pavement surfaces. Install these signs no further than 500 feet in advance of the beginning of this pavement condition on primary routes with speed limits of 60 MPH or less and no less than 500 feet in advance of the beginning of this pavement condition on interstate routes. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon creation of this pavement condition and maintain these signs until this pavement condition is eliminated.

Install "Steel Plate Ahead" signs (W8-24-48) in advance of an area of roadway where temporary steel plates are present. Install these signs no further than 300 feet in advance of locations where steel plates are present. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon installation of a temporary steel plate and maintain the signs until the temporary steel plates are removed.

The Contractor shall maintain the travel patterns as directed by the traffic control plans and shall execute construction schedules expeditiously. The Contractor shall provide the Resident Engineer with no less than a two-week prior notification of changes in traffic patterns.

During nighttime flagging operations, flaggers shall wear a safety vest and safety pants that comply with the requirements of ANSI / ISEA 107 standard performance for Class 3 risk exposure, latest revision, and a fluorescent hard hat. The safety vest and the safety pants shall be retroreflectorized and the color of the background material of the safety vest and safety pants shall be fluorescent orange-red or fluorescent yellow-green.

During nighttime flagging operations, the contractor shall illuminate each flagger station with any combination of portable lights, standard electric lights, existing street lights, etc., that will provide a minimum illumination level of 108 Lx or 10 fc.

During nighttime flagging operations, supplement the array of advance warning signs with a changeable message sign for each approach. These changeable message signs are not required during daytime flagging operations. Install the changeable message signs 500' in advance of the advance warning sign arrays. Messages should be "Flagger Ahead" and "Prepare To Stop".

TRAFFIC CONTROL PROCEDURES SPECIFIC TO TRAFFIC SIGNAL WORK OPERATIONS –

Utilize a vehicle train consisting of a primary work vehicle and no less than 1 shadow vehicle. The shadow vehicle is required for all Traffic Signal Work Operations except on a two-lane roadway for a time duration of 15 minutes or less when no pedestrian workers are present, excluding the flagger. A second

shadow vehicle is necessary in some applications on multilane roadways as depicted on the Standard Drawings. Install and maintain the vehicle train as directed by these special provisions, , the Standard Drawings For Road Construction, and the Engineer.

Two-Lane Two-Way Roadways

A. Utilize flagging operations to control the traffic flow around the work site where the vehicle train is operating.

B. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W20-4-48-A	One Lane Road Ahead
W20-1-48-A	Road Work Ahead

C. Maintain two-way radio communications between all flaggers.

Multilane Roadways

A. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration of 15 minutes or less, advance warning signs may be omitted.

B. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 15 minutes but less than 60 minutes, advance warning signs are required. Typical advance warning signs required for a temporary closure of a travel lane shall include the following:

W4-2R(L)-48	Lane Ends symbol
W20-5R(L)-48-A	Right (Left) Lane Closed Ahead
W20-1-48-A	Road Work Ahead

C. Utilization of flaggers to control the traffic flow in the travel lanes adjacent to the travel lane the vehicle train is operating in is PROHIBITED except as allowed in the Standard Drawings Requirements for a Temporary Cessation of Traffic Flow for a time duration of 3 minutes or less.

D. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. Only flaggers and advance warning signs are required on the approaches intersecting the travel lane the vehicle train is operating in. Traffic control devices are not required on the intersecting approaches. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W20-4-48-A	One Lane Road Ahead
W20-1-48-A	Road Work Ahead

E. **During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 60 minutes, install a standard lane closure as directed by these special provisions, the Standard Drawings For Road Construction, and the Engineer.**

Conduct all equipment and material preparations prior to entering the roadway.

Conducting traffic signal work or conducting any activities that interfere with or create disruptions to normal traffic operations during morning, mid-day, and afternoon-evening high traffic volume peak periods is PROHIBITED. The contractor shall observe all lane closure restrictions.

Conduct all work activities within the boundaries of a travel lane closed to vehicular traffic or a pedestrian thoroughfare closed to pedestrian traffic. Conducting work activities over a travel lane open to traffic is PROHIBITED. Conducting work activities over a pedestrian thoroughfare open to pedestrian traffic is PROHIBITED. Do not conduct any work activities in any manner over a thoroughfare open to vehicular or pedestrian traffic.

When advance warning signs are required to supplement the vehicle train, install the advance warning signs at spacing intervals based on the regulatory speed limit of the roadway prior to beginning any work. When a work zone traffic control plan or a work zone traffic control standard drawing is not provided to indicate the spacing intervals for a typical 3 advance warning sign array installation, utilize the sign placement intervals below. **These sign intervals do not apply to the sign intervals of the advance sign intervals for standard lane closures.**

ADVANCE WARNING SIGN PLACEMENT INTERVALS	
URBAN / RURAL (LOW SPEED) ≤ 35 MPH	200 / 200 / 200 Feet
URBAN / RURAL (INTERMEDIATE SPEED) 40 - 50 MPH	350 / 350 / 350 Feet
RURAL (HIGH SPEED) ≥ 55 MPH	500 / 500 / 500 Feet
INTERSTATE	1000 / 1500 / 2600 Feet

LANE CLOSURE RESTRICTIONS –

The lane closure restrictions stated below are project specific, for all other restrictions, see supplemental specification, "Restrictions", dated September 1, 2015.

The Contractor shall install all lane closures as directed by the Standard Specifications For Highway Construction (latest edition), the Standard Drawings For Road Construction, these special provisions, the MUTCD, and the Engineer. The Contractor shall close the travel lanes of two-lane two-way roadways by installing flagging operations. The Contractor shall close the travel lanes of multilane roadways as directed by the typical traffic control standard drawings designated for lane closures on primary routes.

The Department prohibits lane closures on primary and secondary routes during any time of the day that traffic volumes in the travel lanes remaining open to traffic exceed 800 vehicles per hour per lane per direction. The Department reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the plans, these special provisions, and the Engineer.

Flagging operations are considered to be lane closures for two-lane two-way operations and shall be subject to all restrictions for lane closures as specified by this contract.

Lane closures, including flagging operations, are restricted to maximum distances of 2 miles. Install all lane closures according to the typical traffic control standard drawings. On occasions when daytime lane closures must be extended into the nighttime hours, substitute the nighttime lane closure standards for the daytime lane closure standards.

The Department reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the Standard Specifications, these special provisions, and the Engineer.

Installation and maintenance of a lane closure is PROHIBITED when the Contractor is not actively engaged in work activities specific to the location of the lane closure unless otherwise specified and approved by the Engineer. The length of the lane closure shall not exceed the length of roadway anticipated to be subjected to the proposed work activities within the work shift time frame or the maximum lane closure length specified unless otherwise approved by the Engineer. Also, the maximum lane closure length specified does not warrant installation of the specified lane closure length when the length of the lane closure necessary for conducting the work activity is less. The length and duration of each lane closure, within the specified parameters, shall require approval by the Engineer prior to installation. The length and duration of each lane closure may be reduced by the Engineer if the work zone impacts generated by a lane closure are deemed excessive or unnecessary.

The presence of temporary signs, portable sign supports, traffic control devices, trailer mounted equipment, truck mounted equipment, vehicles and vehicles with trailers relative to the installation or removal of a closure and personnel are prohibited within the 15 to 30 foot clear zone based upon the roadway speed limit during the prohibitive hours for lane closures specified by these special provisions.

The truck mounted changeable message signs are in addition to the requirements for trailer mounted changeable message signs. Truck mounted changeable message signs and trailer mounted changeable message signs are not interchangeable.

SHOULDER CLOSURE RESTRICTIONS -

The Department prohibits the Contractor from conducting work within 15' of the near edge of the adjacent travel lane on the outside shoulders or the median areas under a shoulder closure during any time that traffic volumes exceed 800 vehicles per hour per direction. The hourly restrictions for lane closures shall also apply to work activities conducted under a shoulder closure within 15' of the near edge of an adjacent travel lane or a median area. The Department reserves the right to suspend work conducted under a shoulder closure if any traffic backups develop and are deemed excessive by the Engineer. Maintain all shoulder closure restrictions as directed by the plans, these special provisions, and the Engineer.

On primary and secondary roadways, the Department prohibits the Contractor from conducting work within 1' or less of the near edge of an adjacent travel lane under a shoulder closure. All work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within 1' of the near edge of an adjacent travel lane shall be conducted under a lane closure.

The Contractor shall install all shoulder closures as directed by the typical traffic control standard drawings designated for shoulder closures, and the Engineer. Substitution of the portable plastic drums with oversized cones during nighttime shoulder closures is PROHIBITED.

TYPICAL TRAFFIC CONTROL STANDARD DRAWINGS -

The typical traffic control standard drawings of the "Standard Drawings For Road Construction", although compliant with the MUTCD, shall take precedence over the MUTCD. The typical traffic control standard drawings of the "Standard Drawings For Road Construction" shall apply to all projects let to contract.

ADDENDUMS

(Addendums to the "2007 Standard Specifications for Highway Construction")

(A) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles (paragraph 2) -

When working within the rights-of-way of access-controlled roadways such as Interstate highways, the Contractor's vehicles may only change direction of travel at interchanges. These vehicles are prohibited from crossing the roadway from right side to the median or vice versa. Use a flagger to control the Contractor's vehicles when these vehicles attempt to enter the roadway from a closed lane or the median area. Ensure the flagger does not stop roadway traffic, cause roadway traffic to change lanes, or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

The Contractor shall have flaggers available to control all construction vehicles entering or crossing the travel lanes of secondary and primary routes. The RCE shall determine the necessity of these flaggers for control of these construction vehicles. The RCE shall consider sight distance, vertical and horizontal curves of the roadway, prevailing speeds of roadway traffic, frequency of construction vehicles entering or crossing the roadway and other site conditions that may impact the safety of the workers and motorists when determining the necessity of these flaggers. Ensure these flaggers do not stop roadway traffic, cause roadway traffic to change lanes or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways with posted regulatory speed limits of 55 MPH or greater and average daily traffic volumes {ADT} of 10,000 vehicles per day or greater, all construction and work vehicles possessing any one or more of the vehicular characteristics listed below are only permitted to enter and exit a right or left shoulder work area during the presence of active lane closures unless otherwise directed by the RCE. These vehicles are not permitted to enter or exit these work areas without the presence of active lane closures unless otherwise directed by the RCE. Shoulder closures are unacceptable and insufficient methods for control of traffic at ingress / egress areas for these vehicles. The restrictive vehicular characteristics include the following:

- Over six (6) tires
- Tandem rear axles
- A base curb weight greater than 8000 lbs.
- A gross vehicular weight greater than 12000 lbs. unless performing duties as a shadow vehicle while supporting a truck mounted attenuator
- A trailer in tow except under the following conditions:
  - Trailers transporting traffic control devices (including but not limited to standard and 42" oversized traffic cones, portable plastic drums, signs, portable sign supports, u-channel and square steel tube sign posts) relative to the installation of lane closures, shoulder closures or other traffic control operations approved by the RCE
  - Trailer mounted traffic control devices (including but not limited to advance warning arrow panels, changeable message signs, temporary traffic signals, highway advisory radios, work zone intelligent transportation systems and trailer towed truck mounted attenuators)

(B) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles -

Auxiliary Warning Lights for Vehicles and Equipment -

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

All auxiliary warning light models shall meet *Society of Automotive Engineers* (SAE) Class I standards and SAE Standard J575 relative to *Tests for Motor Vehicle Lighting Devices and Components* and these specifications.

The amber/yellow color of the dome/lens of an auxiliary warning light device shall meet SAE Standard J578 for amber/yellow color specifications.

Auxiliary warning lights with parabolic reflectors that rotate shall rotate around a halogen lamp at a rate to produce approximately 175 flashes per minute. The parabolic reflector shall produce a minimum 80,000 candle power and a minimum 54,000 candela through an SAE Standard J846 approved amber dome.

Equip strobe type flashing auxiliary warning light devices with photosensitive circuit controls to adjust the lighting intensity in response to changes in ambient light conditions such as from day to night. These lights shall have a double-flash capability rated at approximately 80 double flashes per minute and produce a minimum 24 joules of flash energy at the highest power level setting.

Acceptable auxiliary warning light models shall provide sufficient light output to be clearly recognizable at a minimum distance of 1750 feet.

Mount all auxiliary warning light devices intended to function as the auxiliary warning light system or as an element thereof on vehicles and equipment at locations no less than 3 feet above the ground and in conspicuous locations to provide visibility to approaching motorists.

Auxiliary warning light devices and/or models that mount in the locations of the standard vehicle lighting system are unacceptable as the specified auxiliary warning light system due to restrictive simultaneous visibility capabilities from multiple sight angles. However, auxiliary warning light devices that mount in the standard vehicle lighting system locations are acceptable as supplements to the specified lighting devices mounted in locations that do meet the minimum height requirements and provide simultaneous visibility capabilities from multiple sight angles.

Standard vehicle hazard warning lights are only permitted as supplements to the specified auxiliary warning light devices.

(C) General Requirements for Providing and Maintaining Traffic Control Devices in the Work Zone (Section 602) –

Sub-section 602.4 Construction (paragraph 8) -

Mount flat sheet signs straight and level and with the face of the signs perpendicular to the surface of the roadway. This requirement applies to flat sheet signs whether they are portable or have the embedded supports. Mount advance construction signs 2 feet from the edge of a paved shoulder or the

face of a curb, or if no paved shoulder exists, 6 feet to 12 feet from the edge of an adjacent travel lane to the nearest edge of the signs. The mounting height of single signs mounted on ground embedded sign supports is no less than 7 feet or no greater than 8 feet from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. Any secondary sign on the same assembly has a minimum mounting height of 6 feet from the ground to the bottom edge of the secondary sign. Ensure that signs mounted on portable sign supports, including advance construction signs, regulatory signs, warning signs, etc., have a minimum mounting height of 5 feet from the ground to the bottom edge of the sign. Provide special sign mounting assemblies, when necessary, in areas of double-layered guardrail, concrete median barrier, or bridge parapet walls.

(D) Category I Traffic Control Devices (Section 603) –

Sub-section 603.2.2 Oversized Traffic Cones (paragraph 6) -

Reflectorize each oversized traffic cone with 4 retroreflective bands: 2 orange and 2 white retroreflective bands. Alternate the orange and white retroreflective bands, with the top band always being orange. Make each retroreflective band not less than 6 inches wide. Utilize Type III – Microprismatic retroreflective sheeting for retroreflectorization on all projects let to contract after May 1, 2010 unless otherwise specified. Separate each retroreflective band with not more than a 2-inch non-reflectorized area. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the cone surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

Sub-section 603.2.3 Portable Plastic Drums (paragraph 3) -

Reflectorize each drum with Type III – Microprismatic retroreflective sheeting: 2 orange and 2 white retroreflective bands, 6 inches wide on all projects let to contract after May 1, 2010 unless otherwise specified. Alternate the orange and white retroreflective bands with the top band always being orange. Ensure that any non-reflectorized area between the orange and white retroreflective bands does not exceed 2 inches. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

(E) Category II Traffic Control Devices (Section 604) –

Sub-section 604.2.1 Type I and Type II Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle in the direction of passing traffic. The stripes shall be 6 inches wide.

Sub-section 604.2.2 Type III Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle. Apply the sloping orange and white stripes in accordance with the requirements of the Plans, SCDOT Standard Drawings and the MUTCD. The stripes shall be 6 inches wide.

(F) **Temporary Concrete Barrier** (Sub-section 605.2.3.2) –

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 6) -

Previously used temporary concrete barrier walls are subject to inspection and approval by the RCE before use. Ensure that previously used temporary concrete barrier walls are in good condition. Defects to a temporary concrete barrier wall that may disqualify a section of wall for use include gouges, cracks, chipped, or spalled areas. A defect that exposes reinforcing steel warrants immediate disqualification. A disqualification grade type defect shall consist of measurements in excess of 1 inch, entirely or partially within the boundaries of the end connection areas and the drainage slot areas as illustrated in the "Standard Drawings for Road Construction", and/or in excess of 4 inches for all areas beyond the end connection areas. To warrant disqualification, these measurements shall exceed the specified dimensions in all three directions, width, height, and depth. A defect that exceeds the specified dimensions in only one or two of the three directions does not warrant disqualification.

Temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel may be repaired in accordance with the following requirements. Repair is prohibited on temporary concrete barrier walls with defects 6 inches or greater in all three directions, width, height, and depth.

For repair of temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel, repair the defect with a premanufactured patching material specifically fabricated for patching structural concrete. The strength of the patch must meet or exceed the design strength of the class 3000 concrete of the temporary concrete barrier wall. Perform the repair procedures in accordance with all requirements and instructions from the manufacturer of the patch material. Use a bonding compound between the patch material and the concrete unless specifically stated by the manufacturer that a bonding compound is not required. If the manufacturer states that application of a bonding compound is optional, SCDOT requires application of a bonding compound compatible with the patch material. If cracking occurs within the patched area, remove the patch material completely and repeat the repair process. The contractor shall submit documentation stating all repairs have been conducted in accordance with these requirements prior to installing any temporary concrete barrier walls with repairs. Utilization of temporary concrete barrier walls with repairs shall require approval by the RCE prior to installation.

The Contractor shall submit certification documents for the patch material utilized for repairs to the Engineer prior to placing temporary concrete barrier walls that have been repaired on the project site.

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 5) -

In regard to projects let to contract after January 1, 2017, ALL NCHRP Report 350 compliant temporary concrete barrier walls placed on a project site SHALL comply with the requirements for the recessed approval stamp as directed by the SCDOT Standard Drawings. Those NCHRP Report 350 compliant temporary concrete barrier walls with the original recessed approval stamp that reads "SCDOT 350" will continue to be acceptable on projects let to contract after January 1, 2017. However, those temporary concrete barriers with the "SCDOT 350" identification plate attached to the side of the barrier walls with mechanical anchors previously grandfathered will no longer be acceptable on projects let to contract after January 1, 2017.

(G) Construction Signs (Sub-section 605.4.1.1) –

On all projects relative to **interstate highways** let to contract after January 1, 2016, all signs attached to portable sign supports on and/or adjacent to **interstate highways** shall be rigid. Fabricate each of these rigid signs from an approved aluminum laminate composite rigid sign substrate approved by the Department. Utilization of signs fabricated from roll-up fabric substrates attached to portable sign supports installed on and/or adjacent to **interstate highways** will no longer be acceptable on projects let to contract after January 1, 2016.

ONLY those portable sign supports specified and approved for support of rigid signs fabricated from approved aluminum laminated composite rigid sign substrates and included on the Approved Products List for Traffic Control Devices in Work Zones, latest edition, are acceptable. To facilitate location of acceptable portable sign supports, the listing of portable sign supports is now separated into two (2) sections; "Portable

Sign Supports for Use with Roll-Up Signs ONLY" and "Portable Sign Supports for Use with Roll-Up Sign Substrates and Rigid Sign Substrates".

The trade names of the approved aluminum laminate composite rigid sign substrates are "Acopan", "Alpolic", "Dibond" and "Reynolite". These rigid sign substrates are restricted to thicknesses no greater than 2 millimeters.

Rigid signs fabricated from standard aluminum sign blanks or any other rigid material other than Acopan, Alpolic, Dibond or Reynolite are PROHIBITED for attachment to portable sign supports. However, rigid signs fabricated from standard 0.080 and 0.100 inches thick aluminum sign blanks will continue to be acceptable for mounting on ground mounted sign supports.

Signs fabricated from roll-up fabric substrates approved by the Department will continue to be acceptable for use on and/or adjacent to secondary and primary roadways unless otherwise directed by the Department.

The minimum mounting height of signs mounted on these portable sign supports shall continue to be 5 feet from the ground to the bottom edge of the sign except where a minimum 7 foot mounting height is required in accordance with the standard specifications, the standard drawings, these special provisions and the MUTCD, latest edition.

(H) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.2.2.2.3.3 Color (paragraph 1) -

Use industrial grade enamel paint for cover of the metal aspects of the unit. Provide and attach supplemental striping to the rear face of the unit with a minimum Type III high intensity retroreflective sheeting unless otherwise directed by the Department. Utilize an alternating 4 to 8 inch black and 4 to 8 inch yellow 45-degree striping pattern that forms an inverted "V" at the center of the unit that slopes down and to the sides of the unit in both directions from the center.

(I) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.4.2.2 Truck-Mounted Attenuators (paragraph 6) -

A direct truck mounted truck mounted attenuator is mounted and attached to brackets or similar devices connected to the frame of a truck with a minimum gross vehicular weight (GVW) of 15,000 pounds (actual weight) unless otherwise directed. A trailer towed truck mounted attenuator is towed from behind and attached via a standard pintle hook / hitch to the frame of a truck with a minimum gross vehicular weight (GVW) of 10,000 pounds (actual weight) unless otherwise directed.

Each truck utilized with a truck mounted attenuator shall comply with the manufacturer's requirements to ensure proper operation of the attenuator. The minimum gross vehicular weight (GVW) (actual weight) for each truck shall comply with these specifications unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to specific requirements for the device in question.

If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the

steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure in its entirety and shall not protrude from the steel structure in any manner.

(J) Trailer-Mounted Changeable Message Signs (Sub-section 606.3.2) -

Sub-section 606.3.2.7 Controller (paragraphs 1-4) -

The controller shall be an electronic unit housed in a weatherproof, rust resistant box with a keyed lock and a light for night operation. Provide the unit with a jack that allows direct communications between the on-board controller and a compatible personal computer. The unit shall have a LCD display screen that allows the operator to review messages prior to displaying the message on the sign.

The controller shall have the capability to store 199 factory preprogrammed messages and up to 199 additional messages created by the user in a manner that does not require a battery to recall the messages. Also, the controller shall allow the operator the capability to program the system to display multiple messages in sequence.

Provide the controller with a selector switch to allow the operator to control the brightness or intensity level of the light source of the sign panel. The selector switch shall include "bright," "dim" and "automatic" modes; inclusion of additional modes is permissible. When the selector switch is in the "automatic" mode, a photosensitive circuit shall control the brightness or intensity level of the light source in response to changes in ambient light such as from day to night and other various sources of ambient light.

Equip each sign with remote communications capabilities, such as utilization of cellular telephone or internet browser technology, to allow the operator to revise or modify the message selection from the office or other remote location. Also, provide protection to prohibit unauthorized access to the controller, (i.e. password protection).

Sub-section 606.5 Measurement (paragraph 2) -

- Trailer-mounted changeable message signs are included in the lump sum item for Traffic Control in accordance with **Subsections 107.12** and **601.5** of the “2007 Standard Specifications for Highway Construction”. No separate measurement will be made for trailer-mounted changeable message signs unless the contract includes a specific pay item for trailer-mounted changeable message signs.
- The Contractor shall provide, install, operate, and maintain the trailer-mounted changeable message sign per traffic control set-up as directed by the Plans, the “Standard Drawings for Road Construction”, these Special Provisions, the Specifications, and the Engineer.

Sub-section 606.6 Payment (paragraph 2) -

In addition to **Subsections 107.12** and **601.6**, the payment for Traffic Control is full compensation for providing, installing, removing, relocating, operating, and maintaining trailer-mounted advance warning arrow panels and trailer-mounted changeable message signs as specified or directed and includes providing the units’ primary power source; repairing or replacing damaged or malfunctioning units within the specified time; providing traffic control necessary for installing, operating, and maintaining the units; and all other materials, labor, hardware, equipment, tools, supplies, transportation, incidentals, and any miscellaneous items necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other items of the Contract.

Sub-section 606.6 Payment (paragraph 3) -

Disregard this paragraph unless the Contract includes a specific pay item for trailer-mounted changeable message signs.

(K) **Temporary Pavement Markings (Sub-section 609.4.1) –**

Sub-section 609.4.1.1.1 Application Requirements General (in addition to paragraph 3) -

On two-lane two-way roadways, apply and place temporary or permanent pavement markings, as specified hereupon, prior to the end of each day's work or shift or reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines on edge lines and solid center lines and 4-inch wide by 10 feet long broken lines with a 30-foot gap for broken center lines and lane lines unless otherwise specified. The center line pavement markings shall be either double yellow solid lines, yellow broken lines or an appropriate combination of a yellow solid line and yellow broken lines for passing / no passing zones. Placement of a singular yellow solid line for a center line pavement marking is unacceptable. The edge line pavement markings shall be a white solid line.

On multilane primary and secondary roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines, utilized for edge lines and solid center lines, and 4-inch wide by 10 feet long broken lines with a 30-foot gap, utilized for lane lines and turn lanes, unless otherwise specified. The center line pavement markings shall be either double yellow solid lines or an appropriate combination of a yellow solid line and 4-inch wide by 10 feet long yellow broken lines for two-way left turn median areas. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas. The lane lines between travel lanes and turn lanes shall be 4-inch wide by 10 feet long white broken lines with a 30-foot gap.

However, on two-lane two-way and multilane primary and secondary roadways, application of a 4-inch wide solid line utilized for an edge line adjacent to an earth shoulder, white or yellow, may be delayed up to 72 hours after eradication of the original line when the length of eradicated line at a single location is no longer than 250 feet. In the event of multiple locations along the same line, each location must be separated from the adjacent location by no less than 250 feet with a cumulative total distance of eradicated line of no more than 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location. If the length of eradicated line exceeds 250 feet at any single location, the distance interval between multiple adjacent locations is less than 250 feet or a cumulative total distance of multiple locations of eradicated line exceeds 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location, replace the eradicated line(s) prior to reopening the adjacent travel lane to traffic.

On interstate roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 6-inch wide solid lines, utilized for edge lines, and 6-inch wide by 10 feet long white broken lines with a 30-foot gap, utilized for lane lines between travel lanes and auxiliary lanes, unless otherwise specified. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas.

On all roadways, apply and place white stop bars and white triangle yield bars in all locations where previous stop bars and triangle yield bars have been eradicated by the work. Apply and place white stop bars and white triangle yield bars at intersections controlled by stop and yield signs within 72 hours of the eradication of the original pavement marking. Apply and place white stop bars at signalized intersections controlled by traffic control signals and at railroad crossings prior to reopening a closed travel lane to traffic.

Within the limits of existing turn lanes on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work unless otherwise directed by the RCE. Apply and place white arrows within 72 hours of the eradication of the original pavement markings. However, in regard to newly constructed turn lanes, apply and place white arrows the within turn lanes as directed by the RCE.

Within the limits of existing lane-drop sites on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work prior to the end of each day's work or shift or reopening the closed travel lane to traffic. In regard to newly constructed lane-drop sites, apply and

place white arrows within the travel lane to be terminated prior to opening the travel lane to traffic and as directed by the RCE.

(L) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (Revision to paragraph 8) -

On two-lane, two-way roadways, passing zones may be eliminated within the work zone through application of 4-inch double yellow centerline pavement markings if determined feasible and directed to do so by the Plans and/or the RCE. Apply no passing zone markings as specified by the Plans, the Specifications, the MUTCD and the RCE.

(M) Flagging Operations (Sub-section 610.4.1) –

Sub-section 610.4.1.1 Flagging Operations (paragraph 1) -

Use a flagging operation to control the flow of traffic when two opposing directions of traffic must share a common travel lane. A flagging operation may be necessary during a lane closure on a two-lane two-way roadway, an intermittent ramp closure or an intermittent encroachment of equipment onto a portion of the roadway. Utilize flagging operations to direct traffic around work activities and maintain continuous traffic flow at reduced speeds when determined to be appropriate by the RCE. As stated above, flagging operations shall direct traffic around the work activities and maintain continuous traffic flow, therefore, stopped traffic shall not be required to stop for time durations greater than those listed below unless otherwise directed by the RCE. Begin measurement of the time interval immediately upon the moment the Flagger rotates the Stop/Slow paddle to display the “Stop” condition to the approaching motorists.

LENGTH OF CLOSURE	MAXIMUM TIME DURATION FOR STOPPED TRAFFIC
1 MILE or LESS	5 Minutes
1 to 2 MILES	7 ½ Minutes

If the work activities require traffic to be stopped for periods greater than 5 to 7 ½ minutes as stated above, consider alternate work methods, conducting work activities during times of lowest traffic volumes such as during the hours of darkness or complete road closure with detour installation.

(N) Paving and Resurfacing (Sub-section 611.4.1) –

Sub-section 611.4.1.2 Requirements (paragraph 8) -

Whenever travel lanes with acceptable grade elevation differences are open to traffic, provide “Uneven Lanes” signs (W8-11-48) or “Uneven Pavement” signs (W8-11A-48). Reflectorize these signs with a fluorescent orange colored prismatic retroreflective sheeting unless otherwise specified. Install these signs adjacent to roadways with uneven pavement surfaces between travel lanes or between travel lanes and the adjacent paved shoulders. Install these signs at intervals no greater than 2600 feet.

Traffic Signal
Supplemental Technical Specifications

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Supplemental Technical Specification for

General Provisions for Traffic Signals

SCDOT Designation: SC-M -675

1.1 Description

1.1.1 General

This specification details the construction method for traffic signals in accordance with the latest edition of the South Carolina Department of Transportation "Standard Specifications for Highway Construction", the SCDOT Standard Traffic Signal Drawings, the latest revision of the "Manual on Uniform Traffic Control Devices for Streets and Highways", the SCDOT Traffic Signal Design Guidelines, and the PLANS.

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 Department. The CONTRACTOR shall install the traffic signal(s) to provide a complete modern and operational installation.

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 Department. Deviations from the Plans must be approved by the Department.

Prior to the beginning of construction, the CONTRACTOR shall schedule in a "Pre-Construction Conference" at a time and place to be coordinated by the Department. 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.

After the completion of the project, the CONTRACTOR shall furnish to the District Traffic Engineer, three (3) "red- lined" sets of "as-built" 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.

1.1.2 Maintenance of Operation

Existing traffic signals shall REMAIN IN OPERATION until the new/modified installation has been satisfactorily tested, and placed in operation. The testing shall be accomplished without hazard to the traveling public and while the signal heads are suitably BAGGED WITH BURLAP. All signal heads that are in place but not in use, shall be covered with BURLAP or an alternative approved by the Department. Plastic bags are NOT acceptable.

After approval is received from the Department, the new signal heads shall be switched into service during the controller phase that is being displayed by the existing equipment and the existing equipment shall be turned off simultaneously. Immediately after the new signal equipment has been made operational, the existing signal heads shall be turned off and removed.

The CONTRACTOR shall completely coordinate work between the sub-contractors and shall carefully stage the project to minimize the impact to traffic.

1.1.3 Operation, Maintenance, and Emergency Service

The CONTRACTOR shall be responsible for the operations of all existing and newly installed signals from the "NOTICE TO PROCEED" until final acceptance of the project. This shall include all daily maintenance of signals and any emergencies which may arise. The CONTRACTOR is also responsible and liable for proper and safe operation of the traffic signal(s). Maintenance of signal operations is considered incidental to the pay item "Traffic Control" if a separate pay item is not provided for these activities.

Maintenance of Detection is required for all signals. Detection of Signals identified as Adaptive/Responsive or High Priority in the plans or special provisions must be maintained and will be paid for in accordance with Table 1 of Section 688.2. Detection of Signals not identified as Adaptive/Responsive or High Priority in the plans or special provisions must be maintained and will be paid for in accordance with Table 1 of Section 688.2.

I. Restriction – The CONTRACTOR shall not change the phasing or other operation of a signalized intersection without Departmental approval.

II. Procedure – The Contractor and a representative of the Department shall perform a walk thru of all signals to determine if any repairs are needed prior to the Contractor assuming maintenance responsibility. Prior to construction activities that may affect the operation of the signal, the CONTRACTOR shall request the Department's concurrence and the CONTRACTOR shall assume responsibility for operations and maintenance of the traffic signal. This request shall be in writing to the Department and shall have a written response. In the absence of the request, any activity of the CONTRACTOR, which effect the operation of a signal shall be deemed evidence of the CONTRACTOR's assumption of responsibility for the operation and maintenance of the signal. In addition to accepting maintenance responsibility, the CONTRACTOR also assumes financial responsibility for repairs until final acceptance.

III. New Signals – Signals installed by the CONTRACTOR shall be maintained by the CONTRACTOR until the Department formally accepts the work (see Final Inspection & Final Acceptance).

IV. Requirement – The CONTRACTOR shall perform EMERGENCY REPAIRS AND SERVICES as required, to ensure continuity of operation of the traffic signal(s) and associated equipment. This shall include re- placement of malfunctioning LED modules.

V. Technician – The CONTRACTOR shall provide at least one (1) qualified LOCAL signal technician, subject to on-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 Resident Construction Engineer 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.

VI. Response Time – The CONTRACTOR shall be ON-SITE of the malfunctioning signal for emergency service within 4 hours of notification by SCDOT.

VII. Restoration of Normal Service – Once the Contractor has started repair work/emergency service, the CONTRACTOR shall restore a malfunctioning signal to normal phase operations uninterrupted.

VIII. Time Changes (EST/DST) – As part of Maintenance, the CONTRACTOR shall reset all time clocks to local legal time.

IX. Records – 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.

X. Failure to Perform – 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. In addition the Contractor shall pay liquidated damages to SCDOT in the amount of **ONE THOUSAND, FIVE HUNDRED ($1,500) DOLLARS FOR EACH OCCASION, FOR EACH DAY (UNTIL CORRECTED).**

1.1.4 Utility Coordination

Prior to the beginning of any construction activities, the CONTRACTOR shall coordinate as necessary with the Utility Company to provide power and any necessary attachment agreements, as well as, ensuring all utilities are identified and avoided during construction.

1.1.5 Contract Schedule

Unless noted otherwise in the *Special Provisions*, the CONTRACTOR shall furnish the Department with a **WEEKLY SCHEDULE** for the **TRAFFIC SIGNAL CONSTRUCTION** work, each Friday, for the **TWO (2) WEEKS** 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.

1.1.6 Permits, Codes, Licenses, and Abilities

All work shall be performed in a safe and workmanlike manner, to meet the highest industry standards, 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 to the District Electrical Supervisor at the preconstruction meeting or 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.

1.1.7 Integration

Integration will be performed by the Department or local government signal maintenance staff. The CONTRACTOR shall coordinate with the Department to determine project schedule and time frame for integration. The CONTRACTOR shall provide a minimum of two weeks' notice to the Department or local government signal maintenance staff for integration to allow adequate time for delivery of cabinets, controllers, and conflict monitors.

Signal maintainers will contact the Contractor with any issues regarding the provided equipment. The CONTRACTOR will replace deficient equipment within a reasonable time frame and to meet project schedules.

1.1.8 Equipment

The Department will not furnish signal equipment, unless noted otherwise in the Special Provisions or on the Plans.

The Contractor shall furnish all NEW equipment (submittal of invoices required), including incidental items. Used and refurbished equipment or any equipment with less than 80% of the warranty remaining at installation will not be accepted.

To ensure compatibility, any additional equipment required during the life of this contract due to a Change Order or Extra Work, shall be purchased by the CONTRACTOR from the same manufacturer as the original item. 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 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 must 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 the Department. The CONTRACTOR shall provide letters from the manufacturers of the cabinet and controller indicating the submitted equipment is on the SCDOT Qualified Product List. All warranties, serial numbers, documentation, and receipts shall be provided with the cabinet assembly and controller delivery.

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 that is not on the SCDOT Qualified Product List. The documents are to be submitted a minimum of TWO WEEKS PRIOR TO INSTALLATION to the Department's Resident Construction Engineer FOR APPROVAL. At the time of such submission, the CONTRACTOR shall provide a copy of the Transmittal Letter to the Resident Construction Engineer.

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 non-availability of type of equipment due to unforeseen delivery or material shortages (contractor ordering equipment late does not apply) and/or vendor going out of business. The Department may allow equipment substitutions for the following reasons:

- The product is determined by the Department to be of better quality than the originally submitted equipment.
- The Contractor is replacing non-QPL items with QPL items or SCDOT Equipment Contract items.
- The equipment is experimental in nature and the Department wants to test it.

The Department will not pay for furnish and/or installation costs of any materials installed without prior approval and acceptance.

1.1.9 Inspection

Quality Acceptance and Inspection is the responsibility of the Department. The Department will designate those individuals responsible for inspection, which may include the District Electrical Supervisor (DES). Also, local government personnel may be involved in the inspection of traffic signals that are part of a signal maintenance agreement with the Department. 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.

The Department's designated inspector will provide a punch list of outstanding items to be addressed prior to Final Inspection.

1.1.10 Final Inspection and Final Acceptance

The CONTRACTOR shall request a final inspection only after all the punch list items are completed. The CONTRACTOR shall provide a minimum of one week notice prior to the desired date of the final inspection. The Resident Construction Engineer shall receive confirmation from the Contractor forty-eight (48) hours before to the final inspection that the project is on schedule and ready for inspection.

Upon completion of the Final Inspection and correction of any deficiencies, the work will be subject to a sixty (60) day operational test. Any problems that arise during this period must be resolved and a NEW sixty (60) day test period shall begin. The CONTRACTOR remains responsible for the maintenance and repairs of any deficiencies to the signal until Final Acceptance. Final Acceptance occurs after sixty (60) days of faultless operation. All signal equipment and warranties will be transferred to the Department at Final Acceptance. The Department will become responsible for the signal operations and maintenance upon Final Acceptance of the entire project.

1.1.11 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 Department.

1.2 Mobilization

Section 103.10 and 103.11 of the STANDARD SPECIFICATIONS is amended as indicated below for traffic signal projects.

- Pay Item Number 1031000 Mobilization (LS) includes all the signals and signal related work in the contract.
- Pay Item Number 1031010 Mobilization (EA) will be paid per traffic signal or per ¼ mile for fiber installation (Each).
- These Pay Items include demobilization.

1031000	MOBILIZATION	LS
1031010	MOBILIZATION	EA

The Pay Item Numbers associated with Mobilization of Material addresses payment for using special equipment to move large items furnished by the Department from a location designated by the Department to the project site.

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

1.3 Payment for Materials on Hand

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

When permitted by the Department, 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 unsecured locations either ON- or OFF-SITE. Other items (signal heads, detector amplifiers, controllers, cabinets, etc.) may be stored in a secured/protected location either ON- or OFF-SITE. The equipment shall be labeled SCDOT with 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 the items and not to exceed the paid invoice amount.
- Only items measured by 'EACH' shall be eligible
- Only items with unit prices exceeding one thousand and five hundred ($1500) dollars shall be eligible.

Supplemental Technical Specification for

Electrical Conduit

SCDOT Designation: 675.1

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 an 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

Supplemental Technical Specification for

Electrical Cable

SCDOT Designation: SC-M -677.1 (6/20)

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 Drawings for Electrical Wiring Assignments (677-100-001 to 677-100-004); (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 Cable

- Install each cable run with the number of conductors indicated in the Standard Drawing 677-100-001 Electrical Wiring Assignment – Signal Heads. 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 677-100-001 Electrical Cable Wiring Assignment – Signal Heads.
- 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
FYA: To Each Approach	6 pair (12 conductor) BLACK

1.3.4 Loop lead-in Wiring

- Install each cable run with the number of conductors indicated in the Standard Drawing 677-100-004 Electrical Cable Wiring Assignment – Vehicle Detection –Inductance Loops. 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 677-100-004 Electrical Cable Wiring Assignment – Vehicle Detection –Inductance Loops.
- 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 677-100-003 Electrical Cable Wiring Assignment – Pedestrian Heads and Pedestrian Buttons 2. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.
- Run cable for each phase or approach in accordance with Standard Drawing 677-100-002 Electrical Cable Wiring Assignment – Pedestrian Heads and Pedestrian Buttons 1.
- The list below is a guide to general usage--

Option A – For pedestrian heads that reside on separate poles

Pedestrian Signal	2 pair (4 conductor) BLACK
Pedestrian Push Button	2 pair (4 conductor) GRAY

Option B – For pedestrian heads that reside on the same pole

Pedestrian Signal	4 pair (8 conductor) BLACK
Pedestrian Push Button	4 pair (8 conductor) GRAY

1.3.6 Push Button Wiring

- Install each cable run with the number of conductors in accordance with Standard Drawing 677-100-003 Electrical Cable Wiring Assignment – Pedestrian Heads and Pedestrian Buttons 2. These include the provision of spare conductors. The substitution of additional cables to attain the required number of conductors shall not be permitted.

- Run cable for each phase or approach in accordance with Standard Drawing 677-100-002 Electrical Cable Wiring Assignment – Pedestrian Heads and Pedestrian Buttons 1.
- The list below is a guide to general usage--

Option A – For push buttons that reside on separate poles

Pedestrian Push Button 2 pair (4 conductor) GRAY

Option B – For push buttons that reside on the same pole

Pedestrian Push Button 4 pair (8 conductor) GRAY

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 CONTROLLER AND CABINET ASSEMBLY.

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
	FURNISH & INSTALL NO. 14 COPPER WIRE, 12 CONDUCTOR - BLACK	LF

Supplemental Technical Specification for

Fiber Optic Cable

SCDOT Designation: 677.3

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 Drawings 677-300-01 Communications – Overhead Fiber Interconnect and 677-300-02 Communications – Underground Fiber 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 radium of the fiber optic cable as listed in Table1. 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)	
Millimeters	Inches	Centimeters	Inches	Centimeters	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 dynometer (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

Supplemental Technical Specification for

Fiber Interconnect Centers

SCDOT Designation: 677.4

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 c 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

Supplemental Technical Specification for

Factory Terminated Patch Panel

SCDOT Designation: 677.6

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

Supplemental Technical Specification for

Wireless Network Communications Link

SCDOT Designation: 677.7

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

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

Supplemental Technical Specification for

Detector Loop

SCDOT Designation: 678.1

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 678-100-01 Vehicle Detection – Inductive Detection. 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 be 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 or 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

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

Supplemental Technical Specification for

Wireless Vehicle Detection System

SCDOT Designation: 678.2

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/ANTENNAS** - Wireless REPEATERS/ANTENNAS mounted on the side of the roadway, either at the intersection or adjacent to set back sensors, 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℉ /-38.3℃ to +176℉ / +80℃. 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/Antenna

- A REPEATER/ANTENNA radio communicating directly to a CABINET INTERFACE shall support at least 10 SENSORs. A REPEATER/ANTENNA communicating to a CABINET INTERFACE via an intermediate REPEATER (i.e., tandem operation) shall support at least 6 SENSORs. A REPEATER/ANTENNA shall be battery-powered, solar powered or a combination of the two. The REPEATER/ANTENNA battery shall be long-term (5+ years) and field replaceable. A

REPEATER/ATENNA shall meet the requirements of NEMA TS2-2003, section 2.1.5 Temperature and Humidity. All REPEATER/ANTENNA 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/ANTENNA 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.

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

1.4 Measurement

Pay Item 677049C, 677049D, 677049E, and 677049F includes furnishing and installing all necessary hardware, software, mounting hardware, equipment, cables, 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

677049C	FURNISH WIRELESS DETECTION SYSTEM W/O SENSORS (INC SETBACK DETECTION CAPABILITY FOR 2 DIRECTIONS	EA

677049D	FURNISH WIRELESS DETECTION SYSTEM W/O SENSORS (INC SETBACK DETECTION CAPABILITY FOR 3 DIRECTIONS	EA
677049E	FURNISH WIRELESS DETECTION SYSTEM W/O SENSORS (INC SETBACK DETECTION CAPABILITY FOR 4 DIRECTIONS	EA
677049F	FURNISH WIRELESS DETECTION SYSTEM W/O SENSORS (w/o SETBACK DETECTION CAPABILITY)	EA
677049G	FURNISH MANUFACTURER TECHNICIAN ASSISTANCE	HR
6770494	FURNISH & INSTALL FLUSH MOUNTED WIRELESS SENSOR INC EPOXY	EA
6887961	INSTALL FLUSH MOUNTED WIRELESS SENSOR	EA
6887962	REMOVE FLUSH MOUNTED WIRELESS SENSOR	EA
6887963	INSTALL SET BACK LOOP EQUIPMENT	EA
6887964	INSTALL CABINET EQUIPMENT	EA

Supplemental Technical Specification for

Electric Service

SCDOT Designation: 680.1

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.

1.3.3 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.

1.3.4 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:

ITEM		**USAGE**	
		Flashing Beacons	*Traffic Signal*
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) Rigid metallic (galvanized or aluminum) for steel or concrete poles	1 inch 1 inch	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.

1.3.5 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

Supplemental Technical Specification for

Splice Box / Junction Box

SCDOT Designation: 680.2

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 Drawing 675-100-01 Splice Box – Installation Details.

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

Supplemental Technical Specification for

Wood Pole / Back Guy Assembly

SCDOT Designation: 682.1

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 Drawing 682-300-01 Steel Cable – Wood Pole and Span Wire Service Grounding and Bonding. 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

Supplemental Technical Specification for

Steel Cable

SCDOT Designation: 682.3

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

Supplemental Technical Specification for

Pedestrian Pole and Base

SCDOT Designation: 682.4

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 Drawing 686-300-01 Pedestrian Treatments – Pedestrian Head/Button Mounting Types and Foundations.

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

Supplemental Technical Specification for

Battery Backup System

SCDOT Designation: 684.1

1.1 Description

This work shall consist of installing and/or furnishing Battery Back-Up Systems for installation at traffic signals in accordance with these Specifications, at the locations shown on the Plans, and in accordance with manufacturers specification and Standard Drawings. This item shall include all electrical accessories and other items specified.

1.2 Materials

Acceptable materials shall meet Material Specification M684.1 Battery Back-up System, 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 Battery Back-Up System.
- The Contractor shall furnish the Engineer with any warranties on materials that are provided by the Manufacturer or Vendor as normal trade practice or the match warranty on existing state contract items.

1.3.2 Cabinet/ Foundation

Install cabinet enclosure in accordance with manufacturers specifications and instructions, including any foundation or ,mounting assemblies. .

1.3.3 Battery Back-up System

Install Battery Back-Up System in accordance with manufacturers' specifications and instructions, to operate traffic signal during power outages or at specified times. Contractor shall test Battery Back-up System for SCDOT approval prior to payment.

1.4 Measurement

- Battery Back-up System will be measured by EACH including all equipment, cables, conduit, cabinet enclosures and foundations/mounting elements, and batteries.

:

1.5 Payment

6845518	FURNISH & INSTALL BATTERY BACK-UP SYSTEM, INCLUDING FOUNDATION	EA
6888243	INSTALL BATTERY BACK-UP SYSTEM, INCLUDING FOUNDATION	EA

Supplemental Technical Specification for

Signal Heads

SCDOT Designation: 686.1

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 (686-000-01, 686-100-01, 686-100-02, 686-100-03, and 686-100-05).

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

Supplemental Technical Specification for

Pedestrian Signal Head

SCDOT Designation: 686.3

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.

1.3 Construction

1.3.1 General

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

1.3.2 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.

1.3.3 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.

1.4 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.

1.5 Payment

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

Supplemental Technical Specification for

Pedestrian Push Button Station Assembly with Sign

SCDOT Designation: 686.4

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
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

Supplemental Technical Specification for

LED Blankout Sign

SCDOT Designation: 686.5

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.

1.3 Construction

1.3.1 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.

1.3.2 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

1.3.3 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.

1.4 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.

1.5 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

Supplemental Technical Specification for

Removal Salvage and Disposal of Equipment and Materials

SCDOT Designation: 688.1

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 dismounted 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 sump 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

Supplemental Technical Specification for

Temporary Adjustment of Traffic Signal Equipment and Timings

SCDOT Designation: 688.2

1.1 Description

1.1.1 General

This work consists of the Temporary Adjustment of traffic control signal equipment and materials during the construction of the project. This item has been established to cover the equipment, materials, and labor that may be required to temporarily adjust the physical location of traffic signal features, such as poles, controller, steel cable, electrical cable, signal heads, detection, etc. This item is also used to cover the installation and removal of a TEMPORARY CONSTRUCTION SIGNAL.

Temporary Adjustment may be necessary at all signalized intersections within the limits of the construction project. After all Temporary Adjustments have been made and after the road construction has been completed, the final result shall be the traffic signals shown in the Plans.

The amount of work required by this item will vary greatly between projects. The Contractor should carefully study the Plans and Specifications to understand the work required.

1.1.2 Continuity of Signal Operation

The Maintenance of Traffic (as provided in the Traffic Control Plan), and the SAFETY OF TRAFFIC is of prime importance. Safety will be enhanced by providing for the continuous operation of traffic signals. Full Continuity of Operation shall be maintained by the CONTRACTOR and temporary signal devices shall be in place prior to construction activities that will affect signal operation. Damage to or failure of the existing traffic detection during the project shall be repaired by the CONTRACTOR, in accordance with Table 1.

Signals shall NOT be arbitrarily turned off for the convenience of the CONTRACTOR. When the Department gives permission to briefly turn off a signal, complete intersection control using a flagger and/or Police to direct traffic shall be provided.

Any damage to or failure of the detection of High Priority intersections shall require the contractor to be onsite and ACTIVELY repairing or replacing the detection with temporary detection within THIRTY-SIX (36) HOURS. The CONTRACTOR shall provide temporary detection equipment until the final detection is installed and operational. Upon installation of the final detection equipment, the CONTRACTOR shall remove the temporary detection equipment. If the temporary detection equipment will be used as the permanent detection equipment in the final configuration, payment will be made for both TEMPORARY

ADJUSTMENT OF TRAFFIC SIGNAL EQUIPMENT and the applicable permanent detection pay items.

Traffic Adaptive and Traffic Responsive signal systems shall maintain detection for the life of the project. Any damage to or failure of the detection of these systems shall require the contractor to be onsite and ACTIVELY repairing or replacing the detection with temporary detection within FOUR (4) HOURS. At traffic signals using wireless detection, which could be damaged by the project, the CONTRACTOR shall remove the roadway sensors and install temporary detection prior to construction activities. The CONTRACTOR shall ensure the roadway sensors for the wireless detection is replaced in the specific lane and location for which it is coded.

The table below details the requirements for all signalized intersections and the associated liquidated damages for failure to re-establish detection.

Table 1:

Intersection Type (as identified in Plans or Special Provisions)	Contractor Onsite and Actively Re-establishing Detection	Temporary Adjustment Pay Item	Permanent Detection Pay Item	Liquidated Damages for Failure to Perform / Maintain Detection
Adaptive/Responsive	4 hours	6885993	Per Contract	$1500 per Intersection per day
High Priority	36 hours	6885993	Per Contract	$1500 per Intersection per day
All others	14 days	1071000	Per Contract	$1500 per Intersection per day

The CONTRACTOR shall coordinate installation and removal of temporary detection equipment with the Department's designated signal inspectors.

Unless noted otherwise on the Plans or stated in the Special Provisions, it is not permissible to adopt "uncoordinated" operation of adjacent signals. Damage to the interconnection cable between adjacent signals shall be repaired immediately by the CONTRACTOR, at no cost to the Department

When necessary the District Traffic ENGINEER should be requested to provide temporary controller timing settings. These temporary time settings may occur throughout the project life and therefore the contract will be paid for each site visit as necessary by bid item: **TEMPORARY TIMING ADJUSTMENT PER SITE VISIT**. This work shall include all intersections needing timing adjustments per site visit. Site shall be defined as project limits.

Temporary Signals shall be fully reliable, fully functional, and of professional appearance. This includes placing the signal heads at the proper HEIGHT above the road, correctly ALLIGNING the signal heads with the lanes of traffic, and placing the signal heads at the proper DISTANCE from the stop line (see SCDOT Standard Drawings). The installation of a temporary Controller shall include transferring operation while simultaneously turning off the old controller

1.1.3 Coordination of Work

The CONTRACTOR is advised to completely coordinate work between sub-

contractors and to carefully stage the project to minimize the work required by this item.

1.1.4 Final Configuration

Signal equipment that has been relocated or adjusted shall be considered as "temporary". The CONTRACTOR shall plan and stage the work so that the end result is a traffic signal installation conforming to the plans and using all NEW equipment.

1.1.5 Operation, Maintenance and Emergency Service (as indicated in 675 General Provisions)

There is no separate pay item for Operation, Maintenance and Emergency Service. However, it is required as part of the contract for projects that involve signal construction or operations.

1.1.6 Specific Items

1.1.6.1 Possession

All TEMPORARY signal heads, signs, detection, and poles shall revert to the CONTRACTOR at the end of the Project. All temporary NEW Controllers and Cabinets shall revert to the Department or to the Jurisdiction at the end of the project.

1.1.6.2 Signal Heads

Signal heads not in use shall be covered with a burlap bag. Signal heads shall be shifted side-to- side to be over traffic lanes as they are opened or closed to traffic.

1.1.6.3 Poles

The location of temporary and final signal poles shall be approved by the Department.

1.1.6.4 Joint Use Poles

Poles used for traffic signals are often owned and used by other overhead cable utility companies. Full coordination and cooperation with those utilities shall be maintained when staging the signal work. The CONTRACTOR shall furnish the temporary and final poles as necessary for Continuity of Operation. Back Guys shall be provided for wood poles to sufficiently keep the pole vertical.

1.1.6.5 Temporary Detection

Temporary Detection may include microwave, infrared, sonic, magnetometers, video, or inductance loops. The equipment shall be installed per the manufacturer's specifications. Temporary detection equipment shall be compatible with the traffic signal equipment, but shall not reside on the SCDOT network.

1.1.6.6 Detector Loops

Final Detector Loops shall only be installed after completion of all work activities which might damage the inductance loops.

1.1.6.7 Miscellaneous Equipment

Minor equipment may be RE-USED in temporary adjusted configurations, but not in the final configuration. This includes steel cable, electrical cable, conduit, pedestrian buttons and signs, temporary detection, and spliceboxes/pullboxes/handboxes not utilized in the new signalization. The CONTRACTOR shall furnish sufficient steel cable and electrical cable to provide Continuity of Operation.

1.1.6.8 Signs

Highway signs on existing steel cable (span wires), shall be transferred to the adjusted spans, and placed in the same physical alignment. The Contract will usually specify new signs for the final configuration. (Ground mounted signs are covered in Section 107.11 of the STANDARD SPECIFICATIONS.)

1.1.6.9 Electric Service

The CONTRACTOR shall install temporary electric service(s) as necessary to operate the signal(s). Coordination with the local power company and with the Department is the responsibility of the CONTRACTOR, as well as, all permits and licenses.

1.1.6.10 Communication Service

The CONTRACTOR shall maintain communication service(s) as necessary to operate the signal(s). Communications between the signal(s) and the SCDOT NETWORK in accordance with ITS standards shall be kept at all times.

1.2 Measurement

Temporary Adjustment of Traffic Signal Equipment will be measured as EACH, one per intersection for the life of the project. This includes adjustment of traffic signal equipment (signal heads, overhead signs, span wire, etc.), and installation of temporary signal equipment (signal heads, detection, poles, etc.) impacted or necessitated by Construction Operations, as often as necessary.

Temporary Timing Adjustments will be measured as EACH. This work shall include all intersections needing timing adjustments per site visit which signal timings are properly adjusted as directed. Site shall be defined as project limits.

The CONTRACTOR shall provide all signal materials and related equipment to adjust these features as often as necessary during the course of the project.

1.3 Payment

Temporary Adjustment of traffic signals shall be paid at the line item Contract price. The line item includes the Installation AND Removal of all temporary traffic signal equipment:

6885993	TEMPORARY ADJUSTMENT OF TRAFFIC SIGNAL EQUIPMENT	EA

Temporary Timing Adjustment of traffic signals shall be paid at the line item Contract price:

6885996	TEMPORARY TIMING ADJUSTMENTS PER SITE VISIT	EA

Pay Item Notes

This specification is not limited to these pay items. Other pay items may be applicable.

Supplemental Technical Specification for

Video Detection System

SCDOT Designation: 688.3

1.6 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.

1.7 Materials

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

1.8 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.

1.9 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.

1.10 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

Supplemental Technical Specification for

Radar Detection System

SCDOT Designation: 688.4

1.1 Description

1.1.1 General

This work shall consist of furnishing and/or installing a Radar Detection System (RDS) to detect vehicles on a roadway by transmitting electromagnetic radar signals through the air. The signals bounce off vehicles in their paths and part of the signal is returned to the Radar Detection System. The returned signals are then processed to determine traffic parameters. A Radar Detection System (RDS) shall interface with a 170 Traffic Signal Controller cabinet/ 2070 Controller. The system shall be installed per the manufacturers recommended installation requirements.

The Radar Presence Detector (RDS) system will include the following equipment:

- Radar Units (Stop bar radar, Set back radar, Speed/volume side-fire radar)
  - Sensor Outputs
  - Enclosure
- Radar Cabinet Interface
  - System Hardware
  - Interface panel
  - Contact closure input file cards
  - Communication ports
  - Software
- Sensor Cable

1.1.2 Maintenance

- The RDS shall not require cleaning or adjustment to maintain performance.
- The RDS shall not rely on battery backup to store configuration information, thus eliminating any need for battery replacement. Once the RDS is calibrated, it shall not require recalibration to maintain performance unless the roadway configuration changes. The mean time between failures shall be 10 years.

1.1.3 Operating Conditions

- The RDS shall maintain accurate performance in all weather conditions, including rain, freezing rain, snow, wind, dust, fog and changes in temperature and light, including direct light on sensor at dawn and dusk.
- RDS operation shall continue in rain up to 1 in. (2.5 cm) per hour.
- The RDS shall be capable of continuous operation over an ambient temperature range of -40°F to 165.2°F (-40°C to 74°C). The RDS shall be capable of continuous operation over a relative humidity range of 5% to 95% (non-condensing).

1.1.4 Manufacturing

- The RDS shall be manufactured and assembled in the USA.
- The internal electronics of the RDS shall utilize automation for surface mount assembly, and shall comply with the requirements set forth in IPC-A-610C Class 2, Acceptability of Electronic Assemblies.

- The RDS shall undergo a rigorous sequence of operational testing to ensure product functionality and reliability. Testing shall include the following:
  - Functionality testing of all internal sub-assemblies
  - Unit level burn-in testing of 48 hours' duration or greater
  - Final unit functionality testing prior to shipment
- Test results and all associated data for the above testing shall be provided for each purchased RDS by serial number, upon request.

1.1.5 Certification

- Each RDS shall be certified by the Federal Communications Commission (FCC) under CFR 47, part 15, section 15.249 as an intentional radiator.
- The FCC certification shall be displayed on an external label on each RDS according to the rules set forth by the FCC. The RDS shall comply with FCC regulations under all specified operating conditions and over the expected life of the RDS.

1.1.6 Support

Contractor shall ensure the RDS manufacturer provides both training and technical support services.

1.1.7 Training

The manufacturer-provided training shall be sufficient to fully train installers and operators in the installation, configuration, and use of the RDS to ensure accurate RDS performance as specified in 689.3 Traffic Signal System Training of the Traffic Signal Supplemental Specifications.

1.1.8 Network Compatibility

RDS must be approved by SCDOT IT Department to reside on SCDOT Traffic Signal Communications Network. For the protection of the SCDOT, all networkable devices are required to be hardened and secured using an industry standard. SCDOT uses the National Institute of Standards and Technology Cybersecurity framework, but recognizes that other comparable frameworks and standards exist. Among these frameworks are:

- NIST RMF
- NIST CSF
- ISO IES 27001/ISO 27002
- SOC 2
- IASME Governance
- CIS Controls version 7
- COBIT 5
- FedRAMP
- HIPAA
- GDPR
- FISMA
- NERC CIP
- HITRUST CSF

1.1.9 Warranty

There shall be a two-year warranty provided against material and workmanship defects.

1.2 Materials

1.2.1 Radar Detection System (Radar Units, Radar Cabinet Interface, Cable)

- Radar Operating frequency of 24.0 to 24.25 GHz (K-band) utilizing a matrix of radars
- Two half-duplex RS-485 com ports with dedicated detection communication
- Power consumption less than 10 watts @ 9-28 VDC
- Ambient operating temperature: -29°F to 165°F with humidity: Up to 95% RH
- Must have Onboard surge protection
- Weight less than 5 lbs. (2.27 kg)

1.2.2 Radar Unit Types

1.2.2.1 Stop Bar Detection Units

- The RDS shall present real-time presence data in 10 lanes. The RDS shall support a minimum of 16 zones.
- The RDS shall support a minimum of 16 channels.
- The RDS shall be able to detect and report presence in lanes with boundaries as close as 6 ft. (1.8 m) from the base of the pole on which the RDS is mounted.
- The RDS shall be able to detect and report presence in lanes located within the 140 ft. (42.7 m) arc from the base of the pole on which the RDS is mounted.
- The RDS shall be able to detect and report presence for vehicles within a 90-degree field of view.
- The RDS shall be able to detect and report presence in up to 10 lanes.
- The RDS shall be able to detect and report presence in curved lanes and areas with islands and medians.
- The RDS shall work in the 24GHz frequency range, providing 245 MHz of detection bandwidth.

1.2.2.2 Set Back Advance Detection Units

- The Set Back RDS shall provide up to 900’ detection zone for trucks, and up to 600’ for cars.
- The Set Back RDS shall provide detection at 50’ from mounting with a 50’ lateral detection zone.
- The Set Back RDS Detection unit shall work in the 10 GHz frequency range or higher.
- The Set Back RDS shall provide continuous tracking from initial detection point to the intersection.
- The Set Back RDS shall provide dynamic Estimated Time of Arrival ETA, to the intersection, providing dilemma zone protection as an optional functionality.

1.2.2.2 Speed/Volume Side-Fire Detection

- The Speed/Volume Side-Fire RDS shall provide detection for speed and volume data collected by lane for minimum of 10 lanes of multi-directional traffic
- The Speed/Volume Side-Fire RDS shall provide detection from 6’ from mounting up to 250’ in a 65 degree vertical field of view.
- The Speed/Volume Side-Fire RDS shall work in the 24 GHz frequency range, providing 245 MHz of detection bandwidth.

1.2.3 Radar Unit Properties

1.2.3.1 Sensor Outputs

- The RDS shall support user-selectable zone to channel mapping.
- The RDS shall be able to trigger channels when all selected zones are active.
- The RDS shall be able to combine multiple zones to a channel output, and shall have channel output extend and delay functionality.
- The RDS algorithms shall mitigate detections from wrong way or cross traffic.

- The RDS system shall have fail-safe mode capabilities for contact closure outputs if communication is lost

1.2.3.2 External Properties

- All external parts of the RDS shall be ultraviolet-resistant, corrosion-resistant, and protected from fungus growth and moisture deterioration.

1.2.3.3 Enclosure

- The RDS shall be enclosed in a Lexan EXL polycarbonate.
- The enclosure shall be classified “f1” outdoor weather ability in accordance with UL 746C. The RDS shall be classified as watertight according to the NEMA 250 standard.
- The RDS enclosure shall conform to test criteria set forth in the NEMA 250 standard for type 4X enclosures. Test result shall be provided for each of the following type 4X criteria:
  - External icing (NEMA 250 clause 5.6)
  - Hose-down (NEMA 250 clause 5.7)
  - 4X corrosion protection (NEMA 250 clause 5.10)
  - Gasket (NEMA 250 clause 5.14)
- The RDS shall be able to withstand a drop of up to 5 ft. (1.5 m.) without compromising its functional and structural integrity.
- The RDS enclosure shall include a connector that meets the MIL-C-26482 specification. The MIL-C-26482 connector shall provide contacts for all data and power connections.

1.2.3.4 Radar Design

- The RDS shall be designed with multiple radars, enabling the sensor to provide detection over a large area and to discriminate lanes for stop bar radar and side-fire radar accuracy.

1.2.3.5 Frequency Stability

- The circuitry shall be void of any manual tuning elements that could lead to human error and degraded performance over time.
- All transmit modulated signals shall be generated by means of digital circuitry, such as a direct digital synthesizer, that is referenced to a frequency source that is at least 50 parts per million (ppm) stable over the specified temperature range, and ages less than 6 ppm per year. Any up conversion of a digitally generated modulated signal shall preserve the phase stability and frequency stability inherent in the digitally generated signal.
- The RDS shall not rely on temperature compensation circuitry to maintain transmit frequency stability.
- The bandwidth of the transmit signal of the RDS shall not vary by more than 1% under all specified operating conditions and over the expected life of the RDS.

1.2.3.6 Antenna Design

- The RDS antennas shall be designed on printed circuit boards.
- The vertical beam width of the RDS at the 6 dB points of the two-way pattern shall be 65 degrees or greater. The antennas shall cover a 90-degree horizontal field of view.
- The side lobes in the RDS two-way antenna pattern shall be -40 dB or less.

1.2.3.7 Resolution

- The RDS shall transmit a signal with a bandwidth of at least 245 MHz.

1.2.4 Radar Cabinet Interface

1.2.4.1 System Hardware

- Each RDS shall have a traffic cabinet preassembled backplate or integrated cabinet device with the following:

- AC/DC power conversion
- Surge protection
- Terminal blocks for cable landing
- Communication connection points
- Ethernet TCP/IP communication
- SDLC (Optional) communication

- The preassembled backplate for the RDS shall be a cabinet side mount or rack mount.
- The integrated cabinet device for the RDS shall be a shelf mount with an option to cabinet side mount.

1.2.4.2 Contact Closure Input File Cards

- The RDS shall use contact closure input file cards with 2 or 4 channel capabilities.
- The contact closure input file cards for the RDS shall be compatible with industry standard detector racks.

1.2.4.3 Electrical

- The RDS shall consume less than 10 W.
- The RDS shall operate with a DC input between 10 VDC and 28 VDC. The RDS shall have onboard surge protection.

1.2.4.4 Communication Ports

- The RDS shall have two communication ports, and both ports shall communicate independently and simultaneously.
- The RDS shall support the upload of new firmware into the RDS's over either communication port. The RDS shall support the user configuration of the following:
  - Response delay
  - Push port
- The communication ports shall support a 9600 bps baud rate.

1.2.4.5 RF Channels

- The RDS shall provide at least 8 RF channels so that multiple units can be mounted in the same vicinity without causing interference between them.

1.2.4.6 Verification

- The RDS shall have a self-test that is used to verify correct hardware functionality. The RDS shall have a diagnostics mode to verify correct system functionality.

1.2.4.7 Configuration

- *Auto-configuration.* The RDS shall have a method for automatically defining traffic lanes, stop bars and zones without requiring user intervention. This auto-configuration process shall execute on a processor internal to the RDS and shall not require an external PC or other processor.
  The auto-configuration process shall work under normal intersection operation and may require several cycles to complete.

- *Manual Configuration*. The auto-configuration method shall not prohibit the ability of the user to manually adjust the RDS configuration.
  The RDS shall support the configuring of lanes, stop bars and detection zones in 1-ft. (0.3-m) increments. When lanes have variable widths or have variable spacing (e.g. gore between lanes), precise resolution is necessary.

1.2.4.8 Software Compliance

- The RDS shall include graphical user interface software that displays all configured lanes and the current traffic pattern using a graphical traffic representation.
- The RDS shall include the ability to do counting and pulsed channels.
- The graphical interface shall be Microsoft Windows compliant.
- The software shall be installed and operate on a SCDOT provided Windows operating system.
- The software shall support the following functionality:
    - Operate over a TCP/IP connection
    - Give the operator the ability to save/back up the RDS configuration to a file or load/restore the RDS configuration from a file
    - Allow the backed-up sensor configurations to be viewed and edited
    - Provide zone and channel actuation display
    - Provide a virtual connection option so that the software can be used without connecting to an actual sensor.
- Local or remote sensor firmware upgradability.

1.2.4.9 Sensor Cable

- The cable shall be the Orion Wire Combo-22042002-PVCGY or an equivalent cable that conforms to the following specifications:
    - 6-conductor cable that attaches to an 8-pin MIL-C-26482 connector
    - The RS-485 conductors shall be 2 twisted pairs.
    - The RS-485 conductors shall have nominal capacitance conductor to conductor of less than 40 pF/ft at 1 kHz.
    - The RS-485 conductors shall have nominal conductor DC resistance of less than 16.7 ohms/1000 ft. at 68°F.
    - The power conductors shall be a twisted pair.
    - The power conductors shall have nominal conductor DC resistance of less than 11 ohms/1000 ft. at 68°F.
    - The entire cable shall be shielded with an aluminum/mylar shield with a drain wire.
    - The cable shall have a diameter of 0.41 in. The power wires in the cable shall be 20 AWG; the communications wires shall be 22 AWG.
    - The cable shall be UV resistant, as per the UL 720 Hour Sunlight Resistance Test

1.3 Construction

- Installation shall be in accordance with manufacturer's instructions.
- Mounting hardware for RDS's will not drill into the existing signal support poles.
- Cable will be continuous from RDS to the controller cabinet.
- Contractor shall provide post installation testing to the Engineer for consideration and approval.
- Stop bar detection RDS shall be mounted between 15' - 35' on a vertical pole or mast arm.
- Setback detection RDS shall be mounted between 17' - 40' on a vertical pole or mast arm.
- Speed / volume detection RDS shall be mounted between 17' - 40' on a vertical pole or mast arm.

1.4 Measurement

Furnishing and/or Installing Components of a Radar Detection System shall be measured as EACH unit and includes all hardware and cables necessary for installation and operation, and license.

1.5 Payment

	FURNISH & INSTALL RADAR DETECTION SYSTEM for STOP BAR DETECTION INC. 150' CABLE & MOUNTING HARDWARE	EA
	FURNISH & INSTALL CABINET INTERFACE COMPONENTS for STOP BAR DETECTION	EA
	FURNISH & INSTALL RADAR DETECTION SYSTEM for SET BACK DETECTION INC. 150' CABLE & MOUNTING HARDWARE	EA
	FURNISH & INSTALL CABINET INTERFACE COMPONENTS for SET BACK DETECTION	EA
	FURNISH & INSTALL RADAR FOR SPEED/VOLUME DETECTION INC 150' CABLE & MOUNTING HARDWARE	EA
	FURNISH & INSTALL CABINET INTERFACE COMPONENTS for SPEED/VOLUME DETECTION	EA
	FURNISH & INSTALL RADAR DETECTION CABLE TO CROSS ROADWAY	LF

Supplemental Technical Specification for

Steel Strain Pole and Foundation

SCDOT Designation: 688.5

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 688-500-01 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

Supplemental Technical Specification for

Concrete Strain Pole

SCDOT Designation: 688.6

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

- Augur 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 688-600-01.
- 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.
- Capp 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

Supplemental Technical Specification for

Controller and Cabinet Assembly

SCDOT Designation: 688.7

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 688-700-01 Signal Cabinet – Base Mounted Cabinet.
- 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 Drawing 688-700-01 Signal Cabinet – Base Mounted Cabinet)
- 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 688-700-01 Signal Cabinet – Base Mounted Cabinet 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.
- 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

Supplemental Technical Specification for

Flasher Cabinet Assembly

SCDOT Designation: 688.8

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 surrestor
- 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

Supplemental Technical Specification for

Solar Powered Flasher Assembly

SCDOT Designation: 688.9

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 square perforated posts.
- 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

Supplemental Technical Specification for

Working Crew with Equipment

SCDOT Designation: 689.1

1.1 Description

This item shall consist of performing work for the SCDOT, on a per hour bases for equipment and labor. This will include the contractor furnishing a crew of four persons, one bucket truck, one line truck and one foreman's vehicle to be worked at the line item price for working crew with equipment. The crew will need to be able to perform duties in the field of traffic signal installation and revisions. This item will be used for emergency calls and unforeseen work which cannot be predicted and there is no pay for. All work under this item, shall be approved by the ENGINEER, prior to engaging in any work where this item may be used. The ENGINEER reserves the right to refuse or engage this item. While engaged in this line item, there shall be no other line engaged by the contractor. The ENGINEER reserves the right to engage Primary Traffic Control while working under this line item. Engaging in any other line items in this contract while working under this line item will need the approval of the ENGINEER.

1.2 Construction

All work performed under this item shall have written approval from the ENGINEER before engaging in any work under this item. This item is to be used when there are unforeseen problems such as wet holes, borrowing roadways, rock holes and any other deemed problems or emergencies. In case of an emergency, the ENGINEER will call the CONTRACTOR in line for assistance with the installation or maintenance of an intersection, in this case both parties must agree on engaging this item. The ENGINEER will issue a work order and grant permission in writing to engage in this item.

1.3 Measurement

Working Crew With Equipment will be measured per HOUR.

1.4 Payment

Working Crew With Equipment accepted and measured as provided above, will be paid at the contract unit price bid for:

6887990	WORKING CREW WITH EQUIPMENT	HR

Payment for working crew with equipment will be made per work order for the total hours worked on that work order. If the work order begins after the normal workday or on the weekend, time can be

charged at a rate of 1 ½ times pay per hour. This extra pay rate must be agreed on between the contractor and the ENGINEER prior to beginning work.

Pay Item Notes

This specification is not limited to these pay items. Other pay items may be applicable.

Supplemental Technical Specification for

Traffic Signal System Training

SCDOT Designation: 689.3

1.1 Description

This work consists of providing Traffic Signal System Training.

1.2 Materials

1.2.1 General

The **CONTRACTOR** shall provide complete training for **DEPARTMENT** and maintaining agency personnel and representatives in the operation and maintenance of the traffic signal system components. The training program shall consist of formal classroom lectures and "hands-on" workshops with central and field equipment. The **CONTRACTOR** shall provide all personnel and instructors necessary for all training. The instructors shall be employees of the manufacturer(s) of the traffic signal system components, or approved equal.

All training classes must be completed prior to the beginning of any system/intersection operational testing. Training classes shall not overlap without prior approval of the **DEPARTMENT**. Training class schedules shall be consistent with the working schedules of the class attendees. Training shall only be scheduled on weekdays and training days shall generally consist of six (6) to eight (8) hours.

The **CONTRACTOR** shall develop and provide all necessary training materials, aids, and manuals.

The **CONTRACTOR** shall provide training and training materials for up to 15 people in each training class. The **DEPARTMENT** shall provide a listing of the expected trainees for each training session once the proposed training materials are approved.

As part of the **CONTRACT** materials submission requirements, the **CONTRACTOR** shall submit for approval copies of all training program subjects, training materials, aids, manuals, class agendas, class schedules (includes dates and times) and training locations. All submission materials must be approved by the **DEPARTMENT** before permission to begin training is given.

1.2.2 Training Program Subjects

The **CONTRACTOR** shall provide training on the subjects listed in the special provisions. The **CONTRACTOR** shall address the theory of operation and the technical and practical aspects of each component. Specific and thorough attention should be afforded to day-to-day operation, programming, testing, fault-diagnosis and repair of each component. Training related to specific hardware components shall include hands-on demonstrations utilizing sample components identical to those components installed in the field. Training on the proper use of specific tools utilized during installation, testing, and maintenance of various system components shall be addressed.

1.2.3 Acceptance of Training

Within 7 calendar days of the completion of each training class, the **DEPARTMENT** shall provide acceptance or non-acceptance of the training program. If the training program is not accepted, the **CONTRACTOR** shall correct the deficiencies in the training program and provide again the necessary class(es) at his expense. Acceptance of system training of each training program subject will be based on the following criteria:

- Thoroughness and completeness of instructional coverage of the training program subject;
- Thoroughness and appropriateness of the training program subject materials, including class demonstration and audio/visual aids, to the instructional coverage; and,
- Class instructor's ability to answer class attendees and clarify training material to the satisfaction of the class attendees.

The DEPARTMENT reserves the right to halt an ongoing class, if that class will clearly not be accepted.

For all training classes that are not acceptable, the **DEPARTMENT** shall provide information on which training classes are not acceptable and specify why within 7 calendar days of the completion of each training class. Within 15 calendar days of notification of non-acceptance of the training program, the **CONTRACTOR** shall submit for approval revised training program materials that correct the deficiencies in the non-accepted training classes. These materials shall clearly demonstrate the **CONTRACTOR**'s revisions to the training program and shall include a new training program schedule. All of the **CONTRACTOR**'s requirements and responsibilities for the original training program shall be borne by the **CONTRACTOR**.

Once the revised training program is approved, the **CONTRACTOR** shall again provide the training classes for the original class attendees or specific substitutes for original attendees. The **CONTRACTOR** is only responsible for providing subsequent training classes for those classes that were not accepted as part of the original training program.

1.3 Measurement

This item shall be measured and paid on an HOURLY rate.

1.4 Payment

Training shall be paid for at the Contract price bid for the item established for:

6886020	TRAINING BEING SIGNAL RELATED SYSTEM TRAINING	HR

to be paid at the conclusion of the training, which shall be full compensation for the provision of signal system training, including all materials and incidentals to perform the work as specified.

Pay Item Notes

This specification is not limited to these pay items. Other pay items may be applicable.

Supplemental Technical Specification for

Steel Pole with Mast-Arm

SCDOT Designation: 690.1

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.

1.3.2 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.
- 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.

1.3.3 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.

1.3.4 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 **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.

1.3.6 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.

1.3.7 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.

1.3.8 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.

1.3.9 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.

1.3.10 Design Criteria

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.

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.

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.**

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

1.4 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.

1.5 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

Supplemental Technical Specification for

Short-Range Radio Device Detector System

SCDOT Designation: 699.1

1.1 Description

This work shall consist of furnishing and/or installing a Short- Range Radio Device Detector System to detect vehicles on a roadway by using battery- powered magnetometer- type sensors that communicate their detection data by radio to a roadside communications hub before the data is relayed to a local traffic controller and, optionally, a central software system or a data server as may be desired.

The Short- Range Radio Device Detection System shall be capable of monitoring and measuring vehicular and pedestrian movement by identifying and comparing unique Bluetooth (BT) MAC (Media Access Control) addresses associated with Short- Range Radio enabled electronic devices. The system can be used to collect high quality, high- density travel times by sampling a portion of actual travel activity from the traffic stream of a predetermined route. The B T MAC address received by a sequence of two or more Short- Range Radio Device receivers shall be matched and used to develop a sample of travel time for that particular segment of the roadway, based on the relative detection times recorded by the adjacent units. The BT MAC address being detected shall be both discoverable and non-discoverable.

1.2 Materials

The Short- Range Radio enabled device (sensor) shall be an anonymous Short- Range Radio Device BT MAC address, which is a hardware identifier for the manufacturer and specific electronic device type. BT MAC addresses are not associated with any specific user account or any specific vehicle. The BT MAC address shall not be linked to a specific person through any type central database, but is assigned by the Short- Range Radio Device electronic chip manufacturer and shall not be tracked through the sales chain. Privacy concerns typically associated with alterative probe systems shall be eliminated.

A. **Requirements (Type A, Type B, and Type C)**

The Short- Range Radio Device Detection System shall be connected to, and work in conjunction with the support data processing system, located in a designated server. All The Short- Range Radio Device Detection units shall adhere to the following requirements:

- Short- Range Radio Device: Class 1 Transceiver with 4 dB to 8 dB Omni Directional Antenna
- Environmental: - 30°C to +65°C, 5 – 90% humidity
- Connectivity: IP/Ethernet 10/100 Base- T (minimum)
- I/O ports: minimum one (1) RJ45 Ethernet port

a. Short- Range Radio Device Detection System, Type A

Provide a Short- Range Radio Device Detection System that can be installed in a typical signal or ITS cabinet. The unit shall be enclosed in its own housing and sit on a shelf within the cabinet. Utilize a conduit, as shown on the plans, for routing the antenna cable, and attach the antenna at the location shown on the plans. The power for the Short- Range Radio Device Detection System, Type A unit shall come from typical cabinet power (110 VAC) receptacles or terminal block. Supply all wiring for the Short- Range Radio Device Detection System Type A unit. Should the unit require a POE adapter or transformer to VDC, submit the adapter or transformer to the Department for review. The Contractor shall supply all surge protection devices for the external POE adapter or transformer.

b. Short- Range Radio Device Detection System, Type B

Provide a Short- Range Radio Device Detection System that is self enclosed in a NEMA 4X enclosure that can be mounted to a pole, mast arm or cabinet structure. The voltage input shall be between 6 and 30 VDC, or be able to connect to 110 VAC with appropriate transformers and adapters, as determined by the Department. The Short- Range Radio Device Detection System Type B unit shall be wired to a cabinet or approved communication/power source, as shown on the plans. The unit shall not reside within the cabinet. Provide all grounding, wiring, adapters, transformers, and surge protection devices needed to support the Short- Range Radio Device Detection System Type B unit, as installed.

c. Short- Range Radio Device Detection System, Type C

Provide a Short- Range Radio Device Detection System that is self enclosed in a NEMA 4X enclosure that can be mounted to a pole, mast arm or cabinet structure. Provide a Solar Power Array, which includes the solar panel, charging unit and batteries necessary for solar power. The Short- Range Radio Device Detection System Type C unit shall also include a GSM cellular modem with antennas, or approved equivalent. This Short- Range Radio Device Detection System type shall be a completely wireless installation. Provide all grounding, wiring, adapters, transformers, and surge protection devices needed to support the Short- Range Radio Device Detection System Type C unit, as installed.

d. Short- Range Radio Device Detection System Support Data System Software and Database

Provide a Support Data System software package, including all necessary database 3rd party software required in order for the software to run as intended in support and conjunction of the Short- Range Radio Device sensor system. The software shall be installed on a server designated by the Department. It is the Contractor's responsibility to populate and configure the database for each field Short- Range Radio Device Detection System, and to test the accuracy of the data. The data shall be in an XML format compatible with the Department's central software. The software shall also display a real time chart or graph showing calculated travel time and speeds of the sampled vehicles and BT MAC address counts. The Short- Range Radio Device Detection System support software is required for all new Short- Range Radio Device Detection System installations, but shall not be required for additional Short- Range Radio Device Detection System sensor installations on an existing network.

B. **Functional Requirements for the Short- Range Radio Device Detection System**

The sensor shall be capable of delivering data from both an Ethernet connection and a wireless cellular modem. The Short- Range Radio Device Detection sensor working in conjunction with the network's support data processing system must deliver real- time speed and travel time information in XML format to the central software system for routes where the sensors are deployed. The system shall be able to add multiple pairs of Short- Range Radio Device Detection sensors to form a network of manageable travel routes. Each route will display the data for the first and last sensor in addition to the travel- time and speed information for that segment. The Short- Range Radio Device Detection sensor shall be able to detect, at a minimum, within a radius of 300 feet when mounted on a pole or mast arm. The data processing shall be able to filter and 'throw out' BT MAC addresses that do not supply accurate information when compared to other device time stamps of the segment between two Short- Range Radio Detection devices. The data shall be smoothed, and be able to process median and mean average speeds. The following data shall be able to be compared and filtered, as needed, to deliver the most accurate information:

1. Pedestrians
2. Oversize Vehicles
3. Mass Transit (i.e. nearby trains or buses)

The Short- Range Radio Device Detection System equipment shall contain advanced features designed to allow the unit to operate efficiently in a remote environment. Diagnostic and configuration information shall be able to be viewed remotely, such that the health and operating status of the sensor is known. The system shall be designed to be able to automatically or remotely "reboot" if a condition is detected that requires such action.

1.3 Construction

Installation

A. Installation shall be in accordance with manufacturer's instructions.

Testing

A. Develop and submit plans for post- installation testing to the Engineer for consideration and approval. Ensure the plans test all functional requirements .

B. Provide the Engineer with the appropriate XML data interface, as necessary, for testing of the travel time accuracy and integration into the central software.

1. Post- installation test procedures: Utilize the following test procedures after the Short-Range Radio Device Detection System has been installed in its entirety as shown on the Plans. Commence no post- installation testing until all Short- Range Radio Device Detection sensors systems in the project have been configured, calibrated and programmed to communicate on the SCDOT network to the support data system software. At a minimum, provide the following on the test plan to be submitted and approved by the Engineer:
   a. Inspect all Short- Range Radio Device Detection System field components to ensure proper installation and cable termination.
   b. Inspect the quality and tightness of ground and surge protector connections.
   c. Check power supply voltage and outputs and ensure device connections are as specified in the Plans.
   d. Verify that the installation of cables and connections between all Short- Range Radio Device units, antennas and field cabinets and/or components are as specified in the Plans
   e. Demonstrate that each Short- Range Radio Device unit is fully operational and gathering the required data types at the specified and necessary interval.

1.4 Measurement

Furnishing and/or Installing Components of a Short- Range Radio Device Detector System shall be measured as EACH unit and includes all hardware and cables necessary for installation and operation, and license.

1.5 Payment

6990000	Short-Range Radio Device Detection System Support Data System Software and Database	LS
6990010	Short-Range Radio Device Detector System Type A- w/ License	EA
6990011	Short-Range Radio Device Detector System Type B - w/ License	EA
6990012	Short-Range Radio Device Detector System Type C - w/ License	EA

DIVISION II - SECTION 5

CWS/BGWC – WATER & SEWER SPECIFICATIONS

SPECIFICATIONS

HWY 557 UTILITIES RELOCATION

YORK COUNTY, SOUTH CAROLINA

for

CAROLINA WATER SERVICE

JULY 2018

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GMC PROJECT NUMBER: CGRE180016

HWY 557 UTILITIES RELOCATION

FOR

Carolina Water Service

GMC PROJECT NO. CGRE180016

TABLE OF CONTENTS

SECTION 33 05 23.16 - UTILITY PIPE JACKING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and incidentals required to install carrier pipe at the design line and grade, inside casing pipe installed by boring and jacking at locations indicated on the drawings. The work shall be performed in accordance with the requirements shown on the Drawings, and requirements specified herein.

B. The Contractor shall be responsible for sizing the shafts. The size of the shafts shall, however, be adequate for construction of any structures indicated on the Drawings and to provide adequate space to meet the Contractor's work requirements for his selected methods of construction.

C. All construction operations shall be planned and performed with full regard to safety and to keep traffic interference to an absolute minimum.

D. Boring operations will be subject to review by the Engineer, and the Owner, as applicable. The Owner will have full authority to stop work if, in its opinion, the work may cause damage or endanger traffic.

E. The Contractor shall be responsible for repair or replacement of any roadway settlement or damage as a result of the work for a period of two (2) years after completion of boring and tunneling operations. Repairs shall be performed at no additional cost to the Owner and shall be completed to the full satisfaction of the Owner.

F. The Contractor shall notify the Owner and Engineer a minimum of 72 hours prior to performing work.

1.2 QUALITY ASSURANCE

A. Perform all work in accordance with current applicable regulations and codes of all Federal, State and local agencies.

B. The Contractor's Engineer shall be a professional engineer, registered in the State of South Carolina, and shall have at least 5 years experience in design of jacked casing, design of temporary shaft supports, design of dewatering, and design of blocking and grouting.

C. The contractor performing boring and jacking shall meet the following minimum experience requirements.

D. All work described in this section shall be supervised at all times by at least one superintendent or foreman in charge of construction meeting the minimum experience requirements, as follows.

E. All casing pipe welding shall be performed by qualified welders in accordance with the requirements of ANSI/American Welding Society (AWS) D1.1/D1.1M.

1.3 SUBMITTALS

A. Experience Submittals: Submit supporting documentation for all experience qualifications required by paragraph 1.02 no later than 14 days after Notice to Proceed (NTP) is issued. Provide references to substantiate all experience and certifications.

B. Shop Drawings & Product Data:

1. Casing pipe details including sizes, connection, and weld details and material certificates.
2. Skids, blocking, casing spacers, spiders, or other proposed methods of installing, locating and blocking carrier.
3. Lubricating / stabilizing products.

C. Design Calculations and Method Statements:

1. Submit design calculation and method statements detailing equipment, and construction methods to be used for boring and jacking operations.
2. Design calculation and method statement submittals shall specifically address the following and shall be signed and sealed by the Contractor's South Carolina licensed professional engineer(s):

    a. Proposed schedule and construction sequence including carrier pipe installation schedule.
    b. Dewatering system design, and means for controlling ground water and surface drainage.
    c. Method of soil stabilization and/or ground water control at the face.
    d. Methods for ensuring, verifying and maintaining casing and carrier pipe alignment and grade through completion of the work.
    e. A work plan addressing methods and materials for installing and blocking carrier pipe within casing and for preventing carrier pipe movement during all phases of the installation and grouting process.
    f. Action plan for responding to potential utility movement, including list of emergency contacts for all utilities in right-of-way at bore location(s).

3. Daily reports shall be provided to the Engineer by 8:00 a.m. the following workday. These shall be in a standard format to be used throughout the project, and include at least the daily production, total production and ground conditions encountered.

1.4 DEFINITIONS

A. Band – A ring of steel welded at or near the front end of the lead section of casing to cut relief and strengthen casing.

B. Boring – method by which a conduit is pushed or pulled into place, in this case, using Horizontal Auger Bore equipment.

C. Carrier pipe – pipe directly enclosing a transmitted fluid.

D. Casing – outer steel sleeve enclosing a carrier pipe.

E. Exit Shaft – a shored excavation from which the boring and jacking equipment is retrieved from the ground, and from which the carrier pipe emerges from the casing.

F. Launch Shaft – a shored excavation in which the boring and jacking equipment is installed into the ground, and from which the boring and jacking operations are launched and performed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be stored, protected, and handled in accordance with the manufacturer's recommendations, and acceptable to the Engineer.

B. Casing:

1. Casing pipe shall be new and unused pipe made from steel plate with smooth interior and exterior walls to reduce jacking force and prevent rotation. Steel casing pipe material shall have a minimum yield strength of 35,000 psi, and material shall conform to AWWA C200 and ASTM A53 (Type E or S), and/or, ASTM A139, Grade B.
2. Lubrication/stabilizing fluid for use in the excavated annulus shall consist of slurry created from bentonite and potable water. Polymer or other non-clay chemical additives may only be employed with prior acceptance of the Engineer. All polymers or chemical additives must be shown to have no adverse effects on ground water or soil chemistry. Grease shall not be used as a casing lubricant.
3. The steel casing pipe shall have a minimum thickness of at least 0.5 inches, unless greater thicknesses are required to support the bore and/or to withstand jacking loads. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
4. Minimum casing pipe diameters are shown and/or described in the contract documents. Larger casings may be provided at no additional cost to the owner, with the acceptance of the Engineer.
5. Casing pipes shall be joined by welding and shall have machine-cut ends, cut square with the long axis of the casing pipe. At least one end shall be beveled.
6. Any casing pipe damaged during jacking operations shall be repaired in place by the Contractor or filled with grout and abandoned.

C. Shoring, Blocking, & Spacers:

1. Ground support bulkheads shall be constructed of steel or hardwood, and shall incorporate appropriate filter materials to prevent loss of soil into excavation heading.
2. All blocking and wedges shall be hardwood.
3. Casing spacers or spiders shall be constructed of steel, polymer resin, or hardwood, or other material approved by the Engineer, and shall not result in metal-to-metal contact between the carrier pipe and the casing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Boring and casing installation shall be performed so as not to interfere with, interrupt or endanger the roadway surface and activity thereon, and to prevent settlement of the road surface, structures, and utilities above and in the vicinity of the casing.

B. Casing and Shaft Support Design: Design of the casing and shafts for the site conditions and anticipated jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to right-of-way width, boring and jacking casing lengths less than 20 feet may be necessary.

C. The casing pipe, as a minimum, shall extend to the shoulder break or six (6) feet beyond the edge of pavement on fill slopes, whichever is greater; three (3) feet beyond the ditch line in cuts; and on curbed sections to the back of the sidewalk area. On freeways, expressways, and other controlled access highways the encasement shall extend to the access control lines, the outside of frontage roads, or a sufficient distance to allow for future highway improvements. Exceptions must be approved by the State Highway Engineer.

D. The Contractor shall support the ground continuously in a manner that will prevent loss of ground and will keep the perimeters and face of the casing and shafts stable. Collapse of soil into the casing shall be prevented.

E. The Contractor shall be responsible for all effects on road traffic resulting from ground loss, including all costs and coordination required to meet the traffic control requirements of SCDOT and the Owner, including costs related to traffic control, permit acquisitions, fees, and fines.

F. Activity within SCDOT right-of-ways:

1. The Contractor shall be responsible for coordinating and scheduling of all construction work within the highway right-of-way.
2. Boring and jacking work shall not impede the flow of traffic along the roadway being crossed.
3. All installations shall be performed to maintain free flow in existing drainage ditches, pipes, culvers, or other surface drainage facilities of the highway, street or its connections.
4. In no instance will the Contractor be permitted to leave equipment on the pavement or shoulder overnight. When equipment is not in use, equipment and vehicles shall be kept at least 30 feet from the edge of the travel lanes.

3.2 SAFETY

A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as not to damage the roadbed or interfere with normal traffic over it.

B. Observe all applicable safety requirements of the regulations of the authorities having jurisdiction over the site.

C. Perform all activities related to the work in accordance with the applicable Occupational Safety and Health Act underground construction regulations, including but not limited to Part 1926, Section 800 of Title 29 of the Code of Federal Regulations (29 CFR 1926.800)..

3.3 LAUNCH AND EXIT SHAFTS

A. No open excavation will be allowed within the limits of the encasement without the Engineers approval. All sheeting, shoring and bracing shall be provided as necessary for the satisfactory and safe performance of the work. All work areas shall be maintained in a suitable dry condition at all times.

B. All launch and exit shafts for boring and jacking shall be completely positively shored. Shoring designs shall be designed for all potential loads, including but not limited to earth and water loads, surcharge loads, and any jacking thrust loads.

C. Shafts shall allow ample working room for the Contractor's operations. All temporary shaft supports shall be removed to a depth of at least five feet below ground surface after the work is completed.

D. Shafts shall be established safely beyond the surfaced area of the highway so as to avoid impairing the roadway during installation of the pipeline. The near edge of the shaft shall be no closer to the edge of pavement than its depth below the pavement surface unless bulkheaded. Under no conditions shall the near edge of the shaft be closer than five (5) feet to the edge of pavement. Adequate protection and warning devices will be provided while the portal is open.

E. Carrier pipe shall be installed through the shafts and bedding and backfill.

F. Shafts shall not be left open during hours of darkness when work is not ongoing. Backfilling shall be accomplished as soon as practicable upon completion of grouting between the casing and carrier pipe.

3.4 BORING AND JACKING OPERATIONS

A. Casing pipes shall be installed to the limits shown on the Contract Drawings.

B. Boring and jacking shall be performed in a continuous 24-hour-per-day operation when the auger head is within SCDOT right-of-way. The requirement to perform boring and jacking on a continuous 24-hour-per-day basis shall not relieve the Contractor of compliance with all applicable noise ordinances.

C. Lubrication/stabilizing fluid shall be injected to completely fill the excavated annulus continuously throughout all boring operations. Bore collars shall be sealed to prevent leakage of the lubrication/stabilizing fluid into the shafts. In no event shall jacking or lubricant injection be discontinued for a sufficient period to cause the casing pipe to "freeze" in place.

D. Thrust blocks shall be designed to transfer jacking loads to the ground without causing excessive deflection of the shoring, or disturbance to adjacent structures or utilities.

E. The cutting head shall not protrude more than 12 inches past the end of the casing and shall remain centered at all times while boring. All augers shall be greater than 75% of the casing pipe inside diameter. Overcut shall not exceed more than 1 inch.

F. Alignment and grade of the casing pipe shall be consistently maintained throughout boring and jacking operations. Tolerances for installation of the casing pipe shall be plus or minus 6 inches in the Horizontal and plus or minus 6 inches in the Vertical.

G. Development of voids outside the casing pipe shall be prevented. Spoils removal rates shall be monitored for potential over excavation. All suspected or potential void locations shall be recorded and reported to the Engineer. Upon completion of casing installation, the Contractor shall note all locations where voids may have developed, and shall pump grout to fill voids until refusal.

H. If boring is stopped for any reason, the exposed face of the excavation shall be fully protected with a steel or hardwood ground support bulkhead designed and installed to prevent any movement of ground into the excavation. The bulkhead shall incorporate appropriate filter materials to prevent loss of soils into the excavation, and shall incorporate weep holes or other means to prevent build up of ground water pressure against the bulkhead.

3.5 CARRIER PIPE INSTALLATION

A. Carrier pipe shall be positioned within the casing pipe by sliding on structural-grade hardwood, or on spiders or casing spacers custom-designed and fabricated by or for the Contractor. There shall be no metal-to-metal contact between the carrier pipe and any part of the skid, spider, spacer, blocking, or banding. Carrier pipe shall not be slid directly on the casing pipe or on any rail, centralizer, cradle or backfill installed within the casing pipe.

B. Carrier pipe shall be supported by skids, spiders, or spacers spaced no further than 10 feet apart.

C. Lubricant shall be applied between the skid, spider, or spacer and the casing pipe or rail, centralizer, cradle or backfill material installed within the casing pipe.

D. Carrier pipe, casing pipe, and joints shall not be deformed or damaged during carrier pipe installation.

E. Carrier pipe coating and linings shall be protected throughout installation, and shall be repaired in a manner acceptable to the Engineer prior to blocking within the carrier pipe.

F. Carrier pipe shall be tested as specified. The ends of the carrier pipe shall be extended from the casing to where it intersects the proposed alignment, the edge of right-of-way or if outside of the right-of-way five (5) feet from the end of the casing, as applicable. The ends of the carrier pipe shall be plugged or sealed until final connection with upstream and downstream lines have been made.

G. Each end of the Casing pipe shall be sealed with pull on or wrap around end seal or brick and mortar.

H. Maximum allowable deflection of the casing after installation shall be 1 percent of the inside diameter of the casing.

3.6 RESTORATION

A. All areas disturbed by construction shall be restored to existing or better than original condition and maintained until accepted by the Owner.

B. The Contractor shall place readily identifiable and suitable markers at the rights-of-way-lines to mark the casing crossing.

END OF SECTION 33 05 23.16

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SECTION 33 12 16 – VALVES AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of valves to be used is shown on the drawings, in schedules, and specified.

B. A Related Work Specified Elsewhere:

1. Section 33 13 00 - Disinfection of Potable Water Mains

C. Valves wrenches, extensions, handles, operators, and handwheels shall be provided for each valve. The Contractor shall provide one T-handle valve wrench for all below grade valves with square operating nut.

1.2 SUBMITTALS

A. Submit shop drawings or manufacturer's product data on all items in Part 2.

B. Submit copies of report on hydrostatic and leakage tests conducted in accordance with AWWA C504, Section 12, to the Engineer for Butterfly Valves.

C. Submit sworn affidavit from the manufacturer that all valves comply with all applicable provisions of ANSI/AWWA standards.

PART 2 - PRODUCTS

2.1 GATE VALVE

A. Manufacturers:

1. Mueller
2. American Flow Control

B. Gate valves shall be cast iron bodied, bronze mounted, double disc, O-ring type with non-rising stem and opening counter-clockwise. Valves shall be manufactured in accordance with AWWA C500, latest revision, for NRS valves and designed for 150 psi working pressure. Valves for buried service shall have mechanical joint ends and operating nut in accord with AWWA C500. Two socket valve wrenches shall be provided with extensions as required. Valves for above ground shall be American Standard Flanged, with wheel operator.

C. Valves smaller than 3 inches in diameter shall be all bronze, screwed gate valves meeting the requirements of Federal Specification WW-V-54C, as manufactured by Crane, or Walworth, or equivalent, and suitable for the service required.

2.2 AIR RELEASE/VACUUM VALVES

A. Air release vacuum valves shall be provided in accordance with sound engineering practice at the high points along the pipeline where shown on the drawings. Valves shall be standard series combination

air release valves as manufactured by APCO Valve and Primer Corporation or Valmatic.

B. Air valve shall be installed on a ductile iron tapped coupling or tapping saddle. Gate valve and brass piping (nipples) shall be of the same size as air valve N.P.T.

C. Air valve shall be fitted with a vent pipe installed with appropriate pipe couplings for easy removal of the air valve and/or concrete box. Vent pipe (Schedule 80 PVC) shall be installed through concrete box at a positive grade to the concrete valve marker. Vent pipe riser (galvanized iron pipe) with U-shaped fitting shall be secured to concrete marker. Opening to be protected with stainless steel insert screen.

D. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

2.3 BUTTERFLY VALVES

A. Manufacturers:

1. Mueller
2. Pratt

B. Butterfly valves shall conform to AWWA C504. Laying length of all classes shall be Table 2, short body. Valves shall be rated at 150 psig working pressure. Valves shall be bubble tight at rated pressure and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valves shall have mechanical joint ends for buried service and flanged joints in the vaults and above grade. Valves shall open in the counterclockwise direction.

C. Valve body shall be ductile or cast iron per ASTM A 126, Class B, or ASTM A 48, Class 40, with integrally cast hubs for shaft bearing housing.

D. The valve disc shall be of heat treated ductile iron, cast iron or of alloy cast iron per ASTM A 436, latest revision, Type I, Class I. The disc shall rotate 90º from full open to tight shut position.

E. Valve shaft shall be of solid one-piece design or stub shaft. Shaft, taper pins, lockwashers and nuts shall be 18-8 or Type 304 stainless steel. A shaft seal and bronze gland follower, studs and nuts shall be provided in the valve body. Shaft seals shall be in accordance with Section 10 of AWWA C504.

F. Valve seat shall be of molded BUNA-N rubber, recess mounted, bonded and/or mechanically secured to the valve body or disc. Valves may be furnished with rubber seats clamped securely to the cast iron discs and mating against stainless steel seating surface in the valve body.

G. Valves shall be fitted with sleeve type bearings of self-lubricating corrosion resistant material.

2.4 VALVE BOXES

A. Valve boxes shall be provided for all buried valves. Valve boxes shall consist of cast iron base and adjustable top section with cover that shall be marked “Water”. Extensions shall be provided as required to meet grade.

2.5 TAPPING SLEEVES AND VALVES

A. Manufacturers:

1. Mueller
2. American Flow Control
3. IPSCO

B. Cast iron tapping sleeves and valves shall be used to make "wet" taps into the existing water mains where shown on the drawings. The tapping sleeve shall be of the split type with mechanical joints, cast iron bolts and flanged outlet for connection to the tapping valve. Contractor shall verify type of existing main before ordering sleeve. The tapping sleeve shall be pressure tested in the field to verify pressure rating. The tapping valve shall have an inlet flange to match the sleeve and a mechanical joint outlet for connection to water main pipe. Tapping valve and tapping sleeve shall be rated for 150 psi working pressure, open counter-clockwise with nonrising stem and have BUNA-N O-rings. Provide valve with box.

2.6 TAPPING SADDLES

A. Tapping saddles shall be used to make "wet" taps into the existing water mains where shown on the drawings. Tapping saddle bodies shall be made of malleable iron conforming to ASTM A 47 Grade 32510, or ductile iron conforming to ASTM A 536. Straps shall be made of carbon steel conforming to ASTM A 307, electro-galvanized with Di-Chromate Seal. Nuts shall be cold formed, semi-finished, heavy hex steel electro-galvanized with Di-Chromate Seal. Gaskets shall be made of synthetic rubber and shall be suitable for service at maximum operating temperature of piping system, and as specified in individual piping specification sections.

B. Tapping saddles shall be Rockwell 313 double strap iron service saddles, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Valves, gates and accessories shall be installed as shown on the drawings.

B. Valves, gates and accessories shall be installed plumb and true in a first class manner, consistent with the manufacturer's recommendations.

C. Valves, gates and accessories shall be installed with care to prevent undue strain upon the valve, operators, or other associated pieces of equipment.

3.2 SETTING VALVES AND BOXES

A. Valves and valve boxes as specified in the preceding paragraphs shall be installed where shown on the drawings unless otherwise directed. Valves shall be set plumb with the base of the valve box centered over the valve and resting on compacted backfill. The top section of the box shall be set to allow equal movement above and below finished grade. After being correctly positioned, fill shall be carefully tamped around the valve box for a distance of 4 feet on all sides of the box. In paved areas, top of the cover shall be flush with the finished paving. In off-street areas, the cover shall be set 1 inch above existing grade unless otherwise directed by the Engineer and a precast concrete collar shall be placed around the top of the box as shown in the typical details.

END OF SECTION 33 12 16

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SECTION 33 12 19 – FIRE HYDRANT ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, tools, and incidentals required to install complete hydrant assemblies as shown on Drawings and specified herein.

1.2 DEFINITIONS

A. Where the expression “fire hydrant assembly” is used, it includes the fire hydrant tee, fire hydrant valve, valve box, valve marker, connecting pipes, the fire hydrant body, restraint devices, washed stone, touch-up paint, and all other necessary materials and equipment for a complete and functional installation as shown on the Construction Drawings and Construction Details.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer’s specifications, catalog cuts and literature:

a. Hydrant
b. Hydrant tee.
c. Hydrant valve.
d. Standard fittings.
e. Restraining devices.

B. Shop Drawings:

1. Manufacturer’s drawings and cut sheets showing all important details of construction, including dimensions.

PART 2 - PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:

1. Mueller.

a. Super Centurion 250-A421.

B. Hydrant Design:

1. Breakaway traffic type.
2. 6-inch pipe connection.

3. 4-1/2-inch valve opening.
4. 2 - 2-1/2-inch hose nozzles.
5. 1 – 4 inch pumper nozzle.
6. 150 psi working pressure.
7. Bronze working parts.
8. National Standard hose threads.
9. Lubricant sealed bonnet assembly.
10. Conforming to AWWA Specification C502.

C. Compatibility:

1. Verify that connections are as typically found in the system, and are compatible with equipment of the local fire department.

D. Paint:

1. Order hydrant to match green color of existing hydrants within Owner's system.

2.2 FIRE HYDRANT CONNECTOR PIPE

A. Provide ductile iron connector pipe positioned between the fire hydrant and the gate valve.

B. Offset design connector pipe may be used so that the fire hydrant can be adjusted to ensure placement at the proper grade, with an anchoring feature at both ends so that when used with M.J. split glands, a restrained joint is provided, such as the Gradelock, manufactured by Assured Flow Sales, Inc.

C. Use plain end ductile iron pipe for connector pipe, with joints restrained by tie rods or by Meg-a-lug, manufactured by EBBA Iron, Inc.

2.3 WATER MAIN HYDRANT TEE

A. Provide water main hydrant tee with a 6-inch tee outlet to the hydrant.

B. Provide water main hydrant tee with an anchoring feature on the 6-inch leg so that when used with an M.J. split gland, a restrained joint is provided between the tee and the gate valve.

C. Welded-on outlets may be used in lieu of tees

PART 3 - EXECUTION

2.4 SETTING HYDRANTS

A. Connect fire hydrants to the mains with a mechanical joint hydrant tee, ductile iron connector pipe, and a gate valve, all part of the assembly. After connections are made, bury the hydrant at such elevation that the "bury line" on the hydrant is at finished grade. Backfill around the fire hydrant with gravel as shown on the Drawings and in such a manner as to insure complete drainage of the hydrant when closed. Thoroughly compact all backfill around the hydrant to the surface of the ground. Before installing any hydrant or valve, exercise care to see that all foreign material is removed from the interior of the barrel. Tighten stuffing boxes and open and close the hydrant and valve to see that all parts are in working condition.

B. Where hydrants are being connected to an existing water main, verify the depth of bury and order barrel and shaft extensions as required for the measured bury.

2.5 TESTING HYDRANTS

A. Upon completion of installation of waterlines, perform flow tests of fire hydrants. Record available pressure, flow rate, and residual pressure to demonstrate conformance with SCDHEC requirements.

END OF SECTION 33 12 19

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SECTION 33 13 00 - DISINFECTION OF POTABLE WATER MAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, tools, testing, and incidentals required to disinfect all new potable water mains and any existing potable water mains that are contaminated during construction activities.

B. Section includes:

1. Requirements for disinfection of new water mains.
2. Requirements for disinfection of existing water mains, which have been relocated or contaminated by construction operations.
3. Requirements for materials used during disinfection.
4. Requirements for flushing and testing potable water lines that have been disinfected.

C. Owner-Furnished Material: Potable water for disinfection purposes.

1.2 SUBMITTALS

A. Quality Control Submittals:

1. Design Data: Fourteen (14) days prior to disinfection of potable water lines, submit detailed outline of proposed sequence of disinfection, manner of filling and flushing, source and quality of water to be used, sampling locations, and disposal of wasted water.
2. Test Reports: Submit for each test performed. Include location of sample point, volume of sample, date and time of sample, signature of sampler, and lab certification.

1.3 QUALITY ASSURANCE

A. Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

B. Regulatory Requirements: Perform disinfection activities in accordance with South Carolina Department of Health and Environmental Control (SCDHEC). If the requirements of this Section are in conflict with requirements of regulatory agencies, the latter shall govern.

C. Comply with AWWA C651 – Disinfecting Water Mains.

1.4 SEQUENCE & SCHEDULING

A. Coordinate disinfection sampling and testing with the Owner.

B. Perform preliminary flushing and pressure testing before disinfection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chlorine:

1. Chlorine gas-water solution, or a continuous direct chlorine feed is preferred.
2. Use high-test calcium hypochlorite or tablet method of disinfection only when approved by Engineer and performed in accordance with applicable AWWA standards.
3. Do not use tablet form calcium hypochlorite for disinfecting mains greater than 12 inches in diameter or greater than 2,500 feet in length.

PART 3 - EXECUTION

3.1 GENERAL

A. Disinfect water mains and appurtenances in accordance with AWWA C651.

B. Provide SCDHEC approved testing agency to collect and test disinfected water samples.

C. The Contractor shall be liable for damages arising from direct contact of granular calcium hypochlorite with solvent welding materials used to join PVC pipe.

3.2 PREPARATION

A. Chlorine:

1. Liquid Chlorine:

a. Apply chlorine gas-water solution by means of solution feed chlorinating device or, if approved by Engineer, feed dry gas directly through proper devices for regulating rate of flow and providing effective diffusion of gas into water within the main being treated.
b. Provide chlorinating devices for feeding solutions of chlorine gas that prevent backflow of water into chlorine cylinder.Calcium Hypochlorite:

c. Prepare granular calcium hypochlorite as water mixture prior to introduction into main. Make dry powder into paste and thin to approximately 1 percent chlorine solution.
d. To prepare chlorine solution, add one (1) pound of calcium hypochlorite (65 percent – 70 percent available Chlorine) to 7.5 gallons of water.

B. Pipeline Preparation:

1. Provide bulkheads, flanges, valves, bracing, blocking, blowoffs or other temporary materials that may be required for flushing and venting piping.
2. Flush units thoroughly to remove any foreign material. Flushing flow rate must produce a minimum velocity of 2.5 feet per second in the pipeline being flushed. Flushing must continue until a minimum of three turnovers of water occur in the section of pipeline being flushed. Do not connect any flushing device directly to any sewer.
3. After flushing has been satisfactorily completed, perform pressure and leakage tests.
4. Release entrapped air at high points and fill units with disinfecting agent and water to allow disinfecting agent to come in contact with interior surfaces.

5. If complete venting cannot be accomplished through available outlets, provide necessary corporation cocks and vent piping.
6. Remove temporary materials after disinfection is complete.

3.3 FIELD QUALITY CONTROL

A. Disinfection:

1. Disinfect by introducing disinfecting agent into the water, which is being pumped into the system not more than 10 feet from the supply source, in such manner that the entire system will be filled with water containing a minimum chlorine concentration of 25 mg/L at any location.
2. Retain solution in main for not less than twenty-four (24) hours, and no more than forty-eight (48) hours, with a minimum residual concentration of 10 mg/L sustained before the system is flushed out. Flush out the line thoroughly with potable water of satisfactory bacteriological quality before beginning the sampling program.
3. Disinfecting Valves:

    a. Operate valves and appurtenances while main is being disinfected to ensure surfaces of valves are disinfected.

4. Swabbing:

    a. Flush and swab pipe, fittings, or valves that must be placed in service immediately with 5 percent solution of calcium hypochlorite immediately prior to assembly.
    b. Secure approval from the Engineer before using this method of disinfection.

B. Sampling:

1. Collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet.
2. Prior to sampling, reduce chlorine residual to normal system residual levels. Reduce residual levels to non-detectable in those systems normally not chlorinated.
3. Collect each of the two (2) samples at least twenty-four (24) hours apart. The samples must show the water line to be absent of total coliform bacteria.
4. Measure and report the chlorine residual.
5. If the membrane filter method of analysis is used for the coliform analysis, report non-coliform growth.
6. Repeat sampling and testing if the non-coliform growth is greater than eighty (80) colonies per one-hundred (100) milliliters.
7. All samples must be analyzed by a State certified laboratory.
8. If required by SCDHEC, perform turbidity, pH and/or heterotrophic plate count tests.
9. Submit test certifications to Engineer within 48 hours after satisfactory test results are received from testing laboratory.

3.4 FINAL FLUSHING AND TESTING

A. Following chlorination, flush the system until replacement water in system is proven to be comparable in quality to water that will enter system.

B. Above acceptable condition of water delivered by each system shall continue for at least two (2) days, as demonstrated by laboratory examination of samples. Laboratory tests shall show chlorine residual, after final flushing, of less than 1 mg/l (ppm).

C. Repetition of Flushing and Testing:

1. If initial treatment results in unsatisfactory bacterial tests, repeat disinfection until satisfactory results are obtained.

D. Prevent entry of contaminated water into previously disinfected units or systems.

E. Do not directly connect flushing devices to any sewer.

END OF SECTION 33 13 00

SECTION 33 14 13 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for public line, including p**otable water line**
2. Positive-displacement meters.
3. Pipe support systems.
4. Bedding and cover materials.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.
8. AWWA C200 - Steel Water Pipe, 6 In. (150 mm) and Larger.
9. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
10. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied.
11. AWWA C206 - Field Welding of Steel Water Pipe.
12. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
13. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
14. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
15. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
16. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
17. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
18. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
19. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
20. AWWA C606 - Grooved and Shouldered Joints.
21. AWWA C700 - Cold-Water Meters - Displacement Type, Metal Alloy Main Case.
22. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
23. AWWA C702 - Cold-Water Meters - Compound Type.
24. AWWA C707 - Encoder-Type Remote-Registration Systems for Cold-Water Meters.

25. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
26. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
27. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
28. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

C. National Fire Protection Association:

1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

D. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Coordinate Work of this Section with termination of water main connection at Site boundary, connection to Carolina Water Service, and trenching.

1.4 PREINSTALLATION MEETINGS

A. Convene minimum **one week** prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Preconstruction Photographs: Submit digital files of photographs of Work areas and material storage areas.

E. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and **invert** elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Valves: Mark valve body with manufacturer's name and pressure rating.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Store PE and PVC materials out of sunlight.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C151.

2. Bituminous Outside Coating: Comply with AWWA C151.
3. Pipe Mortar Lining:

    a. Comply with AWWA C104.
    b. Thickness: Double.

4. PE Encasement: Comply with AWWA C105.
5. Pipe Class:

    a. Comply with AWWA C151.
    b. Class 150

6. Fittings:

    a. Material: **Ductile** iron; comply with AWWA C110.
    b. Coating and Lining:

        1) Bituminous Coating: Comply with AWWA C110.
        2) Cement-Mortar Lining: Comply with AWWA C104; double thickness.

7. Joints:

    a. Mechanical and Push-on Joints: Comply with AWWA C111.
    b. Flanged Joints: Comply with **AWWA C115**
    c. **Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal.**

B. PVC:

1. Comply with AWWA **C900**, Class **165**.
2. Fittings: Comply with AWWA **C900**.
3. Joints:

    a. Comply with **ASTM D3139**.
    b. Seals: PVC flexible elastomeric.
    c. Solvent-cement couplings are not permitted.

2.2 ACCESSORIES

A. Air-Release Valves:

1. As located on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Pipe Cutting:

1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
3. Grind edges smooth with beveled end for push-on connections.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Piping:

1. Comply with AWWA C**600**.
2. Handle and assemble pipe according to manufacturer instructions **and as indicated on Drawings**.
3. Steel Rods, Bolts, Lugs, and Brackets: Coat buried steel before backfilling.
4. Maintain **10** feet of horizontal separation between water main and **sewer** piping.
5. Ductile-Iron Piping and Fittings: Comply with AWWA C600.
6. Prevent foreign material from entering pipe during placement.
7. Allow for expansion and contraction without stressing pipe or joints.
8. Close pipe openings with watertight plugs during Work stoppages.
9. Install access fittings to permit disinfection of water system performed under Section **330110.58 - Disinfection of Water Utility Piping Systems**.
10. Cover:

    a. Establish elevations of buried piping with not less than 3 feet of cover.
    b. Measure depth of cover from final surface grade to top of pipe barrel.

B. Testing:

1. Pressure test piping system according to AWWA C600 and following:

    a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
    b. Conduct hydrostatic test for a minimum of **two** hours.
    c. Slowly fill section to be tested with water; expel air from piping at high points.
    d. Install corporation cocks at high points.
    e. Close air vents and corporation cocks after air is expelled.
    f. Raise pressure to specified test pressure.
    g. Observe joints, fittings, and valves under test.
    h. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest.
    i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.

j. Maintain pressure within plus or minus 5 psi of test pressure.
k. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
l. Compute maximum allowable leakage using following formula:

1) L = SD x sqrt(P)/C.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic test, psig.
6) C = 148,000.

m. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
n. Leakage:

1) If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
2) Correct visible leaks regardless of quantity of leakage.

END OF SECTION 33 14 13

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PVC Pipe
2. Ductile Iron Pipe
3. Ductile Iron Fittings
4. Concrete Pipe
5. HDPE Pipe
6. HDPE Fittings
7. Accessories

B. Standards

1. Standards: Supply all products and perform all work in accordance with applicable American Society of Testing and Material (ASTM), American Water Works Associations (AWWA), American National Standards Institute (ANSI), or other recognized standards.
2. Latest revisions of all standards are applicable.

1.2 SUBMITTALS

A. Product Data: Manufacturer information indicating pipe material to be used, and pipe accessories.

B. Manufacturer's Certificate: Products meet or exceed specified requirements.

C. Certified mill certificate showing conformance to all requirements specified herein.

D. Manufacturer Instructions: Special procedures required to install specified products.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. General arrangement and dimensional drawings.

1.3 QUALITY ASSURANCE

A. Perform Work according to applicable SCDHEC, OSHA, AWWA, and ASTM standards.

PART 2 - PRODUCTS

2.1 PVC PIPE

A. General

1. All PVC pipe and fittings shall be clearly marked as to size, ASTM, Company, SDR, and date of manufacture. No pipe shall be accepted that is more than 120 days old when delivered to the job site.
2. Pipe shall be manufactured of PVC having a cell classification of 12454 or 12364 as defined in ASTM D 1784. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc. shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound.
3. A certified mill certificate showing conformance to all requirements specified above shall be provided to the Engineer with each shipment of pipe delivered to the job site.
4. All PVC pipe shall be green in color and stenciled "SANITARY SEWER."
5. PVC pipe shall not be used in locations where the pipe has a cover less than four feet, where crossing creek or ravine bottoms, where the pipe may be exposed, or where sewers are laid under railroads, powerline easements, or roadway rights of way.

B. PVC Pipe for Gravity Sewers

1. PVC pipe for gravity sewers shall be manufactured in accordance with ASTM D 3034 for 4" through 15" SDR 35/26 and F679 for 18" through 36" 46PS/115PS sewer pipe.
2. Joints shall be of the rubber gasket slip on type conforming to ASTM D 3212 under both pressure and vacuum. The bell shall be an integral part of the pipe with the same strength. Spigot ends shall be beveled.
3. Elastomeric gaskets shall meet the requirements of ASTM F477. Gaskets shall be locked in, NAPCO, HARCO, or approved equal.
4. PVC pipe material at different depth of burial, as defined from the final ground surface to the bottom of the pipe, shall conform to the following schedule:

    a. 4' to 15' SDR 35 with a minimum pipe stiffness of 46 PSI
    b. 15' to 22' SDR 26 with a minimum pipe stiffness of 115PSI
    c. > 22' use Ductile Iron or other alternate material, as directed by the Engineer.

5. Transitions from PVC pipe to Ductile Iron pipe shall be made only at manholes.

C. PVC Pipe for Low Pressure Sewer

1. PVC pipe for force mains shall be PVC SDR 21 and shall comply with ASTM D 2241. Gaskets shall be locked in (Rieber joint) and meet ASTM F477.

2.2 DUCTILE-IRON PIPE:

A. Where ductile iron pipe is specified for use in the construction of gravity sewers or force main, it shall be Pressure Class 350 ductile iron manufactured in accordance with requirements of AWWA C151/A21.51 complete with a cement mortar lining per AWWA C104, unless otherwise indicated on the drawings.

B. Pipe laying lengths shall be provided in 18 or 20 feet nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

C. All ductile iron pipes and fittings, installed in a trench conditions shall receive a shop-applied bituminous coating 1-mil thick, minimum in accordance with AWWA C151/ANSI A21.51.

D. All exposed pipe and fittings shall be provided with a shop prime and painted as specified.

E. Where flexible joint iron pipe is called for on the plans, it shall conform to the same specifications as ductile iron. The joints shall be of the ball and socket type either bolted or keyed and, if of the bolted type, the bolts and nuts shall be made of stainless steel. The trench in which this pipe is installed shall be excavated to a depth that will provide a cover of not less than 3' over the top of the pipe when it is in place.

F. All ductile iron sewer main pipes shall be color coded green by painting a 3” green stripe along the crown of the pipe barrel.

G. Push-on joints

1. Where push-on joint ductile iron pipe is called out on the Drawings, the push-on joints shall conform to AWWA C111.
2. Push-on joints shall be Fastite, as manufactured by American Ductile Iron Pipe, Tyton as manufactured by US Pipe, or pre-approved equal. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less.

H. Restrained Joint Pipe

1. Where Restrained Joint Ductile Iron Force Main is called out on the Drawings, the restraining devices shall be Megalug 1100 series or approved equals.
2. Where Restrained Joint Ductile Iron Force Main w/ Grip Lock Gaskets is called out on the plans, the restraining devices shall be US Pipe Field Lok 350, American Fast-Grip, McWane Ductile TR Flex, or approved equal.

I. Flanged Joint Pipe

1. Where flanged joint ductile iron pipe is called out on the Drawings, the pipe shall conform to AWWA C115 with gaskets and bolts conforming to AWWA C115 Appendix A.
2. Bolt circle and bolt holes match those of ANSI B16.1 class 125 and ANSE B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure.
3. Bolts and nuts shall be type 316 stainless steel, conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
4. Gaskets shall be full faced specially designed for a working pressure greater than 250 psi and shall be Toruseal as manufactured by American, US Pipe Flange-Tyte , or approved equal.

2.3 DUCTILE-IRON FITTINGS

A. Ductile iron fittings shall be provided in locations as shown on the plans or in locations deemed necessary by the Engineer. Ductile iron fittings 12” and smaller shall be rated for 350 psi working pressure and fittings larger than 12” shall be rated for 250 psi working pressure.

B. Fittings shall be manufactured in accordance with AWWA C153 and provided with mechanical joints. All fittings shall be provided with a thin cement lining in accordance with AWWA C104.

C. Use Tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating, bolts and nuts shall be carbon steel coated with corrosion inhibiting fluoropolymer composite material. Mechanical joint fittings shall be furnished with sufficient quantities of accessories as required for each joint. All mechanical joints shall be restrained.

D. Ductile Iron fittings with retainer glands shall be provided.

E. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6” beyond the connection in accordance with AWWA C105.

F. Concrete thrust block/restraints shall be 2500 psi concrete poured in place against undisturbed soil at each fitting location.

G. Where 90 degree deflections occur along the route of the force main, two (2) 45 degree bends shall be used where possible.

2.4 REINFORCED CONCRETE PIPE:

A. Reinforced concrete pipe shall conform to ASTM C76, latest revision and as specified herein. Cement for the pipe shall conform to ASTM C150 Type II or I, except that tricalcium aluminate shall not exceed 8%. A minimum of 7.5 bags of cement shall be used for each cubic yard of concrete. Fine and coarse aggregate shall conform to ASTM C33, and the coarse aggregate shall be made from 100 percent limestone. Manufacturer’s mill certificates of chemical composition and mix shall be provided to verify that these requirements are met. The concrete alkalinity shall be a minimum 0.70 equivalent $CaCO_3$ or above. Inspection and rejection Sections 15 and 16 of the ASTM C76 shall apply, except that inspection shall be at the Contractor's expense. Basis of acceptance of the pipe shall be in accordance with 5.1.1 of ASTM C76.

B. Reinforced concrete pipe for cuts in excess of 12 feet shall meet the requirements for design strength of ASTM C76, Class IV, with wall thicknesses B or C. All designs shall be approved by physical test of sample pipe at the manufacturer's expense. Reinforced concrete pipe for cuts of 12 feet or less shall meet the requirements for design strength of ASTM C76, Class III, with wall thicknesses B or C.

C. The placement of reinforcement in 24" and larger diameter pipe shall be such that the circumferential reinforcement is not closer than 1 1/2" to the inside surface of the pipe.

D. All testing as specified herein shall be performed by a commercial testing laboratory as approved by the engineer with work being done at the contractor's expense.

E. Pipe bedding shall be Class C as shown on the drawings and as shown in the Concrete Pipe Design Manual, latest edition.

F. Concrete pipe shall be furnished with joints of the round rubber gasket type using bell and spigot design meeting ASTM C443, latest revision. Absorption of the concrete pipe shall not exceed 6% of the dry weight.

G. Concrete pipe shall be lined if indicated on the drawings.

2.5 POLYETHYLENE PIPE

A. All polyethylene pipe and fittings shall be molded from Virgin PE4710 HDPE resins in accordance with the requirements of ASTM D3035 and manufactured to comply with ASTM F714.

B. Unless otherwise specified, the nominal size and DR shall be as shown on the Drawings. HDPE fittings shall be fully pressure rated.

C. GRAVITY SEWER - Profile wall polyethylene pipe and fittings for gravity sewers shall be of the spiral wound type. The pipe shall be made of high density, high molecular weight polyethylene pipe material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D-1248. The pipe shall be provided with rubber gasket joints that meet the non-pressure requirements of ASTM F477. Special heavy wall pipe sections having a smooth outside wall shall be supplied for all manholes and connections to other types of pipe.

D. PRESSURE MAINS – HDPE pipe and fittings shall have a nominal IPS (iron pipe size) outside diameter per ASTM F714. Pipe sections shall be joined on the job site above ground into continuous length by the butt-fusion method in accordance with ASTM F2620, and be performed in strict accordance with the manufacturer's recommendations. Butt-fusion fittings shall comply with ASTM D3261.

E. HDPE pipe shall be joined to ductile iron valves and fitting with a DIPS size MJ adapter kit. Pipe stiffeners shall be used to maintain roundess of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's recommendations.

F. Pipe shall be supplied in lengths not less than 40 feet long, of the size and wall thickness as shown on the plans. The combined soil pipe system shall be reviewed and approved by the pipe manufacturer to ensure an installation limiting maximum deflection of the pipe to less than five percent of base diameter, when both soil and maximum water loads are applied. The pipe shall be handled and installed in strict accordance with the recommendations of the manufacturer.

2.6 ACCESSORIES

A. Polywrap: Where indicated on the drawings ductile iron pipe shall be wrapped in 6 mil polyethylene encasement in accordance with AWWA C105. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6" beyond the connection.

B. Protective Lining: The Contractor shall provide interior protective lining where indicated on the drawings or specified below.

1. Ductile iron pipe and fittings shall receive an epoxy lining of the interior surface where indicated on the drawings. The interior protective liner shall be an amine cured novalac epoxy applied to a dry film thickness of 40 mils minimum, and shall be Protecto 401™ Ceramic Epoxy or approved equal. Ductile iron pipe to be lined shall not be cement mortar lined. Epoxy linings shall be inspected for holidays using an electrical detector.
2. T-LOCK liner shall be supplied for concrete pipe when indicated on the drawings. The liner shall be constructed of a combination of PVC resin, pigments and plasticizers compounded as manufactured by Ameron Protective Coatings, Western Environmental, or approved equal. The liner shall have a thickness of 0.065 inches with a coverage of not less than 270 degrees. Tee shaped locking extensions of the same material as the liner shall be integrally extruded with the sheet. The extensions shall be 2.5 inches apart and 0.375 inches high. The lining shall be installed with the locking extensions running parallel with the longitudinal axis of the pipe. The concrete pipe shall be poured against the liner material in strict accordance with the manufacturer, the integrity of the liner shall be tested prior to shipment, and any pinholes located shall be repaired and retested. No pipe with damaged lining will be installed or accepted until and unless the damage has been repaired to the satisfaction of the engineer. Field joints using mortar and joint flaps mating with the locking extensions shall be carefully installed as recommended by the manufacturer.

C. Pipe weights

1. Unless otherwise noted in the Specifications, all gravity sewer pipe installed with less than three diameters of cover over the top of the pipe barrel shall be provided with concrete weights to prevent flotation.
2. The weights shall be spaced at ten feet centers, with each weight weighing not less than 800 pounds. The weights may be constructed of a cast iron bolt on design, or they may be of the concrete cast in place type for below ground installations. Cast in place weights shall each contain two No. 3 rebars bent over and around the pipe barrel to provide adequate tensile strength to the upper part of the weight. Above ground portions of concrete weights shall be neatly formed and rubbed upon completion of the work.

D. Air Vacuum Valves

1. Where air vacuum valves are specified for installation on sewage force mains, the price bid shall include a standard manhole six feet deep constructed over the force main and a valve assembly constructed in accordance with the following specifications.
2. All air release and vacuum valves shall be sized per the manufacturer and approved by the engineer prior to installation based on the owner’s preferences and the anticipated line pressures.
3. Sewage air and vacuum valves shall permit unrestricted passage of air during filling of the force main. The valve body shall be stainless steel with stainless steel screws, unless indicated (stainless steel) in the plan set. The float and all internal metal parts shall be stainless steel, and the valve shall be designed so that the venting mechanism does not come into contact with sewage. The air and vacuum combination valves for sewage shall be ARI Model D-020 or equal. The valve shall have a NPT inlet sized by the manufacturer and shall be fitted with a back flushing device.
4. The air release valve shall be connected to the force main by a threaded connection on the top of the force main and, if necessary, a tapped tee shall be used for this connection. Between the main connection and the air release valve a shut off valve matching the size of the valve and 1" blow off valve shall be furnished and installed.

5. Contractor is responsible for providing an odor control device for each Combination Air Release/Vacuum Valve.
6. Manufacturers:

    a. APCO, Schaumburg, IL.
    b. ARI Flow Control Accessories
    c. Or Approved Equal

E. Tracer Wire

1. Insulated copper wire shall be installed on all non-metallic pipe force mains. The wire shall be 10 gauge stranded type TW copper marker wire with electronically continuous joints with blue or purple thermoplastic insulation recommended for direct burial. The marker wire shall be brought up to laterals at right of way clean outs and valve boxes so as to be readily accessible to system operators. All wire connections and splices shall be tied and tightly taped with insulated electrical tape. All costs associated with the installation of the marker wire shall be included in the price bid for the pipe.
2. Detection Tape

    a. Green metallic detection tape shall be provided for all PVC pipes.
    b. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tape shall be marked "CAUTION SEWER MAIN BURIED BELOW."
    c. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 3-inches and have a minimum thickness of 5 mil.
    d. Tape shall be marked "CAUTION SEWER MAIN BURIED BELOW."
    e. All tracer wire termination points will use a test station. Test stations shall be Lite Duty Snakepit test station (LD14*TP) green in color, as manufactured by Copperhead industries LLC, Rhino TracerPed Triview Green (P692TGI), or equal.

F. SEWERS ON PIERS

1. Where indicated on the plans or designated by the Engineer, the sewer shall be laid on concrete piers.
2. Pipe on Piers shall be ductile iron restrained joint. Each joint shall be supported by a pier located behind the bell of the pipe. Long span pipe may be used to reduce the number of joints.
3. Where a steel casing pipe is indicated on the drawings, it shall meet the size, strength and material requirements of Section 33 05 23.16. The pipe shall be supported with two spiders at every joint. The casing pipe shall extend a minimum of 4 feet into the embankment on either side of the span. Each end of the casing shall be sealed with 8" thick non-shrink grout bulkhead. The lower end of the casing shall have a 2" diameter galvanized steel drain. Each end of the casing shall be vented with a 2" vent pipe.
4. Piers shall be as detailed on the drawings. Concrete shall have a minimum compressive strength of 4000 psi.
5. All Piers shall be set truly vertical and all horizontal bracing shall be truly horizontal.
6. All exposed ferrous metals shall be painted or coated according to the following schedule:

    a. 1 Latex Primer, 3 coats

b. DTM Acrylic coating Sherwin Williams B66-100/200 Series SW4069 Emerald Ice.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Protect and support existing sewer lines, utilities, and appurtenances in accordance with the Occupational safety and health act (OSHA) of 1970 (PL 91-596), as amended.

B. Utilities:

1. Coordinate with other utilities and the Engineer to eliminate interference.
2. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION:

A. The Contractor shall assume responsibility for all materials and equipment stored, protection of his product and compliance with all federal, state and local safety regulations.

B. All pipe shall be installed in strict accordance with the latest published recommendations of the manufacturer, with particular regard to the preparation of the trench bottom, making of joints, and backfill material, placement and compaction.

C. Care shall be takin in loading, transporting, and unloading to prevent damage to pipe or fittings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before laying, and the Engineer notified of any defect. No piece shall be installed which is defective. Only outside slings shall be used for lifting. Under no conditions shall lifting be from interior surfaces. The Contractor shall be responsible for all materials furnished by him and shall replace all such material found defective in manufacture of damaged in handling after deliver at no additional cost to the Owner.

D. Gravity sewer pipes, structures and manholes shall be installed and tested as specified to the grades, elevations, alignments, and orientations shown on the drawings within the following tolerances:

1. Pipe center line horizontal position at any point:	±0.50 feet
2. Pipe center line horizontal position difference between any two joints (maximum):	0.10 feet
3. Elevations of bases, openings, appurtenances, and tops of any structure or manhole (except pipe invert elevations):	±0.10 feet
4. Horizontal orientation (rotation) of any structure or manhole or any pipe penetration face:	±2.0 degrees

E. Under no circumstances should installation of sewer pipes, structures, and manholes to the tolerances specified herein results in a reverse grade. Any pipe, structures, and manholes outside of these tolerances or at an inverse grade shall be removed and replaced with correct work. Materials may be reinstalled only as approved in writing by the Engineer. Otherwise, removed pipe and manholes shall be removed from the site and replaced at no additional cost to the Owner.

F. Joints shall be made in the following manner:

1. Mechanical Joint: Mechanical joints shall be in accordance with AWWA C600 and the instructions of the manufacturer. Pipe lubricant shall beet the requirements of AWWA C111.
2. Push-on joints shall be made in strict accordance with the manufacturer's instructions.
3. Pipe shall be laid with bell ends upstream.
4. Flange Joints: Flange joints conforming to AWWA C110 can be joined with Class 125 B16.1 flanges shown in ANSI B16.1 but not with Class 250 B16.1 flanges. Flange joints should be fitted so that the contact faces bear uniformly on the gasket. The joint should be made with relatively uniform bolt stress.

G. Pipe shall be laid and maintained to the required lines and grades with fittings at the required locations and spigots centered in bells as applicable.

H. All HDPE Force mains shall be installed in accordance with the requirements of ASTM D2321. Class IV and Class V materials shall not be used in the pipe zone.

I. All ductile iron and PVC force mains and fittings shall be installed in conformance with AWWA C600.

J. All gravity sewer pipe shall be installed utilizing a laser beam device to ensure correct horizontal and vertical alignment. The laser beam shall be of a type approved by the Engineer. Each laser beam shall be calibrated at the factory before being used for this work. At 30 day intervals, each laser beam device shall be field checked and recalibrated if necessary by the manufacturer and a certificate authenticating its accuracy provided to the Engineer.

K. Before the pipe is placed in position, the bottom of the trench shall be uniformly graded so that the pipe will have a bearing for its full length. As each section of pipe is set in place a small excavation shall be made to provide a place for the bell.

L. Each section of pipe shall be inspected and cleaned before being placed in position and it shall be arranged so that any permissible defects are at the top. Earth shall be scraped and tamped under the pipe where necessary to bring it to correct line and grade. Pipe shall be laid with the bell up-grade.

M. The bell of each joint shall be wiped clean before the gasket is inserted in it and the gasket covered with lubricant meeting the requirements of AWWA C111 before the pipe sections are jointed together.

N. Where pipe laying is suspended at the lunch hour, at night, during inclement weather or at any other time, the open end of the pipe line shall be provided with a tight fitting plug in order to prevent the entrance of dirt, mud and animals.

O. The Contractor shall be responsible for removing and cleaning any foreign debris that enters the sewer system.

P. Wye-branches shall be installed in the line opposite every house, and in other locations if so directed by the Engineer. Any omission of these appurtenances shall be corrected by the Contractor without additional cost to the Owner. The Contractor shall maintain a complete and accurate record showing the location of each wye-branch installed. The locations will be given as a distance up grade from each manhole. The written record may be kept on the cut sheet provided by the Engineer and shall be given to him on completion of each line. The record shall state whether the wye-branch is facing right or left when looking up grade and if riser pipe is installed, the amount shall be recorded. In each instance the Contractor will make every effort to install the wye-branch at the location requested by the property owner.

Q. At any location where the sanitary sewer line must cross a potable water line, the sanitary sewer line shall be three feet below the water main. If the distance between the sanitary sewer line and the potable water line is less than three feet, the sanitary sewer line shall be constructed of ductile iron pipe or encased for a distance of 5 feet on each side of the crossing.

R. All disturbed areas along the pipeline shall be grassed as soon as possible after backfilling operations have been completed.

1. The maximum length of area disturbed before soil stabilization techniques will be required shall be 500 feet.

3.4 OBSTRUCTIONS

A. Each building, wall, fence, pole, bridge, railroad, driveway or other property or improvement encountered is to be carefully protected from all injury, and in the event that any of the foregoing are damaged or removed during the progress of the work the same shall be repaired or replaced within a reasonable time, and before final acceptance of the work shall be returned to as good condition as before the work started. Special care must be exercised in trenching under or near railroads in order to avoid or minimize delays and the danger of injury resulting therefrom, and the Contractor must use care in all phases of the construction work, for he will be held liable for damages caused by carelessness.

B. In excavating, backfilling and laying pipe care must be taken not to remove, disturb or injure any water or sewer pipes or other conduits or structures. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operation, and within a reasonable time shall repair any damage done to them. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.

C. When necessary, the Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any pipes, conduits, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss or for interference with the normal operation of the utility.

D. When pipes or conduits providing service to adjoining buildings are broken during the progress of the work, the Contractor shall repair them at once at his own expense, or if required by the

utility involved, shall pay the utility the proper charges for having such repairs made by the utility's own forces. Delays, such as would result in buildings being without service overnight or for a needlessly long period during the day, will not be tolerated, and the Owner reserves the right to make repairs at the Contractor's expense without prior notice. Should it become necessary to move the position of a pipe, conduit or structure it will be done by the Contractor in strict accordance with the instructions given by the Engineer or utility involved.

E. The Contractor shall notify all utilities involved of his intention to excavate in the locations specified and request that any underground utilities be located in advance of the construction work. Where ordered by the Engineer, the Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding them may be determined before pipe laying reaches the obstruction.

3.5 PIPELINES UNDER PAVEMENT

A. Where sewers are to be laid under pavement, and the installation of casing pipe or the use of cast iron pipe inserted in a bored hole is not required or specified, the Contractor will be permitted to cut and replace this pavement. In the event that subsurface operations result in injury or damage to the pavement, the necessary repairs shall be made by the Contractor at no additional cost to the Owner. In the event of the pavement on either side of the pipe line cracking or otherwise becoming disturbed or broken due to Contractor's operations, he shall repair or replace same at his own expense and without additional compensation.

B. In the event of the State Highway Department requiring a bond or certified check to guarantee the replacement of highway paving, the Contractor shall furnish this security at his own expense.

C. Where pipelines are to be laid underneath paved sidewalks, the Contractor will be required to install them by; means of tunneling, and where it becomes necessary to cut and replace the sidewalk it shall be replaced as soon as practicable after the trench has been backfilled and tamped. The replaced surface shall be 12 inches wider than the width of the trench, the excess width being equally distributed on both sides.

D. The Contractor will receive no additional compensation for laying sewers under pavement unless this item of work is set up as a separate item in the Proposal.

3.6 TRAFFIC CONTROL

A. It shall be the responsibility of the Contractor for all traffic control along any portion of the job. Where required, all necessary flagmen, traffic cones and traffic control plans shall be in place on both County roads and State highways to meet road department specifications.

B. Traffic control plan shall be in conformance with the Manual on Uniform Traffic Control Devices. In the event actual physical conditions warrant additional traffic control devices, they shall be installed in conformance with the M.U.T.C.D. as directed by the South Carolina Department of Transportation District Engineer.

C. It should be noted that work for this project takes place along a very busy section of four-lane highway. The contractor shall be familiar with the project area prior to bid and implement an effective traffic control plan in accordance with the M.U.T.C.D.

3.7 FIELD QUALITY CONTROL

A. As each section of the work is completed it shall be thoroughly cleaned and all excess mortar, earth, brick or other foreign matter removed. Before acceptance of the work the system as a whole shall be cleaned and inspected and a full circle of light shall show in all sewer between manholes.

B. The Contractor will be responsible for supplying the Engineer with accurate record drawings at the conclusion of the project. The Contractor will be responsible for keeping “asbuilt” drawings current throughout the duration of the project. Pay requests will not be approved unless “asbuilt” drawings are accurate and are kept current with the work that has been performed.

C. Final CCTV Inspection: The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, in the presence of the Owner after installation of all new sewer pipes. A digital copy of the final inspection shall be provided to the owner and to the engineer. All costs associated with the final CCTV Inspection shall be included in the price bid for pipe.

3.8 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

B. Wherever possible, topsoil shall be removed from all areas to be disturbed by construction, and stockpiled. Land exposure shall be minimized in terms of area and time. All exposed areas subject to erosion shall be covered as quickly as possible by the grassing and seeding specified elsewhere or by mulching or vegetation. Natural vegetation shall be retained whenever possible.

C. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

END OF SECTION 33 31 00

DIVISION II - SECTION 6

ROLLER COMPACTED CONCRETE SPECIAL PROVISIONS

(1) SECTION 501: ROLLER COMPACTED CONCRETE:

1. GENERAL

1.1 Description: Roller Compacted Concrete (RCC) consists of aggregate, portland cement and possibly other supplementary cementitious materials (fly ash, slag), and water. RCC is proportioned, mixed, placed, compacted, and cured in accordance with these specifications. Ensure that the RCC conforms to the lines, grades, thickness, and typical cross section shown in the plans or otherwise established by the RCE. When used as base course, it will be covered with one or more lifts of asphalt as shown on the Plans. Otherwise, the RCC will provide the final riding surface.

2. SUBMITTALS

2.1 Proposed RCC mix design: At least 45 days prior to the beginning of placing of RCC in the roadway, submit a proposed mix design to the State Materials Engineer at the SCDOT Office of Materials and Research for review. If the mix design appears satisfactory to the SCDOT, prepare and test a trial batch mixture at the Contractor's facilities to verify that the design criteria for strength are met. Perform batch mixture preparation and testing in the presence of representatives of the SCDOT Office of Materials and Research. Make no production until an approved mix design has been obtained.

3. MATERIALS

3.1 General: The RCE will approve all materials to be used for RCC construction based on laboratory tests or certifications of representative materials that will be used in the actual construction. All materials must conform to Section 700 of the *SCDOT Standard Specifications for Highway Construction*, unless otherwise modified herein.

3.2 Portland Cement, Fly Ash, and Water-Granulated Blast Furnace Slag: All cementitious material must conform to Section 501.2.1. Pozzolanic substitution for portland cement shall be allowed as specified in Section 701.4.9. If the use of silica fume is desired, have the type and usage pre-approved by the SCDOT State Materials Engineer.

3.3 Aggregates: Obtain all aggregates to be used from qualified sources appearing on the SCDOT Qualified Products Listing for aggregates. Use no aggregate where the plasticity index of the aggregate exceeds 5. Aggregates may be obtained from a single source or borrow pit, or may be a blend of fine and coarse aggregates. Use well-graded aggregate without gradation gaps and conforming to the following gradation:

Sieve Size	Percent Passing by Weight
1 inch	100
¾ inch	90-100
½ inch	70-100
3/8 inch	60-85
#4	40-60
#16	20-40
#100	6-18
#200	2-8

3.4 Water: Use only water conforming to Section 701.2.11 of the Standard Specifications.

3.5 Curing Compound: Where curing compounds are used, only those white-pigmented products shown in the current edition of SCDOT Qualified Products List 33 shall be used.

4. DESIGN STRENGTH: Use a mix design that demonstrates a compressive strength of 4000 psi within 28 days when specimens prepared according to ASTM C 1435 are tested according to AASHTO T 22. At least two sets of three cylinders will be produced, with one set being tested at 4 days and the other at 28 days. To determine the compressive strength for a set, two of the specimens will be tested. If the weaker of the two specimens is at least 90 percent of the strength of the stronger specimen, then the two values will be averaged to determine the overall compressive strength. If the weaker specimen has less than 90 percent of the strength of the stronger specimen, then the third specimen will be broken and all three specimens will be averaged. If one individual result is much lower or much higher than the other two due to defects in the specimen, that value may be discarded at the State Materials Engineer's discretion.

5. EQUIPMENT

5.1 General: Construct roller compacted concrete with any combination of equipment that will produce a completed pavement meeting the requirements for mixing, transporting, placing, compacting, finishing, and curing as provided in this specification.

5.2 Mixing Plant: Locate the mixing plant within a thirty-minute haul time from the point of RCC placement. Use only plants capable of producing an RCC pavement mixture in the proportions defined by the final approved mix design and within the specified tolerances. <u>The capacity of the plant must be sufficient to produce a uniform mixture at a rate compatible with the placement equipment</u>. If the plant is unable to produce material at a rate adequate to prevent unnecessary cold joints and frequent paver stoppages, the RCE may halt production until such time that a plant of appropriate capacity is used. Have the plant inspected and approved by the SCDOT Office of Materials and Research prior to production of material under these specifications.

5.2.1 Pugmill Plant: Use only pugmill plants of the central plant type with a twin-shaft pugmill mixer, capable of batch or continuous mixing, equipped with synchronized metering devices and feeders to maintain the correct proportions of aggregate, cement, pozzolan, and water. Other pugmill plant requirements are as follows:

5.2.1.1 *Aggregate Storage*: If previously blended aggregate is furnished, storage may be in a stockpile from which it is fed directly to a conveyor feeding the mixer. If aggregate is furnished in two size groups, follow proper stockpiling techniques to ensure aggregate separation.

5.2.1.2 *Aggregate Feed Rate*: Use aggregate bins with a feed rate controlled by a variable speed belt, or an operable gate calibrated to accurately deliver any specified quantity of material. If two aggregate size stockpile sources are used, the feed rate from each bin must be readily adjustable to change aggregate proportions, when required. Feed rate controls must maintain the established proportions of aggregate from each

stockpile bin when the combined aggregate delivery is increased or decreased.

5.2.1.3 *Plant Scales*: Plant scales, if utilized, for any weigh box or hopper must comply with Section 701.3.2.

5.2.1.4 *Cement and Pozzolan Material Storage*: Supply separate and independent storage silos for portland cement and pozzolan. At plants with two or more silos in which different types of cement or cementitious materials are stored, ensure that each silo has a sign at each fill inlet to reduce the potential for loading errors. Make the sign from a durable material, with minimum two-inch high by ¼-inch wide letters that are raised, indented, or cut. Ensure that the sign clearly identifies the material that is in the silo and may be easily read even when completely coated with dust. Flat signs with painted or applied letters are not acceptable.

5.2.1.5 *Preblended Portland Cement and Pozzolan*: If using preblended portland cement and pozzolan (such as fly ash or slag), employ blending equipment acceptable to the RCE and demonstrate, with a testing plan, the ability to successfully produce a uniform blended material meeting the mix design requirements. Perform testing on at least a daily basis to ensure both uniformity and proper quantities.

5.2.1.6 *Cement and Pozzolan Feed Unit*: Provide a satisfactory means of dispensing portland cement and pozzolan, volumetrically or by weight, to ensure a uniform and accurate quantity of cementitious material enters the mixer.

5.2.1.7 *Water Control Unit*: Use a water control unit capable of measuring the required amount of water for the approved mix by weight or volume. Ensure that the unit is equipped with an accurate metering device. Vary the amount of water to be used only with the approval of the RCE.

5.2.1.8 *Gob Hopper*: For continuous operating pugmills, provide a gob hopper attached to the end of the final discharge belt to temporarily hold the RCC discharge in order to allow the plant to operate continuously.

5.2.2 *Rotary Drum Mixer:* Provide a rotary drum batch mixer capable of producing a homogeneous mixture, uniform in color, and having all coarse aggregate coated with mortar. Equip the mixer with batching equipment to meet the following requirements:

5.2.2.1 *Weighing Equipment*: Measure the amounts of cement, pozzolan, and aggregate entering into each batch of RCC by direct weighing equipment. Use only weighing equipment that is readily adjustable in order to compensate for the moisture content of the aggregate or to change the proportionate batch weights. Include a visible dial or equally suitable device that will accurately register the scale load from zero to full capacity. The cement and pozzolan may be weighed separately or

cumulatively in the same hopper on the same scale, provided the cement is weighed first.

5.2.2.2 *Weigh Hoppers*: Use only bulk cement and pozzolan weigh hoppers that are equipped with vibrators to operate automatically and continuously while weighing hoppers are being dumped. Ensure that the weigh hopper has sufficient capacity to hold not less than 10 percent in excess of the cementitious material required for one batch.

5.2.2.3 *Water Metering*: Measure the amount of water entering each batch of RCC by weight or volume. Use only equipment capable of measuring the water to within a tolerance of plus or minus one percent and equipped with an accurate gauge or dial measuring device. Vary the amount of water to be used only with the approval of the RCE. During batching, admit water to the mixer only through the water measuring device and then only at the time of charging.

5.2.2.4 *Mixing Time*: Use only drum mixers equipped with an accurate clock or timing device, capable of being locked, for visibly indicating the time of mixing after all the materials, including the water, are in the mixer.

5.2.2.5 *Recharging*: Discharge all material in the drum before recharging. Ensure that the volume of mixed material per batch does not exceed the manufacturer's rated capacity of the mixer.

5.3 Paver: Place RCC using a Material Transfer Device allowing side discharge and track paver to prevent rutting of the Aggregate No. 789 to be placed on the subgrade under the RCC. Place RCC with a high-density asphalt-type paver subject to approval by the RCE. Use only pavers equipped with compacting devices capable of producing an RCC pavement with a minimum of 90 percent of the maximum density in accordance with AASHTO T 180, Method D prior to any additional compaction. Ensure that the paver is of suitable weight and stability to spread and finish the RCC material, without segregation, to the required thickness, smoothness, surface texture, cross-section, and grade.

5.4 Compactors: Use self-propelled steel drum vibratory rollers having a minimum static weight of 10 tons for primary compaction. For final compaction, use either a steel drum roller, operated in a static mode, or a rubber-tired roller of equal or greater weight. Only use walk-behind vibratory rollers or plate tampers for compacting areas inaccessible to large rollers.

5.5 Haul Trucks: Use trucks for hauling the RCC material from the plant to the paver with covers available to protect the material from inclement weather. To ensure adequate and continuous supply of RCC material to the paver, have a sufficient number of trucks. If the number of trucks is inadequate to prevent frequent starts and stops of the paver, cease production until additional trucks are obtained.

5.6 Water Trucks: Keep at least one water truck, or other similar equipment, on-site and available for use throughout the paving and curing process. Equip such equipment with a spreader pipe containing fog spray nozzles capable of evenly applying a fine spray of water to the surface of the RCC without damaging the final surface.

5.7 Inspection of Equipment: Before start-up, the Contractor's equipment will be carefully inspected. Should any of the equipment fail to operate properly, cease work until the deficiencies are corrected.

5.8 Access for Inspection and Calibration: Provide the RCE or RCE's representative access at all times for any plant, equipment, or machinery to be used in order to check calibration, scales, controls, or operating adjustments.

6. CONSTRUCTION REQUIREMENTS

6.1 Preparation of Subgrade: Before the RCC processing begins, prepare the subgrade in accordance with Section 208 of the SCDOT Standard Specifications.

6.2 Quality Control Test Specimens: For each day's production, up to 1500 cubic yards of mix produced, prepare at least three sets of test specimens in accordance with ASTM C 1435 under the direct observation of the RCE or RCE's representative. A set of specimens consists of three cylinders. Make an additional three sets for each additional 1500 cubic yards or fraction thereof. Cure and transport the specimens to the Contractor's (or mix producer's) Office of Materials and Research-approved laboratory in accordance with ASTM C 31. Test two cylinders for compressive strength in accordance with ASTM C 39 at 3 days, 7 days, and 28 days under the direct observation of the RCE or RCE's representative. If the measured compressive strength between two cylinders varies by more than 10 percent of the stronger cylinder, test the third cylinder and average the results of the three cylinders. Otherwise, average the measured compressive strengths of the two cylinders tested at 28 days to determine the compressive strength of the lot. Retain the compressive strength test results for inspection by the RCE.

If the compressive strength measured at 3 days indicates that the 28-day compressive strength will be less than 3500 psi, investigate the potential causes of the low strengths and report to the RCE within 24 hours. If the compressive strength measured at 3 days indicates 28-day compressive strengths less than 3200 psi, immediately stop production and notify the RCE. Do not resume production until the cause of the discrepancy has been determined to the satisfaction of the RCE. The RCE may adjust compressive strength targets at 3 days as production continues based on field experience.

6.3 Mixing Process: Use the same mixture for the entire project unless otherwise stated in the project documents. If, during production, the source of portland cement, pozzolan, or aggregates is changed, then suspend production and submit a new mix design to the RCE for approval. Do not exceed the manufacturer's rated capacity for dry concrete mixtures in the mixing chamber. Keep the sides of the mixer and mixer blades free of hardened RCC or other buildups. Routinely check mixer blades for wear and replace if wear is sufficient to cause inadequate mixing.

6.3.1 *Mixing Time*: Use a mixing time adequate to ensure a thorough and complete mixing of all materials. Do not allow the mixing time, after all materials including water are in the mixer, to be less than 1½ minutes for one cubic yard and 20 seconds for each additional cubic yard.

6.3.2 *Mixture Ingredient Tolerances*: Ensure that the mixing plant receives the quantities of individual ingredients to within the following tolerances:

Material	Variation by Weight
Cementious Material	±2.0%

Water	±3.0%
Aggregates	±4.0%

6.3.3 *Plant Calibration:* Prior to commencement of RCC production, carry out a complete and comprehensive calibration of the plant in accordance with the manufacturer's recommended practice. Provide all scales, containers, and other items necessary to complete the calibration. After completion of the initial calibration, calibrate the plant periodically as directed by the RCE. Plants listed on SCDOT Qualified Product List 28 at the time of RCC production are exempt from this requirement, although the SCDOT reserves the right to require additional calibration if variation in mixture quantities are suspected.

6.3.4 *Daily Reports:* Supply daily plant records of production and quantities of materials used that day to the RCE. These records may be used as a check on plant calibration.

6.4 Transportation: Transport the RCC pavement material from the plant to the areas to be paved in dump trucks equipped with retractable protective covers for protection from rain or excessive evaporation. Ensure that the trucks are dumped clean with no buildup or hanging of RCC material in the corners. Have the dump trucks deposit the RCC material directly into the hopper of the paver or into a secondary material distribution system that deposits the material into the paver hopper. Dump truck delivery must be timed and scheduled so that RCC material is spread and compacted within the specified time limits.

6.5 Placing:

6.5.1 *Subbase Condition:* Prior to RCC placement, ensure that the surface of the subbase is clean and free of foreign material, ponded water, and frost. Ensure that the subbase is uniformly moist at the time of RCC placement. If sprinkling of water is required to remoisten certain areas, ensure that the method of sprinkling will not form mud or pools of freestanding water. Correct soft or yielding subbase areas prior to placement of RCC as specified in Section 6.1 above.

6.5.2 *Weather Conditions:*

6.5.2.1 *Cold Weather Precautions:* Employ cold weather precautions as detailed in Section 501.4.6 of the Standard Specifications.

6.5.2.2 *Hot Weather Precautions:* During periods of hot weather or windy conditions, take special precautions to minimize moisture loss due to evaporation. Cooling of aggregate stockpiles by shading or the use of a fine mist may be required. Protective covers may be required on dump trucks. Keep the surface of the newly placed RCC pavement continuously moist.

6.5.2.3 *Rain Limitations:* Conduct no placement of RCC pavement during rain conditions sufficient to be detrimental to the finished product. Placement may continue during light rain or mists provided the surface of the RCC pavement is not eroded or damaged in any way. Use dump truck covers during these periods. The RCE may terminate paving at any time when, in the RCE’s judgement, the rain is detrimental to the finished product.

6.5.3 *Paver Requirements:* Place all RCC with an approved paver as specified in Section 5.3 and also meet the following requirements:

6.5.3.1 *Filling the Paver:* Do not allow the quantity of RCC material in the paver to approach empty between loads. Maintain the material above the auger at all times during paving.
Stopping the Paver: Ensure that the paver proceeds in a steady, continuous operation with minimal starts and stops, except to begin a new lane. Maximum paver speed during laydown is 10 feet per minute. Higher paver speeds may be allowed at the discretion of the RCE if the higher speeds may be obtained without distress to the final product or cause additional starts and stops.

6.5.3.2 *Surface Condition:* Ensure that the surface of the RCC pavement is smooth, uniform, and continuous without excessive tears, ridges, or aggregate segregation once it leaves the paver.

6.5.4 *Inaccessible Areas:* Pave all areas inaccessible to either roller or paver with cast-in-place concrete meeting the compressive strength requirements of these specifications.

6.5.5 *Adjacent Lane Pavement:* Place adjacent paving lanes within 60 minutes. If more than 60 minutes elapses between placement of adjacent lanes, the vertical joint must be considered a cold joint and prepared in accordance with Section 6.7 below. At the discretion of the RCE, this time may be increased or decreased depending on ambient conditions of temperature, wind, and humidity. Multiple pavers may be used in tandem to reduce the occurrence of cold joints.

6.5.6 *Hand Spreading:* Broadcasting or fanning the RCC material across areas being compacted is not permissible. Such additions of materials may only be done immediately behind the paver and before any compaction has taken place. Any segregated coarse aggregate shall be removed from the surface before rolling.

6.5.7 *Segregation:* If segregation occurs in the RCC during paving operations, placement shall cease until the cause is determined and corrected to the satisfaction of the RCE. If the segregation is judged by the RCE to be severe, remove and replace the segregated area at no additional cost to the Department.

6.6 Compaction:

6.6.1 *Time to Compaction Start:* Ensure that compaction begins with the placement process and is completed within 60 minutes of the start of the mixing at the plant. The time may be increased or decreased at the discretion of the RCE depending on ambient conditions of temperature and humidity. Do not permit delays in rolling unless approved by the RCE. Plan operations and supply sufficient equipment to ensure that these criteria are met.

6.6.2 *Rolling:* Determine the sequence and number of passes by vibratory and non-vibratory rollers to obtain the specified density and surface finish. Only operate rollers in the vibratory mode while in motion. Rubber-tire rollers may be used for final compaction. Use additional rollers if specific density requirements are not obtained or if placing operations get ahead of the rolling operations.

6.6.3 *Rolling Longitudinal and Transverse Joints:* Do not operate the roller within 2 feet of the edge of a freshly placed lane until the adjacent lane is placed. Then, roll both edges of the two lanes together within the allowable time. If a cold joint is planned, then roll the complete lane and follow cold joint procedures as specified in Section 6.7 below.

6.6.4 *Inaccessible Areas:* Compact areas inaccessible to large rollers using walk-behind rollers or hand tampers.

6.6.5 *Density Requirements:* Field density tests will be performed in accordance with SC-T-33 as soon as possible, but no later than 30 minutes after the completion of the rolling. Only wet density is used for evaluation. The required minimum density is 98 percent of the maximum laboratory density obtained according to AASHTO T 180 (Method D). The in-place density and moisture content may be determined with a nuclear moisture-density gauge. The gauge will be calibrated for moisture content at the beginning of the work and at any time during the work. RCC properly placed and compacted, but not meeting the density requirements, shall be cored and tested at the Contractor's expense. If the tested area achieves 28-day design strength, it will be paid at the full unit price. If the tested area indicates strength less than 3500 psi but greater than 3150 psi, payment will be made as follows:

Compressive Strength (psi)	Price Reduction (Percent of Unit Bid Price)
3300-3499	5
3150-3299	15

If the cores indicate strengths less than 3150 psi at 28 days or longer, the Department will evaluate the results and may reject the affected area and require removal and replacement or elect to pay at a reduced rate.

6.7 Joints:

6.7.1 *Fresh Vertical Joints:* A joint is considered a fresh joint when an adjacent RCC lane is placed within 60 minutes of placing the previous lane or as specified by the RCE based on ambient conditions. Fresh joints do not require special treatment.

6.7.2 *Cold Vertical Joints:* Any planned or unplanned construction joints that do not qualify as fresh joints are considered cold joints. Prior to placing fresh RCC mixture against a compacted cold vertical joint, thoroughly clean the cold joint of loose or foreign material. Wet the vertical joint face and maintain it in a moist condition immediately prior to placement of the adjacent lane.

6.7.2.1 *Sawing Cold Vertical Joints:* For uncompacted surfaces or slopes more than 15 degrees from the vertical, cut the joint vertically for the full depth. Within 2 hours of final compaction, the edge of a cold joint may be cut with approved mechanical equipment. For edges cut after 2 hours, sawcut to the full depth of the pavement. Demonstrate any modification or substitution of the sawcutting procedure to the RCE for approval prior to use. In no

case allow cutting of the edge to cause raveling or tearing of the surface. Moisten the cut edge immediately prior to placement of the adjacent lane.

6.7.3 *RCC Pavement Joints at Structures:* Line structures such as manholes, valves, or concrete curb and gutter with joint filler as defined in Section 501.2.6.1 of the Standard Specifications.

6.7.4 *Control Joints:* Construct transverse contraction joints at regular intervals up to 20-feet in the RCC pavement to induce cracking at pre-selected locations unless otherwise indicated on the Plans or as directed by the RCE. At the option of the Contractor, soft-cut or green-cut saws may be utilized as soon as possible behind the rolling operation and set to manufacturer's recommendations. Conventional cut saws must be used as soon as the sawing operation will not result in raveling or other damage to the RCC pavement, but not more than 18 hours after RCC placement. Cut all joints to 1/4 the depth of the RCC pavement to a single saw blade width.

6.8 Finishing: Ensure that the finished surface of the RCC pavement, when tested with a 10-foot straightedge or crown surface template, does not vary from the straightedge or template by more than 1/4 inch at any one point and shall be within 5/8 inch of the specified finished grade. When surface irregularities are outside these tolerances, diamond-grind the surface to meet the tolerance at no additional cost to the SCDOT.

6.9 Curing: Immediately after final rolling and compaction testing, keep the surface of the RCC pavement continuously moist until an approved curing compound, a suitable prime coat, or a layer of asphalt concrete is applied.

6.9.1 *Water Cure:* Apply water cure by water trucks equipped with fog spray nozzles, soaking hoses, sprinkling system, or other means such that a uniform moist condition on the surface of the RCC is ensured. Apply this moisture in a manner that will not erode or damage the surface of the finished RCC pavement.

6.9.2 *Curing Compound:* Do not use curing compounds when the RCC material is to be promptly covered with asphalt. Apply curing compound as indicated in Section 501.4.11 of the Standard Specifications, except that the minimum rate of curing compound application is 0.09 gallons per square yard (11 square yards per gallon) unless a higher rate is specified by the curing compound manufacturer.

6.10 Traffic: Protect the RCC from vehicular traffic during the curing period. Completed portions of the RCC pavement may be opened to automotive and light truck traffic as soon as the strength is sufficient to prevent damage to the RCC. The pavement may be opened to unrestricted traffic after 4 days. If the temperature drops below 40^{o} F, then the period of time the temperature is below 40^{o} F will be added to the minimum time to opening.

6.11 Maintenance: Maintain the RCC pavement in good condition until all work is completed and accepted. Perform such maintenance at no additional cost to the SCDOT.

6.12 Thickness: Provide and operate equipment capable of extracting a small (approximately 1 inch diameter or greater) core to determine the pavement thickness. Extract samples in the presence of the RCE or RCE's representative unless otherwise directed.

6.13 Thickness Tolerance - The thickness of the completed RCC is measured at staggered intervals not to exceed 250 feet in length for two-lane roads.

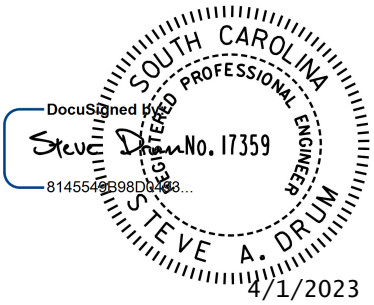
Measure the core to the nearest 1/8 inch at three different, evenly spaced locations and record the average. Where the RCC is deficient by more than 1/2 inch, correct such areas by removal and replacement. Where the measured thickness is more than 1/2 inch thicker than shown on the Plans, it is considered as the specified thickness, plus 1/2 inch. The average job thickness is the average of the depth measurements determined as specified above. Should this average thickness be more than 1/4 inch below the specified thickness, an adjusted unit price is used in calculating payment. This adjusted contract unit price bears the same ratio to the contract unit price as the square of the average thickness bears to the square of the specified thickness. When the contract includes more than one road, each road is considered separately.

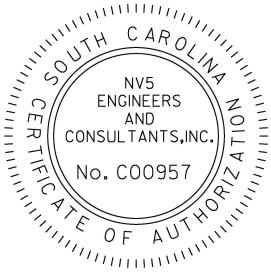
7. MEASUREMENT AND PAYMENT

7.1 Measurement: The quantity measured for payment under this supplemental specification is the number of square yards of RCC Pavement completed and accepted, and measured in place along the surface of normal width of through-lane pavement. Pavement constructed outside the area designated to be paved will be disregarded in computing the number of square yards. Construction of control joints will not be measured separately and no direct payment will be made for this work.

7.2 Basis of Payment: The quantity, as measured above, will be paid for at the contract unit price for RCC Pavement, of the thickness specified, which price and payment will be full compensation for furnishing all materials, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work. Pavement that is deficient in thickness, but is permitted to be left in place, will be paid at the reduced unit price as provided in Section 6.13. No compensation will be allowed for the materials or labor involved in the removal of defective material. Payment includes all direct and indirect costs and expenses required to complete the work. Payment will be made under:

Item Number	Description	Unit
5010108	ROLLER COMPACTED CONCRETE PAVEMENT-8” UNIFORM	SY





DIVISION II - SECTION 7

RIGHT-OF-WAY PLAT SPECIAL PROVISIONS

SECTION 809: RIGHT OF WAY PLAT:

Description:

The contractor by the "Substantial Work Complete" date shall prepare a right of way plat signed and sealed by a Professional Land Surveyor (PLS) licensed to practice in the state of South Carolina. The right of way plat shall be in accordance with the requirements of Section 49-460-A "General Property Survey" as outlined in the South Carolina "Standards of Practice Manual" for land surveyors. A copy of the plat will be recorded, by the contractor, in the Register Mesne Conveyance (RMC) office of the county or counties in which the project resides. The contractor will provide one copy of the plat on a full sized plan sheet(s) (22" X 36") and submit to the resident construction engineer to be included in the as-built plans. In addition, the contractor shall furnish one PDF copy of the plat sheet(s) and one copy of the cad file(s) of the plat to York County.

Materials: Rebar Cap R/W Marker

Materials used shall comply with those listed on SCDOT Standard Drawing Nos. 809-105-00 or 809-110-00.

Construction Requirements:

The PLS shall set right of way markers along all new right of way lines as well as along any present right of way being retained by the Department at intervals listed on the SCDOT Standard Drawings. Right of way markers shall not be placed at points common to side property lines and/or corners. In the event that the plan reflects a break in the right of way along a side property line the right of way marker will not be set without the side property line being retraced and established by way of survey. The PLS shall prepare a plat documenting the location of all Right of Way Markers set and reflecting the as-built station and offset from the plan alignment. The plat shall show the entire project corridor as an enclosed strip or parcel of land to include the mainline and all side roads as defined on the project plan.

Measurement and Basis of Payment:

The item Right of Way Plat is paid on a lump sum (LS) basis; and therefore, there is no specific measurement for this item. The unit price bid for Property Right of Way Plat shall include all costs for labor, materials, equipment, services of a PLS and any related fees or costs associated with producing a plat, recording the plat at the RMC office, and all required copies. Each marker placed in accordance with the Standard Drawings complete and accepted will be measured and paid at the unit price bid.

Item No.	Description	Unit
8091010	RIGHT OF WAY MARKER (REBAR AND CAP)	EA
8091000	RIGHT OF WAY MARKER (REINFORCED CONCRETE)	EA
8091050	RIGHT OF WAY PLAT	LS

DIVISION III

ATTACHMENTS