

NOTIFICATION OF ADDENDUM

ADDENDUM NO. 1

DATED 7/23/2021

Control	0617-02-001
Project	BR 2021(752)
Highway	PR 22
County	NUECES

Ladies/Gentlemen:

Attached please find an addendum on the above captioned project. Included in the attachment is an addendum notification which details the changes and the respective proposal pages which were added and/or changed.

Except for new bid insert pages, it is unnecessary to return any of the pages attached.

Bid insert pages must be returned with the bid proposal submitted to the Department, unless your firm is submitting a bid using a computer print out. The computer print out must be changed to reflect the new bid item information.

Contractors and material suppliers, etc. who have previously been furnished informational proposals are not being furnished a copy of the addendum. If you have a subcontractor on the above project, please advise them of this addendum. Acknowledgment of this addendum is not requested if your company has been issued a proposal stamped "This Proposal Issued for Informational Purposes."

You are required to acknowledge receipt of this addendum on the Addendum Acknowledgement form contained in your bid proposal by placing a mark in the box next to the respective addendum.

Failure to Acknowledge receipt of this addendum in your bid proposal will result in your bid not being read.

SUBJECT: PLANS AND PROPOSAL ADDENDUMS

PROJECT: BR 2021(752)

CONTROL: 0617-02-001

COUNTY: NUECES

LETTING: 08/04/2021

REFERENCE NO: 0723

PROPOSAL ADDENDUMS

- _ PROPOSAL COVER
X BID INSERTS (SH. NO.: ALL SHEETS)
_ GENERAL NOTES (SH. NO.:)
X SPEC LIST (SH. NO.: 3-3)
_ SPECIAL PROVISIONS:
_ ADDED:

DELETED:

- X SPECIAL SPECIFICATIONS:
ADDED: 4189

DELETED:

- X OTHER: PLAN SHEET & OTHER CHANGES

DESCRIPTION OF ABOVE CHANGES
(INCLUDING PLANS SHEET CHANGES)

*****BID INSERTS*****

ADDING THE FOLLOWING ITEM: 4189-6001

*****SPEC LIST*****

ADDING THE FOLLOWING SPEC: 4189

*****PLAN SHEETS*****

SHEET 004A (ESTIMATE & QUANTITY): ADDING THE ABOVE MENTIONED ITEM

Printed Name of Authorized Signer: _____

Signature of Authorized Signer: _____ Date: _____

PROJECT BR 2021(752)
 COUNTY NUECES

Proposal Sheet
 TxDOT
 FORM 234-B I-61-5M

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	305	6018		SALV,HAUL & STKPL RCL APH PV (2") DOLLARS and CENTS	SY	1,200.000	1
	340	6104	003	D-GR HMA(SQ) TY-D SAC-B PG64-22 DOLLARS and CENTS	TON	2.000	2
	354	6045		PLANE ASPH CONC PAV (2") DOLLARS and CENTS	SY	1,200.000	3
	427	6007	003	EPOXY WATERPROOF FINISH (TY X) DOLLARS and CENTS	SF	9,660.000	4
	428	6001		PENETRATING CONCRETE SURFACE TREATMENT DOLLARS and CENTS	SY	11,835.000	5
	429	6001		CONC STR REPAIR(CLEAN & COAT WTH EPOXY) DOLLARS and CENTS	SF	72.000	6
	429	6002		CONC STR REPAIR (EPOXY MORTAR) DOLLARS and CENTS	SF	41.000	7
	429	6003		CONC STR REPAIR(DECK REP(PART DEPTH)) DOLLARS and CENTS	SF	32.000	8
	429	6007		CONC STR REPAIR (VERTICAL & OVER- HEAD) DOLLARS and CENTS	SF	2,006.000	9

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	439	6013		MULTI-LAYER POLYMER OVERLAY DOLLARS and CENTS	SY	17,280.000	10
	446	6050	005	CLEAN & PAINT BASE PLATE DOLLARS and CENTS	EA	14.000	11
	483	6013		SHOT BLASTING DOLLARS and CENTS	SY	17,280.000	12
	483	6016		MILLING CONCRETE SLAB (1/4IN) DOLLARS and CENTS	SY	2,400.000	13
	500	6001		MOBILIZATION DOLLARS and CENTS	LS	1.000	14
	502	6001	008	BARRICADES, SIGNS AND TRAFFIC HAN- DLING DOLLARS and CENTS	MO	19.000	15
	506	6022	002	CONSTRUCTION EXITS (INSTALL) (TY 3) DOLLARS and CENTS	SY	156.000	16
	506	6024	002	CONSTRUCTION EXITS (REMOVE) DOLLARS and CENTS	SY	156.000	17
	506	6035	002	SANDBAGS FOR EROSION CONTROL DOLLARS and CENTS	EA	66.000	18
	506	6038	002	TEMP SEDMT CONT FENCE (INSTALL) DOLLARS and CENTS	LF	2,000.000	19
	506	6039	002	TEMP SEDMT CONT FENCE (REMOVE) DOLLARS and CENTS	LF	2,000.000	20
	510	6003		ONE-WAY TRAF CONT (PORT TRAF SIG) DOLLARS and CENTS	MO	4.000	21

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	512	6025		PORT CTB (MOVE)(SGL SLP)(TY 1) DOLLARS and CENTS	LF	15,390.000	22
	512	6067		PTB (FRN&INSTL)(F SHAPE)(TY 1) OR (STL) DOLLARS and CENTS	LF	3,930.000	23
	512	6069		PTB (MOVE)(F SHAPE)(TY 1) OR (STL) DOLLARS and CENTS	LF	3,780.000	24
	512	6071		PTB (REMOVE)(F SHAPE)(TY 1) OR (STL) DOLLARS and CENTS	LF	3,930.000	25
	514	6001		PERM CTB (SGL SLOPE) (TY 1) (42) DOLLARS and CENTS	LF	60.000	26
	514	6004		PERM CTB (SGL SLOPE) (TY 4) (42) DOLLARS and CENTS	LF	10.000	27
	545	6003		CRASH CUSH ATTEN (MOVE & RESET) DOLLARS and CENTS	EA	1.000	28
	545	6005		CRASH CUSH ATTEN (REMOVE) DOLLARS and CENTS	EA	1.000	29
	545	6019		CRASH CUSH ATTEN (INSTL)(S)(N)(TL3) DOLLARS and CENTS	EA	1.000	30
	662	6046		WK ZN PAV MRK REMOV (REFL) TY I-A DOLLARS and CENTS	EA	762.000	31
	662	6048		WK ZN PAV MRK REMOV (REFL) TY I-C DOLLARS and CENTS	EA	659.000	32
	662	6056		WK ZN PAV MRK REMOV (TRAF BTN) TY W DOLLARS and CENTS	EA	1,971.000	33

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	662	6058		WK ZN PAV MRK REMOV (TRAF BTN) TY Y DOLLARS and CENTS	EA	2,279.000	34
	662	6075		WK ZN PAV MRK REMOV (W)24"(SLD) DOLLARS and CENTS	LF	52.000	35
	662	6109		WK ZN PAV MRK SHT TERM (TAB)TY W DOLLARS and CENTS	EA	765.000	36
	668	6005		PREFAB PAV MRK TY B (W)(4")(BRK)CNTST DOLLARS and CENTS	LF	1,640.000	37
	672	6010		REFL PAV MRKR TY II-C-R DOLLARS and CENTS	EA	128.000	38
	677	6001		ELIM EXT PAV MRK & MRKS (4") DOLLARS and CENTS	LF	7,491.000	39
	678	6001		PAV SURF PREP FOR MRK (4") DOLLARS and CENTS	LF	14,042.000	40
	678	6003		PAV SURF PREP FOR MRK (7") DOLLARS and CENTS	LF	1,640.000	41
	776	6036		REPAIR (STL POST RETROFIT) DOLLARS and CENTS	EA	12.000	42
	776	6046		REPAIR METAL RAIL (C4) DOLLARS and CENTS	LF	76.000	43
	776	6054		REPAIR (CORROSION MITIGATION) DOLLARS and CENTS	EA	800.000	44
	780	6002		CNC CRACK REPAIR (DISCRETE)(INJECT) DOLLARS and CENTS	LF	11.000	45

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	780	6004		CONC CRCK REPR(DISCRETE)(ROUT AND SEAL) DOLLARS and CENTS	LF	496.000	46
	784	6192		REPAIR STEEL (CORROSION MITIGATION) DOLLARS and CENTS	EA	24.000	47
	785	6004		BRIDGE JOINT REPAIR (ARMOR) DOLLARS and CENTS	LF	104.000	48
	785	6010		BRIDGE JOINT REPLACEMENT (ARMOR) DOLLARS and CENTS	LF	1,872.000	49
	786	6001		CARBON FIBER REINF POLYMER PROTEC- TION DOLLARS and CENTS	SF	13,535.000	50
	786	6002		CARBON FIBER REINF POLYMER STRENGTHNING DOLLARS and CENTS	SF	906.000	51
	4002	6001		REPLACE ELASTOMERIC BEARING PADS DOLLARS and CENTS	EA	155.000	52
	4002	6002		REPLACE ELASTOMERIC BEARING PADS (LARGE DOLLARS and CENTS	EA	16.000	53
	4106	6006		POLYESTER POLYMER CONC OVERLAY (2- 1/4") DOLLARS and CENTS	SY	2,400.000	54
	4132	6001		EMBEDDED GALVANIC ANODES DOLLARS and CENTS	EA	3,240.000	55
	4188	6001		FRP ENCAPSULATION DOLLARS and CENTS	LS	1.000	56

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	4189	6001		CATHODIC PROTECTION SYSTEM DOLLARS and CENTS	LS	1.000	57
	5048	6002		FLOATING TURBIDITY BARRIER(FUR & INST) DOLLARS and CENTS	LF	1,150.000	58
	5048	6003		FLOATING TURBIDITY BARRIER (REMOVE) DOLLARS and CENTS	LF	1,150.000	59
	6000	6003		REPLACE ABOVE-GROUND CONDUIT DOLLARS and CENTS	LF	5.000	60
	6001	6002		PORTABLE CHANGEABLE MESSAGE SIGN DOLLARS and CENTS	EA	6.000	61
	6038	6001		MULTIPOLYMER PAV MRK (W)(4")(SLD) DOLLARS and CENTS	LF	6,561.000	62
	6038	6002		MULTIPOLYMER PAV MRK (W)(4")(BRK) DOLLARS and CENTS	LF	2,560.000	63
	6038	6014		MULTIPOLYMER PAV MRK (Y)(4")(SLD) DOLLARS and CENTS	LF	6,561.000	64
	6185	6002	002	TMA (STATIONARY) DOLLARS and CENTS	DAY	12.000	65
	6185	6003	002	TMA (MOBILE OPERATION) DOLLARS and CENTS	HR	48.000	66

CONTROL : 0617-02-001
PROJECT : BR 2021(752)
HIGHWAY : PR 22
COUNTY : NUECES

TEXAS DEPARTMENT OF TRANSPORTATION

GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS: ADOPTED BY THE TEXAS DEPARTMENT OF
----- TRANSPORTATION NOVEMBER 1, 2014.
STANDARD SPECIFICATIONS ARE INCORPORATED
INTO THE CONTRACT BY REFERENCE.

ITEMS 1 TO 9 INCL., GENERAL REQUIREMENTS AND COVENANTS
ITEM 305 SALVAGING, HAULING, AND STOCKPILING RECLAIMABLE ASPHALT
PAVEMENT
ITEM 340 DENSE-GRADED HOT-MIX ASPHALT (SMALL QUANTITY) (300)(301)
(320)(520)(585)
ITEM 354 PLANING AND TEXTURING PAVEMENT
ITEM 427 SURFACE FINISHES FOR CONCRETE (420)
ITEM 428 PENETRATING CONCRETE SURFACE TREATMENT (427)
ITEM 429 CONCRETE STRUCTURE REPAIR (421)(431)(440)(780)
ITEM 439 BRIDGE DECK OVERLAYS (420)(421)(429)(440)(483)
ITEM 446 FIELD CLEANING AND PAINTING STEEL (441)(445)
ITEM 483 CONCRETE BRIDGE DECK SURFACING
ITEM 500 MOBILIZATION
ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING
ITEM 504 FIELD OFFICE AND LABORATORY
ITEM 506 TEMPORARY EROSION, SEDIMENTATION, AND ENVIRONMENTAL
CONTROLS (161)(432)(556)
ITEM 510 ONE-WAY TRAFFIC CONTROL (502)
ITEM 512 PORTABLE TRAFFIC BARRIER (420)(421)(424)(440)(442)
ITEM 514 PERMANENT CONCRETE TRAFFIC BARRIER (400)(416)(420)(421)
(424)(440)(442)(448)
ITEM 545 CRASH CUSHION ATTENUATORS (421)
ITEM 662 WORK ZONE PAVEMENT MARKINGS (666)(668)(672)(677)
ITEM 668 PREFABRICATED PAVEMENT MARKINGS (678)
ITEM 672 RAISED PAVEMENT MARKERS (677)(678)
ITEM 677 ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS (300)
(302)(316)
ITEM 678 PAVEMENT SURFACE PREPARATION FOR MARKINGS (677)
ITEM 776 METAL RAIL REPAIR (429)(441)(445)(446)(448)(450)
ITEM 780 CONCRETE CRACK REPAIR

ITEM 784 STEEL MEMBER REPAIR (421) (441) (442) (446) (448) (780)
 ITEM 785 BRIDGE JOINT REPAIR OR REPLACEMENT (429) (438) (448) (449)
 (454)
 ITEM 786 CARBON FIBER REINFORCED POLYMER (CFRP) (429)

SPECIAL PROVISIONS: SPECIAL PROVISIONS WILL GOVERN AND TAKE
 ----- PRECEDENCE OVER THE SPECIFICATIONS ENUMERATED
 HEREON WHEREVER IN CONFLICT THEREWITH.

REQUIRED CONTRACT PROVISIONS, FEDERAL-AID CONSTRUCTION CONTRACTS
 (FORM FHWA 1273, MAY, 2012)

WAGE RATES

SPECIAL PROVISION "NONDISCRIMINATION" (000---002)
 SPECIAL PROVISION "CERTIFICATION OF NONDISCRIMINATION IN EMPLOYMENT"
 (000---003)
 SPECIAL PROVISION "NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO
 ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE
 ORDER 11246" (000---004)
 SPECIAL PROVISION "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
 CONSTRUCTION CONTRACT SPECIFICATIONS" (000---005)
 SPECIAL PROVISION "ONTHEJOB TRAINING PROGRAM" (000---006)
 SPECIAL PROVISION "CERTIFICATE OF INTERESTED PARTIES (FORM 1295)"
 (000--1019)
 SPECIAL PROVISION "CARGO PREFERENCE ACT REQUIREMENTS IN FEDERAL AID
 CONTRACTS" (000---241)
 SPECIAL PROVISION "DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL AID
 CONTRACTS" (000---394)
 SPECIAL PROVISION "SCHEDULE OF LIQUIDATED DAMAGES" (000---658)
 SPECIAL PROVISION "NOTICE OF CONTRACTOR PERFORMANCE EVALUATIONS"
 (000---659)
 SPECIAL PROVISIONS TO ITEM 2 (002---009) (002---011) (002---013)
 SPECIAL PROVISIONS TO ITEM 3 (003---011) (003---013)
 SPECIAL PROVISIONS TO ITEM 5 (005---002) (005---003)
 SPECIAL PROVISIONS TO ITEM 6 (006---001) (006---012)
 SPECIAL PROVISIONS TO ITEM 7 (007---004) (007---008) (007---010)
 (007---011)
 SPECIAL PROVISIONS TO ITEM 8 (008---030) (008---033)
 SPECIAL PROVISIONS TO ITEM 9 (009---010) (009---011)
 SPECIAL PROVISION TO ITEM 300 (300---017)
 SPECIAL PROVISION TO ITEM 302 (302---003)
 SPECIAL PROVISION TO ITEM 316 (316---002)
 SPECIAL PROVISION TO ITEM 340 (340---003)
 SPECIAL PROVISION TO ITEM 421 (421---009)
 SPECIAL PROVISION TO ITEM 427 (427---003)
 SPECIAL PROVISION TO ITEM 440 (440---004)
 SPECIAL PROVISION TO ITEM 441 (441---002)
 SPECIAL PROVISION TO ITEM 442 (442---001)
 SPECIAL PROVISION TO ITEM 446 (446---005)
 SPECIAL PROVISION TO ITEM 449 (449---002)
 SPECIAL PROVISION TO ITEM 502 (502---008)
 SPECIAL PROVISION TO ITEM 506 (506---002)
 SPECIAL PROVISION TO ITEM 520 (520---002)

SPECIAL PROVISION TO ITEM 666 (666---007)
SPECIAL PROVISION TO SPECIAL SPECIFICATION ITEM 6185 (6185--002)

SPECIAL SPECIFICATIONS:

ITEM 4002 REPLACING ELASTOMERIC BEARING PADS
ITEM 4106 POLYESTER POLYMER CONCRETE BRIDGE DECK OVERLAY
ITEM 4132 EMBEDDED GALVANIC ANODES
ITEM 4188 FRP ENCAPSULATION SYSTEM
ITEM 4189 CATHODIC PROTECTION SYSTEM
ITEM 5048 FLOATING TURBIDITY BARRIER
ITEM 6000 ILLUMINATION MAINTENANCE
ITEM 6001 PORTABLE CHANGEABLE MESSAGE SIGN
ITEM 6038 MULTI-POLYMER PAVEMENT MARKINGS (MPM) (677)(6291)
ITEM 6185 TRUCK MOUNTED ATTENUATOR (TMA) AND TRAILER ATTENUATOR (TA)
ITEM 6291 MOBILE RETROREFLECTIVITY DATA COLLECTION FOR PAVEMENT
MARKINGS

GENERAL: THE ABOVE-LISTED SPECIFICATION ITEMS ARE THOSE UNDER WHICH
----- PAYMENT IS TO BE MADE. THESE, TOGETHER WITH SUCH OTHER
PERTINENT ITEMS, IF ANY, AS MAY BE REFERRED TO IN THE ABOVE-
LISTED SPECIFICATION ITEMS, AND INCLUDING THE SPECIAL
PROVISIONS LISTED ABOVE, CONSTITUTE THE COMPLETE SPECIFI-
CATIONS FOR THIS PROJECT.

Special Specification Item 4189

Cathodic Protection System



1. DESCRIPTION

Furnish all labor, tools, materials, equipment, and services necessary to install cathodic protection (CP) system (including bulk sacrificial anodes below mudline and distributed anodes inside the FRP encapsulation forms) and provide applicable connections and electrical work required for the function of the CP system. The CP system is to be installed as shown in the plans or as directed.

2. MATERIALS

2.1. General.

Furnish and install new materials. All equipment and materials supplied should be similar to that which has been in satisfactory service for at least 5 yrs.

Products must be produced by manufacturers regularly engaged in the manufacture of similar items.

The cost of all tests and analysis of the proposed substitute materials will be paid for by the Contractor. If the proposed substitutions require changes in the Contract Work, the Contractor will bear the costs related to such substitutions.

2.2. Bulk Anodes.

Provide materials specifically intended for bulk anode applications and 120 lb. minimum Al-Zn-In anode with the composition in accordance with Table 1.

Table1
Bulk Anode Composition

Element	Alloy %
Zinc (Zn)	2.80-6.50
Indium (In)	0.010-0.020
Silicon (Si)	0.08-0.2
Copper (Cu)	0.006 max.
Iron (Fe)	0.120 max.
Mercury (Hg)	--
Cadmium (Cd)	0.002 max.
Gallium	--
Others Each	0.02 max.
Others Total	0.05 max.
Aluminum	Balance

Provide anodes with a nominal size of 24 in. long, 7 in. wide, and 7 in. depth. Provide anode with geometric dimension not deviating by more than 10% and having the following galvanic properties in seawater shown in Table 2.

Table2
Anode Galvanic Properties

Property	Limit
Open Circuit Potential	1,100 mV (to Ag-AgCl ref.)

Efficiency	Min. 85%
Current Capacity	Min. 1150 Amp-hr./lb.
Consumption Rate -pounds/amp-yr	7.6 lb.

Provide mild steel eyebolt anode core steel material conforming to ASTM A36. Steel core dimensions will be as shown in the plans or as directed.

Provide documentation of approved quality assurance system and provide documentation of the anode manufacturing and testing process in accordance with NACE SP0387. Mark each anode and identify with the manufacturer's name, type of anode, and heat and sequence number. Mark all anodes (stamp) with heat and charge numbers and anode code (type of material). Package anodes in the manufacturer's plant in a package suitable both for lifting and transfer using a forklift, marine transportation, and long-term storage onsite.

Conduct factory tests and inspections as specified herein. Record the results of the tests and inspections and provide a certificate of conformity certifying that the anodes comply in all respects to the specifications. The anodes will not be approved by the Department unless all quality control documents and certificates were submitted to the Department in an orderly manner before shipment. As a minimum, conduct the following tests:

- visual inspection of cracks, surface irregularities, and straightness – 100% of total quantity according to NACE SP0387 for shrinkage, surface contamination, straightness, transverse and longitudinal cracks,
- random chemical analysis by spectrograph: Samples of each heat will be taken for chemical analysis,
- weight test – 10% random selected of total quantity according to anode weight tolerance (each) - $\pm 3\%$, and the total contract weight will not be below the nominal contract weight,
- dimensional inspection – 10% of total quantity according to anode mean length - $\pm 3\%$, anode mean width - $\pm 5\%$, and anode mean depth - $\pm 10\%$, and
- samples of each heat will be taken for tests of anode material current capacity, closed-circuit potential and efficiency; NACE SP0387 and NACE TM0190.

The following manufactures are pre-approved for use on this project

- Galvotec Alloys, Inc.
- Farwest Corrosion Control Company, and
- M&M Industries, Inc.

2.3.

Distributed Anodes. Distributed galvanic units will be zinc with nominal exterior dimensions of approximately of 1 in. by 3 in. by length shown in the plans. The distributed anode unit will consist of 2 lb. of zinc per ft. of anode for anodes installed at splash zone and will consist of 1.2 lb of zinc per ft. of anode for anodes installed on tie beams above splash zone as shown in the plans. The zinc anode will be manufactured in compliance with ASTM B418 Type II.

The zinc will be alkali-activated with a pH greater than 14 and encased in an alkaline low resistance cementitious precast mortar and an internal alkaline-resistant reinforcing mesh that completely surrounds the zinc core. The anode unit will contain FRP reinforcing to resist expansion. The anode unit will not contain constituents that are corrosive to reinforcing steel such as chlorides, bromides, or other halides as per ACI 222R. The zinc will be uniformly distributed along the length of the anode unit.

The anode system will have a proven track record of the anode technology showing satisfactory field performance with a minimum of three projects of similar size and application.

The galvanic protection will be Galvashield DAS distributed anode system by Vector Corrosion Technologies or approved equal.

- 2.4. **Anodes Wiring.** Supply bulk anodes with No. 6 AWG stranded copper wire with high molecular weight polyethylene (HMWPE) insulation brazed to a 1/2 in. diameter steel bar connected to steel eyebolt core as shown in the plans. Extend the anode wire from the point of connection to the anode to the associated junction box. Provide wire of sufficient length to avoid splicing wires.
- Supply distributed anode units with a minimum of 2 integral 18-gauge grade 304 stainless steel wires of sufficient length to make connections between both adjacent anodes.
- Provide be No.8 AWG stranded copper wire with red HMWPE insulation for anode header wire from distributed anodes to dedicated junction box. Provide wire of sufficient length to avoid splicing wires.
- 2.5. **Fasteners.** Provide Stainless Steel type 316 for all bolts, washers, anchors, and other fasteners used for installation of stainless steel angle, conduits, and junction boxes, unless otherwise specified in the plans or as directed. After installation, epoxy coat all bolts and fasteners with the Epoxy Coating per Section 2.17.
- 2.6. **Junction Boxes.** Provide 316 stainless steel NEMA Type 4X Junction boxes per the requirements of NEMA 250, with 14-gauge steel body. Size boxes as shown in the plans or as directed.
- Provide hinges built of 316 stainless steel with stainless steel pin. Ensure a watertight seal. Furnish a neoprene gasket with the box and stainless steel lockable hasp. Provide externally mounted monitoring boxes as shown in the plans or as directed.
- Label boxes with a black plastic tag bolted to the front panel of the box. Engrave tag in a color that contrasts with the identification of the box. Use minimum height lettering of 3/4 in.
- Provide panel boards for junction boxes made of phenolic plastic 1/4 in. thick and sized as indicated. Install brass double nutted bolts, nuts and lock washers on the panel boards as indicated. Provide stainless steel hardware for mounting the panel board inside the junction box.
- After installation, epoxy coat the junction boxes and hardware with the Epoxy Coating.
- 2.7. **Cable connection lugs.** Provide high conductivity high strength copper alloy such as IlSCO Type SLU, IlSCO Type CP, or approved equal. Aluminum or steel subcomponents are not permitted for cable connection lugs. Provide copper alloy for all current-carrying bolts and hardware.
- 2.8. **Shunts.** Provide shunts with resistance such that a 5 Amp current causes a voltage drop of 50 millivolts (i.e. 0.010 ohms). Provide 1/2 in. wide by 3-3/4 in. long flat manganin ribbon-style shunts such as Holloway Type JB.
- 2.9. **Buss Bars.** Provide copper buss bars (5 in. to 14 in. X 3/4 in. X 1/8 in.), and copper alloy bolts, nuts, and washers.
- 2.10. **Drain or Breather Plug.** Provide steel Universal Drain or Breather, 1/2 in, Raintight. Appleton ECDB50HP or approved equal.
- 2.11. **Diodes.** Install 8-Amp Solenoid Diode, with ring connectors at each end sized to fit connection bolts on the bus bar and shunt as shown in the plans or as directed.
- 2.12. **Negative Connections to the Reinforcement Wires.** Provide negative wires with single conductor, stranded copper, No. 8 AWG in size, with black HMWPE insulation and in colors as shown in the plans or as directed. Provide negative wires that are specifically designed for cathodic protection services and suitable for direct burial in corrosive soil, conforming to UL44. Wires with cut or damaged insulation will not be accepted and require replacement of the entire length of wire.
- 2.13. **Wire Identification Markers.** Code all wires with durable military grade, heatshrink labels with pertinent identification information as shown in the Plans and conforming to IEEE 323-2003, AMS-DTL-23053, MIL-M-

81531, and MIL-STD-883E. Apply markers to the wires at a minimum of 6 in. and no more, than 12 in. from the terminal connection end of the wire.

- 2.14. **Exothermic Weld Kits.** Wire-to-reinforcement connections are made by the exothermic welding process. Weld charges and mold size will be as specified by the manufacturer for various reinforcement sizes and surface configurations. Care should be taken during installation to be sure correct charges are used. Provide Cadweld as manufactured by Erico Products, Inc., Thermoweld as manufactured by Continental Industries, Inc., or equal. Use Duxseal packing as manufactured by Johns Manville or equal where necessary to prevent leakage of molten weld metal.
- 2.15. **Pin Brazing.** Provide pin brazing for connecting wires to structures in strict accordance with the manufacturer's recommendations. Make connections at locations indicated. Use an electric-arc silver soldering process specifically designed to minimize the pipeline heat effects associated with the wire connection process. Use a brazing gun ferrule holder sized accordingly to accommodate the brazing pin and ferrule. Use a direct-connect type brazing pin, with no threaded connections. Use a ceramic ferrule sized accordingly to accommodate the brazing pin. Use a brazed connection type for the wire lug; crimp lugs will not be allowed. Use pin brazing hardware and consumable material produced by a single manufacturer. Use "BAC Pin Brazing" by BAC Corrosion Control, or approved equal. Use wire lug type M1. Use "Direct Brazing pin, standard with fuse wire" type brazing pin for brazing No. 8 AWG wire and larger.
- 2.16. **L-shaped Stainless Steel Sections (Angle).** Secure anode wires, as shown in the Plans, within conduit bolted to a 6 in. by 6 in. by 3/8 in. coated stainless steel angle. Pre-drill the bolt holes on angle before coating. Provide a minimum of 3 additional anchoring holes to accommodate any location conflict with reinforcing steel. Shop coat the angle with the Epoxy Coating. Apply the epoxy and cure per the manufacturer's recommendations before transporting the assembly to the site.
- 2.17. **Epoxy Coating.** Coat welds, stainless steel L-shape section, hardware, connections points, and other areas specified with 100% solids, surface tolerant, fast cure epoxy for coating metal and concrete in wet or damp locations. Use A-788 Splash Zone Compound or approved equal. Surface preparation, application and quality control must be done per manufacturer's recommendations.
- 2.18. **PVC Conduit and Fittings.** Provide rigid PVC conduit and fittings conforming to the requirements of EPC-40-PVC conduit of NEMA TC 2 and fittings for EPC-40-PVC conduit of NEMA TC 3. Provide conduit and fittings that are UL 651 listed.
- 2.19. **Stainless Steel Conduits and Fittings.** Provide rigid Type 316 stainless steel schedule 40 conduits sized as shown in the plans.
- 2.20. **Concrete Repair Material.** Provide pre-approved concrete repair material in accordance with DMS-4655, *Concrete Repair Materials* for vertical or overhead repair.
- 2.21. **Delivery.** Deliver materials to the site in original containers and packaging with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, lot number, directions for storing, and complete manufacturer's written instructions.
- 2.22. **Storage.** Store and handle materials in accordance with manufacturer's written instructions and safety requirements. Remove from site, and replace at no cost to Department, any materials that are damaged or otherwise negatively affected by not being stored or handled in accordance with manufacturer's written instructions. Store materials on land and transport to the site only the amount expected to be installed each day. Do not store materials on temporary structures on the water overnight.
- 2.23. **Replacement Anodes.** Furnish to the Department 10 anodes for future replacement needs.

3. EQUIPMENT

- 3.1. **General.** Provide all equipment required to perform the work. Not all the required equipment may be specified in this article. Quantities are not specified, and duplicate equipment may be necessary to perform the work.
- 3.2. **Concrete Reinforcing Steel Locator.** Electromagnetic or magnetic equipment capable of locating reinforcing steel within concrete.
- 3.3. **Multimeter.** True-RMS meter with minimum 10 MegOhm internal impedance capable of measuring voltage and resistance to a precision of 1 mV and 0.1 Ohms, respectively.
- 3.4. **Reference Electrode.** Silver-silver chloride reference electrode with a minimum diameter of 1 in. and a porous tip. The unit must be calibrated and stored in accordance with the manufacturer's instruction and verified against another reference electrode onsite.
- 3.5. **Resistance Meter.** Resistance meter with minimum of 200 mA test current and an input impedance of 10 MegOhm or more. The unit must be calibrated in accordance with the manufacturer's instruction and contain a calibration sticker.
- 3.5.1. **Concrete Removal and Repair Equipment.** Meet requirements of TxDOT Item 429, *Concrete Structure Repair*.
- Concrete coring equipment
 - Pneumatic chipping hammers nominal 15 lb. class or less.
 - High-pressure, oil-free compressed air equipment capable of removing dust and dirt.
 - Percussive or rotary drilling equipment for making holes in concrete substrate.
 - Equipment for mixing and transporting concrete.
 - Equipment for finishing of placed concrete.

4. CONSTRUCTION

- 4.1. **Submittals**
- 4.1.1. **Data Sheet.** Provide manufacturer's literature and technical data for each type of manufactured material and product indicated.
- 4.1.2. **Anode Factory Testing and Inspection Certification.** Provide anode factory testing and inspection certification.
- 4.1.3. **Quality Control Plan.** Provide a CP quality control plan with proposed testing means and methods, and sample data collection forms. The CP quality control plan will be authored by a NACE-certified cathodic protection specialist (CP-4).
- 4.1.4. **Shop Drawings.** Shop drawing details for electrical connections of bulk anodes. Provide proposed electrical connection details approved by the anode manufacturer. Include connections to bulk anodes, distributed anode assemblies, embedded reinforcing steel, and junction boxes.
- Include procedures to remove concrete for electrical connection and approved concrete repair material.
 - Include mounting details for bulk anodes, distributed anode assemblies, wiring, and junction boxes.
- 4.1.5. **Electrical Continuity Report.** Provide the test results for electrical continuity testing of reinforcement, and negative and anode wires continuity before and after concrete placement. The electrical continuity report will be authored by a NACE-certified cathodic protection specialist (CP-4).

- 4.1.6. **Cathodic Protection System Activation Report.** Provide cathodic protection report authored by a NACE-certified cathodic protection specialist (CP-4).
- 4.2. **Field Quality Control.** Engage a NACE-qualified cathodic protection technician (CP-2 qualification or higher) to confirm electrical continuity testing of reinforcement, negative and anodes wires continuity before and after concrete placement. Test cathodic protection system before and after activation. The electrical continuity report, CP quality control and activation report will be authored by a NACE-certified cathodic protection specialist (CP-4). The CP quality control and testing plan will be signed by the CP-4. Submit CP quality control and testing plan for Engineer review.
- 4.3. **Surface Preparation.** See Special Specification 4188, "FRP Encapsulation System" for surface preparation requirements for concrete beneath FRP encapsulation form before installation of distributed anodes. Concrete surface area for the installation of the bulk anode will be cleaned by abrasive blasting, water blasting or other means to remove all marine growth to allow installation of the bulk anode.
- 4.4. **Exposed Conduit Assemblies.** Shop-coat new stainless steel sections with the Epoxy Coating. Submit product data sheets and obtain approval of paint system before performing the work.
- 4.5. **Installation of Bulk Anode Assemblies.** Install anodes in accordance with recommendations of anode manufacturer at locations specified in the plans.
- Place anodes adjacent to footing or piles at a minimum depth of 2 ft. below mud line. The contractor will be responsible for all the necessary surveying to determine the mud line elevations. Place anodes horizontally and offset from the footing or pile by 2 ft. as shown in the plans or as directed.
 - Place the stainless steel angle just below the bottom of the FRP and extend 2 ft. below the mudline, unless FRP form extends to the mudline. In that case, install the stainless steel angle on the FRP form in dry condition and patch the anchor holes per FRP manufacturer's recommendations.
 - Extend anode wires from the anode up through conduit mounted on the stainless steel angle, up under the FRP to the associated junction box. Where the wires exit the FRP the wires will be placed inside the stainless steel conduit. Terminate the conduit at the appropriate junction box.
 - Place the wires in conduit at all locations where the wires are exposed and not under the FRP. Extend the conduits a minimum of 6 in. beneath the FRP.
 - Using a portable silver-silver chloride reference electrode measure and record each anode's potential to earth using the anode wire. The measured potential threshold indicating that the anode wire is installed properly and the anode is functional will be -1100 mV. Remove and replace all anodes that do not meet the threshold.
- 4.6. **Installation of Distributed Anode Assemblies.** Install anode assemblies in accordance with recommendations of the anode manufacturer at locations specified in the plans or as directed.
- Install disturbed zinc anodes beneath FRP encapsulation forms at elevations shown in the plans. Attach the anodes to the existing surface of concrete using concrete anchors per the manufacturer's recommendations. Install distributed galvanic anode units with an even spacing around the concrete surface. Secure the anodes against 1/2 in. or larger spacers to allow consolidation of the concrete around the anode.
- At each pier and bent connect all anode cores together using pre-fabricated anode wires (2 per anode). Route each wire in opposite directions and tie into the adjacent anode wire as shown in the plans.
- Attach the anode header wire to the stainless steel wire via split-bolt. Encapsulate the split bolt with Epoxy Coating after assembly and verification of wire electrical continuity. The number of anode header locations per anode assembly as shown on the plans. Install the anode headers at even spacing where more than one anode header is specified for an anode assembly.

Route the anode header wires up through conduit mounted on the stainless steel angle, up under the FRP to the associated junction box. Where the wires exit the FRP the wires will be placed inside the stainless steel conduit. Terminate the conduit at the appropriate junction box.

Place the wires in the conduit at all locations where the wires are exposed and not under the FRP. Extend the conduits a minimum of 6 in. beneath the FRP.

For grout or concrete mix used to fill the annulus between the existing concrete surface and the FRP encapsulation see Special Specification 4188, "FRP Encapsulation System."

- 4.7. **Junction Boxes (Test stations).** Construct junction boxes (test stations) as shown in the plans.
- Install junction boxes at the locations shown in the plans. Install the bottom of the junction box a minimum of 5 ft. above the finished top of the footing. Place all exposed negative and anode wire runs in stainless steel conduit as shown in the plans.
 - Anchor the junction box to the concrete column using four stainless steel anchor bolts.
 - Route negative and anode wires, and terminate them in the appropriate junction boxes as shown in the plans. Leave a minimum of 24 in. of extra wire in its terminus in each box.
 - Place wire identifiers on all wires before backfill or encasement, and installation of junction box.
 - Connect negative wires to one of the three buss bars. Connect the anode wires to the other two buss bars. Leave the shunts disconnected until the CP system is ready for activation.
 - After installation, test all wire connections at the junction box to ensure that they meet the requirements of the specification.
- 4.8. **Connection to Rebar (Negative Connection).** After exposing reinforcing bars, verifying electrical continuity of steel bars, and abrasive blasting to SSPC-SP10 (Near White Metal), connect a No. 8 AWG copper wire with black HMWPE insulation to exposed steel. Make the connection by pin brazing the wire directly to the rebar or exothermically welding the wire to a bond plate that is welded to the rebar as shown in the plans. Make the number of negative connections as shown in the plans. Coat all welded and pin brazed connection points using the Epoxy Coating.
- Using a portable silver-silver chloride reference electrode measure and record the steel bar's potential to earth and the end of the negative wire connection (the end that will terminate in the junction box) to earth. To indicate electrical continuity the two potentials must not vary by more than 5 mV.
 - Wire placement: Extend negative wires from the point of connection through conduit, up under the FRP to the associated junction box. Where the wires exit the FRP, place the wires inside a Schedule 40 stainless steel conduit per this specification item.
 - Concrete restoration: After connection to rebar is made, repair concrete area per the *TxDOT Concrete Repair Manual*. Abrasive blast the exposed reinforcing steel before patching and use approved bonding agent products.
- 4.9. **Cathodic Protection Testing.** Test the wires and potentials before and after activation of the cathodic protection system per NACE SP0408. If the measurements do not meet the stated criteria stated in this document determine the causes and conduct repairs, at Contractor's expense.
- When all construction is completed and before connection the anode wires to the associated buss bar remeasure the anode-to-earth potential to a fixed-location using a portable silver-silver chloride reference electrode. To indicate anode wire is installed properly and the anode is functional the potential measured must be -1100 mV.
 - When all construction is completed and before connecting the negative wires to the associated buss bar re-measure the negative wire-to-earth potential at a minimum of two locations per bent or pier. Negative wire potential will be compared to pre-burial or encasement measurement (keeping the reference electrode at the same location for both sets of measurements). The potentials will be within 5 mV of each other. Record these values as the Native negative potentials.

- Once the negative and anode wires have passed the potential measurement tests above then connect the wires to the appropriate buss bar. Install the 0.01 Ohm shunt and diode as shown in the plans. Connect the three buss bars together through the shunts and let the CP system polarize.
- Measure and record the On and Instant Off negative wire-to-earth potentials using the portable silver-silver chloride reference electrode placed at the same locations as when the Native negative potentials were measured.
- Measure and record the current output across the shunt.
- The criteria used to indicate adequate corrosion protection of reinforcing steel will be per NACE Standard SP0408.

Present all test data in the Cathodic Protection System Activation Report authored by the NACE-certified cathodic protection specialist (CP-4). Report all deficiencies found in the CP system. Include a statement on the functionality of the CP system in relation to criteria. The report must be signed by the CP-4. Submit the report to the Engineer for acceptance and approval.

- 4.10. **Rebar Electrical Continuity Testing.** Test the electrical continuity between reinforcing bars in all cathodically protected areas (a minimum of 5 locations per 100 sq. ft.) by an alternative direct current reverse polarity resistance testing and potential measurement testing with a fixed location reference electrode per ISO 12696 as specified below. If the criteria are not met, the electrical continuity is not met and additional provisions such as adding bond wires or rebar welding will be required to restore electrical continuity at Contractor's expense. To be considered electrically continuous, all steel elements must meet the following criteria:

- an individual stable resistance reading less than 1 Ohm, or
- resistance reading that do not change by more than 0.1 Ohm when the polarity of the instrument lead is reversed, or
- a stable potential measurement with a difference of 1 mV or less between all rebar where reference electrode is placed at a fixed location in soil.

Present all test data in the Electrical Continuity Report authored by the NACE-certified cathodic protection specialist (CP-4). The report must be signed by the CP-4. Submit the report to the Engineer for acceptance and approval.

5. MEASUREMENT

This Item will be measured as Lump Sum.

6. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured under "Measurement" will be paid for at the unit price bid for "Cathodic Protection System". This price is full compensation for providing and installing anodes, electrical continuity, wiring and associated hardware, electrical testing, replacement anodes, and for tools, labor, equipment, and incidentals.

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