

# 220

**Letting June 17, 2022**

## **Notice to Bidders, Specifications and Proposal**



**Contract No. 60T46  
COOK County  
Section 2012-008I  
Route FAI 90/94  
Project NHPP-L3MU(512)  
District 1 Construction Funds**

Prepared by

Checked by

F

(Printed by authority of the State of Illinois)



- 1. TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 12:00 p.m. June 17, 2022 at which time the bids will be publicly opened from the iCX SecureVault.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60T46  
COOK County  
Section 2012-008I  
Project NHPP-L3MU(512)  
Route FAI 90/94  
District 1 Construction Funds**

**(5.45-Mile) Kennedy Expressway Reversible lanes. REVLAC System rehabilitation. The REVLAC system consists of 115 swing gates, 6 arresting barriers and 4 nodal buildings ComCenter controls. Fiber optic cables, and Programmable Logic Controllers (PLC)**

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.  
  
(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to re-advertise the proposed improvement, and to waive technicalities.

By Order of the  
Illinois Department of Transportation

Omer Osman,  
Secretary

INDEX  
FOR  
SUPPLEMENTAL SPECIFICATIONS  
AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2022

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

No ERRATA this year.

SUPPLEMENTAL SPECIFICATIONS

Std. Spec. Sec.

Page No.

No Supplemental Specifications this year.

RECURRING SPECIAL PROVISIONS

The following RECURRING SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

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## STATE OF ILLINOIS

### SPECIAL PROVISIONS

The following Special Provisions supplement the “*Standard Specifications for Road and Bridge Construction*,” adopted January 1, 2022, the latest edition of the “Manual of Uniform Traffic Control Devices for Streets and Highways,” and the “Manual of Test Procedures for Materials” in effect on the date of invitation for bid; and the Supplemental Specifications and Recurring Special Provisions indication on the Check Sheet included herein, which apply and govern the construction of FAI Route 90/94 (I-90/94), Project L3MU(512), Section 2017-08I, Cook County, Contract No. 60T46 and in case of conflict with any or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

FAI Route 90/94 (Kennedy Expressway)  
Project NHPP-L3MU(512)  
Section 2012-008I  
Cook County  
Contract No. 60T46

#### LOCATION OF IMPROVEMENT

The southern limit of improvement is the Kennedy Expressway (I-90/94) at a point approximately 200 feet south of the centerline of W. Fulton Street and extends in a northerly direction to a point approximately 500 feet north of the centerline of Foster Avenue on the Edens Expressway (I-94) and a point 400 feet south of Lawrence Avenue on the Kennedy Expressway (I-90) for a combined distance of 28,960 feet (5.49 miles). The project is located in Cook County and within the City of Chicago.



## **DESCRIPTION OF IMPROVEMENT**

The work consists of a rehabilitation of the Reversible Lane Access Control System (REVLAC) that allows reversible traffic flow along the Kennedy Expressway (I-90/94). Major scope items include:

- Replacement of existing swing gate assemblies and the gate arms.
- Replacement of existing impact restraining barriers and repair to barrier foundations.
- Removal of existing DC control cabling and replacing with fiber optic cable in the same conduits.
- Improvements to the nodal building power systems, including installation of new standby diesel generators.
- Replacement of existing DC Control Power Inverter system with a new AC UPS backup system.
- Installation of paved parking lots at nodal buildings A and E.
- Removal of Nodal Building B.
- Replacement of nodal building lighting.
- Rehabilitation of nodal building HVAC systems.
- Miscellaneous repairs to concrete, brick, etc. to each nodal building.
- Installation of new CCTV cameras to provide full coverage of the REVLAC corridor.
- Replacement of the existing Programmable Logic Controller (PLC) local input/output (I/O) racks in each nodal building and headquarters. Includes the installation of remote I/O cabinets at swing gates, barriers and DMS signs.
- Replacement of the existing operator interface panels with new computer graphic control interfaces.
- New fiber optic network for interconnection of each buildings PLC control network and separate network to interconnect each building and Headquarters.

## **RESTRICTIVE START DATE**

The Contractor will not be allowed to proceed with any work that requires permanent lane closures or impacts the operation of the REVLAC system prior to **Monday, April 1<sup>st</sup>, 2024 at 5:00 AM.** Advance work may be completed at REVLAC building and the ITS installation in advance of this date.

The Contractor will not be allowed initiate removal of existing operating REVLAC system components unless the Contractor can document that that a minimum of 50% of all gate and barrier systems and associated components manufactured and are ready to be installed by March 23<sup>rd</sup>, 2024. The Department may permit the Contractor to be begin removal efforts if a mitigation plan outlining the manufacturing schedule is provided to and approved by the Department ensuing a October 31<sup>st</sup>, 2024 completion.

### **MAINTENANCE OF ROADWAYS (D-1)**

Effective: September 30, 1985

Revised: November 1, 1996

Beginning on the date that work begins on this project, the Contractor shall assume responsibility for normal maintenance of all existing roadways within the limits of the improvement. This normal maintenance shall include all repair work deemed necessary by the Engineer, but shall not include snow removal operations. Traffic control and protection for maintenance of roadways will be provided by the Contractor as required by the Engineer.

If items of work have not been provided in the contract, or otherwise specified for payment, such items, including the accompanying traffic control and protection required by the Engineer, will be paid for in accordance with Article 109.04 of the Standard Specifications.

### **COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS**

This contract abuts and/or overlaps with other concurrent contracts listed below. The Contractor shall cooperate with the other Contractors in the phasing and performance of his/her work so as not to delay, interrupt or hinder the progress or completion of work being performed by the other Contractors.

The Contractor shall schedule their work in order to minimize any conflicts that may arise between contracts as specified in Article 105.08 of the Standard Specifications. No additional compensation will be allowed for delays or inconveniences resulting from activities of other contractors. Projects to be coordinated include;

**IDOT Contract 62D79: I-94 FAI 94 (Edens Expwy) / FAP Route 346 (US 41) Fiber Backbone CCTV Cameras and DMS Signs.** This project extends from **Montrose Avenue to Park Blvd.** The Smart Highway project will install a fiber optic backbone, CCTV cameras and DMS signs. The fiber optic cable will be terminated into REVLAC building E through the installation of new conduits and building penetrations. Project will install a Dynamic Message Sign within the limits of 60T46 on WB I-90/94 between Addison and Irving Park Road. Other project elements are not anticipated to impact 60T46.

**IDOT Contract 62K74: I-90/94 FAI 90/94: I-90/94 (Kennedy Expwy) I-94 (Edens Expwy) to Hubbard St Bridge Deck Overlay, Bridge Joint Repairs and Pavement Patching**

Contract 62K74 is anticipated to be on the January 2023 letting with an anticipated start of construction on April 1, 2023. Contract 62K74 is a two year project with work scheduled during both the 2023 and 2024 construction seasons. Bridge overlay work in the inbound (eastbound) local lanes will be completed in between April 1, 2023 and October 31, 2023. The bridge overlay work in the reversible lanes as well as replacement of some of the sign structures and foundations will be completed between April 1, 2024 and October 31, 2024.

**The reversible lanes will be closed to traffic between April 1, 2024 and October 31, 2024 to accommodate both Contracts 62K74 and 60T46.** All work associated with the removal and installation the REVLAC system must occur between April 1, 2024 and October 31, 2024. Advanced installation work, including the installation of ITS devices, may occur in advance of the reversible lane closure, however no I-90/94 inbound lane or shoulder closures will be permitted during the inbound bridge overlay work.

Between April 1, 2024 and October 31, 2024 the maintenance of traffic under Contract 60T46 will be coordinated with Contract 62K74 as follows.

- 60T46 – Responsible for traffic control to close reversible lanes starting April 1, 2024 through the duration of both contracts 60T46 and 62K74. Traffic control must remain in place until both Contracts 60T46 and 62K74 have been completed and directed by the Engineer. Traffic control must be removed within 48 hours of the completion of both projects.
- 60T46 – Responsible for the traffic control associated with lane and shoulder closures associated with advance work, foundation work, barrier wall repairs, and the installation of ITS devices. **No lane or shoulder closures will be allowed concurrent with bridge overlay lane and shoulder closures associated with Contract 62K74.**
- 62K74 – Responsible for any lane or shoulder closures for sign structure or barrier wall work associated with bridge overlay and sign structure work.
- 62K74 – Traffic control within the work zone related to bridge overlay work to alert contractors to hazards within the work zone related to 62K74.
- 62K74 – Responsible for traffic mitigation strategy and implementation throughout work zone limits.

Weekly coordination calls between the two projects are suggested to coordinate construction schedules and phase shifts.

<b>Area of Overlapping Work area</b>	<b>Work Effort to be Coordinated</b>	<b>Suggested Coordination</b>
Sta 298+00	REVLAC DMS on sign structure to be replaced.	60T46 Work must be completed before local and systemwide testing.
Sta 344+00 – 345+00	CCTV 50' Camera installed near sign structure to be replaced.	Install CCTV prior to overlay work. Provide as-builts to 60K74 contractor.
Sta 385+00	ITS Conduit to be installed under North Avenue and North Avenue Bridge Overlay	Install conduit prior to overlay work. Provide as-builts to 60K74 contractor.
Sta 438+00	ITS Conduit and new camera to be installed adjacent to Webster Ave.	Install CCTV and conduit prior to overlay work. Provide as-builts to 60K74 contractor.
496+50	Sign Structure with REVLAC DMS and within gate replacement area	60T46 - Remove gates and cables. Proof conduits. 60K74 to complete foundation work. Complete sign structure foundation work.
Sta 501+00 – 502+00	Gate replacement near Diversey bridge overlay	Coordinate installation schedules to avoid work area conflicts.
Sta 526+00- 527+00	REVLAC Gate replacement on Sacramento bridge overlay.	Coordinate installation schedules to avoid work area conflicts.
Sta 541+00	ITS Camera to be installed adjacent to Kedzie Ave.	Install CCTV prior to overlay work. Provide as-builts to 60K74 contractor.
Sta 619+50	ITS Camera to be installed adjacent to Pulaski Road	Install CCTV prior to overlay work. Provide as-builts to 60K74 contractor.

**STATUS OF UTILITIES (D1)**

Effective: June 1, 2016

Revised: January 1, 2020

Utility companies and/or municipal owners located within the construction limits of this project have provided the following information regarding their facilities and the proposed improvements. The tables below contain a description of specific conflicts to be resolved and/or facilities which will require some action on the part of the Department's contractor to proceed with work. Each table entry includes an identification of the action necessary and, if applicable, the estimated duration required for the resolution.

**Utilities To Be Adjusted**

Conflicts noted below have been identified by following the suggested staging plan included in the contract. The company has been notified of all conflicts and will be required to obtain the necessary permits to complete their work; in some instances, resolution will be a function of the construction staging. The responsible agency must relocate, or complete new installations as noted below; this work has been deemed necessary to be complete for the Department's contractor to then work in the stage under which the item has been listed.

**No utilities are anticipated to require adjustment.**

**UTILITIES TO BE WATCHED AND PROTECTED**

The areas of concern noted below have been identified as utilities that may require protection and or coordination. The information provided is not a comprehensive list of all remaining utilities, but those which during coordination were identified as ones which might require the Contractor to take into consideration when making the determination of the means and methods that would be required to construct the proposed improvement. In some instances, the Contractor will be responsible to notify the owner in advance of the work to take place so necessary staffing on the owner's part can be secured.

Location/Stage	Type	Description	Name & Address of Utility	Action
TBD	TBD	TBD	TBD	"Watch and Protect"

The following contract information is what was used during the preparation of the Plans as provided by the owner of the facility.

Agency/Company Responsible to Resolve Conflict	Name of Contact	Address	Phone	E-mail Address
ComEd	Stan Plodzien or Jamie Gwin	1000 Commerce Drive Flr 1 Oak Brook, IL 60523	(630) 573-5453 or (630) 573-5423	sp3264@att.com or jg8128@att.com
Peoples Gas	Eric Stall & Aaron Meyer	200 East Randolph Floor 24-s Chicago, IL 60601	312-240-4707	<a href="mailto:erstell@integrysgroup.com">erstell@integrysgroup.com</a> <a href="mailto:aaron.meyer@peoplesgasdelivery.com">aaron.meyer@peoplesgasdelivery.com</a>
NiCor	Bruce Koppang	1844 Ferry Road Naperville, IL	630-573-5433	bkoppan@southernco.com
AT&T (KCI Technologies)	Bobby Akhter (Ken Caudill)	1000 Commerce Drive Floor 1 Oak Brook, IL 60523	630-573-5453	ba3817@att.com <a href="mailto:Ken.Caudill@kci.com">Ken.Caudill@kci.com</a>
Chicago Transit Authority	Abdin Carrillo	567 W. Lake St. Chicago, IL6061	(312) 681-3913	acarrillo@transitchicago.com
Pace Bus	Dispatch Center	550 West Algonquin Rd Arlington Heights, IL 60005	708-225-3344 847-724-4144	
Comcast Cable	Ted Wyman	688 Industrial Drive Elmhurst, IL 60126	(224) 229-5850	Ted_Wyman@comcast.com
Crown Castle	Rebecca Caldwell	2000 Corporate Dr. Canonsburg, PA 15317		Fiberdigfacilities@CrownCastle.com
City of Chicago Department of Water Management – Water Section	Sme Xhaferllari, Jason McCubbin, John Hart, Albert Wtorkowski, Vito Montana, Rolando Villalon, & Angela Krueger	1000 East Ohio Street +51, Room 306 Chicago, IL 60611	(312) 217-7928, (312) 742-3619 & (312) 744-5070  Jason McCubbin can be contacted directly by telephone at (312) 217-7928.	IDOT Construction or the IDOT Contractor should send an e-mail to the CDWM - Water CTR general email <a href="mailto:FACM@ctrwater.net">FACM@ctrwater.net</a> and carbon copy Jason McCubbin at <a href="mailto:Jason.McCubbin@ctrwater.net">Jason.McCubbin@ctrwater.net</a> at least a couple of days prior to needing a CDWM- Water inspector on site.  Sme Xhaferllari, <a href="mailto:angela.krueger@cityofchicago.org">angela.krueger@cityofchicago.org</a> , <a href="mailto:Albert.Wtorkowski@cityofchicago.org">Albert.Wtorkowski@cityofchicago.org</a> , <a href="mailto:Darren.Ujano@ctrwater.net">Darren.Ujano@ctrwater.net</a> , <a href="mailto:Jason.McCubbin@ctrwater.net">Jason.McCubbin@ctrwater.net</a> , & <a href="mailto:Rolando.villalon@cityofchicago.org">Rolando.villalon@cityofchicago.org</a>

The above represents the best information available to the Department and is included for the convenience of the bidder. The days required for conflict resolution should be considered in the bid as this information has also been factored into the timeline identified for the project when setting the completion date. The applicable portions of the Standard Specifications for Road and Bridge Construction shall apply.

Estimated duration of time provided above for the first conflicts identified will begin on the date of the executed contract regardless of the status of the utility relocations. The responsible agencies will be working toward resolving subsequent conflicts in conjunction with contractor activities in the number of days noted.

The estimated relocation duration must be part of the progress schedule submitted by the contractor. A utility kickoff meeting will be scheduled between the Department, the Department's contractor and the utility companies when necessary, the contractor is responsible for contacting J.U.L.I.E. prior to all excavation work.

### **EXISTING UTILITIES**

The Contractor shall familiarize themselves with the locations of all utilities and structures that may be found in the vicinity of the construction. The Contractor shall conduct his operations to avoid damage to the above-mentioned utilities and structures. Should any damage occur due to the Contractor's negligence, repairs shall be made by the Contractor at his expense in a manner acceptable to the Engineer.

The Contractor shall notify all utility owners of his construction schedule and shall coordinate construction operations with utility owners so that relocation of utility lines and structures may proceed in an orderly manner. Notification shall be in writing, with copies transmitted to the Engineer.

### **CTA FLAGGING AND COORDINATION**

All work to be done by the Contractor on, over, or in close proximity of the CTA (Chicago Transit Authority) right-of-way and infrastructure shall be performed according to Article 107.12 of the Standard Specifications and this specification. This specification includes language from CTA Master Specification Section 01 35 15, "Special Project Procedures for Adjacent Construction." No interruption to CTA service will be allowed unless approved in writing by the CTA.

The CTA's Representative for this project will be:

Mr. Abdin Carrillo  
Project Manager, Construction Oversight  
(312) 681-3913  
acarrillo@transitchicago.com

**No work as part of this contract is anticipated be on, over, or in close proximity to CTA right-of-way or that would impact CTA operations.**

**COMPLETION DATE PLUS WORKING DAYS (D-1)**

Effective: September 30, 1985

Revised: January 1, 2007

Revise Article 108.05 (b) of the Standard Specifications as follows:

“When a completion date plus working days is specified, the Contractor shall complete all contract items and safely open all roadways to traffic by 11:59 PM on **October 31, 2024** except as specified herein.

The Contractor will be allowed to complete all clean-up work and punch list items within 10 working days after the completion date for opening the roadway to traffic. Under extenuating circumstances, the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic, may be completed within the working days allowed for clean-up work and punch list items. Temporary lane closures for this work may be allowed at the discretion of the Engineer.

The Special Provision for “Failure to Complete the Work on Time” shall apply to both the completion date and the number of working days.

**FAILURE TO COMPLETE THE WORK ON TIME (D-1)**

Effective: September 30, 1985

Revised: January 1, 2007

Should the Contractor fail to complete the work on or before the completion date as specified in the Special Provisions for “Interim Completion Date” or “Completion Date Plus Working Days”, or within such extended time as may have been allowed by the Department, the Contractor shall be liable to the Department in the amount of **\$10,000**, not as a penalty but as liquidated damages, for each calendar day or a portion thereof of overrun in the contract time or such extended time as may have been allowed. In fixing the damages as set out herein, the desire is to establish a certain mode of calculation for the work since the Department’s actual loss, in the event of delay, cannot be predetermined, would be difficult of ascertainment, and a matter of argument and unprofitable litigation. This said mode is an equitable rule for measurement of the Department’s actual loss and fairly takes into account the loss of use of the roadway if the project is delayed in completion. The Department shall not be required to provide any actual loss in order to recover these liquidated damages provided herein, as said damages are very difficult to ascertain. Furthermore, no provision of this clause shall be construed as a penalty, as such is not the intention of the parties.

A calendar day is every day shown on the calendar and starts at 12:00 midnight and ends at the following 12:00 midnight, twenty-four hours later.



**KEEPING THE EXPRESSWAY OPEN TO TRAFFIC**

Effective: March 22, 1996  
 Revised: January 21, 2015

Whenever work is in progress on or adjacent to an expressway, the Contractor shall provide the necessary traffic control devices to warn the public and to delineate the work zone as required in these Special Provisions, the Standard Specifications, the State Standards and the District Freeway details. All Contractors' personnel shall be limited to these barricaded work zones and shall not cross the expressway.

The Contractor shall request and gain approval from the Illinois Department of Transportation's Expressway Traffic Operations Engineer at [www.idotlcs.com](http://www.idotlcs.com) twenty-four (24) hours in advance of all daily lane, ramp and shoulder closures and 7 days in advance of all permanent and weekend closures on all Freeways and/or Expressways in District One. This advance notification is calculated based on workweek of Monday through Friday and shall not include weekends or Holidays.

**LOCATION: I-90/94 Kennedy REVERSIBLE LANES**

**Full Closure of the Reversible lanes permitted Monday, April 1<sup>st</sup> 5:00 A.M. – Thursday, October 31<sup>st</sup> 11:59 P.M.**

**LOCATION: I-94 Edens: Lake-Cook to I-90 Kennedy Junction**

WEEKNIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
			to	
Sunday-Thursday	1-Lane*	9:00 P.M.	to	5:00 A.M.
	2-Lane	11:00 P.M.	to	5:00 A.M.
Friday	1-Lane*	10:00 P.M. (Fri)	to	8:00 A.M. (Sat)
	2-Lane	11:59 P.M. (Fri)	to	6:00 A.M. (Sat)
Saturday	1-Lane*	9:00 P.M. (Sat)	to	10:00 A.M. (Sun)
	2-Lane	11:59 P.M. (Sat)	to	8:00 A.M. (Sun)

\* Kennedy 1-Lane Closure hours may be more restrictive if the Reversible Lanes are closed.

**LOCATION: I-90/94 Kennedy: E. River Road to Ohio**

WEEK NIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
			to	
Sunday - Thursday	1-Lane*	9:00 PM	to	5:00 AM
	2-Lane	11:59 PM	to	5:00 AM
Friday	1-Lane*	10:00 PM (Fri)	to	8:00 AM (Sat)
	2-Lane	11:59 PM (Fri)	to	6:00 AM (Sat)
Saturday	1-Lane*	9:00 PM (Sat)	to	10:00 AM (Sun)
	2-Lane	11:59 PM (Sat)	to	8:00 AM (Sun)

\* Kennedy 1-Lane Closure hours may be more restrictive if the Reversible Lanes are also closed.

**LOCATION: I-90/94 Kennedy: Ohio/Ontario Feeder Ramps**

WEEK NIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
Sunday - Thursday	1-Lane	9:00 PM	to	5:00 AM
	2-Lane	11:59 PM	to	5:00 AM
Friday	1-Lane	10:00 PM (Fri)	to	8:00 AM (Sat)
	2-Lane	11:59 PM (Fri)	to	6:00 AM (Sat)
Saturday	1-Lane	9:00 PM (Sat)	to	10:00 AM (Sun)
	2-Lane	11:59 PM (Sat)	to	8:00 AM (Sun)

In addition to the hours noted above, temporary shoulder and non-system interchange partial ramp closures are allowed weekdays between 9:00 A.M. and 3:00 P.M. and between 7:00 P.M. and 5:00 A.M.

Narrow Lanes and permanent shoulder closures will not be allowed between Dec. 1st and April 1st.

All daily lane closures shall be removed during adverse weather conditions such as rain, snow, and/or fog and as determined by the Engineer. Also, the Contractor shall promptly remove their lane closures when Maintenance forces are out for snow and ice removal.

Additional lane closure hour restrictions may have to be imposed to facilitate the flow of traffic to and from major sporting events and/or other events

All lane closure signs shall not be erected any earlier than one-half (1/2) hour before the starting hours listed above. Also, these signs should be taken down within one-half (1/2) hour after the closure is removed.

The Contractor will be required to cooperate with all other Contractors when erecting lane closures on the expressway. All lane closures (includes the taper lengths) without a three (3) mile gap between each other, in one direction of the expressway, shall be on the same side of the pavement. Lane closures on the same side of the pavement with a one (1) mile or less gap between the end of one work zone and the start of taper of next work zone should be connected. The maximum length of any lane closure on the project and combined with any adjacent projects shall be three (3) miles. Gaps between successive permanent lane closures shall be no less than two (2) miles in length.

Private vehicles shall not be parked in the work zone. Contractor's equipment and/or vehicles shall not be parked on the shoulders or in the median during non-working hours. The parking of equipment and/or vehicles on State right-of-way will only be permitted at the locations approved by the Engineer.

Check barricades shall be placed every 1000' within a lane closure to prevent vehicles from driving through closed lanes.

Temporary ramp closures for service interchanges will only be permitted at night during the restricted hours listed for temporary one-lane closures within the project limits. However, no two (2) adjacent entrance and exit ramps in one direction of the expressway shall be closed at the same time.

Should the Contractor fail to completely open, and keep open, the ramps to traffic in accordance with the above limitations, the Contractor shall be liable to the Department for liquidated damages as noted under the Special Provision, "Failure to Open Traffic Lanes to Traffic".

**FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC (D-1)**

Effective: March 22, 1996

Revised: February 9, 2005

Should the Contractor fail to completely open and keep open all the traffic lanes to traffic in accordance with the limitations specified under the Special Provisions for "Keeping the Expressway Open to Traffic", the Contractor shall be liable to the Department for the amount of:

One lane or ramp blocked = \$ 3,000

Two lanes blocked = \$ 6,000

Not as a penalty but as liquidated and ascertained damages for each and every 15 minute interval or a portion thereof that a lane is blocked outside the allowable time limitations. Such damages may be deducted by the Department from any monies due the Contractor. These damages shall apply during the contract time and during any extensions of the contract time.

**TRAFFIC CONTROL PLAN (D-1)**

Effective: September 30, 1985

Revised: January 1, 2007

Traffic Control shall be according to the applicable sections of the Standard Specifications, the Supplemental Specifications, the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", any special details and Highway Standards contained in the plans, and the Special Provisions contained herein.

Special attention is called to Article 107.09 of the Standard Specifications and the following Highway Standards, Details, Quality Standard for Work Zone Traffic Control Devices, Recurring Special Provisions and Special Provisions contained herein, relating to traffic control.

The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

**STANDARDS:**

- 701106 OFF-ROAD OPERATIONS, MULTILANE, 15' TO 24' FROM PAVEMENT EDGE
- 701106 OFF-ROAD OPERATIONS, MULTILANE, MORE THAN 15' AWAY
- 701428 TRAFFIC CONTROL SETUP AND REMOVAL FREEWAY/EXPRESSWAY
- 701901 TRAFFIC CONTROL DEVICES
- 704001 TEMPORARY CONCRETE BARRIER
- 782006 GUARDRAIL & BARRIER REFLECTOR MOUNTING DETAILS

DETAILS:

- TC-17 TRAFFIC CONTROL FOR SHOULDER CLOSURES AND PARTIAL RAMP CLOSURES
- TC-18 FREEWAY/EXPRESSWAY SIGNING FOR FLAGGING OPERATIONS AT WORK ZONE OPENINGS

DISTRICT 1 SPECIAL PROVISIONS:

- MAINTENANCE OF ROADWAYS
- KEEPING THE EXPRESSWAYS OPEN TO TRAFFIC (D-1)
- FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC (D-1)
- PUBLIC CONVENIENCE AND SAFETY (D-1)
- TRAFFIC CONTROL PLAN (D-1)
- TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS) (D-1)

CONTRACT SPECIAL PROVISIONS:

- CLEANING OF TRAFFIC CONTROL DEVICES

RECURRING SPECIAL PROVISIONS:

BDE SPECIAL PROVISIONS:

- TRAFFIC SPOTTERS
- WORK ZONE TRAFFIC CONTROL DEVICES

**PUBLIC CONVENIENCE AND SAFETY (D-1)**

Effective: May 1, 2012

Revised: July 15, 2012

Add the following to the end of the fourth paragraph of Article 107.09:

“If the holiday is on a Saturday or Sunday, and is legally observed on a Friday or Monday, the length of Holiday Period for Monday or Friday shall apply.”

Add the following sentence after the Holiday Period table in the fourth paragraph of Article 107.09:

“The Length of Holiday Period for Thanksgiving shall be from 5:00 AM the Wednesday prior to 11:59 PM the Sunday After”

Delete the fifth paragraph of Article 107.09 of the Standard Specifications:

“On weekends, excluding holidays, roadways with Average Daily Traffic of 25,000 or greater, all lanes shall be open to traffic from 3:00 P.M. Friday to midnight Sunday except where structure construction or major rehabilitation makes it impractical.”

## **TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)**

Effective: March 8, 1996

Revised: April 1, 2019

Description. This work shall include furnishing, installing, maintaining, replacing, relocating, and removing all traffic control devices used for the purpose of regulating, warning, or directing traffic. Traffic control and protection shall be provided as called for in the plans, applicable Highway Standards, District One Expressway details, Standards and Supplemental Specifications, these Special Provisions, or as directed by the Engineer.

General. The governing factor in the execution and staging of work for this project is to provide the motoring public with the safest possible travel conditions on the expressway through the construction zone. The Contractor shall arrange his operations to keep the closing of lanes and/or ramps to a minimum.

The Contractor shall be responsible for the proper location, installation, and arrangement of all traffic control devices. Special attention shall be given to existing warning signs and overhead guide signs during all construction operations. Warning signs and existing guide signs with down arrows shall be kept consistent with the barricade placement at all times. The Contractor shall immediately remove, completely cover, or turn from the motorist's view all signs which are inconsistent with lane assignment patterns.

The Contractor shall coordinate all traffic control work on this project with adjoining or overlapping projects, including barricade placement necessary to provide a uniform traffic detour pattern. When directed by the Engineer, the Contractor shall remove all traffic control devices that were furnished, installed, or maintained by him under this contract, and such devices shall remain the property of the Contractor. All traffic control devices shall remain in place until specific authorization for relocation or removal is received from the Engineer.

Additional requirements for traffic control devices shall be as follows.

- (a) Traffic Control Setup and Removal. The setting and removal of barricades for the taper portion of a lane closure shall be done under the protection of a vehicle with a truck/trailer mounted attenuator and arrow board per State Standard 701428 and Section 701 of the Standard Specifications. Failure to meet this requirement will be subject to a Traffic Control Deficiency. The deficiency will be calculated as outlined in Article 105.03 of the Standard Specifications. Truck/trailer mounted attenuators shall comply with Article 1106.02(g) or shall meet the requirements of NCHRP 350 Test Level 3 with vehicles used in accordance with manufacturer's recommendations and requirements.

(b) Sign Requirements

- (1) Sign Maintenance. Prior to the beginning of construction operations, the Contractor will be provided a sign log of all existing signs within the limits of the construction zone. The Contractor is responsible for verifying the accuracy of the sign log. Throughout the duration of this project, all existing traffic signs shall be maintained by the Contractor. All provisions of Article 107.25 of the Standard Specifications shall apply.
  - (2) Work Zone Speed Limit Signs. Work zone speed limit signs shall be installed as required in Article 701.14(b) and as shown in the plans and Highway Standards. Based upon the existing posted speed limit, work zone speed limits shall be established and signed as follows.
    - a. Existing Speed Limit of 55mph or higher. The initial work zone speed limit assembly, located approximately 4200' before the closure, and shall be 55mph as shown in 701400. Additional work zone 45mph assemblies shall be used as required according to Article 701.14(b) and as shown in the Highway Standards and plans. WORK ZONE SPEED LIMIT 55 PHOTO ENFORCED assemblies may be omitted when this assembly would normally be placed within 1500 feet of the END WORK ZONE SPEED LIMIT sign. If existing speed limit is over 65mph then additional signage should be installed per 701400.
    - b. Existing Speed Limit of 45mph. The advance 55mph work zone speed limit assembly shown in 701400 shall be replaced with a 45mph assembly. Additional work zone 45mph assemblies shall be used as required according to Article 701.14(b) and as shown in the Highway Standards and plans. WORK ZONE SPEED LIMIT 55 PHOTO ENFORCED assemblies shall be eliminated in all cases. END WORK ZONE SPEED LIMIT signs are required.
  - (3) Exit Signs. The exit gore signs as shown in Standard 701411 shall be a minimum size of 48 inch by 48 inch with 12 inch capital letters and a 20 inch arrow. EXIT OPEN AHEAD signs shown in Standard 701411 shall be a minimum size of 48 inch by 48 inch with 8 inch capital letters.
  - (4) Uneven Lanes Signs. The Contractor shall furnish and erect "UNEVEN LANES" signs (W8-11) on both sides of the expressway, at any time when the elevation difference between adjacent lanes open to traffic equals or exceeds one inch. Signs shall be placed 500' in advance of the drop-off, within 500' of every entrance, and a minimum of every mile.
- (c) Drums/Barricades. Check barricades shall be placed in work areas perpendicular to traffic every 1000', one per lane and per shoulder, to prevent motorists from using work areas as a traveled way. Check barricades shall also be placed in advance of each open patch, or excavation, or any other hazard in the work area, the first at the edge of the open traffic lane and the second centered in the closed lane. Check barricades, either Type I or II, or drums shall be equipped with a flashing light.

To provide sufficient lane widths (10' minimum) for traffic and also working room, the Contractor shall furnish and install vertical barricades, in lieu of Type II or drums, along the cold milling and asphalt paving operations. The vertical barricades shall be placed at the same spacing as the drums.

- (d) Vertical Barricades. Vertical barricades shall not be used in lane closure tapers, lane shifts, exit ramp gores, or staged construction projects lasting more than 12 hours. Also, vertical barricades shall not be used as patch barricades or check barricades. Special attention shall be given, and ballast provided per manufacture's specification, to maintain the vertical barricades in an upright position and in proper alignment.
- (e) Temporary Concrete Barrier Wall. Prismatic barrier wall reflectors shall be installed on both the face of the wall next to traffic, and the top of sections of the temporary concrete barrier wall as shown in Standard 704001. The color of these reflectors shall match the color of the edgelines (yellow on the left and crystal or white on the right). If the base of the temporary concrete barrier wall is 12 inches or less from the travel lane, then the lower slope of the wall shall also have a 6 inch wide temporary pavement marking edgeline (yellow on the left and white on the right).
- (f) Flaggers. One flagger will be required for each separate activity of an operation that requires frequent construction vehicles to enter or leave a work zone to or from a lane open to traffic. Temporary traffic control and flagger position shall be according to District One Detail TC-18 – Expressway Flagging, or as directed by the Engineer.
- (g) Full Expressway Closures. Full Expressway Closures will only be permitted for a maximum of 15 minutes during the allowable hours listed in the Keeping the Expressway Open to Traffic Special Provision. During Full Expressway Closures, the Contractor will be required to close off all lanes except one, using Freeway Standard Closures. The Contractor will be required to provide one changeable message sign to be placed at the direction of the Engineer. The sign shall display a message as directed by the Engineer. A Maintenance of Traffic Plan shall be submitted to the District One Expressway Traffic Control Supervisor 14 days in advance of the planned work; including all stage changes. The Maintenance of Traffic Plan shall include, but not be limited to: lane and ramp closures, existing geometrics, and equipment and material location. The District One Expressway Traffic Control Supervisor (847-705-4151) shall be contacted at least 3 working days in advance of the proposed road closure and will coordinate the closure operation with police forces.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing, installing, maintaining, replacing, relocating, and removing traffic control devices required in the plans and these Special Provisions. Traffic control and protection required under Standards 701101, 701400, 701401, 701402, 701406, 701411, 701416, 701426, 701428, 701446, 701901 and District details TC-8, TC-9, TC-17, TC-18 and TC-25 will be included with this item.

Basis of Payment.

- (a) This work will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS). This price shall be payment in full for all labor, materials, transportation, handling, and incidental work necessary to furnish, install, maintain, replace, relocate, and remove all Expressway traffic control devices required in the plans and specifications.

In the event the sum total value of all the work items for which traffic control and protection is required is increased or decreased by more than ten percent (10%), the contract bid price for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS) will be adjusted as follows:

$$\text{Adjusted contract price} = .25P + .75P [1 \pm (X - 0.1)]$$

Where: "P" is the bid unit price for Traffic Control and Protection

Where: "X" =		$\frac{\text{Difference between original and final sum total value of all work items for which traffic control and protection is required}}{\text{Original sum total value of all work items for which traffic control and protection is required.}}$
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The value of the work items used in calculating the increase and decrease will include only items that have been added to or deducted from the contract under Article 104.02 of the Standard Specifications and only items which require use of Traffic Control and Protection.

- (b) The Engineer may require additional traffic control be installed in accordance with standards and/or designs other than those included in the plans. In such cases, the standards and/or designs will be made available to the Contractor at least one week in advance of the change in traffic control. Payment for any additional traffic control required will be in accordance with Article 109.04 of the Standard Specifications.
- (c) Revisions in the phasing of construction or maintenance operations, requested by the Contractor, may require traffic control to be installed in accordance with standards and/or designs other than those included in the plans. Revisions or modifications to the traffic control shown in the contract shall be submitted by the Contractor for approval by the Engineer. No additional payment will be made for a Contractor requested modification.
- (d) Temporary concrete barrier wall will be measured and paid for according to Section 704.
- (e) Impact attenuators, temporary bridge rail, and temporary rumble strips will be paid for separately.
- (f) Temporary pavement markings shown on the Standard will be measured and paid for according to Section 703 and Section 780.
- (g) All pavement marking removal will be measured and paid for according to Section 703 or Section 783.
- (h) Temporary pavement marking on the lower slope of the temporary concrete barrier wall will be measured and paid for as TEMPORARY PAVEMENT MARKING, 6".
- (i) All barrier wall reflectors will be measured and paid for according to Section 782.
- (j) The Changeable Message Sign required for Full Expressway Closures shall not be paid for separately.



**TRAFFIC CONTROL FOR WORK ZONE AREA (D-1)**

Effective: September 14, 1995

Revised: January 1, 2007

Work zone entry and exit openings shall be established daily by the Contractor with the approval of the Engineer. All vehicles including cars and pickup trucks shall exit the work zone at the exit openings. All trucks shall enter the work zone at the entry openings. These openings shall be signed in accordance with the details shown elsewhere in the plans and shall be under flagger control during working hours.

The Contractor shall plan his trucking operations into and out of the work zone as well as on to and off the expressway to maintain adequate merging distance. Merging distances to cross all lanes of traffic shall be no less than 1/2 mile. This distance is the length from where the trucks enter the expressway to where the trucks enter the work zone. It is also the length from where the trucks exit the work zone to where the trucks exit the expressway. The stopping of expressway traffic to allow trucks to change lanes and/or cross the expressway is prohibited.

Failure to comply with the above requirements will result in a Traffic Control Deficiency charge. The deficiency charge will be calculated as outlined in Article 105.03 of the Standard specifications. The Contractor will be assessed this daily charge for each day a deficiency is documented by the Engineer.

**TRAFFIC CONTROL SURVEILLANCE (EXPRESSWAYS)**

Effective: October 25, 1995

Revised: January 21, 2015

The contractor shall provide a person with a vehicle to survey, inspect and maintain all temporary traffic control devices when a lane is closed to traffic, when hazards are present adjacent to or within 10 foot of the edge of pavement for more than 24 hours, or as directed by the Engineer.

The surveillance person is required to drive through the project, to inspect all temporary traffic control devices, to correct all traffic control deficiencies, if possible, or immediately contact someone else to make corrections and to assist with directing traffic until such corrections are made, at intervals not to exceed 4 hours. This person shall list every inspection on an inspection form, furnished by the Engineer, and shall return a completed form on the first working day after the inspections are made.

The Contractor shall supply a telephone staffed on a 24-hour-a-day basis to receive any notification of any deficiencies regarding traffic control and protection or receive any request for improving, correcting or modifying traffic control, installations or devices, including pavement markings. The Contractor shall dispatch additional men, materials and equipment as necessary to begin to correct, improve or modify the traffic control as directed, within one hour of notification by this surveillance person or by the Department. Upon completion of such corrections and/or revisions, the Contractor shall notify the Department's Communication Center at (847) 705-4612.

Method of Measurement. Traffic Control Surveillance will be measured on calendar day basis. One calendar day is equal to a minimum of six (6) inspections. The inspections shall start within 4 hours after the lane is closed to traffic, a hazard exists within 10 foot from the edge of pavement, or as directed by the Engineer and shall end when the lane closure or hazard is removed or as directed by the Engineer.

Basis of Payment. Surveillance will be paid for at the contract unit price per calendar day or fraction thereof for TRAFFIC CONTROL SURVEILLANCE (EXPRESSWAYS). The price shall include all labor and equipment necessary to provide the required inspection and maintenance on the expressway and on all cross streets which are included in the project. The cost of the materials for the maintenance of traffic control devices shall be included in the traffic control pay items.

**ENGINEER'S FIELD OFFICE TYPE A (SPECIAL) (D-1)**

Effective: December 1, 2011 Revised: May 1, 2013

Revise the first paragraph of Article 670.02 to read:

**670.02 Engineer's Field Office Type A (Special). Type A (Special)** field offices shall have a ceiling height of not less than 7 feet and a floor space of not less than 3000 square feet with a minimum of two separate offices. The office shall also have a separate storage room capable of being locked for the storage of the nuclear measuring devices. The office shall be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the Engineer.

Revise the first sentence of the second paragraph of Article 670.02 to read:

An electronic security system that will respond to any breach of exterior doors and windows with an on-site alarm shall be provided.

Revise the last sentence of the third paragraph of Article 670.02 to read:

Adequate all-weather parking space shall be available to accommodate a minimum of twelve vehicles.

Revise the fifth paragraph of Article 670.02 to read:

Sanitary facilities shall include hot and cold potable running water, lavatory and toilet as an integral part of the office where available. Solid waste disposal consisting of seven waste baskets and an outside trash container of sufficient size to accommodate a weekly provided pick-up service. A weekly cleaning service for the office shall be provided.

Revise subparagraph (a) of Article 670.02 to read:

(a) Twelve desks with minimum working surface 42 inch x 30 inch each and twelve non-folding chairs with upholstered seats and backs.

Revise the first sentence of subparagraph (c) of Article 670.02 to read:

- (c) Two four-post drafting tables with minimum top size of 37-½ inch x 48 inch.

Revise subparagraph (d) of Article 670.02 to read:

- (d) Eight free standing four-drawer legal size file cabinets with lock and an underwriters' laboratories insulated file device 350 degrees one hour rating.

Revise subparagraph (e) of Article 670.02 to read:

- (e) Twenty folding chairs and two conference tables with minimum top size of 44 inch x 96 inch.

Revise subparagraph (h) of Article 670.02 to read:

- (h) Three electric desk type tape printing calculator and two pocket scientific notation calculators with a 1000 hour battery life or with a portable recharger.

Revise subparagraph (i)(2) of Article 670.02 to read:

- (i)(2) Telephones lines. Five separate telephone lines including one line for the fax machine, and two lines for the exclusive use of the Engineer. All telephone lines shall include long distance service and all labor and materials necessary to install the phone lines at the locations directed by the Engineer. The TELCOM company shall configure ROLL/HUNT features as specified by the engineer.

Revise subparagraph (j) of Article 670.02 to read:

- (j) Two plain paper network multi-function printer/copier/scanner machines capable of reproducing prints up to 11 inch x 17 inch within automatic feed tray capable of sorting 30 sheets of paper. Letter size and 11 inch x 17 inch paper shall be provided. The contractor shall provide the multi-function machines with IT support for setup and maintenance.

Revise subparagraph (k) of Article 670.02 to read:

- (k) One plain paper fax machine including maintenance and supplies.

Revise subparagraph (l) of Article 670.02 to read:

- (l) Six four-line telephones, with touch tone, where available, and two digital answering machines, for exclusive use by the Engineer.

Revise subparagraph (m) of Article 670.02 to read:

- (m) One electric water cooler dispenser including water service.

Add the following subparagraphs to Article 670.02:

(s) One 4 foot x 6 foot chalkboard or dry erase board.

(t) One 4 foot x 6 foot framed cork board.

Add the following to Article 670.07 Basis of Payment.

The building or buildings, fully equipped, will be paid for at the contract unit price per calendar month or fraction thereof for ENGINEER'S FIELD OFFICE, TYPE A (SPECIAL).

### **CLEANING OF TRAFFIC CONTROL DEVICES**

All traffic control devices shall be kept clean as stated in Article 701 of the Standard Specifications. In addition, the Contractor shall make sure the traffic control devices are cleaned after snowfalls or snow plowing if needed or as directed by the Engineer. This work will not be measured for payment or paid for separately and shall be included in the other contract pay items for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS).

### **PROTECTION OF EXISTING DRAINAGE FACILITIES DURING CONSTRUCTION**

All existing drainage structures are to be kept free of any debris resulting from construction operations. All work and material necessary to prevent accumulation of debris in the drainage structures will be considered as incidental to the Contract. Any debris in the drainage structures resulting from construction operations shall be removed at the Contractor's own expense, and no extra compensation will be allowed. Any minor ditch grading, modifications to existing drainage structures to ensure proper roadway drainage, culverts under temporary drives, and any bulkheading as directed by the Engineer necessary to provide for the interim drainage for construction staging will not be paid for separately but shall be included in the cost of earth excavation and erosion control. Should reconstruction or adjustment of a drainage structure be required by the Engineer in the field, the necessary work and payment shall be done in accordance with Section 602 and Article 104.02 respectively of the Standard Specifications.

During construction if the Contractor encounters or otherwise becomes aware of any sewers, underdrains or field drains within the right-of-way other than those shown on the Plans, he/she shall so inform the Engineer who shall direct the work necessary to maintain or replace the facilities in service and to protect them from damage during construction if maintained. Existing facilities to be maintained that are damaged because of non-compliance with this provision shall be replaced at the Contractor's own expense. Should the Engineer have directed the replacement of a facility, the necessary work and payment shall be done in accordance with Sections 550 and 601 and Article 104.02 respectively of the Standard Specifications.

## **GENERAL ELECTRICAL REQUIREMENTS (D-1)**

Effective: June 1, 2021

This special provision replaces Articles 801.01 – 801.07, 801.09 – 801-16 of the Standard Specifications.

**Definition.** Codes, standards, and industry specifications cited for electrical work shall be by definition the latest adopted version thereof, unless indicated otherwise.

Materials by definition shall include electrical equipment, fittings, devices, motors, appliances, fixtures, apparatus, all hardware and appurtenances, and the like, used as part of, or in connection with, electrical installation.

**Standards of Installation.** Materials shall be installed according to the manufacturer's recommendations, the NEC, OSHA, the NESC, and AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

All like materials shall be from the same manufacturer. Listed and labeled materials shall be used whenever possible. The listing shall be according to UL or an approved equivalent.

**Safety and Protection.** Safety and protection requirements shall be as follows.

**Safety.** Electrical systems shall not be left in an exposed or otherwise hazardous condition. All electrical boxes, cabinets, pole handholes, etc. which contain wiring, either energized or non-energized, shall be closed or shall have covers in place and be locked when possible, during nonworking hours.

**Protection.** Electrical raceway or duct openings shall be capped or otherwise sealed from the entrance of water and dirt. Wiring shall be protected from mechanical injury.

**Equipment Grounding Conductor.** All electrical systems, materials, and appurtenances shall be grounded. Good ground continuity throughout the electrical system shall be assured, even though every detail of the requirements is not specified or shown. Electrical circuits shall have a continuous insulated equipment grounding conductor. When metallic conduit is used, it shall be bonded to the equipment grounding conductor, but shall not be used as the equipment grounding conductor.

Detector loop lead-in circuits, circuits under 50 volts, and runs of fiber optic cable will not require an equipment grounding conductor.

Where connections are made to painted surfaces, the paint shall be scraped to fully expose metal at the connection point. After the connection is completed, the paint system shall be repaired to the satisfaction of the Engineer.

Bonding of all boxes and other metallic enclosures throughout the wiring system to the equipment grounding conductor shall be made using a splice and pigtail connection. Mechanical connectors shall have a serrated washer at the contact surface.

All connections to structural steel or fencing shall be made with exothermic welds. Care shall be taken not to weaken load carrying members. Where connections are made to epoxy coated reinforcing steel, the epoxy coating shall be sufficiently removed to facilitate a mechanical connection. The epoxy coating shall be repaired to the satisfaction of the Engineer. Where connections are made to insulated conductors, the connection shall be wrapped with at least four layers of electrical tape extended 6 in. (150 mm) onto the conductor insulation.

**Submittals.** At the preconstruction meeting, the Contractor shall submit a written listing of manufacturers for all major electrical and mechanical items. The list of manufacturers shall be binding, except by written request from the Contractor and approval by the Engineer. The request shall include acceptable reasons and documentation for the change.

Within 30 calendar days after contract execution, the Contractor shall submit, for approval, through the Traffic Operations Construction Submittals Application (TOCS) system the manufacturer's product data (for standard products and components) and detailed shop drawings (for fabricated items). Submittals for the materials for each individual pay item shall be complete in every respect. Submittals which include multiple pay items shall have all submittal material for each item or group of items covered by a particular specification, grouped together and the applicable pay item identified. Various submittals shall, when taken together, form a complete coordinated package. A partial submittal will be returned without review unless prior written permission is obtained from the Engineer.

Each PDF document must be a vector format PDF from the originating supplier or program and not scanned images.

The submittal must clearly identify the specific model number or catalog number of the item being proposed.

For further information and requirements regarding the TOCS system, the Contractor should reference the *TOCS Contractors User Guide*.

The submittal shall be properly identified by route, section, county, and contract number.

The Contractor shall have reviewed the submittal material and affixed his/her stamp of approval, with date and signature, for each individual item.

Illegible print, incompleteness, inaccuracy, or lack of coordination will be grounds for rejection.

**Items from multiple disciplines shall not be combined on a single submittal and transmittal. Items for lighting, signals, surveillance and CCTV must be in separate submittals since they may be reviewed by various personnel in various locations.**

The Department may provide a list of pay items broken out by discipline upon request for a particular contract.

The Engineer will review the submittals for conformance with the design concept of the project according to Article 105.04 and the following. The Engineer will stamp the drawings indicating their status as "Approved", "Approved as Noted", "Disapproved", or "Information Only". Since the Engineer's review is for conformance with the design concept only, it shall be the Contractor's responsibility to coordinate the various items into a working system as specified. The Contractor shall not be relieved from responsibility for errors or omissions in the shop, working, or layout drawings by the Engineer's approval thereof. The Contractor shall still be in full compliance with contract and specification requirements.

All submitted items reviewed and marked "Disapproved" or "Approved as Noted" shall be resubmitted by the Contractor in their entirety, unless otherwise indicated within the submittal comments.

Work shall not begin until the Engineer has approved the submittal. Material installed prior to approval by the Engineer, will be subject to removal and replacement at no additional cost to the Department.

**Certifications.** When certifications are specified and are available prior to material manufacture, the certification shall be included in the submittal information. When specified and only available after manufacture, the submittal shall include a statement of intent to furnish certification. All certificates shall be complete with all appropriate test dates and data.

**Authorized Project Delay.** See Article 801.08

**Maintenance transfer and Preconstruction Inspection:**

General. Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor shall request a maintenance transfer and preconstruction site inspection, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any lighting and/or traffic control systems which may be affected by the work. The request for the maintenance transfer and preconstruction inspection shall be made no less than fourteen (14) calendar days prior to the desired inspection date. The maintenance transfer and preconstruction inspection shall:

Establish the procedures for formal transfer of maintenance responsibility required for the construction period.

Establish the approximate location and operating condition of lighting and/or traffic control systems which may be affected by the work

Marking of Existing Cable Systems. The party responsible for maintenance of any existing lighting and/or traffic control systems at the project site will, at the Contractor's request, mark and/or stake, once per location, all underground cable routes owned or maintained by the State. A project may involve multiple "locations" where separated electrical systems are involved (i.e. different controllers). The markings shall be taken to have a horizontal tolerance of at least 1 foot (304.8 mm) to either side. The request for the cable locations and marking shall be made at the same time the request for the maintenance transfer and preconstruction inspection is made. The Contractor shall exercise extreme caution where existing buried cable runs are involved. The markings of existing systems are made strictly for assistance to the Contractor and this does not relieve the Contractor of responsibility for the repair or replacement of any cable run damaged in the course of his work, as specified elsewhere herein. Note that the contractor shall be entitled to only one request for location marking of existing systems and that multiple requests may only be honored at the contractor's expense. No locates will be made after maintenance is transferred, unless it is at the contractor's expense.

Condition of Existing Systems. The Contractor shall conduct an inventory of all existing electrical system equipment within the project limits, which may be affected by the work, making note of any parts which are found broken or missing, defective or malfunctioning. Megger and load readings shall be taken for all existing circuits which will remain in place or be modified. If a circuit is to be taken out in its entirety, then readings do not have to be taken. The inventory and test data shall be reviewed with and approved by the Engineer and a record of the inventory shall be submitted to the Engineer for the record. Without such a record, all systems transferred to the Contractor for maintenance during construction shall be returned at the end of construction in complete, fully operating condition."

### **Maintenance and Responsibility During Construction.**

Lighting Operation and Maintenance Responsibility. The scope of work shall include the assumption of responsibility for the continuing operation and maintenance of the existing, proposed, temporary, sign and navigation lighting, or other lighting systems and all appurtenances affected by the work as specified elsewhere herein. Maintenance of lighting systems is specified elsewhere and will be paid for separately

The proposed lighting system must be operational prior to opening the roadway to traffic unless temporary lighting exists which is designed and installed to properly illuminate the roadway.

Energy and Demand Charges. The payment of basic energy and demand charges by the electric utility for existing lighting which remains in service will continue as a responsibility of the Owner, unless otherwise indicated. Unless otherwise indicated or required by the Engineer duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously at the Owner's expense and lighting systems shall not be kept in operation during long daytime periods at the Owner's expense. Upon written authorization from the Engineer to place a proposed new lighting system in service, whether the system has passed final acceptance or not, (such as to allow temporary lighting to be removed), the Owner will accept responsibility for energy and demand charges for such lighting, effective the date of authorization. All other energy and demand payments to the utility shall be the responsibility of the Contractor until final acceptance.



**Damage to Electrical Systems.** Should damage occur to any existing electrical systems through the Contractor's operations, the Engineer will designate the repairs as emergency or non-emergency in nature.

Emergency repairs shall be made by the Contractor, or as determined by the Engineer, the Department, or its agent. Non-emergency repairs shall be performed by the Contractor within six working days following discovery or notification. All repairs shall be performed in an expeditious manner to assure all electrical systems are operational as soon as possible. The repairs shall be performed at no additional cost to the Department.

Lighting. An outage will be considered an emergency when three or more lights on a circuit or three successive lights are not operational. Knocked down materials, which result in a danger to the motoring public, will be considered an emergency repair.

Temporary aerial multi-conductor cable, with grounded messenger cable, will be permitted if it does not interfere with traffic or other operations, and if the Engineer determines it does not require unacceptable modification to existing installations.

**Marking Proposed Locations for Highway Lighting System.** The Contractor shall mark or stake the proposed locations of all poles, cabinets, junction boxes, pull boxes, handholes, cable routes, pavement crossings, and other items pertinent to the work. A proposed location inspection by the Engineer shall be requested prior to any excavation, construction, or installation work after all proposed installation locations are marked. Any work installed without location approval is subject to corrective action at no additional cost to the Department.

**Inspection of electrical work.** Inspection of electrical work shall be according to Article 105.12 and the following.

Before any splice, tap, or electrical connection is covered in handholes, junction boxes, light poles, or other enclosures, the Contractor shall notify and make available such wiring for the Engineer's inspection.

**Testing.** Before final inspection, the electrical work shall be tested. Tests may be made progressively as parts of the work are completed or may be made when the work is complete. Tests shall be made in the presence of the Engineer. Items which fail to test satisfactorily shall be repaired or replaced. Tests shall include checks of control operation, system voltages, cable insulation, and ground resistance and continuity.

The forms for recording test readings will be available from the Engineer in electronic format. The Contractor shall provide the Engineer with a written report of all test data including the following:

- Voltage Tests
- Amperage Tests
- Insulation Resistance Tests
- Continuity tests
- Detector Loop Tests

Lighting systems. The following tests shall be made.

- (1) Voltage Measurements. Voltages in the cabinet from phase to phase and phase to neutral, at no load and at full load, shall be measured and recorded. Voltage readings at the last termination of each circuit shall be measured and recorded.
- (2) Insulation Resistance. Insulation resistance to ground of each circuit at the cabinet shall be measured and recorded with all loads disconnected. Prior to performance of the insulation resistance test, the Contractor shall remove all fuses within all light pole bases on a circuit to segregate the luminaire loads.

On tests of new cable runs, the readings shall exceed 50 megohms for phase and neutral conductors with a connected load over 20A and shall exceed 100 megohms for conductors with a connected load of 20A or less.

On tests of cable runs which include cables which were existing in service prior to this contract, the resistance readings shall be the same or better than the readings recorded at the maintenance transfer at the beginning of the contract. Measurements shall be taken with a megohm meter approved by the Engineer.

- (3) Loads. The current of each circuit, phase main, and neutral shall be measured and recorded. The Engineer may direct reasonable circuit rearrangement. The current readings shall be within ten percent of the connected load based on material ratings.
- (4) Ground Continuity. Resistance of the system ground as taken from the farthest extension of each circuit run from the controller (i.e. check of equipment ground continuity for each circuit) shall be measured and recorded. Readings shall not exceed 2.0 ohms, regardless of the length of the circuit.
- (5) Resistance of Grounding Electrodes. Resistance to ground of all grounding electrodes shall be measured and recorded. Measurements shall be made with a ground tester during dry soil conditions as approved by the Engineer. Resistance to ground shall not exceed 10 ohms.

ITS. The following test shall be made in addition to the lighting system test above.

Detector Loops. Before and after permanently securing the loop in the pavement, the resistance, inductance, resistance to ground, and quality factor for each loop and lead-in circuit shall be tested. The loop and lead-in circuit shall have an inductance between 20 and 2500 microhenries. The resistance to ground shall be a minimum of 50 megohms under any conditions of weather or moisture. The quality factor (Q) shall be 5 or greater.

Fiber Optic Systems. Fiber optic testing shall be performed as required in the fiber optic cable special provision and the fiber optic splice special provision.

All test results shall be furnished to the Engineer seven working days before the date the inspection is scheduled.

**Contract Guarantee.** The Contractor shall provide a written guarantee for all electrical work provided under the contract for a period of six months after the date of acceptance with the following warranties and guarantees.

- (a) The manufacturer's standard written warranty for each piece of electrical material or apparatus furnished under the contract. The warranty for light emitting diode (LED) modules, including the maintained minimum luminance, shall cover a minimum of 120 months from the date of delivery.
- (b) The Contractor's written guarantee that, for a period of six months after the date of final acceptance of the work, all necessary repairs to or replacement of said warranted material or apparatus for reasons not proven to have been caused by negligence on the part of the user or acts of a third party shall be made by the Contractor at no additional cost to the Department.
- (c) The Contractor's written guarantee for satisfactory operation of all electrical systems furnished and constructed under the contract for a period of six months after final acceptance of the work.

The warranty for an uninterruptable power supply (UPS) shall cover a minimum of two years from date the equipment is placed in operation; however, the batteries of the UPS shall be warranted for full replacement for a minimum of five years.

**Record Drawings.** Alterations and additions to the electrical installation made during the execution of the work shall be made on the PDF copy of the as-Let documents using a PDF editor. Hand drawn notations or markups and scanned plans are not acceptable. These drawings shall be updated daily and shall be available for inspection by the Engineer during the work. The record drawings shall include the following:

- Cover Sheet
- The Electrical Maintenance Contract Management System (EMCMS) location designation, i.e. "L" number
- Summary of Quantities, electrical items only
- Legends, Schedules, and Notes
- Plan Sheets
- Pertinent Details
- Single Line Diagrams
- Other useful information useful to locate and maintain the systems.

Any modifications to the details shall be indicated. Final quantities used shall be indicated on the Summary of Quantities. Foundation depths used shall also be listed.

As part of the record drawings, the Contractor shall inventory all materials, new or existing, on the project and record information on inventory sheets provided by the Engineer.

The inventory shall include:

- Location of Equipment, including rack, chassis, slot as applicable.
- Designation of Equipment
- Equipment manufacturer
- Equipment model number
- Equipment Version Number
- Equipment Configuration
  - Addressing, IP or other
  - Settings, hardware or programmed
- Equipment Serial Number

The following electronic inventory forms are available from the Engineer:

- Lighting Controller Inventory
- Lighting Inventory
- Light Tower Inspection Checklist
- ITS Location Inventory

The information shall be entered in the forms; handwritten entries will not be acceptable; except for signatures. Electronic file shall also be included in the documentation.

When the work is complete, and seven days before the request for a final inspection, the set of contract drawings, stamped "**RECORD DRAWINGS**", shall be submitted to the Engineer for review and approval and shall be stamped with the date and the signature of the Contractor's supervising Engineer or Electrician. The record drawings shall be submitted in PDF format through TOCS, on CD-ROM as well as hardcopy's for review and approval.

In addition to the record drawings, PDF copies of the final catalog cuts which have been Approved and Approved as Noted with applicable follow-up shall be submitted along with the record drawings. The PDF files shall clearly indicate either by filename or PDF table of contents the respective pay item number. Specific part or model numbers of items which have been selected shall be clearly visible. Hard copies of the catalog are not required with this submittal.

The Contractor shall provide three sets of electronically produced drawings in a moisture proof pouch to be kept on the inside door of the controller cabinet or other location approved by the Engineer. These drawings shall show the final as-built circuit orientation(s) of the project in the form of a single line diagram with all luminaires numbered and clearly identified for each circuit.

Final documentation shall be submitted as a complete submittal package, i.e. record drawings, test results, inventory, etc. shall be submitted at the same time. Partial piecemeal submittals will be rejected without review.

A total of three hardcopies and two CD-ROMs of the final documentation shall be submitted. The identical material shall also be submitted through the TOCS system utilizing the following final documentation pay item numbers:

<b>Pay Code</b>	<b>Description</b>	<b>Discipline</b>
FDLRD000	Record Drawings - Lighting	Lighting
FDSRD000	Record Drawings - Surveillance	Surveillance
FDTRD000	Record Drawings - Traffic Signal	Traffic Signal
FDIRD000	Record Drawings - ITS	ITS
FDLCC000	Catalog Cuts - Lighting	Lighting
FDSCC000	Catalog Cuts – Surveillance	Surveillance
FDTCC000	Catalog Cuts – Traffic Signal	Traffic Signal
FDICC000	Catalog Cuts - ITS	ITS
FDLWL000	Warranty - Lighting	Lighting
FDSWL000	Warranty - Surveillance	Surveillance
FDTWL000	Warranty - Traffic Signal	Traffic Signal
FDIWL000	Warranty - ITS	ITS
FDLTR000	Test Results - Lighting	Lighting
FDSTR000	Test Results - Surveillance	Surveillance
FDTTR000	Test Results - Traffic Signal	Traffic Signal
FDITR000	Test Results - ITS	ITS
FDLINV00	Inventory - Lighting	Lighting
FDSINV00	Inventory - Surveillance	Surveillance
FDTINV00	Inventory - Traffic Signal	Traffic Signal
FDIINV00	Inventory - ITS	ITS
FDLGPS00	GPS - Lighting	Lighting
FDSGPS00	GPS - Surveillance	Surveillance
FDTGPS00	GPS - Traffic Signal	Traffic Signal
FDIGPS00	GPS - ITS	ITS

Record Drawings shall include Marked up plans, controller info, Service Info, Equipment Settings, Manuals, Wiring Diagrams for each discipline.

Test results shall be all electrical test results, fiber optic OTDR, and Fiber Optic power meter as applicable for each discipline.

GPS Documentation. In addition to the specified record drawings, the Contactor shall record GPS coordinates of the following electrical components being installed, modified or being affected in other ways by this contract:

- All light poles and light towers.
- Handholes and vaults.
- Junction Boxes
- Conduit roadway crossings.
- Controllers.
- Control Buildings.
- Structures with electrical connections, i.e. DMS, lighted signs.
- Electric Service locations.
- CCTV Camera installations.
- Roadway Surveillance installations.
- Fiber Optic Splice Locations.
- Fiber Optic Cables. Coordinates shall be recorded along each fiber optic cable route every 200 feet.
- All fiber optic slack locations shall be identified with quantity of slack cable included. When sequential cable markings are available, those markings shall be documented as cable marking into enclosure and marking out of enclosure.

Datum to be used shall be North American 1983.

Data shall be provided electronically. The electronic format shall be compatible with MS Excel. Latitude and Longitude shall be in decimal degrees with a minimum of 6 decimal places. Each coordinate shall have the following information:

1. District
2. Description of item
3. Designation
4. Use
5. Approximate station
6. Contract Number
7. Date
8. Owner
9. Latitude
10. Longitude
11. Comments

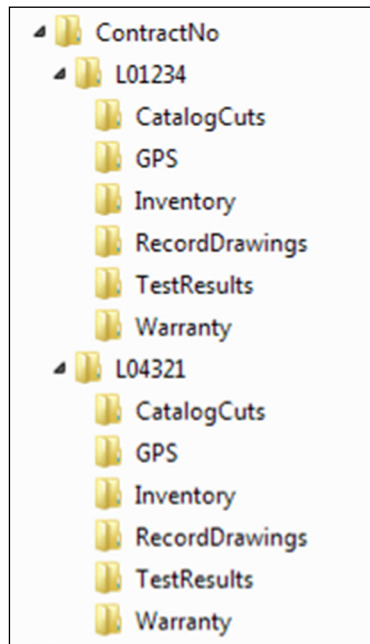
A spreadsheet template will be available from the Engineer for use by the Contractor.

Accuracy. Data collected is to be mapping grade. A handheld mapping grade GPS device shall be used for the data collection. The receiver shall support differential correction and data shall have minimum 5 meter accuracy after post processing.

GPS receivers integrated into cellular communication devices, recreational and automotive GPS devices are not acceptable.

The GPS shall be the product of an established major GPS manufacturer having been in the business for a minimum of 6 years.”

The documents on the CD shall be organized by the Electrical Maintenance Contract Management System (EMCMS) location designation. If multiple EMCMS locations are within the contract, separate folders shall be utilized for each location as follows:



Extraneous information not pertaining to the specific EMCMS location shall not be included in that particular folder and sub-folder.

The inspection will not be made until after the delivery of acceptable record drawings, specified certifications, and the required guarantees.

The Final Acceptance Documentation Checklist shall be completed and is contained elsewhere herein.

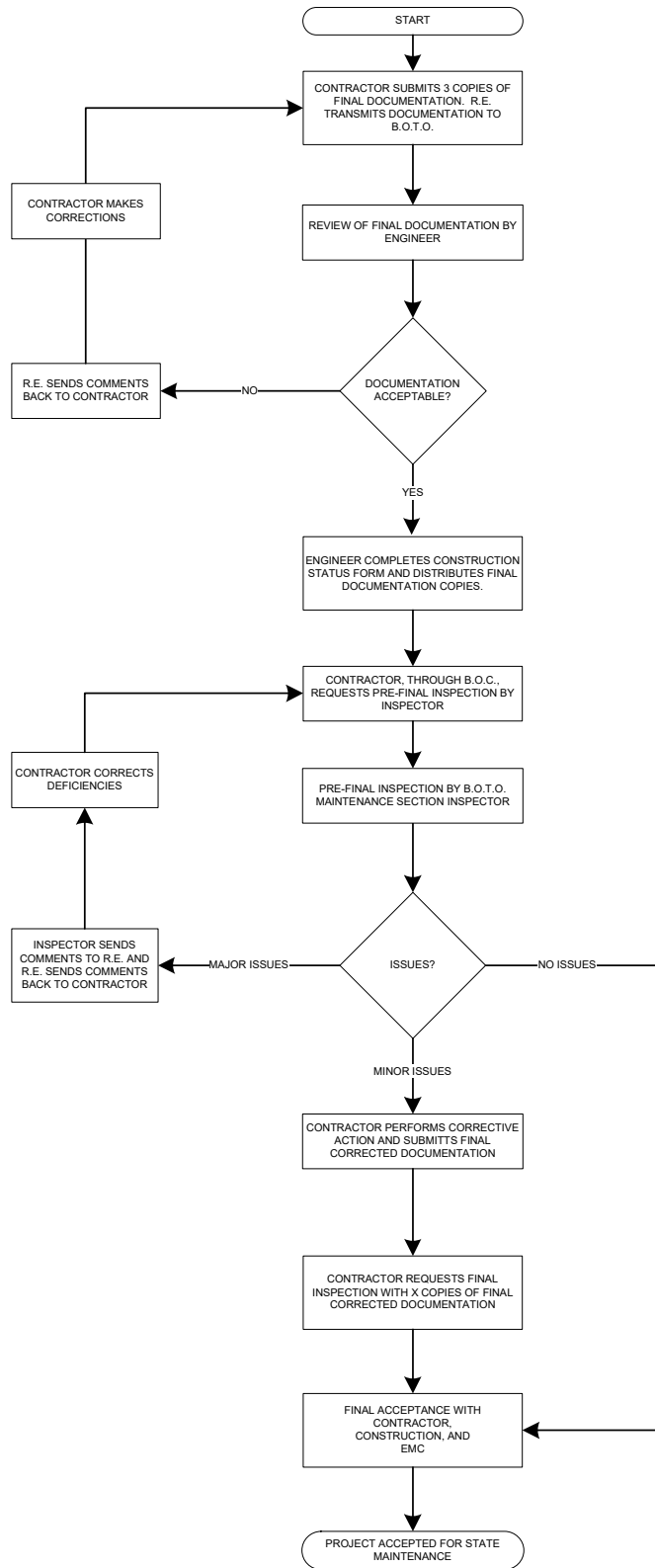
All CD's shall be labeled as illustrated in the CD Label Template contained herein.

**Acceptance.** Acceptance of electrical work will be given at the time when the Department assumes the responsibility to protect and maintain the work according to Article 107.30 or at the time of final inspection.

When the electrical work is complete, tested, and fully operational, the Contractor shall schedule an inspection for acceptance with the Engineer no less than seven working days prior to the desired inspection date. The Contractor shall furnish the necessary labor and equipment to make the inspection.

A written record of the test readings taken by the Contractor according to Article 801.13 shall be furnished to the Engineer seven working days before the date the inspection is scheduled. Inspection will not be made until after the delivery of acceptable record drawings, specified certifications, and the required guarantees.





### Final Acceptance Documentation Checklist

LOCATION	
Route	Common Name
Limits	Section
Contract #	County
Controller Designation(s)	EMC Database Location Number(s)

ITEM	Contractor (Verify)	Resident Engineer (Verify)
<b>Record Drawings</b> -Three hardcopies (11" x 17") -Scanned to two CD-ROMs	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
<b>Field Inspection Tests</b> -Voltage -Amperage -Cable Insulation Resistance -Continuity -Controller Ground Rod Resistance (Three Hardcopies & scanned to two CD's)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>GPS Coordinates</b> -Excel file (Check Special Provisions, Excel file scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Job Warranty Letter</b> (Three Hardcopies & scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Catalog Cut Submittals</b> -Approved & Approved as Noted (Scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Lighting Inventory Form</b> (Three Hardcopies & scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Lighting Controller Inventory Form</b> (Three Hardcopies & scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Light Tower Inspection Form</b> (If applicable, Three Hardcopies & scanned to two CD's)	<input type="checkbox"/>	<input type="checkbox"/>

Three Hardcopies & scanned to two CD's shall be submitted for all items above. The CD ROM shall be labeled as shown in the example contained herein.

**General Notes:**

Record Drawings – The record drawings should contain contract cover sheet, summary of quantities showing all lighting pay item sheets, proposed lighting plans and lighting detail sheets. Submit hardcopies shall be 11” x 17” size. Temporary lighting plans and removal lighting plans should not be part of the set.

Field Inspection Tests – Testing should be done for proposed cables. Testing shall be per standard specifications. Forms shall be neatly filled out.

GPS Coordinates – Check special provisions “General Electrical Requirements”. Submit electronic “EXCEL” file.

Job Warranty Letter – See standard specifications.

Cutsheet Submittal – See special provisions “General Electrical Requirements”. Scan Approved and Approved as Noted cutsheets.

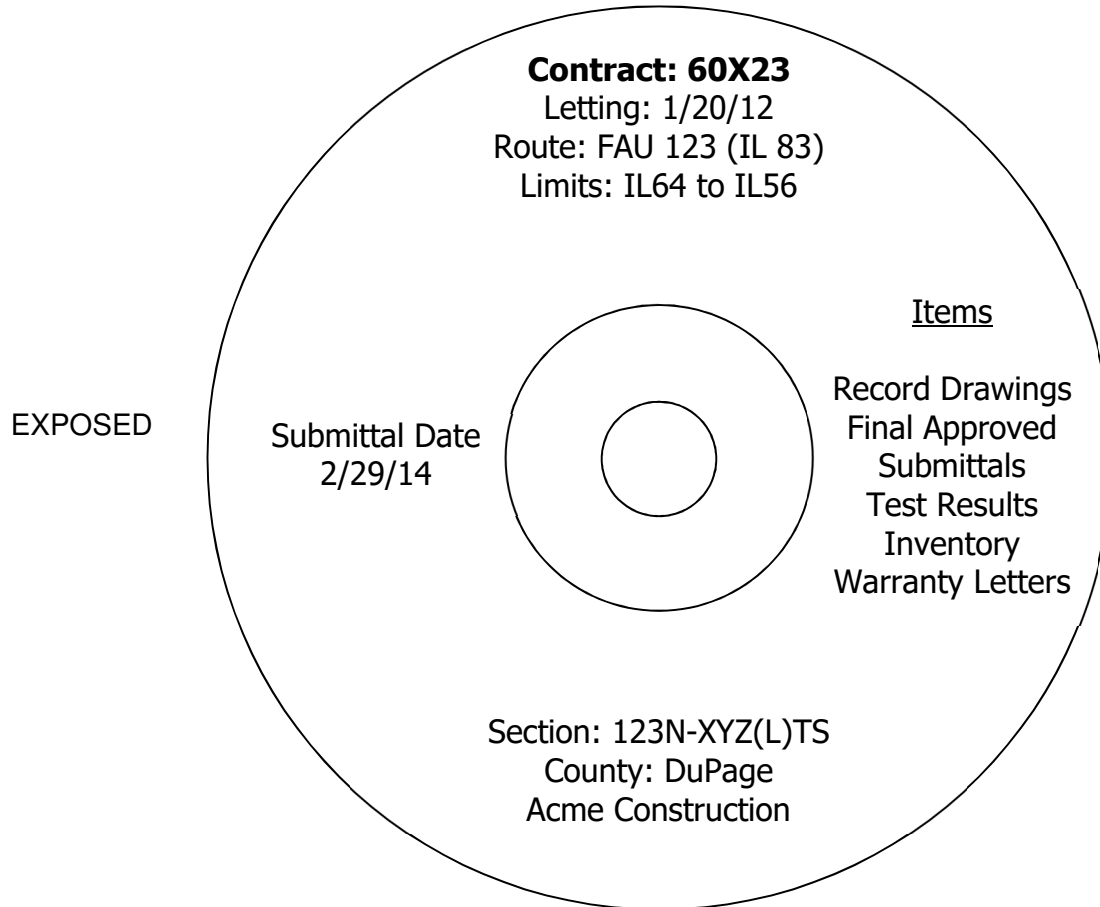
Lighting Inventory Form – Inventory form should include only proposed light poles, proposed light towers, proposed combination (traffic/light pole) lighting and proposed underpass luminaires.

Lighting Controller Inventory Form – Form should be filled out for only proposed lighting controllers.

Light Tower Safety Inspection Form – Form should be filled out for each proposed light tower.

CD LABEL FORMAT TEMPLATE.

**Label must be printed; hand written labels are unacceptable and will be rejected.**



## **RACEWAYS (D-1)**

Effective: January 1, 2012

Revise the first paragraph of Article 811.03(a) of the Standard Specifications to read:

“General. Rigid metal conduit installation shall be according to Article 810.05(a). Conduits terminating in junction and pull boxes shall be terminated with insulated and gasketed watertight threaded NEMA 4X conduit hubs. The hubs shall be Listed under UL 514B. The insulated throat shall be rated up to 105<sup>o</sup> C. When PVC coated conduit is utilized, the aforementioned hubs shall also be PVC coated.”

Add the following to Article 811.03(b) of the Standard Specifications:

“Where PVC coated conduit is utilized, all conduit fittings, couplings and clamps shall be PVC coated. All other mounting hardware and appurtenances shall be stainless steel.”

“The personnel installing the PVC coated conduit must be trained and certified by the PVC coated conduit Manufacturer or Manufacturer’s representative to install PVC coated conduit. Documentation demonstrating this requirement must be submitted for review and approval.”

Add the following to Article 1088.01(a) of the Standard Specifications:

“All iron and steel products, which are to be incorporated into the work, including conduit and all conduit fittings, shall be domestically manufactured or produced and fabricated as specified in Article 106.”

Revise Article 1088.01(a)(3) of the Standard Specifications to read:

- a. PVC Coated Steel Conduit. The PVC coated rigid metal conduit shall be UL Listed (UL 6). The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations shall be UL Listed with PVC as the primary corrosion protect on. Hazardous location fittings, prior to plastic coating shall be UL listed.
- b. The PVC coating shall have the following characteristics:
- c. The exterior and interior galvanized conduit surface shall be chemically treated to enhance PVC coating adhesion and shall also be coated with a primer before the PVC coating to ensure a bond between the zinc substrate and the PVC coating. The bond strength created shall be greater than the tensile strength of the plastic coating.
- d. The nominal thickness of the PVC coating shall be 1 mm (40 mils). The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above -1 °C (30 °F).
- e. An interior urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. The interior coating shall be applied in a manner so there are no runs, drips, or pinholes at any point. The coating shall not peel, flake, or chip off after a cut is made in the conduit or a scratch is made in the coating.

- f. Conduit bodies shall have a tongue-in-groove gasket for maximum sealing capability. The design shall incorporate a positive placement feature to assure proper installation. Certified test results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be submitted for review when requested by the Engineer.
- g. The PVC conduit shall pass the following tests:

Exterior PVC Bond test RN1:

Two parallel cuts 13 mm (1/2 inch) apart and 40 mm (1 1/2 inches) in length shall be made with a sharp knife along the longitudinal axis. A third cut shall be made perpendicular to and crossing the longitudinal cuts at one end. The knife shall then be worked under the PVC coating for 13 mm (1/2 inch) to free the coating from the metal.

Using pliers, the freed PVC tab shall be pulled with a force applied vertically and away from the conduit. The PVC tab shall tear rather than cause any additional PVC coating to separate from the substrate.

Boil Test:

Acceptable conduit coating bonds (exterior and interior) shall be confirmed if there is no disbondment after a minimum average of 200 hours in boiling water or exposure to steam vapor at one atmosphere. Certified test results from a national recognized independent testing laboratory shall be submitted for review and approval. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D870, a 6" length of conduit test specimen shall be placed in boiling water. The specimen shall be periodically removed, cooled to ambient temperature and immediately tested according to the bond test (RN1). When the PVC coating separates from the substrate, the boil time to failure in hours shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, a 6" conduit test specimen shall be cut in half longitudinally and placed in boiling water or directly above boiling water with the urethane surface facing down. The specimen shall be periodically removed, cooled to ambient temperature and tested in accordance with the Standard Method of Adhesion by Tape Test (ASTM D3359). When the coating disbonds, the time to failure in hours shall be recorded.

Heat/Humidity Test:

Acceptable conduit coating bonds shall be confirmed by a minimum average of 30 days in the Heat and Humidity Test. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D1151, D1735, D2247 and D4585, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. The specimens shall be periodically removed and a bond test (RN1) performed. When the PVC coating separates from the substrate, the exposure time to failure in days shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. When the coating disbonds, the time to failure in hours shall be recorded.

Add the following to Article 1088.01(a)(4) of the Standard Specifications:

“All liquid tight flexible metal conduit fittings shall have an insulated throat to prevent abrasion of the conductors and shall have a captive sealing O-ring gasket. The fittings shall be Listed under UL 514B. The insulated throat shall be rated up to 105° C.”

Revise the second paragraph of Article 811.04 of the Standard Specifications to read:

“Expansion fittings and LFNC will not be measured for payment.”

Revise Article 811.05 of the Standard Specifications to read:

“811.05 Basis of Payment. This work will be paid for at the contract unit price per foot for CONDUIT ATTACHED TO STRUCTURE, PVC-COATED GALVANIZED STEEL, of the diameter specified.”

**UNDERGROUND RACEWAYS (D-1)**

Effective: March 1, 2015

Revise Article 810.04 of the Standard Specifications to read:

“Installation. All underground conduits shall have a minimum depth of 30-inches (700 mm) below the finished grade.”

Add the following to Article 810.04 of the Standard Specifications:

“All metal conduit installed underground shall be Rigid Steel Conduit unless otherwise indicated on the Plans.”

Add the following to Article 810.04 of the Standard Specifications:

“All raceways which extend outside of a structure or duct bank but are not terminated in a cabinet, junction box, pull box, handhole, post, pole, or pedestal shall extend a minimum of 300 mm (12”) or the length shown on the Plans beyond the structure or duct bank. The end of this extension shall be capped and sealed with a cap designed for the conduit to be capped.

The ends of rigid metal conduit to be capped shall be threaded, the threads protected with full galvanizing, and capped with a threaded galvanized steel cap.

The ends of rigid nonmetallic conduit and coilable nonmetallic conduit shall be capped with a rigid PVC cap of not less than 3 mm (0.125”) thick. The cap shall be sealed to the conduit using a room-temperature-vulcanizing (RTV) sealant compatible with the material of both the cap and the conduit. A washer or similar metal ring shall be glued to the inside center of the cap with epoxy, and the pull cord shall be tied to this ring.”



**UNIT DUCT (D-1)**

Effective: January 1, 2012

Revise the first paragraph of Article 810.04 to read:

“The unit duct shall be installed at a minimum depth of 30-inches (760 mm) unless otherwise directed by the Engineer.”

Revise Article 1088.01(c) to read:

“(c) Coilable Nonmetallic Conduit.

General:

The duct shall be a plastic duct which is intended for underground use and which can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing and/or installation without adversely affecting its properties of performance. The duct shall be a plastic duct which is intended for underground use and can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing and/or installation without adversely affecting its properties of performance.

The duct shall be made of high density polyethylene which shall meet the requirements of ASTM D 2447, for schedule 40. The duct shall be composed of black high density polyethylene meeting the requirements of ASTM D 3350, Class C, Grade P33. The wall thickness shall be in accordance with Table 2 for ASTM D 2447.

The duct shall be UL Listed per 651-B for continuous length HDPE coiled conduit. The duct shall also comply with NEC Article 354.100 and 354.120.

Submittal information shall demonstrate compliance with the details of these requirements.

Dimensions:

Duct dimensions shall conform to the standards listed in ASTM D2447. Submittal information shall demonstrate compliance with these requirements.

Nominal Size		Nominal I.D.		Nominal O.D.		Minimum Wall	
mm	in	Mm	in	mm	in	mm	in
31.75	1.25	35.05	1.380	42.16	1.660	3.556 +0.51	0.140 +0.020
38.1	1.50	40.89	1.610	48.26	1.900	3.683 +0.51	0.145 +0.020

Nominal Size		Pulled Tensile	
Mm	in	N	lbs.
31.75	1.25	3322	747
38.1	1.50	3972	893

Marking:

As specified in NEMA Standard Publication No. TC-7, the duct shall be clearly and durably marked at least every 3.05 meters (10 feet) with the material designation (HDPE for high density polyethylene), nominal size of the duct and the name and/or trademark of the manufacturer.

Performance Tests:

Polyethylene Duct testing procedures and test results shall meet the requirements of UL 651. Certified copies of the test report shall be submitted to the Engineer prior to the installation of the duct. Duct crush test results shall meet or exceed the following requirements:

Duct Diameter		Min. force required to deform sample 50%	
Mm	in	N	lbs.
35	1.25	4937	1110
41	1.5	4559	1025

**ELECTRIC SERVICE INSTALLATION (D-1)**

Effective: January 1, 2012

**Description.** This item shall consist of all material and labor required to extend, connect or modify the electric services, as indicated or specified, which is over and above the work performed by the utility. Unless otherwise indicated, the cost for the utility work, if any, will be reimbursed to the Contractor separately under ELECTRIC UTILITY SERVICE CONNECTION. This item may apply to the work at more than one service location and each will be paid separately.

**Materials.** Materials shall be in accordance with the Standard Specifications.

**CONSTRUCTION REQUIREMENTS**

**General.** The Contractor shall ascertain the work being provided by the electric utility and shall provide all additional material and work not included by other contract pay items required to complete the electric service work in complete compliance with the requirements of the utility.

No additional compensation will be allowed for work required for the electric service, even though not explicitly shown on the Drawings or specified herein.

**Method of Measurement.** Electric Service Installation shall be counted, each.

**Basis of Payment.** This work will be paid for at the contract unit price each for ELECTRIC SERVICE INSTALLATION, which shall be payment in full for the work specified herein.

## **ELECTRIC UTILITY SERVICE CONNECTION (COMED) (D-1)**

Effective: January 1, 2012

Description. This work shall consist of payment for work performed by ComEd in providing or modifying electric service as indicated.

### **CONSTRUCTION REQUIREMENTS**

General. It shall be the Contractor's responsibility to contact ComEd. The Contractor shall coordinate his work fully with ComEd both as to the work required and the timing of the installation. No additional compensation will be granted under this or any other item for extra work caused by failure to meet this requirement. **Please contact ComEd, New Business Center Call Center, at 1-866-NEW-ELEC (1-866-639-3532) to begin the service connection process. The Cell Center Representatives will create a work order for the service connection(s). The representative will assign the request based upon the location of the project.**

The Contractor shall make particular note of the need for the earliest attention to arrangements with ComEd for service. In the event of delay by ComEd, no extension of time will be considered applicable for the delay unless the Contractor can produce written evidence of a request for electric service within 30 days of execution.

Method of Measurement. The Contractor will be reimbursed for the exact amount of money as billed by ComEd for its services. Work provided by the Contractor for electric service will be paid separately as described under ELECTRIC SERVICE INSTALLATION. No extra compensation will be paid to the Contractor for any incidental materials and labor required to fulfill the requirements as shown on the Plans and specified herein.

Basis of Payment. This This work will be paid for at the contract lump sum price for ELECTRIC UTILITY SERVICE CONNECTION which shall be reimbursement in full for electric utility service charges.

## **GROUNDING OF ITS SUBSYSTEMS (D-1)**

Effective: March 12, 2009

The grounding of ITS subsystems shall meet the requirements of Section 806 of the Standard Specifications. In addition, amend Article 806.03 of the Standard Specifications to include:

General. All ITS subsystems (ramp metering system, dynamic message sign system, system detector stations, etc.), associated equipment, and appurtenances shall be properly grounded in strict conformance with the NEC and as shown on the Plans.

Testing shall be according to Section 801. 13(a)(5) of the Standard Specifications:

- a) The grounded conductor (neutral conductor) shall be white color-coded. This conductor shall be bonded to the equipment-grounding conductor only at the Electric Service installation. All power cables shall include one neutral conductor of the same size as the phase (hot) conductors.
- b) The equipment-grounding conductor shall be green color-coded. The following is in addition to Section 801.04 of the Standard Specifications.
  - 1) Equipment grounding conductors shall be XLP insulated No. 6, unless otherwise noted on the Plans, and bonded to the grounded conductor (neutral conductor) only at the Electric Service Installation. The equipment-grounding conductor is paid for separately and shall be continuous. The Earth shall not be used as the equipment-grounding conductor.
  - 2) Equipment grounding connectors shall be bonded, using a listed grounding conductor, to all ramp meters, DMS, and detector cabinets, handholes, and other metallic enclosures throughout the ITS subsystems, except where noted herein. A listed electrical joint compound shall be applied to all conductor terminations, connector threads, and contact points.
  - 3) All metallic and non-metallic raceways containing ITS circuit runs shall have a continuous equipment grounding conductor, except raceways containing only detector loop lead-in circuits, circuits under 50 volts and/or fiber optic cable will not be required to include an equipment grounding conductor.
- c) The grounding electrode conductor shall be similar to the equipment grounding conductor in color-coding (green) and size. The grounding electrode conductor is used to connect the ground rod to the equipment grounding conductor and is bonded to ground rods via exothermic welding, listed pressure connectors, listed clamps or other approved listed means.

Basis of Payment. Payment shall be included in the various items associated with ITS.

## **UNDERGROUND RACEWAYS**

Add the following to Article 810.04 of the Standard Specifications:

“All conduits shall be proofed with a mandrel after installation to ensure that conduits are clear of debris and the intact without kinks or crushing. A pull tape shall be installed in empty conduits.”

## **SLOTTED DRAIN (D-1)**

Effective: September 30, 1985

Revised: January 1, 2007

This work consists of furnishing and installing slotted drains at the locations shown in the plans.

Slotted drain shall be corrugated steel pipe conforming with the applicable requirements of Section 542 of the Standard Specifications, the details shown in the plans and as described herein.

The pipe shall be cut along the longitudinal axis and reinforced with a grate of solid spacer bars. The grate assembly shall be made from structural steel suitably welded to form the open slot and shall be hot-dip galvanized to meet the provisions of AASHTO M 111. The slot depth shall be as shown in the plans. The slot width shall be 1-3/4 inches. Spacer bars shall be 3/16 inch solid web spacers on 6 inch (150 mm) centers for the full depth of the grating.

Joints and couplers for slotted drain shall provide ring compression capability across the full width of the joint. The band coupler shall butt up against the grating. A single band bolt shall be provided for band tensioning.

The slotted drain shall be installed in a trench excavated to the required grade, wide enough to accommodate the drain pipe. If the trench is excavated too deep, the additional depth shall be filled with approved fine aggregate and compacted to the satisfaction of the Engineer. The slotted drain must be properly positioned in the trench prior to backfilling. The upper end of the drain shall be capped as directed by the Engineer.

After the slotted drain has been leveled to grade a lean grout shall be used as backfill. The grout backfill shall extend upward one half the diameter of the drain pipe. The rest of the backfill may be aggregate base course material Type B meeting the requirements of Article 351.05(b) of the Standard Specifications and shall be placed and compacted as directed by the Engineer. This backfill material shall extend upward to the top of the subgrade. Once the slotted drain is backfilled it should be covered prior to placing the final surfacing.

Method of Measurement: This work will be measured in feet in place.

Basis of Payment: This work will be paid for at the contract unit price per foot for SLOTTED DRAIN 12" WITH 2 1/2" SLOT which price shall include all accessories required for connecting the slotted drain pipes and connections to drainage structures where necessary.

## **MODIFY EXISTING CONTROLLER CABINET**

### **Description.**

This work shall consist of modifying an existing controller cabinet to provide power to a CCTV camera site as shown in the Plans.

### **Materials.**

Circuit Breakers shall be thermal magnetic bolt-on type with a minimum interrupt capacity of 10,000 symmetrical amperes at 120 volts. All materials and equipment required to install circuit breakers and terminate cables shall be included.

### **Construction Requirements**

The Contractor shall install an additional 30 amp circuit breaker in the existing controller cabinet at locations indicated in the Plans. Electrical cables of the size indicated in the Plans shall be terminated in the controller cabinet to provide power to a CCTV camera site.

### **Basis of Payment**

This work will be paid for at the contract unit price per each for MODIFY EXISTING CONTROLLER CABINET.

## **AGGREGATE FOR CONCRETE BARRIER (D1)**

Effective: February 11, 2004

Revised: January 24, 2008

Add the following paragraph to Article 637.02 of the Standard Specifications:

“The coarse aggregate to be used in the concrete barrier walls shall conform to the requirement for coarse aggregate used in Class BS concrete according to Article 1004.01(b), paragraph 2.”

## CLEANING AND PAINTING EXISTING STEEL STRUCTURES

**Description.** This work shall consist of cleaning and painting of the following structures:

1. Locations 1: Camera Tower (base only)
- 2.

The Contractor shall furnish all materials, equipment, labor, and other essentials necessary to accomplish this work and all other work described herein and as directed by the Engineer.

**Materials.** All materials to be used on an individual structure shall be produced by the same manufacturer.

The Bureau of Materials and Physical Research has established a list of all products that have met preliminary requirements. Each batch of material, except for the penetrating sealer, shall be tested and assigned a MISTIC approval number before use. The specified colors shall be produced in the coating manufacturer's facility. Tinting of the coating after it leaves the manufacturer's facility is not allowed.

The paint materials shall meet the following requirements of the Standard Specification and as noted below:

<u>Item</u>	<u>Article</u>
(a) Waterborne Acrylic	1008.04
(b) Aluminum Epoxy Mastic	1008.03
(c) Organic Zinc Rich Primer	1008.05
(d) Epoxy/ Aliphatic Urethane	1008.05
(e) Penetrating Sealer (Note 1)	
(f) Moisture Cured Zinc Rich Urethane Primer (Note 2)	
(g) Moisture Cured Aromatic/Aliphatic Urethane (Note 2)	
(h) Moisture Cured Penetrating Sealer (Note 3)	

Note 1: The Epoxy Penetrating Sealer shall be a cross-linked multi component sealer. The sealer shall have the following properties:

- (a) The volume solids shall be 98 percent (plus or minus 2 percent).
- (b) Shall be clear or slightly tinted color.

Note 2: These material requirements shall be according to the Special Provision for the Moisture Cured Urethane Paint System.

Note 3: The Moisture Cured Penetrating Sealer manufacturer's certification will be required.

Submittals. The Contractor shall submit for Engineer review and acceptance, the following plans and information for completing the work. The submittals shall be provided within 30 days of execution of the contract unless given written permission by the Engineer to submit them at a later date. Work cannot proceed until the submittals are accepted by the Engineer. Details for each of the plans are presented within the body of this specification.

- a) Contractor/Personnel Qualifications. Evidence of Contractor qualifications and the names and qualifications/experience/training of the personnel managing and implementing the Quality Control program and conducting the quality control tests, and certifications for the CAS (Coating Application Specialists) on SSPC-QP1 and QP2 projects.
- b) Quality Control (QC) Program. The QC Program shall identify the following; the instrumentation that will be used, a schedule of required measurements and observations, procedures for correcting unacceptable work, and procedures for improving surface preparation and painting quality as a result of quality control findings. The program shall incorporate at a minimum, the Department's Quality Control Daily Report form, or a Contractor form (paper or electronic) that provides equivalent information.
- c) Inspection Access Plan. The inspection access plan for use by Contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations.
- d) Surface Preparation/Painting Plan. The surface preparation/painting plan shall include the methods of surface preparation and type of equipment to be utilized for washing, hand/power tool cleaning, removal of rust, mill scale, paint or foreign matter, abrasive blast or water jetting, and remediation of chloride. If detergents, additives, or inhibitors are incorporated into the water, the Contractor shall include the names of the materials and Safety Data Sheets (SDS). The Contractor shall identify the solvents proposed for solvent cleaning together with SDS.

If cleaning and painting over existing galvanized surfaces are specified, the plan shall address surface preparation, painting, and touch up/repair of the galvanized surfaces.

The plan shall also include the methods of coating application and equipment to be utilized.

If the Contractor proposes to heat or dehumidify the containment, the methods and equipment proposed for use shall be included in the Plan for the Engineer's consideration.

- a) Paint Manufacturer Certifications and Letters. When a sealer is used, the Contractor shall provide the manufacturer's certification of compliance with Department testing requirements listed under "Materials" above. A certification regarding the compatibility of the sealer with the specified paint system shall also be included. When rust inhibitors are used, the Contractor shall provide a letter from the coating manufacturer indicating that the inhibitor is compatible with, and will not adversely affect the performance of the coating system.

If the use of a chemical soluble salt remover is proposed by the Contractor, provide a letter from the coating manufacturer indicating that the material will not adversely affect the performance of the coating system.



The paint manufacturer's most recent application and thinning instructions, SDS and product data sheets shall be provided, with specific attention drawn to storage temperatures, and the temperatures of the material, surface and ambient air at the time of application.

A letter or written instructions from the coating manufacturer shall be provided indicating the length of time that each coat must be protected from cold or inclement weather (e.g., exposure to rain) during its drying period, the maximum recoat time for each coat, and the steps necessary to prepare each coat for overcoating if the maximum recoat time is exceeded.

- a) Abrasives. Abrasives to be used for abrasive blast cleaning, including SDS. For expendable abrasives, the Contractor shall provide certification from the abrasive supplier that the abrasive meets the requirements of SSPC-AB1. For steel grit abrasives, the certification shall indicate that the abrasive meets the requirements of SSPC-AB3.
- b) Protective Coverings. Plan for containing or controlling paint debris (droplets, spills, overspray, etc.). Any tarpaulins or protective coverings proposed for use shall be fire retardant. For submittal requirements involving the containment used to remove lead paint, the Contractor shall refer to Special Provision for Containment and Disposal of Lead Paint Cleaning Residues.
- c) Progress Schedule. Progress schedule shall be submitted per Article 108.02 and shall identify all major work items (e.g., installation of rigging/containment, surface preparation, and coating application).

When the Engineer accepts the submittals, the Contractor will receive written notification. The Contractor shall not begin any paint removal work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, State, or Local regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Contractor Qualifications. Unless indicated otherwise on the contract plans, for non-lead abatement projects, the painting Contractor shall possess current SSPC-QP1 certification. Unless indicated otherwise on the plans, for lead abatement projects the Contractor shall also possess current SSPC-QP2 certification. The Contractor shall maintain certified status throughout the duration of the painting work under the contract. The Department reserves the right to accept Contractors documented to be currently enrolled in the SSPC-QP7, Painting Contractor Introductory Program, Category 2, in lieu of the QP certifications noted above.

Quality Control (QC) Inspections. The Contractor shall perform first line, in process QC inspections. The Contractor shall implement the submitted and accepted QC Program to insure that the work accomplished complies with these specifications. The designated Quality Control inspector shall be onsite full time during any operations that affect the quality of the coating system (e.g., surface preparation and chloride remediation, coating mixing and application, and evaluations between coats and upon project completion). The Contractor shall use the Department's Quality Control Daily Report form to record the results of quality control tests. Alternative forms (paper or electronic) will be allowed provided they furnish equivalent documentation as the Department's form, and they are accepted as part of the QC Program submittal. The completed reports shall be turned into the Engineer before work resumes the following day. The Engineer or designated representative will sign the report. The signature is an acknowledgment that the report has been received, but should not be construed as an agreement that any of the information documented therein is accurate.

Contractor QC inspections shall include, but not be limited to the following:

- a. Suitability of protective coverings and the means employed to control project debris and paint spills, overspray, etc.
- b. Ambient conditions
- c. Surface preparation (solvent cleaning, pressure washing including chalk tests, hand/power tool or abrasive blast cleaning, etc.)
- d. Chloride remediation
- e. Coating application (specified materials, mixing, thinning, and wet/dry film thickness)
- f. Recoat times and cleanliness between coats
- g. Coating continuity and coverage (freedom from runs, sags, overspray, dryspray, pinholes, shadow-through, skips, misses, etc.)

The personnel managing the Contractor's QC Program shall possess a minimum classification of Society of Protective Coatings (SSPC) BCI certified, National Association of Corrosion Engineers (NACE) Coating Inspector Level 2 - Certified, and shall provide evidence of successful inspection of 3 bridge projects of similar or greater complexity and scope that have been completed in the last 2 years. Copies of the certification and experience shall be provided. References for experience shall be provided and shall include the name, address, and telephone number of a contact person employed by the bridge owner.

The personnel performing the QC tests shall be trained in coatings inspection and the use of the testing instruments. Documentation of training shall be provided. The QC personnel shall not perform hands on surface preparation or painting activities. Painters shall perform wet film thickness measurements, with QC personnel conducting random spot checks of the wet film. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Engineer, and acceptance of the replacement(s), by the Engineer.

The Contractor shall supply all necessary equipment with current calibration certifications to perform the QC inspections. Equipment shall include the following at a minimum:

- a. Sling psychrometer or digital psychrometer for the measurement of dew point and relative humidity, together with all necessary weather bureau tables or psychrometric charts. In the event of a conflict between readings with the sling psychrometer and the digital psychrometer, the readings with the sling psychrometer shall prevail.
- b. Surface temperature thermometer
- c. SSPC Visual Standards VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning; SSPC-VIS 3, Visual Standard for Power and Hand-Tool Cleaned Steel; SSPC-VIS 4, Guide and Reference Photographs for Steel Prepared by Water Jetting, and/or SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning, as applicable.
- d. Test equipment for determining abrasive cleanliness (oil content and water-soluble contaminants) according to SSPC abrasive specifications AB1, AB2, and AB3.
- e. Commercially available putty knife of a minimum thickness of 40 mils (1mm) and a width between 1 and 3 in. (25 and 75 mm). Note that the putty knife is only required for projects in which the existing coating is being feathered and tested with a dull putty knife.
- f. Testex Press-O-Film Replica Tape and Micrometer compliant with Method C of ASTM D4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel, or digital profile depth micrometer compliant with ASTM D4417, Method

B. In the event of a conflict between measurements with the two instruments on abrasive blast cleaned steel, the results with the Testex Tape shall prevail. Note that for measuring the profile of steel power tool cleaned to SSPC-SP15, Commercial Grade Power Tool Cleaning, the digital profile depth micrometer shall be used.

- a. Bresle Cell Kits or CHLOR\*TEST kits for chloride determinations, or equivalent
- b. Wet Film Thickness Gage
- c. Blotter paper for compressed air cleanliness checks
- d. Type 2 Electronic Dry Film Thickness Gage per SSPC - PA2, Procedure for Determining Conformance to Dry Coating Thickness Requirements
- e. Standards for verifying the accuracy of the dry film thickness gage
- f. Light meter for measuring light intensity during paint removal, painting, and inspection activities
- g. All applicable ASTM and SSPC Standards used for the work (reference list attached)

The accuracy of the instruments shall be verified by the Contractor's personnel according to the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Engineer for QA observations on an as needed basis.

Hold Point Notification. Specific inspection items throughout this specification are designated as Hold Points. Unless other arrangements are made at the project site, the Contractor shall provide the Engineer with a minimum 4-hour notification before a Hold Point inspection will be reached. If the 4-hour notification is provided and the Work is ready for inspection at that time, the Engineer will conduct the necessary observations. If the Work is not ready at the appointed time, unless other arrangements are made, an additional 4-hour notification is required. Permission to proceed beyond a Hold Point without a QA inspection will be granted solely at the discretion of the Engineer, and only on a case by case basis.

Quality Assurance (QA) Observations. The Engineer will conduct QA observations of any or all phases of the work. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to provide all necessary daily QC inspections of his/her own and to comply with all requirements of this Specification.

The Engineer has the right to reject any work that was performed without adequate provision for QA observations.

Inspection Access and Lighting. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The Contractor shall furnish, erect and move scaffolding or other mechanical equipment to permit close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. Examples of acceptable access structures include:

- Mechanical lifting equipment, such as, scissor trucks, hydraulic booms, etc.
- Platforms suspended from the structure comprised of trusses or other stiff supporting members and including rails and kick boards.
- Simple catenary supports are permitted only if independent life lines for attaching a fall arrest system according to Occupational Safety and Health Administration (OSHA) regulations are provided.
- 

When the surface to be inspected is more than 6 ft. (1.8 m) above the ground or water surface, and fall prevention is not provided (e.g., guardrails are not provided), the Contractor shall provide the Engineer with a safety harness and a lifeline according to OSHA regulations. The lifeline and attachment shall not direct the fall into oncoming traffic. The Contractor shall provide a method of attaching the lifeline to the structure independent of the inspection facility or any support of the platform. When the inspection facility (e.g., platform) is more than 2 1/2 ft. (800 mm) above the ground, the Contractor shall provide an approved means of access onto the platform.

The Contractor shall provide artificial lighting in areas both inside and outside the containment where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 30 foot candles (325 LUX). Illumination for cleaning and painting, including the working platforms, access and entryways shall be at least 20 foot candles (215 LUX). General work area illumination outside the containment shall be employed at the discretion of the Engineer and shall be at least 5 foot candles. The exterior lighting system shall be designed and operated so as to avoid glare that interferes with traffic, workers, and inspection personnel.

Surface Preparation and Painting Equipment. All cleaning and painting equipment shall include gages capable of accurately measuring fluid and air pressures and shall have valves capable of regulating the flow of air, water or paint as recommended by the equipment manufacturer. The equipment shall be maintained in proper working order.

Diesel or gasoline powered equipment shall be positioned or vented in a manner to prevent deposition of combustion contaminants on any part of the structure.

Hand tools, power tools, pressure washing, water jetting, abrasive blast cleaning equipment, brushes, rollers, and spray equipment shall be of suitable size and capacity to perform the work required by this specification. All power tools shall be equipped with vacuums and High Efficiency Particulate Air (HEPA) filtration. Appropriate filters, traps and dryers shall be provided for the compressed air used for abrasive blast cleaning and conventional spray application. Paint pots shall be equipped with air operated continuous mixing devices unless prohibited by the coating manufacturer.

Test Sections. Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be painted in a location(s) which the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. More than one test section may be needed to represent the various design configurations of the structure. The purpose of the test section(s) is to demonstrate the use of the tools and degree of cleaning required (cleanliness and profile) for each method of surface preparation that will be used on the project. Each test section shall be approximately 10 sq. ft. (0.93 sq. m). The test section(s) shall be prepared using the same equipment, materials and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level of cleaning according to the appropriate SSPC visual standards, modified as necessary to comply with the requirements of this specification. The written requirements of the specification prevail in the event of a conflict with the SSPC visual standards. Only after the test section(s) have been approved shall the Contractor proceed with surface preparation operations. Additional compensation will not be allowed the Contractor for preparation of the test section(s).

For the production cleaning operations, the specifications and written definitions, the test section(s), and the SSPC visual standards shall be used in that order for determining compliance with the contractual requirements.

Protective Coverings and Damage. All portions of the structure that could be damaged by the surface preparation and painting operations (e.g., utilities), including any sound paint that is allowed to remain according to the contract documents, shall be protected by covering or shielding. Tarpaulins drop cloths, or other approved materials shall be employed. The Contractor shall comply with the provisions of the Illinois Environmental Protection Act. Paint drips, spills, and overspray are not permitted to escape into the air or onto any other surfaces or surrounding property not intended to be painted. Containment shall be used to control paint drips, spills, and overspray, and shall be dropped and all equipment secured when sustained wind speeds of 40 mph (64 kph) or greater occur, unless the containment design necessitates action at lower wind speeds. The Contractor shall evaluate project-specific conditions to determine the specific type and extent of containment needed to control the paint emissions and shall submit a plan for containing or controlling paint debris (droplets, spills, overspray, etc.) to the Engineer for acceptance prior to starting the work. Acceptance by the Engineer shall not relieve the Contractor of their ultimate responsibility for controlling paint debris from escaping the work zone.

When the protective coverings need to be attached to the structure, they shall be attached by bolting, clamping, or similar means. Welding or drilling into the structure is prohibited unless approved by the Engineer in writing. When removing coatings containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Lead Paint Cleaning Residues contained elsewhere in this Contract. When removing coatings not containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Non-Lead Paint Cleaning Residues contained elsewhere in this Contract.

The Contractor shall be responsible for any damage caused to persons, vehicles, or property, except as indemnified by the Response Action Contractor Indemnification Act. Whenever the intended purposes of the controls or protective devices used by the Contractor are not being accomplished, work shall be immediately suspended until corrections are made. Damage to vehicles or property shall be repaired by the Contractor at the Contractor's expense. Painted surfaces damaged by any Contractor's operation shall be repaired, removed and/or repainted, as directed by the Engineer, at the Contractor's expense.

Weather Conditions. Surfaces to be painted after cleaning shall remain free of moisture and other contaminants. The Contractor shall control his/her operations to insure that dust, dirt, or moisture do not come in contact with surfaces cleaned or painted that day.

- a) The surface temperature shall be at least 5°F (3°C) above the dew point during final surface preparation operations. The manufacturers' published literature shall be followed for specific temperature, dew point, and humidity restrictions during the application of each coat.
- b) If the Contractor proposes to control the weather conditions inside containment, proposed methods and equipment for heating and/or dehumidification shall be included in the work plans for the Engineer's consideration. Only indirect fired heating equipment shall be used to prevent the introduction of moisture and carbon monoxide into the containment. The heating unit(s) shall be ventilated to the outside of the containment. Any heating/dehumidification proposals accepted by the Engineer shall be implemented at no additional cost to the department.
- c) Cleaning and painting shall be done between April 15 and October 31 unless authorized otherwise by the Engineer in writing.

The Contractor shall monitor temperature, dew point, and relative humidity every 4 hours during surface preparation and coating application in the specific areas where the work is being performed. The frequency of monitoring shall increase if weather conditions are changing. If the weather conditions after application and during drying are forecast to be outside the acceptable limits established by the coating manufacturer, coating application shall not proceed. If the weather conditions are forecast to be borderline relative to the limits established by the manufacturer, monitoring shall continue at a minimum of 4-hour intervals throughout the drying period. The Engineer has the right to reject any work that was performed, or drying that took place, under unfavorable weather conditions. Rejected work shall be removed, recleaned, and repainted at the Contractor's expense.

Compressed Air Cleanliness. Prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and painting with conventional spray, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of ASTM D 4285. The tests shall be conducted at least one time each shift for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the compressed air. Effected work shall be repaired at the Contractor's expense.

Low Pressure Water Cleaning and Solvent Cleaning (HOLD POINT). The Contractor shall notify the Engineer 24 hours in advance of beginning surface preparation operations.

- a) Water Cleaning of Lead Containing Coatings Prior to Overcoating. Prior to initiating any mechanical cleaning such as hand/power tool cleaning on surfaces that are painted with lead, all surfaces to be prepared and painted, and the tops of pier and abutment caps shall be washed. Washing is not required if the surfaces will be prepared by water jetting.

Washing shall involve the use of potable water at a minimum of 1000 psi (7 MPa) and less than 5000 psi (34 MPa) according to "Low Pressure Water Cleaning" of SSPC-SP WJ-4. There are no restrictions on the presence of flash rusting of bare steel after cleaning. Paint spray equipment shall not be used to perform the water cleaning. The cleaning shall be performed in such a manner as to remove dust, dirt, chalk, insect and animal nests, bird droppings, loose coating, loose mill scale, loose rust and other corrosion products, and other foreign matter. Water cleaning shall be supplemented with scrubbing as necessary to remove the surface contaminants. The water, debris, and any loose paint removed by water cleaning shall be collected for proper disposal. The washing shall be completed no more than 2 weeks prior to surface preparation.

If detergents or other additives are added to the water, the detergents/additives shall be included in the submittals and not used until accepted by the Engineer. When detergents or additives are used, the surface shall be rinsed with potable water before the detergent water dries.

After washing has been accepted by the Engineer, all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants which remain on the steel surfaces to be painted shall be removed by solvent cleaning according to SSPC – SP1, supplemented with scraping (e.g., to remove large deposits of asphaltic cement) as required. The solvent(s) used for cleaning shall be compatible with the existing coating system. The Contractor shall identify the proposed solvent(s) in the submittals. If the existing coating is softened, wrinkled, or shows other signs of attack from the solvents, the Contractor shall immediately discontinue their use. The name and composition of replacement solvents, together with MSDS, shall be submitted for Engineer acceptance prior to use.

Under no circumstances shall subsequent hand/power tool cleaning or abrasive blast cleaning be performed in areas containing surface contaminants or in areas where the Engineer has not accepted the washing and solvent cleaning. Surfaces prepared by hand/power tool cleaning or abrasive blast cleaning without approval of the washing and solvent cleaning may be rejected by the Engineer. Rejected surfaces shall be recleaned with both solvent and the specified mechanical means at the Contractor's expense.

After all washing and mechanical cleaning are completed, representative areas of the existing coating shall be tested to verify that the surface is free of chalk and other loose surface debris or foreign matter. The testing shall be performed according to ASTM D4214. Cleaning shall continue until a chalk rating of 6 or better is achieved in every case.

- a) Water Cleaning of Non-Lead Coatings Prior to Overcoating. Thoroughly clean the surfaces according to the steps defined above for "Water Cleaning of Lead Containing Coatings Prior to Overcoating." The wash water does not need to be collected, but paint chips, insect and animal nests, bird droppings and other foreign matter shall be collected for proper disposal. If the shop primer is inorganic zinc, the chalk rating does not apply. All other provisions are applicable.
- b) Water Cleaning/Debris Removal Prior to Total Coating Removal. When total coating removal is specified, water cleaning of the surface prior to coating removal is not required by this specification and is at the option of the Contractor. If the Contractor chooses to use water cleaning, the above provisions for water cleaning of lead and non-lead coatings apply as applicable, including collection and disposal of the waste.

Whether or not the surfaces are pre-cleaned using water, the tops of the pier caps and abutments shall be cleaned free of dirt, paint chips, insect and animal nests, bird droppings and other foreign matter and the debris collected for proper disposal. Cleaning can be accomplished by wet or dry methods.

Prior to mechanical cleaning, oil, grease, and other soluble contaminants on bare steel or rusted surfaces shall be removed by solvent cleaning according to SSPC-SP1.

- a) Water Cleaning Between Coats. When foreign matter has accumulated on a newly applied coat, washing and scrubbing shall be performed prior to the application of subsequent coats. The water does not need to be collected unless it contacts existing lead containing coatings.

Laminar and Stratified Rust. All laminar and stratified rust that has formed on the existing steel surfaces shall be removed. Pack rust formed along the perimeter of mating surfaces of connected plates or shapes of structural steel shall be removed to the extent feasible without mechanically detaching the mating surface. Any pack rust remaining after cleaning the mating surfaces shall be tight and intact when examined using a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges in the steel, the work shall be suspended, and the damaged areas repaired to the satisfaction of the Engineer, at the Contractor's expense. The Contractor shall also demonstrate that he/she has made the necessary adjustments to prevent a reoccurrence of the damage prior to resuming work. If surface preparation reveals holes or section loss, or creates holes in the steel, the Contractor shall notify the Engineer. Whenever possible, the Department will require that the primer be applied to preserve the area, and allow work to proceed, with repairs and touch up performed at a later date.



Surface Preparation (HOLD POINT). One or more of the following methods of surface preparation shall be used as specified on the plans. When a method of surface preparation is specified, it applies to the entire surface, including areas that may be concealed by the containment connection points. In each case, as part of the surface preparation process, soluble salts shall be remediated as specified under "Soluble Salt Remediation." The Contractor shall also note that the surface of the steel beneath the existing coating system may contain corrosion and/or mill scale. Removal of said corrosion and/or mill scale, when specified, shall be considered included in this work and no extra compensation will be allowed.

When a particular cleaning method is specified for use in distinct zones on the bridge, the cleaning shall extend into the existing surrounding paint until a sound border is achieved. The edge of the existing paint is considered to be sound and intact after cleaning if it cannot be lifted by probing the edge with a dull putty knife. The sound paint shall be feathered for a minimum of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared steel and the existing coatings. Sanders with vacuum attachments, which have been approved by the Engineer, shall be used as necessary to accomplish the feathering.

- a) Limited Access Areas: A best effort with the specified methods of cleaning shall be performed in limited access areas such as the backsides of rivets inside built up box members. The equipment being used for the majority of the cleaning may need to be supplemented with other commercially available equipment, such as angle nozzles, to properly clean the limited access areas. The acceptability of the best effort cleaning in these areas is at the sole discretion of the Engineer.
- b) Near-White Metal Blast Cleaning: This surface preparation shall be accomplished according to the requirements of Near-White Metal Blast Cleaning SSPC-SP 10. Unless otherwise specified in the contract, the designated surfaces shall be prepared by dry abrasive blast cleaning, wet abrasive blast cleaning, or water jetting with abrasive injection. A Near-White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining.

Random staining shall be limited to no more than 5 percent of each 9 sq. in. (58 sq. cm) of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. With the exception of crevices as defined below, surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined later under "Surface Profile."

At the discretion of the Engineer, after a best effort cleaning, slight traces of existing coating may be permitted to remain within crevices such as those created between the steel and rivets or bolts/washers/nuts, and between plates. When traces of coating are permitted to remain, the coating shall be tightly bonded when examined by probing with a dull putty knife. The traces of coating shall be confined to the bottom portion of the crevices only, and shall not extend onto the surrounding steel or plate or onto the outer surface of the rivets or bolts. Pitted steel is excluded from exemption considerations and shall be cleaned according to SSPC-SP10.

If hackles or slivers are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by reblast cleaning. At the discretion of the Engineer, the use of power tools to clean the localized areas after grinding, and to establish a surface profile acceptable to the coating manufacturer, can be used in lieu of blast cleaning.

If the surfaces are prepared using wet abrasive methods, attention shall be paid to tightly configured areas to assure that the preparation is thorough. After surface preparation is completed, the surfaces, surrounding steel, and containment materials/scaffolding shall be rinsed to remove abrasive dust and debris. Potable water shall be used for all operations. An inhibitor shall be added to the supply water and/or rinse water to prevent flash rusting. With the submittals, the Contractor shall provide a sample of the proposed inhibitor together with a letter from the coating manufacturer indicating that the inhibitor is suitable for use with their products and that the life of the coating system will not be reduced due to the use of the inhibitor. The surfaces shall be allowed to completely dry before the application of any coating.

- a) Commercial Grade Power Tool Cleaning: This surface preparation shall be accomplished according to the requirements of SSPC-SP15. The designated surfaces shall be completely cleaned with power tools. A Commercial Grade Power Tool Cleaned surface, when viewed without magnification, is free of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products, and other foreign matter, except for staining. In previously pitted areas, slight residues of rust and paint may also be left in the bottoms of pits. Random staining shall be limited to no more than 33 percent of each 9 sq. in. (58 sq. cm) of surface area. Allowable staining may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined later under "Surface Profile."

At the Contractor's option, Near-White Metal Blast Cleaning may be substituted for Power Tool Cleaning – Commercial Grade, as long as containment systems appropriate for abrasive blast cleaning are utilized and there is no additional cost to the Department.

- a) Power Tool Cleaning – Modified SP3: This surface preparation shall be accomplished according to the requirements of SSPC-SP3, Power Tool Cleaning except as modified as follows. The designated surfaces shall be cleaned with power tools. A power tool cleaned surface shall be free of all loose rust, loose mill scale, loose and peeling paint, and loose rust that is bleeding through and/or penetrating the coating. All locations of visible corrosion and rust bleed, exposed or lifting mill scale, and lifting or loose paint shall be prepared using the power tools, even if the material is tight.

Upon completion of the cleaning, rust, rust bleed, mill scale and surrounding paint are permitted to remain if they cannot be lifted using a dull putty knife.

- a) Power Tool Cleaning of Shop Coated Steel. When shop-coated steel requires one or more coats to be applied in the field, the surface of the shop coating shall be cleaned as specified under "Water Cleaning of Non-Lead Coatings Prior to Overcoating." If the damage is to a fully applied shop system, water cleaning is not required unless stipulated in the contract. Damaged areas of shop coating shall be spot cleaned according to Power Tool Cleaning - Modified SSPC-SP3. If the damage extends to the substrate, spot cleaning shall be according to SSPC-SP15. The edges of the coating surrounding all spot repairs shall be feathered.
- b) Galvanized Surfaces: If galvanized surfaces are specified to be painted, they shall be prepared by brush-off blast cleaning in accordance with SSPC-SP 16 or by using proprietary solutions that are specifically designed to clean and etch (superficially roughen) the galvanized steel for painting. If cleaning and etching solutions are selected, the Contractor shall submit the manufacturer's technical product literature and SDS for Engineer's review and written acceptance prior to use.

Abrasives. Unless otherwise specified in the contract, when abrasive blast cleaning is specified, it shall be performed using either expendable abrasives (other than silica sand) or recyclable steel grit abrasives. Expendable abrasives shall be used one time and disposed of. Abrasive suppliers shall certify that the expendable abrasives meet the requirements of SSPC-AB1 and that recyclable steel grit abrasives meet SSPC-AB3. Tests to confirm the cleanliness of new abrasives (oil and water-soluble contamination) shall be performed by the Contractor according to the requirements and frequencies of SSPC-AB1 and SSPC-AB3, as applicable. On a daily basis, the Contractor shall verify that recycled abrasives are free of oil and water-soluble contamination by conducting the tests specified in SSPC-AB2.

All surfaces prepared with abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and reblast cleaned at the Contractor's expense.

Surface Profile (HOLD POINT). The abrasives used for blast cleaning shall have a gradation such that the abrasive will produce a uniform surface profile of 1.5 to 4.5 mils (38 to 114 microns). If the profile requirements of the coating manufacturer are more restrictive, advise the Engineer and comply with the more restrictive requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.

The surface profile for SSPC-SP15 power tool cleaned surfaces shall be within the range specified by the coating manufacturer, but not less than 2.0 mils (50 microns).

The surface profile produced by abrasive blast cleaning shall be determined by replica tape or digital profile depth micrometer according to SSPC-PA 17 at the beginning of the work, and each day that surface preparation is performed. Areas having unacceptable profile measurements shall be further tested to determine the limits of the deficient area. When replica tape is used, it shall be attached to the daily report. In the event of a conflict between measurements taken with the replica tape and digital profile depth micrometer, the measurements with the replica tape shall prevail.

The surface profile produced by power tools to SSPC-SP15, shall be measured using the digital profile depth micrometer only. Replica tape shall not be used.

When unacceptable profiles are produced, work shall be suspended. The Contractor shall submit a plan for the necessary adjustments to insure that the correct surface profile is achieved on all surfaces. The Contractor shall not resume work until the new profile is verified by the QA observations, and the Engineer confirms, in writing, that the profile is acceptable.

Soluble Salt Remediation (HOLD POINT). The Contractor shall implement surface preparation procedures and processes that will remove chloride from the surfaces. Surfaces that may be contaminated with chloride include, but are not limited to, expansion joints and all areas that are subject to roadway splash or run off such as fascia beams and stringers.

Methods of chloride removal may include, but are not limited to, steam cleaning or pressure washing with or without the addition of a chemical soluble salt remover as approved by the coating manufacturer, and scrubbing before or after initial paint removal. The Contractor may also elect to clean the steel and allow it to rust overnight followed by recleaning, or by utilizing blends of fine and coarse abrasives during blast cleaning, wet abrasive/water jetting methods of preparation, or combinations of the above. If steam or water cleaning methods of chloride removal are utilized over surfaces where the coating has been completely removed, and the water does not contact any lead containing coatings, the water does not have to be collected. The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Painting Plan.

Upon completion of the chloride remediation steps, the Contractor shall use cell methods of field chloride extraction and test procedures (e.g., silver dichromate) accepted by the Engineer, to test representative surfaces that were previously rusted (e.g., pitted steel) for the presence of remaining chlorides. Remaining chloride levels shall be no greater than 7 $\mu$ g/sq. cm as read directly from the surface without any multiplier applied to the results. The testing must be performed, and the results must be acceptable, prior to painting each day.

A minimum of 5 tests per 1000 sq. ft. (93 sq. m) or fraction thereof completed in a given day, shall be conducted at project start up. If results greater than 7  $\mu$ g/sq. cm are detected, the surfaces shall be recleaned and retested at the same frequency. If acceptable results are achieved on three consecutive days in which testing is conducted, the test frequency may be reduced to 1 test per 1000 sq. ft. (93 sq. m) prepared each day provided the chloride remediation process remains unchanged. If unacceptable results are encountered, or the methods of chloride remediation are changed, the Contractor shall resume testing at a frequency of 5 tests per 1000 sq. ft. (93 sq. m).

Following successful chloride testing the chloride test areas shall be cleaned. SSPC-SP15, Commercial Grade Power Tool Cleaning can be used to clean the test locations when the specified degree of cleaning is SSPC-SP10.

Surface Condition Prior to Painting (HOLD POINT). Prepared surfaces, shall meet the requirements of the respective degrees of cleaning immediately prior to painting, and shall be painted before rusting appears on the surface. If rust appears or bare steel remains unpainted for more than 12 hours, the affected area shall be prepared again at the expense of the Contractor.

All loose paint and surface preparation cleaning residue on bridge steel surfaces, scaffolding and platforms, containment materials, and tops of abutments and pier caps shall be removed prior to painting. When lead paint is being disturbed, cleaning shall be accomplished by HEPA vacuuming unless it is conducted within a containment that is designed with a ventilation system capable of collecting the airborne dust and debris created by sweeping and blowing with compressed air.

The quality of surface preparation and cleaning of surface dust and debris must be accepted by the Engineer prior to painting. The Engineer has the right to reject any work that was performed without adequate provision for QA observations to accept the degree of cleaning. Rejected coating work shall be removed and replaced at the Contractor's expense.

General Paint Requirements. Paint storage, mixing, and application shall be accomplished according to these specifications and as specified in the paint manufacturer's written instructions and product data sheets for the paint system used. In the event of a conflict between these specifications and the coating manufacturers' instructions and data sheets, the

Contractor shall advise the Engineer and comply with the Engineer's written resolution. Until a resolution is provided, the most restrictive conditions shall apply.

Unless noted otherwise, if a new concrete deck or repair to an existing deck is required, painting shall be done after the deck is placed and the forms have been removed.

- a) Paint Storage and Mixing. All Paint shall be stored according to the manufacturer's published instructions, including handling, temperatures, and warming as required prior to mixing. All coatings shall be supplied in sealed containers bearing the manufacturers name, product designation, batch number and mixing/thinning instructions. Leaking containers shall not be used.

b)

The Contractor shall only use batches of material that have a Department MISTIC approval number. For multi-component materials, the batch number from one component is tested with specific batch numbers from the other component(s). Only the same batch number combinations that were tested and approved shall be mixed together for use.

Mixing shall be according to the manufacturer's instructions. Thinning shall be performed using thinner provided by the manufacturer, and only to the extent allowed by the manufacturer's written instructions. In no case shall thinning be permitted that would cause the coating to exceed the local Volatile Organic Compound (VOC) emission restrictions. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed.

The ingredients in the containers of paint shall be thoroughly mixed by mechanical power mixers according to the manufacturer's instructions, in the original containers before use or mixing with other containers of paint. The paint shall be mixed in a manner that will break up all lumps, completely disperse pigment and result in a uniform composition. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the container. Excessive skinning or partial hardening due to improper or prolonged storage will be cause for rejection of the paint, even though it may have been previously inspected and accepted.

Multiple component coatings shall be discarded after the expiration of the pot life. Single component paint shall not remain in spray pots, paint buckets, etc. overnight. It shall be stored in a covered container and remixed before use.

The Engineer reserves the right to sample field paint (individual components and/or the mixed material) and have it analyzed. If the paint does not meet the product requirements due to excessive thinning or because of other field problems, the coating shall be removed from that section of the structure and replaced as directed by the Engineer.

- a) Application Methods. Unless prohibited by the coating manufacturer's written instructions, paint may be applied by spray methods, rollers, or brushes. If applied with conventional or airless spray methods, paint shall be applied in a uniform layer with overlapping at the edges of the spray pattern.
- b)

The painters shall monitor the wet film thickness of each coat during application. The wet film thickness shall be calculated based on the solids by volume of the material and the amount of thinner added. When the new coating is applied over an existing system, routine QC inspections of the wet film thickness shall be performed in addition to the painter's checks in order to establish that a proper film build is being applied.

When brushes or rollers are used to apply the coating, additional applications may be required to achieve the specified thickness per layer.

- a) Field Touch Up of Shop-Coated Steel. After cleaning, rusted and damaged areas of shop-primed inorganic zinc shall be touched up using epoxy mastic. Damaged areas of shop-applied intermediate shall be touched-up using the same intermediate specified for painting the existing structure. Following touch up, the remaining coats (intermediate and finish, or finish only, depending on the number of coats applied in the shop) shall be the same materials specified for painting the existing structure. When inorganic zinc has been used as the shop primer, a mist coat of the intermediate coat shall be applied before the application of the full intermediate coat in order to prevent pinholing and bubbling.

- b) Recoating and Film Continuity (HOLD POINT for each coat). Paint shall be considered dry for recoating according to the time/temperature/humidity criteria provided in the manufacturer's instructions and when an additional coat can be applied without the development of film irregularities; such as lifting, wrinkling, or loss of adhesion of the under coat. The coating shall be considered to be too cured for recoating based on the maximum recoat times stipulated by the coating manufacturer. If the maximum recoat times are exceeded, written instructions from the manufacturer for preparing the surface to receive the next coat shall be provided to the Engineer. Surface preparation and application shall not proceed until the recommendations are accepted by the Engineer in writing. If surfaces are contaminated, washing shall be accomplished prior to intermediate and final coats. Wash water does not have to be collected unless the water contacts existing lead containing coatings.

Painting shall be done in a neat and workmanlike manner. Each coat of paint shall be applied as a continuous film of uniform thickness free of defects including, but not limited to, runs, sags, overspray, dryspray, pinholes, voids, skips, misses, and shadow-through. Defects such as runs and sags shall be brushed out immediately during application. Dry spray on the surface of previous coats shall be removed prior to the application of the next coat.

Paint Systems. The paint system(s) from the list below shall be applied as specified.

The paint manufacturer's relative humidity, dew point, and material, surface, and ambient temperature restrictions shall be provided with the submittals and shall be strictly followed.

Written recommendations from the paint manufacturer for the length of time each coat must be protected from cold or inclement weather (e.g., exposure to rain), during the drying period shall be included in the submittals. Upon acceptance by the Engineer, these times shall be used to govern the duration that protection must be maintained during drying.

Where stripe coats are indicated, the Contractor shall apply an additional coat to edges, rivets, bolts, crevices, welds, and similar surface irregularities. The stripe coat shall be applied by brush or spray, but if applied by spray, it shall be followed immediately by brushing to thoroughly work the coating into or on the irregular surfaces, and shall extend onto the surrounding steel a minimum of 1 in. (25 mm) in all directions. The purpose of the stripe coat is to assure complete coverage of crevices and to build additional thickness on edges and surface irregularities. If the use of the brush on edges pulls the coating away, brushing of edges can be eliminated, provided the additional coverage is achieved by spray. Measurement of stripe coat thickness is not required, but the Contractor shall visually confirm that the stripe coats are providing the required coverage.

The stripe coat may be applied as part of the application of the full coat unless prohibited by the coating manufacturer. If applied as part of the application process of the full coat, the stripe coat shall be allowed to dry for a minimum of 10 minutes in order to allow Contractor QC personnel to verify that the coat was applied. If a wet-on-wet stripe coat is prohibited by the coating manufacturer or brush or roller application of the full coat pulls the underlying stripe coat, the stripe coat shall dry according to the manufacturers' recommended drying times prior to the application of the full coat. In the case of the prime coat, the full coat can also be applied first to protect the steel, followed by the stripe coat after the full coat has dried.

The thicknesses of each coat as specified below shall be measured according to SSPC-PA2, using Coating Thickness Restriction Level 3 (spot measurements 80% of the minimum and 120% of the maximum, provided the entire area complies with the specified ranges).

- a) System 1 – OZ/E/U – for Bare Steel: System 1 shall consist of the application of a full coat of organic (epoxy) zinc-rich primer, a full intermediate coat of epoxy, and a full finish coat of aliphatic urethane. Stripe coats of the prime and finish coats shall be applied. The film thicknesses of the full coats shall be as follows:
  - One full coat of organic zinc-rich primer between 3.5 and 5.0 mils (90 and 125 microns) dry film thickness. The prime coat shall be tinted to a color that contrasts with the steel surface.
  - One full intermediate coat of epoxy between 3.0 and 6.0 mils (75 and 150 microns) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and finish coat.
  - One full finish coat of aliphatic urethane between 2.5 and 4.0 mils (65 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 9.0 and 15.0 mils (225 and 375 microns).

- a) System 2 – PS/EM/U – for Overcoating an Existing System: System 2 shall consist of the application of a full coat of epoxy penetrating sealer, a spot intermediate coat of aluminum epoxy mastic and a stripe and full finish coat of aliphatic urethane.

A full coat of epoxy penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of the aluminum epoxy mastic on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full finish coat of aliphatic urethane shall be applied. The film thicknesses shall be as follows:

- a. One full coat of epoxy penetrating sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- b. One spot coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The color shall contrast with the finish coat.
- c. One full finish coat of aliphatic urethane between 2.5 and 4.0 mils (65 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.



The total dry film thickness for this system, exclusive of the stripe coat, shall be between 8.5 and 13.0 mils (215 and 325 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

- a) System 3 – EM/EM/AC – for Bare Steel: System 3 shall consist of the application of two full coats of aluminum epoxy mastic and a full finish coat of waterborne acrylic. Stripe coats for first coat of epoxy mastic and the finish coat shall be applied. The film thicknesses of the full coats shall be as follows:
  - a. One full coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The first coat of aluminum epoxy mastic shall be tinted a contrasting color with the blast cleaned surface and the second coat.
  - b. One full intermediate coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The intermediate coat shall be a contrasting color to the first coat and the finish coat.
  - c. A full finish coat of waterborne acrylic between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 12.0 and 18.0 mils (360 and 450 microns).

- a) System 4 – PS/EM/AC – for Overcoating an Existing System: System 4 shall consist of the application of a full coat of epoxy penetrating sealer, a spot intermediate coat of aluminum epoxy mastic and a stripe and full finish coat of waterborne acrylic.

A full coat of epoxy penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of the aluminum epoxy mastic on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full finish coat of waterborne acrylic shall be applied. The film thicknesses shall be as follows:

- a. One full coat of epoxy penetrating sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- b. One spot coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The color shall contrast with the finish coat.
- c. One full finish coat of waterborne acrylic between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of the stripe coat, shall be between 8.0 and 13.0 mils (200 and 325 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

- a) System 5 – MCU – for Bare Steel: System 5 shall consist of the application of a full coat of moisture cure urethane (MCU) zinc primer, a full coat of MCU intermediate, and a full coat of MCU finish. Stripe coats of the prime and finish coats shall be applied. The Contractor shall comply with the manufacturer's requirements for drying times between the application of the stripe coats and the full coats. The film thicknesses of the full coats shall be as follows:
- a. One full coat of MCU zinc primer between 3.0 and 5.0 mils (75 and 125 microns) dry film thickness. The prime coat shall be tinted to a color that contrasts with the steel surface.
  - b. One full MCU intermediate coat between 3.0 and 4.0 mils (75 and 100 microns) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and finish coat.
  - c. One full MCU finish coat between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 8.0 and 13.0 mils (200 and 325 microns).

- a) System 6 – MCU – for Overcoating an Existing System: System 6 shall consist of the application of a full coat of moisture cure urethane (MCU) penetrating sealer, a spot coat of MCU intermediate, and a stripe and full coat of MCU finish.

A full coat of MCU penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of MCU intermediate on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full coat of MCU finish shall be applied. The Contractor shall comply with the manufacturer's requirements for drying time between the application of the stripe coat and the full finish coat. The film thicknesses shall be as follows:

- a. One full coat of MCU sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- b. One full MCU intermediate coat between 3.0 and 4.0 mils (75 and 100 microns) dry film thickness. The color shall contrast with the finish coat.
- c. One full MCU finish coat 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 6.0 and 10.0 mils (150 and 250 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

Application of Paint System over Galvanizing: If galvanized surfaces are present and specified to be painted, the Contractor shall apply one of the following as designated on the plans:

- i. A 2-coat system consisting of a full aluminum epoxy mastic coat and a full waterborne acrylic finish coat from System 3. If red rust is visible, rusted areas shall be spot primed with aluminum epoxy mastic prior to the application of the full coat of aluminum epoxy mastic.
- ii. A 2-coat system consisting of a full epoxy coat and a full urethane coat from System 1. If red rust is visible, rusted areas shall be spot primed with organic zinc prior to the application of the full coat of epoxy.

Surface Preparation and Painting of Galvanized Fasteners: The Contractor shall prepare all fasteners (i.e., galvanized nuts, bolts, etc.) by power tool cleaning in accordance with SSPC-SP 2 or SSPC-SP3 to remove loose material. Following hand/power tool cleaning and prior to painting, the surfaces shall be solvent cleaned according to SSPC-SP 1. Slight stains of torqueing compound dye may remain after cleaning provided the dye is not transferred to a cloth after vigorous rubbing is acceptable. If any dye is transferred to a cloth after vigorous rubbing, additional cleaning is required.

The fasteners shall be coated with one coat of an aluminum epoxy mastic meeting the requirements of Article 1008.03 and the same acrylic or urethane topcoat specified above for use on galvanized members.

Repair of Damage to New Coating System and Areas Concealed by Containment. The Contractor shall repair all damage to the newly installed coating system and areas concealed by the containment/protective covering attachment points, at no cost to the Department. The process for completing the repairs shall be included in the submittals. If the damage extends to the substrate and the original preparation involved abrasive blast cleaning, the damaged areas shall be prepared to SSPC-SP15 Power Tool Cleaning - Commercial Grade. If the original preparation was other than blast cleaning or the damage does not extend to the substrate, the loose, fractured paint shall be cleaned to Power Tool Cleaning – Modified SP3.

The surrounding coating at each repair location shall be feathered for a minimum distance of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared areas and the existing coating.

If the bare steel is exposed, all coats shall be applied to the prepared area. For damaged galvanizing, the first coat shall be aluminum epoxy mastic. If only the intermediate and finish coats are damaged, the intermediate and finish shall be applied. If only the finish coat is damaged, the finish shall be applied.

Special Instructions.

- a) At the completion of the work, the Contractor shall stencil the painting date and the paint code on the bridge. The letters shall be capitals, not less than 2 in. (50 mm) and not more than 3 in. (75 mm) in height.

The stencil shall contain the following wording "PAINTED BY (insert the name of the Contractor)" and shall show the month and year in which the painting was completed, followed by the appropriate code for the coating material applied, all stenciled on successive lines:

CODE U (for field applied System 3 or System 4). CODE Z (for field applied System 1 or System 2). CODE AA (for field applied System 5 or System 6).

This information shall be stenciled on the cover plate of a truss end post near the top of the railing, or on the outside face of an outside stringer near one end of the bridge, or at some equally visible surface near the end of the bridge, as designated by the Engineer.

- b) All surfaces painted inadvertently shall be cleaned immediately.

It is understood and agreed that the cost of all work outlined above, unless otherwise specified, has been included in the bid, and no extra compensation will be allowed.

**Basis of Payment.** This work shall be paid for at the contract Lump Sum price for CLEANING AND PAINTING STRUCTURAL STEEL at the Location indicated. Payment will not be authorized until all requirements for surface preparation and painting have been fulfilled as described in this specification, including the preparation and submittal of all QC documentation. Payment will also not be authorized for non-conforming work until the discrepancy is resolved in writing.

Appendix 1 – Reference List

The Contractor shall maintain the following regulations and references on site for the duration of the project:

- Illinois Environmental Protection Act
- ASTM D 4214, Standard Test Method for Evaluating Degree of Chalking of Exterior Paint Films
- ASTM D 4285, Standard Test Method for Indicating Oil or Water in Compressed Air
- ASTM D4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
- SSPC-AB 1, Mineral and Slag Abrasives
- SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives
- SSPC-AB 3, Ferrous Metallic Abrasive
- SSPC-PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements
- SSPC-PA 17, Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
- SSPC-QP 1, Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Structures)
- SSPC-QP 2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint
- SSPC-SP 1, Solvent Cleaning
- SSPC-SP 2, Hand Tool Cleaning
- SSPC-SP 3, Power Tool Cleaning
- SSPC-SP 10/NACE No. 2, Near White Metal Blast Cleaning
- SSPC-SP WJ-4, Waterjet Cleaning of Metals – Light Cleaning
- SSPC-SP 15, Commercial Grade Power Tool Cleaning
- SSPC-SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
- SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
- SSPC-VIS 3, Visual Standard for Power- and Hand-Tool Cleaned Steel
- SSPC-VIS 4, Guide and Reference Photographs for Steel Cleaned by Water Jetting
- SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning
- The paint manufacturer's application instructions, MSDS and product data sheets

## **BUILDING REMOVAL**

**Description.** This work shall consist of the removal and disposal of existing Building "B", together with all foundations, down to a plan 1 foot below the existing grade in the area and also all incidental and collateral work necessary to complete the removal of the building in a manner approved by the Engineer.

Prior to removal the contractor shall identify all services and submit a plan for isolation/disconnection and removal to the Engineer.

**Submittal Requirements.** The Contractor shall submit a demolition plan to the Engineer for review and acceptance, detailing the proposed methods of demolition and the amount location (s) and type(s) of equipment to be used. For work adjacent to or an active roadway, railroad the demolition plan shall include an assessment of the structures condition and an evaluation of the structure prior to removal outlining the safe removal of the building structure. Demolition plan must address dust control and public safety. Plans must be signed and sealed by an Illinois Licensed Structural Engineer.

**Discontinuance of Utilities.** The Contractor shall arrange for the discontinuance of all utility services and the removal of the metering devices that serve the building according to the respective regulations of the utility company involved. The Contractor shall disconnect and seal, in an approved manner, all service outlets that serve any building he/she is to remove.

**Method of Measurement.** This work will be measured for payment as a lump sum item.

**Basis of Payment.** This work will be paid for at the contract lump sum price for BUILDING REMOVAL, number as listed above, which price shall be payment in full for complete removal of the buildings and structures, including any necessary backfilling materials as specified herein. Any salvage value shall be reflected in the contract unit price for this item.

## **JOINT REPAIR**

**Description.** This work shall consist of cleaning and repairing deteriorated joints as shown on the plans.

### **CONSTRUCTION REQUIREMENTS**

**General.** Contractor shall remove rust and paint existing metal roof brackets.

**Submittals.** Proposed materials associated each repair with item shall be submitted for review.

**Method of Measurement.** This work will be measured for payment per each joint repaired.

**Basis of Payment.** This work will be paid for at the contract unit price per each for JOINT REPAIR

## **JOINT SEALER**

**Description.** This work shall consist of cleaning and resealing existing joints between a building floor slab and CMU walls as shown on the plans.

**Materials.** The joint sealant shall be a polyurethane sealant, Type S, Grade NS, Class 25 or better. Use T (T<sub>1</sub> or T<sub>2</sub>) according to ASTM C920.

### **CONSTRUCTION REQUIREMENTS**

**General.** Debris and/or existing joint sealant shall be completely removed prior to sealing the joint. Joint sealants and fillers must be approved for interior and exterior applications.

**Installation.** The sealing material shall be applied as directed by the manufacturer's instructions. The installer shall be authorized installer who is approved or licensed for installation of elastomeric sealants required for this Project.

**Submittals.** The Contractor shall provide product data for each joint-sealant product indicated. For each type and color of joint sealant required, provide samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants. Contractor shall indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates.

Data from sealant manufacturer shall include the following:

- Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
- Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

**Method of Measurement.** This work will be measured for payment per linear foot of joint sealed.

**Basis of Payment.** This work will be paid for at the contract unit price per foot for JOINT SEALER.

## **CLOSED CIRCUIT TELEVISION DOME CAMERA, HD**

### **Description.**

This work shall consist of furnishing and installing an integrated High Definition Closed-Circuit Television (CCTV) Dome Camera Assembly as described herein and as indicated in the Plans.

### **Materials.**

#### General

The HD (High Definition) CCTV Dome Color Camera shall be a rugged, non-pressurized, outdoor surveillance domed camera system. The HD CCTV Dome Camera shall be designed to perform over a wide range of environmental and lighting conditions and automatically switches from color daytime to monochrome nighttime operation. The high definition camera shall be either a Bosch Autodome IP series 7000 HD, Pelco Spectra 1080P HD Series, or a Siquira HSD820H3-E series in compliance with the requirement herein.

Camera shall use a standard Web browser interface for remote administration and configuration of camera parameters. The browser interface shall provide PTZ control including preset and pattern and on-screen display (OSD) for access to camera programming.

All equipment and materials used shall be standard components that are regularly manufactured and utilized in the manufacturer's system.

The manufacturer shall be ISO 14001 Certified. The manufacturer's quality system shall be in compliance with the I.S./ISO 9001/EN 29001, QUALITY SYSTEM. The manufacturer shall provide a three year (3) warranty. The manufacturer shall pay inbound and outbound shipping charges during the warranty period for products returned as warranty claims. The manufacturer shall also provide an advance exchange program for warranty claims.

The warranty period shall begin on the date of final acceptance of the video distribution system. This warranty shall include repair or replacement of all failed components via a factory authorized repair facility. All items sent to the repair facility for repair shall be returned within two weeks of the date of receipt at the facility. The repair facility location shall be in the United States. Any extended warranty coverage required to comply with the specified warranty period shall be provided as a part of this pay item at no additional cost to the Department.



Physical Construction

The CCTV Dome Camera shall be provided in a NEMA 4X or IP66 certified, rugged, weather-resistant package. The CCTV Dome Camera shall also comply with the following requirements:

<b>Environmental</b>	<b>Requirement</b>
IP Rating	IP 66
Weight (max.)	10 lbs.
Overall Dimensions	10" dia. x 14"
Humidity	0 to 100%
Operating temperature	-40°C to 50°C
Mount	1 1/2" NPT

The CCTV dome camera shall be equipped with a fan and heater controlled by a thermostat. The heater shall prevent internal fogging of the lower dome throughout the operating temperature range of the camera.

An optional rugged clear dome bubble shall be available from the CCTV camera manufacturer. The rugged dome shall be made from 3mm thick polycarbonate, designed to meet stringent strength standards without compromising optical clarity. The dome, by itself, shall withstand a 100 foot-pound impact. This energy is equivalent to that of a 10 lb. sledgehammer being dropped from a height of 10 feet. The dome, when installed in the CCTV camera, shall exceed the UL 1598 horizontal impact standard for lighting fixtures, by a factor of 10. The submittal needs to indicate compliance with this requirement.

Power

The CCTV Dome Camera shall be designed to operate from a 120V power source. The appropriate power supply, if required for the CCTV Dome Camera to operate, shall be included as a part of this item. The power requirements for the camera shall comply with the following:

<b>Item</b>	<b>Requirement</b>
Port	RJ-45 for 100Base-TX; Auto MDI/MDI-X;
Cabling Type	CAT5 cable or better for 100Base-TX
Input Voltage	18 to 32 VAC; 24 VAC nominal; 22 to 27 VDC; 24 VDC nominal
Input Power	24 VAC nominal
	25 VA nominal (without heater and blower); 75 VA nominal (with heater and blower)
	24 VDC nominal
	0.7 A nominal (without heater and blower); 3 A nominal (with heater and blower)
PoE	IEEE802.3af (without heater and blower)

Camera

The camera shall provide a minimum of two simultaneous video streams with a 2.1 megapixel (MPx) 1920 x 1080 resolution, auto iris with 30X optical, and 12X digital zoom. The CCTV Dome Camera shall incorporate

<b>Item</b>	<b>Requirement</b>
Sensor Type	1/2.8-inch Type Exmor CMOS sensor
Optical Zoom	30X
Digital Zoom	12X
Maximum Resolution	1920 x 1080
Lens	f/1.6 - f/4.7, (4.3 mm - 129.0 mm optical)
Horizontal Angle of View	59° (wide) - 2° (tele)
Aspect Ratio	16:9
Light Sensitivity	Sensitivity in lux for 90% reflectance, f/1.6 (wide angle), 28 dB gain at 30 IRE (30% of signal level) with Sensitivity Boost OFF; 4X improvement to sensitivity with Sensitivity Boost ON
Color (33 ms) Color (250 ms)	0.65 lux 0.07 lux
Mono (33 ms) Mono (250 ms)	0.20 lux 0.015 lux
Day/Night Capabilities	Yes
IR Cut Filter	Yes
IR Trace	Curves 850 nm and 950 nm
Wide Dynamic Range	80dB
Iris Control	Auto iris with manual override
Backlight Compensation	Auto / Manual
Automatic Gain Control	Auto / Manual
Active Noise Filtering	Auto / Manual
Electronic Image Stabilization (EIS)	30X

Video

Item	Requirement
Video Encoding	H.264 in High, Main, or Base profiles and MJPEG
Video Streams	Up to 2 simultaneous streams, the second stream is variable based on the setup of the primary stream
Frame Rate	Up to 30, 25, 15, 12.5, 10, 8.333, 7.5, 6, 5,3, 2.5, 2, 1 (depending upon coding, resolution, and stream configuration)
Minimum Available Resolutions	1920x1080 1280x720 720 x 480
Supported Protocols	TCP/IP, UDP/IP (Unicast, Multicast IGMP), UPnP, DNS, DHCP, RTP, RTSP, NTP, IPv4, IPv6, SNMP v2c/v3, QoS, HTTP, HTTPS, LDAP (client), SSH, SSL, SMTP, FTP, and 802.1x (EAP)
Security Access	Password protected
Software Interface	Web browser view and setup

PTZ Mechanical

Item	Requirement
Pan Movement	360° continuous pan rotation
Pan Speed	Variable between 400° per second continuous pan to 5.0° per second
Vertical Tilt	Unobstructed tilt of +1° to -90°
Manual Control Speed	Pan speed of 0.1° to 80° per second; tilt operation shall range from 0.5° to 40° per second.
Automatic Preset Speed	Pan speed of 280° and a tilt speed of 160° per second
Presets	255 positions
Tours	2 tours
Preset Accuracy	± 0.2°
Proportional Pan/Tilt Speed	Speed decreases in proportion to the increasing depth of zoom
Motor	Continuous duty and variable speed, operating at 18 to 32 VAC, 24 VAC nominal
Window Blanking	16 blanked windows
Auto Flip	Rotates dome 180° at bottom of tilt travel
Power Consumption	Nominal 45 VA (without heater and blower running) Nominal 75 VA (with heater and blower running)

The camera shall provide a freeze frame feature that freezes a camera image as a preprogrammed preset is called, providing a live view once positioned.

Selections for on/off shall be available through the embedded Web browser.

The camera shall provide image stabilization to compensate for vibration introduced into the camera.

The camera shall support IPv6 configurations in conjunction with IPv4.

#### Still Picture Capture

The camera shall be capable of capturing a still image in JPEG format and automatically transferring this image to an FTP site. The resolution of the image shall be user selectable. The frequency of captures shall be user settable and shall as a minimum range from 1 picture every 30 seconds to 1 picture every five minutes.

#### Video Distribution System (VDS) Control System Driver

The camera and video output shall be controlled and configured through the VDS. Consequently, a software driver for the VDS is required and included as a part of the CCTV camera. The VDS control system is Cameleon ITS manufactured by 360 Surveillance, a division of FLIR. It is the Contractor's responsibility to determine if an existing software driver exists for the propose camera manufacturer. If a driver does not exist for the proposed CCTV camera, the work and cost of developing the driver shall be included in this item.

## **CONSTRUCTION REQUIREMENTS**

### **Installation.**

The Contractor shall install the CCTV camera in accordance with manufacturer's instructions and as shown on the Plans. The camera firmware shall be the latest stable release available at the time of installation.

### Testing

The Contractor shall test each CCTV Dome Camera Assembly in the presence of the Engineer after the camera is installed. This test may be done locally at the camera support structure.

### Documentation

In addition to the initial submittal(s) prior to procurement, the Contractor shall provide installation and operation manuals, documentation of exact equipment model and serial numbers, software/firmware version numbers, in hardcopy and PDF formats on CD-ROM.

### Product Support

The manufacturer shall provide technical support via email, fax and toll-free telephone. The above forms of support shall be provided Monday through Friday, 8:00am to 8:00pm EST.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION DOME CAMERA, HD.

## **REMOVE EXISTING SURVEILLANCE CAMERA EQUIPMENT**

**Description.** This work includes removing CCTV camera, media converter, and enclosure.

**General.** The removal of the existing CCTV camera and associated camera as shown on the plans. Contractor shall use caution when removing cameras and associated cabling to not damaged adjacent equipment to remain in operation. Damaged equipment will be repaired at the contractor's expense.

**Method of Measurement.** Remove existing surveillance camera equipment will be measured for payment as each.

**Basis of Payment.** This work will be paid for at the contract unit price per each for REMOVE EXISTING SURVEILLANCE CAMERA EQUIPMENT

## **DOWNSPOUT CONNECTION**

**Description.** This work shall consist of extending an existing 4" diameter metal downspout pipe to grade level and up to 15 feet away from the building as shown on the plans.

**Materials.** Downspout extensions shall be 20 gauge (min.) sheet metal, with a white acrylic finish. Materials shall be selected for compatibility with the existing downspout.

**General.** The downspout shall be vertically extended to grade level and horizontally extended to route drainage away from the existing foundation and sidewalk.

**Method of Measurement.** Downspout connections will be measured for payment as each.

**Basis of Payment.** This work will be paid for at the contract unit price per each for DOWNSPOUT CONNECTION.

## **FIBER OPTIC SPLICE**

Effective: March 1, 2022

**Description.** The Contractor will splice optical fibers from different cable sheaths and protect them with a splice closure at the locations shown on the Plans. Fiber splicing consists of in-line fusion splices for all fibers described in the cable plan at the particular location.

Two splices are identified. A mainline splice includes all fibers in the cable sheath. In a lateral splice, the buffer tubes in the mainline cable are dressed out and those fibers identified on the plans are accessed in and spliced to lateral cables.

### **Materials.**

Splice Closures. Splice Closures shall be designed for use under the most severe conditions such as moisture, vibration, impact, cable stress and flex temperature extremes as demonstrated by successfully passing the factory test procedures and minimum specifications listed below:

Physical Requirements. The closures shall provide ingress for up to four cables in a butt configuration. The closure shall prevent the intrusion of water without the use of encapsulates.

The closure shall be capable of accommodating splice organizer trays that accept mechanical, or fusion splices. The splice closure shall have provisions for storing fiber splices in an orderly manner, mountings for splice organizer assemblies, and space for excess or un-spliced fiber. Splice organizers shall be re-enterable. The splice case shall be UL rated.

Closure re-entry and subsequent reassembly shall not require specialized tools or equipment. Further, these operations shall not require the use of additional parts.

The splice closure shall have provisions for controlling the bend radius of individual fibers to a minimum of 38 mm (1.5 in.).

## **Factory Testing.**

Compression Test. The closure shall not deform more than 10% in its largest cross-sectional dimension when subjected to a uniformly distributed load of 1335 N at temperatures of –18 and 38 degrees Celsius (0 and 100 degrees Fahrenheit). The test shall be performed after stabilizing at the required temperature for a minimum of two hours. It shall consist of placing an assembled closure between two flat parallel surfaces, with the longest closure dimension parallel to the surfaces. The weight shall be placed on the upper surface for a minimum of 15 minutes. The measurement shall then be taken with weight in place.

Impact Test. The assembled closure shall be capable of withstanding an impact of 28 N-M at temperatures of –18 and 38 degrees Celsius (0 and 100 degrees Fahrenheit). The test shall be performed after stabilizing the closure at the required temperature for a minimum of 2 hours. The test fixture shall consist of 9 kg (20 lb) cylindrical steel impacting head with a 50 mm (2 in.) spherical radius at the point where it contacts the closure. It shall be dropped from a height of 305 mm (12 in.). The closure shall not exhibit any cracks or fractures to the housing that would preclude it from passing the water immersion test. There shall be no permanent deformation to the original diameter or characteristic vertical dimension by more than 5%.

Cable Gripping and Sealing Testing. The cable gripping and sealing hardware shall not cause an increase in fiber attenuation in excess of 0.05 dB/fiber @ 1550 nm when attached to the cables and the closure assembly. The test shall consist of measurements from six fibers, one from each buffer tube or channel, or randomly selected in the case of a single fiber bundle. The measurements shall be taken from the test fibers before and after assembly to determine the effects of the cable gripping and sealing hardware on the optical transmission of the fibers.

Vibration Test. The splice organizers shall securely hold the fiber splices and store the excess fiber. The fiber splice organizers and splice retaining hardware shall be tested per EIA Standard FOTP-II, Test Condition 1. The individual fibers shall not show an increase in attenuation in excess of 0.1 dB/fiber.

Water Immersion Test. The closure shall be capable of preventing a 3 m (10 ft) water head from intruding into the splice compartment for a period of 7 days. Testing of the splice closure is to be accomplished by the placing of the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent 3 m (10 ft) on the closure and cable. This process shall be continued for 30 days. Remove the closure and open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a failure.

Certification. It is the responsibility of the Contractor to insure that either the manufacturer, or an independent testing laboratory has performed all of the above tests, and the appropriate documentation has been submitted to the Department. Manufacturer certification is required for the model(s) of closure supplied. It is not necessary to subject each supplied closure to the actual tests described herein.

### **CONSTRUCTION REQUIREMENTS**

The closure shall be installed according to the manufacturer's recommended guidelines. For mainline splices, the cables shall be fusion spliced. 45 days prior to start of the fiber optic cabling installation, the Contractor shall submit the proposed locations of the mainline splice points for review by the Department.

The Contractor shall prepare the cables and fibers in accordance with the closure and cable manufacturers' installation practices. A copy of these practices shall be provided to the Engineer 21 days prior to splicing operations.

Using a fusion splicer, the Contractor shall optimize the alignment of the fibers and fuse them together. The Contractor shall recoat the fused fibers and install mechanical protection over them.

Upon completing all splicing operations for a cable span, the Contractor shall measure the mean bi-directional loss at each splice using an Optical Time Domain Reflectometer.

When splices are made between identical cables (same manufacturer and cable type) the average optical loss of each splice shall not exceed 0.10 dB. The average is determined by measuring the splice loss in both directions with an OTDR, adding the two readings, and dividing by two. Testing should be performed for both the 1310 and 1550 nm wavelengths. No individual splice loss measured in a single direction shall exceed 0.15 dB.

When splices are made between cables containing fibers of different mode field diameters, the average optical loss of each splice shall not exceed 0.50 dB. The average is determined by measuring the splice loss in both directions with an OTDR, adding the two readings, and dividing by two. Testing should be performed for both the 1310 and 1550 nm wavelengths. No individual splice loss measured in a single direction shall exceed 0.6 dB.

The Contractor shall measure the end-to-end attenuation of each fiber, from connector to connector, using an optical power meter and source. This loss shall be measured at from both directions and shall not exceed 0.5 dB per installed kilometer of single mode cable. Measurements shall be made at both 1300 and 1550 nm for single mode cable. For multimode cable, power meter measurements shall be made at 850 and 1300 nm. The end-to-end attenuation shall not exceed 3.8 dB/installed kilometers at 850nm or 1.8 dB per installed kilometer at 1300nm for multimode fibers.

As directed by the Engineer, the Contractor at no additional cost to the Department shall replace any cable splice not satisfying the required objectives.

The Contractor shall secure the Splice Closure to the side of the splice facility using cable support brackets. All cables shall be properly dressed and secured to rails or racks within the manhole. No cables or enclosures will be permitted to lie on the floor of the splice facility. Cables that are spliced inside a building will be secured to the equipment racks or walls as appropriate and indicated on the Plans.



**Method of Measurement.** Fiber optic splice of the type specified will be measured as each, completely installed and tested with all necessary splices completed within the enclosure, and the enclosure secured to the wall of the splice facility.

**Basis of Payment.** This item shall be paid at the contract unit price each for **FIBER OPTIC SPLICE, LATERAL** or **FIBER OPTIC SPLICE, MAINLINE** of the type specified, which shall be payment in full for the work, complete, as specified herein.

## **CLOSED CIRCUIT TELEVISION CABINET**

**Description.** This work shall include furnishing, installing, calibrating, and testing of a pole-mounted CCTV cabinet at locations shown in the Plans and as directed by the Engineer.

**Materials.** The main components of the system are as described below. All other ancillary connection cables, circuit breakers, brackets, and all other items required for the installation of a fully functional CCTV Cabinet, as shown on drawing(s).

- Cabinet
  - Control Power Transformer
  - CCTV Camera Equipment (per “*Closed Circuit Television Camera Equipment*” specification.)
  - Grounding Bar System
  - Layer III Network Switch (per “*Ethernet Switch*” specification)
  - Surge Suppressors
  - Ethernet Relay
  - Fiber Optic Termination Panel (per “*Fiber Optic Termination Panel, 12F or 24F*” specification)
  - 24 VDC Power Supply
- Grounding System

The following are the specific materials for the system component described above:

- Cabinet. The cabinet shall be a NEMA 4X Stainless Steel, 36” H x 30” W x 12” D enclosure manufactured by Hoffman, model A36H3012SS6LP. The enclosure shall be ordered with a 33” x 27” panel manufactured by Hoffman, model A36P30 or approved equal.
  - The cabinet shall be mounted using a pole mounted kit manufactured by Hoffman, model CPMK30, or approved equal.
  - The Control Power Transformer shall be a 1000 VA from a 208/240/480 to 120 volt power transformer manufactured by Square D model 9070 Type T1000D95 or approved equal.
  - The power supply and other components required per the “*Closed Circuit Television Camera Equipment*” specification
  - The Grounding Bar System shall be a Hoffman model PGS2K or approved equal.
  - The Ethernet switch shall be per the *Ethernet Switch* specification and paid for separately.

- The 120 VAC Surge Suppressor shall be manufactured by Cooper Crouse Hinds model MA15/D/1/SI or approved equal.
- The Power Controller, 8-Channel DIN Ethernet Relay shall be a Digital Loggers model DIN 4 or approved equal.
- A terminal block manufactured by Allen Bradley, model 1492-CD8 or approved equal.
- The fiber optic termination panel shall be *Fiber Optic Termination Panel, 12F or 24F* specification.
- The 24 VDC Power Supply shall be a Click 204 AC/DC power supply manufactured by Wavetronix or Lambda DSP100-24.
- All work associated with the external ground system and connections made internally to the cabinet shall be according to the special provision "GROUNDING OF ITS SUBSYSTEMS (D-1)".

The Contractor shall submit to the Engineer a request for variance when changing equipment. The variance shall be the formal request of an approval of an equal or better substitute for a specified part by providing justification and supporting manufacturer's specifications and other relevant documentation.

### **CONSTRUCTION REQUIREMENTS**

The Contractor shall closely coordinate with the Engineer. This includes, but is not limited to, the following:

#### Pre-Procurement Documentation Approval

- The Contractor shall submit for approval to the Engineer, within 10 business days from NTP, a detailed schedule showing dates for: product submittals and approvals; device configuration by the Department; construction/installation; calibration; testing; burn-in period; and warranty of each cabinet
- The Contractor shall submit for approval to the Engineer, within 10 business days from NTP, a completed Contractor CCTV Cabinet Checklist and associated submittals (checklist shall be developed by the Contractor).

The Contractor shall obtain approval of the schedule, catalog cut sheets, cabinet wiring diagrams, and calculations from the Engineer prior to purchasing any equipment and subsequently performing the installation per the approved documents, contract plans, and specifications.

#### Pre-Installation Requirements

- Thirty (30) days prior to the scheduled field installation of each enclosure, the Contractor shall deliver the network switch to the Department's Network Administrator for configuration and labeling prior to installation by the Contractor or shall configure as directed by the Network Administrator. The IP Relay shall be programmed by the Contractor.
- The Contractor shall take possession of the network switch from the Department upon notification by the Engineer of configuration and labeling completion.

### Cabinet Installation

- The Contractor shall install the CCTV Cabinet on a pole that at the location shown on the plans.
  - The cabinet shall be oriented on the pole perpendicular to the roadway, such that a worker who faces an opened cabinet is also facing the direction of approaching traffic or as directed by the Engineer.
  - The ground rod shall be connected to the exterior of the cabinet pole ground bar as shown on the Plans.
  - All associated conduit, wire, power service feeds, circuit breakers, brackets, etc. as shown on the Plans, and all items and workmanship required to successfully pass the Site Test stated within this specification, will be the sole responsibility of the Contractor and incidental to this pay item.

**Testing.** The Contractor shall be required to perform the following tests after the installation of the CCTV Cabinet. The Contractor shall use the test plans within this special provision to conduct the following tests in the presence of the Engineer.

- First Unit Factory Visual Inspection
- Site Test
- System Test
- 30-Day Burn-in Period
- Final System Acceptance and Training

### First Unit Factory Visual Inspection

The Contractor (or the Contractor's equipment fabricator) shall completely assemble CCTV cabinet unit which includes the cabinet, all equipment, modules, components and complete all internal wiring (including labeling), then provide 5 business days' notice that this unit is ready for inspection. The Contractor shall have one set of contract plans and two sets of shop drawings on site to be redlined with any discrepancies noted. One set of redlines will be retained by the Department. The Contractor shall label all components. The Contractor may optionally perform an AC power test in the shop following successful completion of the Factory Visual Inspection. In lieu of the Factory Visual Inspection, the Contractor can obtain from the manufacturer a product validation certification illustrating that the manufacturer has followed their quality processes and verifies that the unit meets the specifications for operations. This certificate must be submitted to the Engineer for review and approval for the Factory Visual Inspection acceptance.

### Site Testing

The purpose of the Site Test is to have the Contractor demonstrate to the Engineer that all CCTV Cabinet components have been installed, connected, labeled, and configured correctly as per contract plans and as per the manufacturer's requirements, utilizing quality workmanship.

The Site Test shall be performed in conjunction with all associated equipment installed at a common site. A Site Test shall not be performed at the element or component level.

For the Site Test to be accepted, the Contractor shall demonstrate to the Engineer that:

- The installation has been performed as per the plans and as per the manufacturer's recommendations.
- All cabinet components are properly wired and demonstrate continuity and correct grounding utilizing good workmanship.
- The cabinet is attached/orientated to the pole and properly grounded.
- All conduits are secured and sealed, as required.
- All cabinet components demonstrate correct input and/or output voltages when powered/unpowered.
- All connections are tight and cannot be dislodged by incidental contact from the Engineer.
- All equipment inside the enclosure has been labeled.

### System Test

The System Test shall be conducted by the Department, once the cabinet is installed along with all devices to complete a fully operational ITS site.

The System Test demonstrates that the CCTV camera cabinet and associated field devices can be operated at the IDOT ComCenter utilizing the Advanced Traffic Management System (ATMS) software.

For the System Test to begin, the Contractor shall demonstrate to the Engineer that:

- The site is ready for System Testing, by notification in writing to the Engineer within 5 days of the requested start of test.
- Contractor has requested the Engineer to notify the Department when the cabinet is ready to test.

System Test Acceptance of the CCTV Cabinet:

- Department sign off that the CCTV cabinet is integrated and tested for:
  - Communications connectivity from the ATMS to each CCTV Cabinet network switch and associated devices.
  - Accurate video and/or data transmission from each site to the ATMS.
- Contractor received documentation from the Engineer of written approval from the Department verifying the communications connectivity and data transmission are within the Department's requirements.

The Contractor shall be notified in writing from the Engineer that the System Test has passed and the 30-Day Burn-In Period has immediately started. The Department shall be responsible for conducting the 30-Day Burn-in Test.

The Department will complete the System Test within 2 weeks of notification from the Engineer requesting that all CCTV cabinets be tested.

30-Day Burn-in Period

The purpose of the 30-Day Burn-in Period demonstrates that the CCTV Cabinet and associated field devices communicate 100% of the time to the ATMS software and that video is being received during the duration of the test.

For the 30-Day Burn-in Period to be accepted, the Contractor shall demonstrate to the Engineer that:

- The Engineer or Department have not submitted any trouble tickets or written (via email or any failure notification(s) within the 30-Day period.
  - Failure notification shall include, but not be limited to:
    - Any CCTV cabinet and associated field device power or communication error(s).
    - Data accuracy below the manufacturer's specification.
    - Any CCTV Cabinet and associated field device configuration errors.
    - Any operations anomaly that the Contractor cannot explain or rectify.
  - For every one (1) day the Contractor is required to mitigate/fix a problem, an additional one (1) day per testing will be added to the 30-Day test.
- Contractor received documentation from the Engineer of written approval (via email) from the Department verifying the 30-Day Burn-In period has been successfully completed.

### Final System Acceptance and Training

A representative of the Contractor shall witness the final inspection of the CCTV Cabinet performed by the Engineer. Final acceptance of all work associated with this item will be made after:

- Contractor received written approval from the Engineer of Contractor submission to the Engineer for all Record Drawings and Warranty documents including an electronic computer file (MicroStation and PDF) including a sketch of each CCTV cabinet, user/operator manuals, listing each device's location, identification number, and GPS coordinates.
  - The Contractor shall provide three hard and three electronic (PDF) copies of each of the operation and maintenance manuals to the Engineer for approval.
- Notification of Final Acceptance in writing received from the Engineer.

**Warranty.** All CCTV Cabinet equipment shall be warranted and guaranteed against defects and/or failure in design, materials, and workmanship within the warranty period. The Contractor shall submit the warranty terms as part of each material item's shop drawing submittal for approval.

The warranty shall provide that, in the event of a malfunction during the warranty period, the defective system component shall be replaced with a new component by the manufacturer or his/her representative.

Any system component that, in the opinion of the Engineer, fails three (3) times prior to the expiration of the warranty will be judged as an unsuitable system and shall require the entire system be replaced by the device manufacturer or representative with a new system of the same type at no additional cost to the Department. The unsuitable system shall be permanently removed from the project. A failure shall also be defined as the field device becoming unable to comply with all applicable standards at the time of original construction.

All manufacturer's equipment guarantees or warranties shall be included in the maintenance manuals for the subject equipment.

**Method of Measurement.** This work will be measured in units of each.

**Basis of Payment.** This work will be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION CABINET

**FIBER OPTIC INNERDUCT 1 ¼” DIA.**

**Description.** This work shall consist of furnishing, installing, splicing, connecting and demonstrating continuity of fiber optic cable innerduct of sizes specified herein and as shown on the Plans. The innerduct shall be High Density Polyethylene.

**Materials.**

General

The duct shall be a spiral ribbed plastic duct which is intended for underground use and which can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing and/or installation without adversely affecting its properties of performance. The ribbed duct shall have internally designed longitudinal ribs for reduced pulling frictions and increased lubrication effectiveness.

The duct shall be made of high density polyethylene which shall meet the requirements of ASTM D 3035. The innerduct material shall be composed of high density polyethylene meeting the requirements of PE334470E/C as defined in ASTM D3350.

Submittal information shall demonstrate compliance with the details of these requirements.

Dimensions

Duct dimensions shall conform to the standards listed in ASTM D3035, SDR-11. Submittal information shall demonstrate compliance with these requirements.

Nominal Size (diameter)	Inside Diameter (minimum)	Outside Diameter (Average)	Wall Thickness (Min.)	Bend Radius (minimum)	Pull Strength	Weight Average (lbs./100ft.)
1.25”	1.313”	1.660”	0.151”	17”	750	31

Marking

As specified in NEMA Standard Publication No. TC-7, the duct shall be clearly and durably marked at least every 10 feet with the material designation (HDPE for high density polyethylene), nominal size of the duct, and the name and/or trademark of the manufacturer.

Color

Innerduct shall be colored as follows or as directed by the Engineer.

Usage Designation	Color
Fiber Optic Trunk Cable (Ducts containing cables of 96 fibers)	Orange
Fiber Optic Distribution Cable (Ducts containing cables of 12, 6, or 4 fibers and 96 fiber ducts designated as distribution fibers)	Blue

## CONSTRUCTION REQUIREMENTS

**Installation.** Installation of Fiber Optic Innerduct shall be in accordance with Article 810.04 of the Standard Specifications and as specified herein.

### Pulling Tension

Pulling tension of the duct shall be monitored throughout the pull and pulling tension shall not exceed those listed in the above table or the specific manufacturer maximum pulling tensions as indicated in the catalog cut submittals. Failure to monitor the pulling tension will result in non-payment of that particular duct span and the span may be reinstalled with new duct at no additional cost to the State. Lubricants used shall be compatible with the duct.

### Junction Boxes

Where duct passes through junction and/or pull boxes, the duct shall be cut cleanly and rough edges removed to prevent damage to cable being coiled and stored in the box.

### Handholes/Communications Vaults

Where duct passes through handholes or vaults, the duct shall be cut cleanly and rough edges removed to prevent damage to cable being coiled and stored in the handhole or vault.

### Bends

Minimum bending radius shall be in accordance with the above table or the manufacturer's recommended radius, whichever is larger. Bends shall be made so that the duct will not be damaged and the internal diameter of the duct will not be effectively reduced. The degrees of bend in one duct run shall not exceed 360° between termination points.

### In Trench

The trench shall be closed and the site restored to match the surrounding conditions after all loose stones have been removed and all protruding stones have been removed or covered with backfill material as directed by the Engineer.

Where duct is shown to be installed in trench, it shall be installed at a depth not less than 30 inches unless otherwise indicated on the Plans or specifically directed by the Engineer.

Plowing is allowed in lieu of trench and backfill. Unless otherwise indicated or specifically approved by the Engineer, plowing of innerduct shall lay the duct in place and shall not pull the duct through the length of the cut behind a bullet-nose mandrel or similar apparatus. In all cases, plowing operations shall be non-injurious to the duct. The disturbed surface shall be restored to match the surrounding conditions after completion of conduit installation.



In Raceway

Where innerduct is installed in raceways, lubricating compounds shall be used where necessary to assure smooth installation.

Post Installation Testing

Innerduct shall be proofed after installation to ensure that the duct is air-tight and can be pressurized to allow future installation of cable via jetting. The Contractor shall conduct the test in the presence of the Engineer and provide a test report upon completion.

Joints.

All HDPE duct to HDPE duct joints shall be made with an approved duct fusion splicing device.

HDPE coilable non-metallic conduit to non-HDPE coilable non-metallic conduit joints shall be either made with an approved mechanical connector or with a chemical compound. Both methods must be specifically designed for joining HDPE coilable non-metallic conduit. Minimum pullout force for the chemical compound shall be as listed in the following table.

Nominal Size		Pullout Force	
mm	in	N	Lbs.
31.75	1.25	2400	540
38.1	1.50	2535	570
50.8	2.0	3335	750
63.5	2.5	4445	1000
76.2	3.0	6225	1400
101.6	4.0	8890	2000

**Method of Measurement.** This work will be measured for payment in feet in place. Measurements will be made in straight lines along the centerline of the conduit between ends and changes in direction.

Vertical measurement of the duct shall be as follows:

For runs terminating at junction boxes and/or control cabinets, the vertical measurement will be made from the bottom of the trench, or horizontal raceway, to a point 18 inches beyond the center of the junction box or control cabinet.

For runs terminating at poles, the vertical measurement will be taken from the bottom of the trench, or horizontal raceway, to a point 18 inches beyond the center of the pole handhole.

**Basis of Payment.** This item will be paid for at the contract unit price per foot for FIBER OPTIC INNERDUCT 1 1/4" DIA.

## CLOSED CIRCUIT TELEVISION CAMERA EQUIPMENT

**Description.** This work shall consist of furnishing and installing equipment for the control and distribution of CCTV video from the CCTV camera to a Video Collection Point (VCP). This work includes all CAT-6 cable required to interface to the CCTV camera and this equipment. Transmission for the video and control signals shall be by fiber optic cable as specified elsewhere herein and as indicated in the Plans.

### Materials.

#### General

The CCTV equipment shall be mounted in a cabinet provided and paid for separately. The installation and mounting of the CCTV equipment shall be fully coordinated with the cabinet. The equipment shall be securely mounted on a mounting back panel or on a corrosion resistant DIN rail if equipment is configured as such.

The CCTV equipment may be co-located within another equipment controller cabinet as indicated.

#### Closed Circuit Television Camera Power Supply

The Closed Circuit Television Camera Power Supply shall supply power to the camera dome assembly. The requirements include:

Input voltage	120 VAC $\pm$ 10%
Output voltage	24 VAC $\pm$ 10% or PoE
Operating Temperature Range:	-40°C to +70°C (minimum)
Storage Temperature Range:	-40°C to +75°C (minimum)

The power supply shall include an AC power indicator with power on/off switch. All outputs shall be fused. The power supply shall be sized for the dome units being supplied, considering pan/tilt, heating, and blower requirements, and shall not be less than 100 VA.

#### Over-voltage Protection

Over-voltage protection shall be provided on the power conductors, camera control conductors, and the video cables. The specific protection is based on the elements being protected.

### Incoming Power Protection

The incoming power shall be protected with a filtering surge protector that absorbs power line noise and switching transients. The specified performance shall be as follows:

Peak current	20 kA (8x20 $\mu$ s waveshape)
Life Test	5% change
Clamp voltage	280 V typical @ 20 kA
Response time	$\leq$ 5 ns
Continuous service current	10 amps max. 120 VAC/60 Hz
Operating Temperature	-40°C to +75°C (minimum)
Nominal dimensions	7.15 inches by 3.13 inches by 2.3 inches

### Camera Cable Surge Protection

The CAT5/5e/6 cable from the camera shall be protected with a lightning surge protector. The unit shall be fully compatible with the camera cabling and PoE and shall have shielded RJ45 jacks for EMI noise suppression. The unit shall provide high performance 3-stage protection:

1. Differential gas discharge tube
2. PTC resettable fuse
3. Low capacitance diode array

Specific requirements include:

Ethernet Connectors	(2) Shielded RJ45 Ports
Gas Tube Voltage	+/- 90 V
PTC Fuse Rating	+/- 1 A
Clamping Voltage	+/- 58 V
Operating Temperature	-40°C to +80°C
Nominal dimensions	6.3 x 3.2 x 2.2 (inches)

The protector shall protect a minimum of four conductors. [Transmit Data (2 wires) and Receiver Data (2 wires)]

### Ethernet Switch

The Ethernet switch shall meet the requirements specified for the LAYER III (NETWORK) SWITCH and shall be paid for separately.

### Cabinet

The CCTV cabinet shall meet the requirements specified for the CLOSED CIRCUIT TELEVISION CABINET (POLE) and shall be paid for separately under that pay item.

## **CONSTRUCTION REQUIREMENTS**

**General.** The Contractor shall prepare and submit a shop drawing detailing the complete closed-circuit television equipment installation. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer. Particular emphasis shall be given to the cabling and the interconnection of all of the components.

Appropriate connectors shall be furnished and installed to interface the in-cabinet components to the integrated dome camera assembly. The Contractor shall mount the in-cabinet components in the equipment cabinet and connect them to AC power, communications, and video feeds.

### Testing

The Contractor shall test each installed CCTV Camera Equipment. The test shall be conducted from the field cabinet using the standard communication protocol and a laptop computer. The Contractor shall verify that the camera can be fully exercised and moved through the entire limits of Pan, Tilt, Zoom, Focus and Iris adjustments, using both the manual control and presets.

The Contractor shall maintain a log of all testing and the corresponding results. A representative of the Contractor and a representative of the Engineer shall sign the log as witnessing the results. Records of all tests shall be submitted to the Engineer prior to accepting the installation.

### Documentation

One copy of all operations and maintenance manuals for each CCTV component shall be delivered for each assembly installed. In addition, full documentation for all software and associated protocols shall be supplied to the Department on a CD-ROM. The Department reserves the right to provide this documentation to other parties who may be Contracted with an order to provide overall integration or maintenance of this item.

### Warranty

The Contractor shall warranty all materials and workmanship including labor for a period of two years after the completion and acceptance of the installation, unless other warranty requirements prevail. The warranty period shall begin when the Contractor completes all construction obligations related to this item and when the components for this item have been accepted, which shall be documented as the final completion date in the construction status report. This warranty shall include repair and/or replacement of all failed components via a factory authorized depot repair service. All items sent to the depot for repair shall be returned within two weeks of the date of receipt at the facility. The depot location shall be in the United States. Repairs shall not require more than two weeks from date of receipt and the provider of the warranty shall be responsible for all return shipping costs.

The depot maintainer designated for each component shall be authorized by the original manufacturer to supply this service. A warranty certificate shall be supplied for each component from the designated depot repair site indicating the start and end dates of the warranty. The certificate shall be supplied at the conclusion of the system acceptance test and shall be for a minimum of two years after that point. The certificate shall name the Department as the recipient of the service. The Department shall have the right to transfer this service to other private parties who may be contracted to perform overall maintenance of the facility.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION CAMERA EQUIPMENT.

### **CCTV CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT**

**Description.** This work shall consist of furnishing and installing a conventional type round tapered aluminum pole complete with CCTV camera mount and all required hardware including bolt covers as specified herein.

**Materials.** Materials shall be according to the following.

#### Pole Shaft

Unless otherwise indicated the pole shaft shall be made of aluminum conforming to current ASTM designation B 221, alloy 6063 with final temper T6. The shaft shall be spun drawn to smooth circular, tubular, seamless, tapered design.

Unless otherwise indicated, the pole shall be designed and manufactured to withstand equipment dead loadings of up to and including a 75 pound camera having an effective projected area of 1.6 ft<sup>2</sup> on a single 4 foot arm, and shall also to withstand loadings of up to and including the same camera on each of two 4 foot arms oriented at any angle from 45 to 180 degrees apart, meeting the criteria of 2015 AASHTO LRFD for 120 mph wind zone. These loading requirements shall include all camera and arm orientations possible for the given pole height, up to and including the limits given. Information submitted for approval shall document satisfaction of this requirement.

The indicated mounting height shall be taken from the bottom of the pole shaft base plate and shall be obtained with a nominal arm rise of 12 inches as specified elsewhere herein. This shall determine the required length of the pole shaft regardless of the actual mounting method of the pole.

Unless otherwise indicated, poles shall have a 10 inch outside bottom diameter tapering to 6 inch outside top diameter. The shaft shall be designed to accommodate loading of the arm configuration indicated, with a minimum wall thickness of 0.312 inch. Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements.

### Handhole

There shall be an oval shaped opening in the side of the shaft for the purpose of a handhole. Unless otherwise indicated, the centerline of the handhole shall be 18 inch from the bottom of the shaft. The handhole shall be 4 inch x 8 inch in size with the 8 inch dimension being situated vertically and in the same plane as any one of the sides of the base. The opening in the shaft shall be reinforced with a handhole frame situated on the inside of the shaft and welded to the shaft. A 1/2"-13 tapped hole shall be provided in the frame for attaching a mechanical grounding connector. The handhole cover shall be fastened to the frame with 1/4"-20 size steel core nylon hex-head screws and the holes for the screws shall be tapped to match the screws. Unless otherwise indicated, the orientation of the handhole shall be such that its pole face shall be opposite to the pole face exposed to oncoming traffic and unless otherwise indicated, the handhole shall be oriented on a face 90 degrees from arm orientation.

All exposed surfaces of the shaft shall be of a smooth, even texture, free from marks and imperfections. The pole shall have a satin ground finish, 100 grit or finer.

### Top Plate

The top of the pole shaft shall be enclosed with a removable top plate. The top plate shall be secured in place with 300 series galvanized steel screws. The design of the top plate shall be such that it shall not permit entry of water into the shaft.

Grommets at the top portion of the shaft two 1½ inch diameter openings shall be made and two 1¼ inch inside diameter rubber grommets shall be provided, for wiring purposes through the arm(s). The grommet openings shall be at 90 degree angles from the position of the handhole, i.e., there shall be two (2) grommet openings for each shaft, 180 degrees apart from each other and at 90 degrees apart from the handhole, unless otherwise indicated.

### Base Plate

The bottom portion of the shaft shall be fitted with a base. The base shall be a permanent mold casting of aluminum alloy conforming to current Aluminum Association designations 356.0 or 4356.0, with final temper T6. The base shall be welded to the shaft by the inert gas shielded arc method. All welds shall be free from cracks and pores. All shafts with base plates shall be heat treated after welding. The base shall be equipped with anchor bolt covers. Four anchor bolt slots shall be provided in the base to accommodate the required bolt circle diameter. Unless otherwise indicated, poles shall have 15 inch bolt circles. The size of the slots shall be 1¼ inch by 2 inches as detailed on the pole drawing.

### Anchor Bolt Covers

The anchor bolt covers shall be made from aluminum, conforming to current ASTM B 108, S5A F or, B 26, SG70A. The anchor bolt covers shall be fastened to the base with ¼ inch - 20 threaded steel reinforced plastic fasteners. The fasteners shall be threaded with ¼ inch - 20 threaded holes for bolt covers.

### Vibration Damper

The pole shall be coordinated with all cameras being provided on this project to be free of susceptibility to harmful harmonics and vibrations. The pole shall incorporate an internal vibration damper. The material submitted for approval shall address this requirement.

### Bundling

The shafts shall be shipped in bundles without any wrapping on the individual shafts or the entire bundle. Appropriate bundling materials shall be used to make a rigid, long lasting bundle capable of being handled, shipped and stored without shifting or breaking of contents.

### Arm

The arm (bracket) shall be manufactured by the CCTV camera manufacturer and be fully coordinated with the CCTV camera pay item. All openings extending to the camera the bracket shall be free of burrs and rough edges that may be injurious to the wires.

### Vibration Requirements

The detailed design and fabrication of the shaft and of the arms shall be such as to withstand 120 mph AASHTO criteria for wind and vibrations, caused by the wind pressure. There shall be no excessive vibrations in the shaft, arm(s) under moderate wind pressure, where damage may result to the camera(s) and/or its component parts, and/or arms(s). A dampening device, as an integral part of the shaft, shall be installed in the shaft to alleviate such excessive vibrations. The proposed vibration dampening device shall be submitted for Engineer's approval.

No information contained herein shall be construed to relieve the Contractor of the above requirements.

### Certification and Guarantee

The submittal information shall include a written certification of compliance with the contract requirements from the Manufacturer. The certification shall specifically identify the project route, location, section number, and contract number, as applicable and shall identify specifically the equipment covered by the certification. The certification shall be made on the Manufacturer's corporate stationary and it shall be dated and signed by a responsible officer of the company, with the signee's title listed.

In addition, submittal information shall include the guarantee as specified under General Electrical Provisions.

## CONSTRUCTION REQUIREMENTS

**Installation.** The structure shall be set plumb on the foundation without the use of shims, grout or any other leveling devices under the pole base. The arm or bracket shall be set at right angles to the centerline of the pavement, unless otherwise indicated. This item shall be coordinated with the applicable camera (with pole wire and fusing) and foundation with anchor bolts, which shall be provided under separate pay items, as applicable.

Poles shall not be installed until cameras are available for installation at the same time the poles are installed. Poles shall not be installed and left standing without a coordinated installation of arm and camera.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT.

### CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER

**Description.** This work shall consist of constructing a reinforced concrete foundation, of the dimensions indicated, complete with raceways. The foundation depth shall be as shown on the Plans or as directed by the Engineer.

The foundation shall include boring/excavation, reinforcement, concrete, grout, anchor bolts, nuts, washers and raceways as well as clean up and restoration of the location.

**Materials.** Reinforcement bars shall comply with Article 706.10 of the Standard Specifications. Unless otherwise indicated, anchor bolts shall comply with the requirements of ASTM Designation A 687. Unless otherwise indicated, nuts shall be hexagon nuts in conformance with ASTM A 194 grade 2H or ASTM A563 grade DH, and washers shall be in conformance with ASTM F436. The entire length of the anchor bolts as well as the nuts and washers shall be hot dip galvanized in accordance with the requirements of ASTM Designation A 153.

Unless otherwise indicated, conduit raceways shall be heavy wall rigid polyvinylchloride (PVC) conduit, (Schedule 40) UL listed and in conformance with NEMA TC2 and Federal Specification WC 1094A. Raceways shall be of the number and size as indicated.



## CONSTRUCTION REQUIREMENTS

**General.** The foundation depths shall be as directed by the Engineer based upon evaluation of the soil conditions encountered. The Engineer may determine soil condition by visual inspection or, where practical, by the use of a pocket penetrometer and will establish foundation depth based upon the Foundation Depth Table shown on the Plans, where applicable.

**Installation.** The hole for the foundation shall be made by drilling with an auger, of the same diameter as the foundation. The foundation shall be cast in place and allowed to cure for 10 days minimum before the light pole is erected. If soil conditions require the use of a liner to form the hole, the liner shall be withdrawn as the concrete is deposited. The top of the foundation shall be constructed level so that no shims or other leveling device will be needed to set the light standard plumb on the foundation. A liner or form shall be used to produce a uniform smooth side to the top of the foundation. Foundation top shall be chamfered  $\frac{3}{4}$  inch unless otherwise indicated.

Extreme care shall be used in establishing the top elevation of concrete foundations, especially when foundations are installed before final grading is complete. Foundations shall not protrude above grade more than the limits indicated on the Plans, except for specifically indicated locations, and where not otherwise indicated, foundation shall not protrude above grade more than 4 inches above a 60 inch chord centered at the foundation, at any point around the circumference. Where foundation heights extend beyond specified limits, the Engineer may direct replacement of the foundation and the incorrect foundation will not be measured for payment.

The steel reinforcement, the raceway conduits and the anchor bolts shall be secured in place to each other and properly positioned in the augured hole so that at time of pouring of concrete mixture in place the above said components retain their proper positions. Special attention shall be paid to the positioning of the anchor bolts. It is of utmost importance that the anchor bolt projections on top of the foundation, after placement of the concrete, remain in a perfectly vertical position.

The Contractor shall restore areas that have been disturbed or temporarily graded to their original condition. The cost of seeding the restored areas is included in this pay item.

**Method of Measurement.** This work will be measured for payment in feet in place. The length measured will be limited to that shown on the Plans or authorized by the Engineer.

**Basis of Payment.** This work will be paid for at the contract unit price per foot for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER.

## **MASONRY FACE BRICK REPAIR**

**Description.** This work shall consist of removal and replacement of defective face brick units and toothing back into existing face brick units.

**Materials.** Materials shall be according to the following.

- (a) Face brick units shall be ASTM C216, Grade SW, with an average compressive strength of 3,000 psi. Brick units shall have a standard size of 3 5/8 inches thick by 2 1/4 inches high by 8 inches long. Color/texture shall be selected to match the existing units.
- (b) Mortar shall be pre-mixed, pre-colored, pre-packaged, cement-lime based mixture formulated to comply with the requirements of ASTM C270 Type N mortar specifications.
- (c) Corrugated metal ties shall be metal strips not less than 7/8 inches wide, with corrugations having a wavelength of 0.3 to 0.5 inches and an amplitude of 0.06 to 0.10 inches.

## **CONSTRUCTION REQUIREMENTS**

**General.** When ambient air temperature is below 40 degrees F, heat mixing water to maintain mortar temperature between 40 and 120 degrees F until placed. Store materials in a heated area to allow mortar temperatures to remain above 40 degrees F throughout the placement and finishing cycle.

Under hot, dry, and windy conditions, use proper pre-dampening, protection, and moist curing procedures as required to keep mortar moist for 72 hours following final tooling.

**Submittals.** Submit manufacturer's technical data for brick and mortar, including certifications substantiating that products comply with requirements. Submit face brick sample to match existing face brick to the extent possible.

**Method of Measurement.** Masonry Face Brick Repair will be measured in place and the area computed in square feet.

**Basis of Payment.** This work will be paid for at the contract unit price per square foot for MASONRY FACE BRICK REPAIR.

## **MASONRY SEALER**

**Description.** This work shall consist of application of an epoxy sealant over masonry face brick surfaces upon completion of any brick repairs.

**Materials.** The sealer shall be a non-yellowing epoxy-based sealant suitable for use on concrete and masonry.

## **CONSTRUCTION REQUIREMENTS**

**General.** Maintain ambient temperature above 20 degrees F during and twenty-four (24) hours after installation. Do not proceed with application if ice or frost is covering the substrate. Do not proceed if ambient temperature of surface exceeds 100 degrees F. Do not proceed with application in rainy conditions or if heavy rain is anticipated within four (4) hours after application.

Masonry brick surfaces must be cleaned to remove all dirt, dust, efflorescence, mold, salt, grease, oil, paint, and other foreign materials. Acceptable surface cleaning methods include water blasting and using chemical cleaners.

**Installation.** Apply using a pump sprayer with adjustable tip at a spread rate recommended by the manufacturer.

As work progresses, clean spillage using materials and methods recommended by the manufacturer. Remove protective coverings from adjacent surfaces when no longer needed.

**Submittals.** Submit manufacturer's specifications and technical data, including manufacturer's installation instructions and certified test reports indicating compliance with performance requirements specified herein.

**Method of Measurement.** Masonry sealer will be measured for payment in place and the area computed in square feet.

**Basis of Payment.** This work will be paid for at the contract unit price per square foot for MASONRY SEALER.

## **CCTV INTEGRATION**

Effective: March 1, 2022

**Description.** This item provides for the integration of the proposed and existing CCTV video into the REVLAC PLC central control system and changes to the user interface as required. The video shall also be integrated into the existing 360 Cameleon video system.

Contractor shall hire the Department designated and approved subcontractor for this work as needed. The designated subcontractor was responsible for the designing, developing, and testing of the original PLC logic and had significant involvement in the REVLAC system integration. The designated subcontractor has continued to provide PLC logic support since completion of the REVLAC implementation. This item is to establish an account from which funds will be distributed for the payment of the video integration.

Included in this item shall be a Video archiving system. The video archiving system shall be integrated into the REVLAC system as to record all REVLAC operational transitions.

A budgetary allowance of **\$50,000** has been established because the final cost is unknown.

This allowance will not be used to repair damage caused by the Contractor's operations. Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract.

**Method of Measurement.** The invoices submitted by the designated and approved subcontractor for completion of, or a portion of the subcontractor's work shall be measured at a budgeted lump sum cost as described herein.

**Basis of Payment.** This work will be paid for at the contract lump sum price for BUDGETARY ALLOWANCE, CCTV INTEGRATION which shall be reimbursement in full.

## **CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, FOUNDATION, 80 FT. MOUNTING HEIGHT**

**Description.** This work shall consist of the constructing a steel reinforced concrete foundation, of the dimensions indicated in the Plans, complete with raceways. The foundation depth shall be as indicated in the Foundation Depth Table shown on the Plans.

The foundation shall include excavation, reinforcement, concrete, anchor bolts, nuts, washers and raceways as well as clean up and restoration of the location.

**Materials.** Concrete shall be Class SI complying with Article 720 of the Standard Specifications and shall incorporate a Calcium Nitrite Corrosion Inhibitor as specified in Check Sheet #21 of the Supplemental Specifications and Recurring Special Provisions, Adopted February 1, 1995.

Reinforcement bars shall comply with Article 706.10 of the Standard Specifications.

Unless otherwise indicated, anchor bolts shall comply with the requirements of ASTM Designation A 687. Unless otherwise indicated, nuts shall be hexagon nuts in conformance with ASTM A 194 2H or ASTM a 563 DH, and washers shall be in conformance with ASTM F436.

The entire length of the anchor bolts as well as the nuts and washers shall be hot dip galvanized in accordance with the requirements of ASTM Designation A 153.

Unless otherwise indicated, conduit raceways shall be heavy wall rigid polyvinylchloride (PVC) conduit, (Schedule 40) UL listed and in conformance with NEMA TC2 and Federal Specification WC 1094A. Raceways shall be of the number and size as indicated.

### **CONSTRUCTION REQUIREMENTS**

**General.** The foundation depths shall be as shown on the Plans. The hole for the foundation shall be made by drilling with an auger, of the same diameter as the foundation.

**Installation.** The foundation shall be cast in place and allowed to cure for 10 days minimum before the light pole is erected. If soil conditions require the use of a liner to form the hole, the liner shall be withdrawn as the concrete is deposited. The top of the foundation shall be constructed level so that no shims or other leveling device will be needed to set the light standard plumb on the foundation. A liner or form shall be used to produce a uniform smooth side to the top of the foundation. Foundation top shall be chamfered 25 mm (1 inch) unless otherwise indicated.

Extreme care shall be used in establishing the top elevation of concrete foundations, especially when foundations are installed before final grading is complete. Foundations shall not protrude above grade more than the limits indicated on the Plans, except for specifically indicated locations, and where not otherwise indicated, foundation shall not protrude above grade more than 101.6 mm (4 inches) above a 1524.0 mm (60-inch) chord centered at the foundation, at any point around the circumference. Where foundation heights extend beyond specified limits, the Engineer may direct replacement of the foundation and the incorrect foundation will not be measured for payment.

The steel reinforcement, the raceway conduits and the anchor bolts shall be secured in place to each other and properly positioned in the augered hole so that at time of pouring of concrete mixture in place the above said components retain their proper positions. Special attention shall be paid to the positioning of the anchor bolts. It is of utmost importance that the anchor bolt projections on top of the foundation, after placement of the concrete, remain in a perfectly vertical position.

The Contractor shall restore areas that have been disturbed or temporarily graded to their original condition. The cost of seeding the restored areas is included in this pay item.

**Method of Measurement.** This work will be measured for payment in feet in place. The length measured will be limited to that shown on the Plans or authorized by the Engineer.

**Basis of Payment.** This work will be paid for at the contract unit price per foot for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, FOUNDATION, 80 FT. MOUNTING HEIGHT.

## **CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT ENGINEERING SERVICES**

**Description.** This work shall consist of coordination with the City of Chicago Department of Water Management (DWM) to provide a resident engineer to be present on-site during the excavation and installation of the proposed conduits where they cross City of Chicago water mains.

The Contractor shall contact the Force Account Construction Manager at [FACM@ctrwater.net](mailto:FACM@ctrwater.net) two (2) weeks prior to the anticipated construction date so a resident engineer can be assigned to the project. The DWM resident engineer will adhere to the schedule provided by the Contractor, unless notified otherwise.

The Contractor shall issue a certified check in the amount, identified within this specification, payable to the City of Chicago. The check must be hand delivered to the Department of Buildings, Plumbing Permit and Plan Section, 121 North LaSalle Street, Room 906, Chicago, Illinois, 60602 with a copy of the letter from DWM dated April 4, 2019.

**Construction.** It shall be the Contractor's responsibility to contact the DWM and shall coordinate his work fully with the DWM both as to the work required and the timing of the installation. No additional compensation will be granted under this or any other item for extra work caused by failure to meet this requirement.

The contractor shall comply with the following requirements when working near or adjacent to DWM watermains within the project limits.

- Minimum vertical clearance edge-to-edge from all water mains is 18"
- For feeder mains (water mains 16 inches and larger, the minimum horizontal clearance edge-to-edge is 3 feet.
- No proposed above ground facility.
- No proposed above ground facility (tree, cabinet, hand hole, light pole, etc.) can be closer than 5 feet edge-to-edge from a water main or closer than 3 feet edge-to-edge from a water service.
- The DWM prohibits directional boring across water mains within the project limits. Hand excavation is required to field verify the horizontal and vertical location of the existing water mains prior to crossing.
- Foundations for handholes, camera poles and ground mounted cabinets must maintain 5 feet of horizontal separation edge-to-edge and 18 inches vertical separation from existing water mains. The proposed foundations shall avoid conflicts with any existing jacking pits for encased water main.
- Trenches shall not exceed 3 feet in width when crossing below existing watermains. If trench wider than 3 feet is required, the contractor shall design support details and submit to DWM for approval prior to construction.
- A resident engineer is required.

**Method Of Payment.** The Contractor will be reimbursed to the exact amount of money as billed by DWM for its services. Work provided by the Contractor for installation of conduit/unit duct or other equipment described in these special provisions will be paid separately as described under the associated special provision. No extra compensation shall be paid to the Contractor for any incidental materials and labor required to fulfill the requirements as shown on the plans and specified herein.

For bidding purposes, this item shall be estimated as **\$37,500.00.**

**Basis Of Payment.** This work will be paid for at the contract lump sum price for CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT ENGINEERING SERVICES which shall be reimbursement in full for electric utility service charges.

## **CCTV CAMERA STRUCTURE, GALVANIZED STEEL, OF THE HEIGHT SPECIFIED**

**Description.** This work shall consist of furnishing and installing a CCTV camera structure complete with camera lowering device. The structure shall be a galvanized steel structure. The lowering device shall be configured to support a high definition camera with the appropriate power and Ethernet cable connections.

### Definitions.

- CCTV Camera Structure: The complete camera structure and lowering device as one integral working system.
- Pole: The camera structure shaft.
- Lowering Device: The components involved with the mounting, operation, and raising and lowering of the CCTV camera.
- Structure Height: The height of the structure shall be measured as indicated on the Plans.
- Internal Conduit: 1" PVC conduit attached to inside of pole. Internal conduit extends 20' from bottom of pole to pre-drilled hole. Internal conduit only required where mid-camera is required.

**Materials.** Materials shall be according to the following.

### Pole

The pole shall be designed in accordance with 2015 AASHTO LRFD Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals with wind pressure for a 120 mph wind zone. The pole shall be designed for use with a single arm camera lowering device with a total effective area of 2 square feet and total weight of 95 lbs. The structure shall not exceed 1" deflection in a 30 mph (non-gust) wind.

The pole shall be designed and constructed so no structural member or other component is applied in excess of the manufacturer's recommended rating (when applicable) or the published rating, whichever is lower.

The 50 ft. mounting height pole shaft shall be made of one section for field assembly. The 80 ft. mounting height pole shaft shall be made of a maximum of two sections for field assembly. The pole shafts shall be a round cross section and meet the requirements of ASTM A572 or A1011 with a minimum yield strength of 50,000 psi. The pole base plate shall meet the requirements of ASTM A572 or A1011. Anchor bolts shall conform to ASTM F1554 gr. 55. The pole shafts shall also meet or extend the following minimum requirements based on mounting height:



	<b>50 ft. Mounting Height Shaft</b>	<b>80 ft. Mounting Height Shaft</b>
Pole Dia. at Base	14.75"	24"
Min. Bottom Section Wall Thickness	0.3125" (10/32")	0.3125" (10/32")
Min. Top Section Wall Thickness	N/A	0.21875" (7/32")
Overall Pole Height	50'	80'
Base Plate Thickness	1.25"	2"
Bolt Circle Dia.	18.5"	30.0"
Bolt Holes	(4) 1.5" dia.	(8) 1.75" dia.
Anchor Bolts	(4) 1" dia. x 60"	(8) 1 1/2" dia. x 90"

The pole assembly shall be equipped with a 6" x 27" reinforced hand hole opening with a 3 gauge cover and shall be attached with four (4) 1/4"-20 hex head stainless steel screws. The bottom of the hand hole shall be located up 14" from the bottom of the shaft. The hand hole frame shall meet ASTM A529 grade 50 and shall be made from 3/4" x 3 1/2" bar. There shall be a 3/8" diameter rod for wire tie off located at the top of the opening and 1 3/4" from the front of the hand hole frame and also a 1/2" tapped hole located 1 3/4" from the front of the frame at the bottom of the opening as shown on the drawing.

Six (6) 1" i.d. eye rings for power and communication cables are required as shown on the drawing. Two (2) shall be located 38" up from the bottom, two (2) located 6" below the top of the bottom shaft and two (2) 6" below the top of the center shaft.

There shall be a 3 1/2" schedule 40 (4" od) pipe tenon 11 3/4" tall on a 3/8" thick plate welded to the top of the pole. The pipe tenon shall include a 1 3/4" x 5 1/4" slot and two (2) 5/8" holes as shown on the drawing to accommodate the Camera Lowering System arm assembly. A J-hook shall be included inside the top of the tenon assembly and shall include a removable cast aluminum pole top.

Where mid-camera is shown on plans a factory installed 1/2" " grommet hole shall be installed. Grommet hole shall align with one of the bolt holes.

### Lowering Device

The camera lowering system shall be designed to support and lower a high-definition (HD) closed-circuit television (CCTV) camera, lens, housing, PTZ mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations. The camera lowering system device and the pole are interdependent; and thus, must be considered a single unit or system. The lowering system shall consist of a pole, conduit mount adapter, pole adapter for attachment to a pole top tenon, pole top junction box, divided support arm, suspension contact unit, camera junction box, and portable lowering tool. The divided support arm and receiver brackets shall be designed to self-align the contact unit with the pole center line during installation and insure the contact unit cannot twist under high wind conditions. For maximum arm strength, round support arms are not acceptable.

The camera-lowering device shall withstand wind forces of 120mph with a 14 percent gust factor using a 1.65 safety factor. The lowering device manufacturer, upon request, shall furnish independent laboratory testing documents certifying adherence to the stated wind force criteria utilizing, as a minimum effective projected area, the actual EPA or an EPA greater than that of the camera system to be attached. The camera-lowering device to be furnished shall be the product of manufacturers with a minimum of 3 years of experience in the successful manufacturing of camera lowering systems. The lowering device provider shall be able to identify a minimum of 3 previous projects where the purposed system has been installed successfully for over a one-year period of time each.

All pulleys for the camera lowering device and portable lowering tool shall have sealed, self-lubricated bearings, oil tight bronze bearings, or sintered oil-impregnated, bronze bushings. The lowering cable shall be a minimum 1/8-inch diameter stainless steel aircraft cable with a minimum breaking strength of 1740 pounds with (7) strands of 19 wire each.

The electrical connections between the fixed and movable lowering device components shall be designed to conduct high frequency data bits and one (1) volt peak-to-peak video signals as well as the power requirements for operation of dome environmental controls.

The interface and locking components shall be made of stainless steel and or aluminum. All external components of the lowering device shall be made of corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment.

The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or video cabling. The lowering device manufacturer shall provide a conduit mount adapter for housing the lowering cable. This adapter shall have an interface to allow the connection of a Contractor-provided 1.25 inch conduit and be located just below the cable stop block at the pole end of the divided support arm. The Contractor shall supply internal conduit in the pole as directed by the Lowering Device provider. The only cable permitted to move within the pole or lowering device during lowering or raising shall be the stainless steel lowering cable. All other cables must remain stable and secure during lowering and raising operations.

The CCTV Camera Manufacturer shall provide weights and /or counterweights as necessary to assure that the alignment of pins and connectors are proper for the camera support to be raised into position without binding. The lowering unit will have sufficient weight to disengage the camera and its control components in order that it can be lowered properly.

Suspension Contact Unit. The suspension contact unit shall have a load capacity of 600 lbs. with a 4 to 1 safety factor. There shall be a locking mechanism between the fixed and moveable components of the lowering device. The movable assembly shall have a minimum of 2 latches. This latching mechanism shall securely hold the device and its mounted equipment. The latching mechanism shall operate by alternately raising and lowering the assembly using the winch and lowering cable. When latched, all weight shall be removed from the lowering cable. The fixed unit shall have a heavy duty cast tracking guide and means to allow latching in the same position each time. All electrical and video coaxial connections between the fixed and lowerable portion of the suspension contact unit shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The contact unit housing shall be weatherproof with a gasket provided to seal the interior from dust and moisture.

The female and male socket contact halves of the contact unit shall be made of Hypalon. The female brass socket contacts and the male high conductivity brass pin contacts shall be permanently molded into the polymer body.

The current carrying male contacts shall be 1/8 inches in diameter. There shall be two male contacts that are longer than the rest which will make first and break last providing optimum grounding performance. The contacts shall be fully coordinated with the HD CCTV camera defined in pay item "CLOSED CIRCUIT TELEVISION CAMERA."

The current carrying female contacts shall be 1/8 inches I.D. All of the contacts shall be recessed 0.125" from the face of the contact unit. Cored holes in the socket measuring 0.25" in diameter and 0.125" deep molded into the contact unit are centered on each contact on the face of the contact unit to create rain-tight seals when mated with the male contact half.

The wire leads from both the male and female contacts shall be permanently and integrally molded in the Hypalon body. The current carrying and signal wires molded to the contact unit body shall be constructed of #18/1 AWG Hypalon jacketed wire.

The contacts shall be self-wiping with a shoulder at the base of each male contact so that it will recess into the female block, thereby giving a rain-tight seal when mated. The facility manufacturing the electrical contact unit must comply with Mil Spec Q-9858 and Mil Spec I-45208.

Internal Conduit. Polyvinyl Chloride conduit schedule 40.

Camera Junction Box. The camera junction box shall be of two-piece clamshell design with one hinge side and one latch side to facilitate easy opening. The general shape of the box shall be cylindrical to minimize the EPA. The Camera Junction Box shall be cast aluminum with stabilizing weights on the outside of the box to increase room on the interior. The box shall be capable of having up to 40 pounds of stabilizing weights. The bottom of the Camera Junction Box shall be drilled and tapped with a 1-1/2" NPT thread to accept industry standard dome housings and be able to be modified to accept a wide variety of other camera mountings. The junction box shall be gasketed to prevent water intrusion. The bottom of the box shall incorporate a screened and vented hole to allow airflow and reduce internal condensation.

Portable Lowering Tool. The camera-lowering device shall be operated by use of a portable lowering tool. The tool shall consist of a lightweight metal frame and winch assembly with cable as described herein, a quick release cable connector, an adjustable safety clutch and a variable speed industrial duty electric drill motor. This tool shall be compatible with accessing the support cable through the handhole of the pole. The lowering tool shall attach to the pole with one single bolt. The tool will support itself and the load assuring lowering operations and provide a means to prevent freewheeling when loaded. The lowering tool shall be delivered to the Department upon project completion. The lowering tool shall have a reduction gear to reduce the manual effort required to operate the lifting handle to raise and lower a capacity load. The lowering tool shall be provided with an adapter for operating the lowering device by a portable drill using a clutch mechanism. The lowering tool shall be equipped with a positive breaking mechanism to secure the cable reel during raising and lowering operations and prevent freewheeling. The manufacturer shall provide a variable speed, heavy-duty reversible drill motor and a minimum of two complete lowering tools plus any additional tools required by plan notes. The lowering tool shall be made of durable and corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment.

Certification and Guarantee

Shop drawings, product data, and certifications shall be submitted. The submitted information shall be complete and shall include information relative to all specified requirements suitable for verification of compliance.

THE SUBMITTALS SHALL BE ARRANGED AND CROSS-REFERENCED TO THE SPECIAL PROVISIONS AND STANDARD SPECIFICATIONS. FAILURE TO CROSS-REFERENCE THE SUBMITTAL INFORMATION WITH THE SPECIAL PROVISIONS WILL RESULT IN THE SUBMITTAL BEING RETURNED WITHOUT REVIEW.

The submittal information shall be dated, current, project specific, identified as to the project, and shall also include the following calculations and certifications as applicable to the material utilized:

- Shaft design calculations, including Registered Engineer Certification.
- Certification of intent to provide domestic steel in accordance with Article 106.01 of the Standard Specifications.
- Welding details and procedures.
- Letter of intent to provide specified weld inspection reports.
- Confirmation of coordination between anchor rod supplier and the structure manufacturer for adequacy of anchor rod assembly.
- Manufacturer's recommended installation procedures.
- Letter of intent to provide manufacturer's representative during installation and to provide specified installation certification.

All certifications shall be notarized.

### **CONSTRUCTION REQUIREMENTS**

**General.** The pole shall be set plumb on the foundation without the use of shims, grout, or any other leveling devices under the pole base. The arm shall be set at right angles to the centerline of the pavement.

**Installation.** Poles shall not be installed until cameras are available for installation at the same time the poles are installed. Poles shall not be installed and left standing without a coordinated installation of arm and camera. Poles shall not be paid unless the coordinated assembly is complete.

Installation of the lowering device shall be included as a part of CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, GALVANIZED STEEL, of the height specified. This item shall not be paid for separately.

The lowering device manufacturer shall furnish a factory representative to assist the electrical Contractor with the assembly and testing of the first lowering system onto the pole assembly. The manufacturer shall furnish the applicable DOT engineer documentation certifying that the electrical Contractor has been instructed on the installation, operation and safety features of the lowering device. The Contractor shall be responsible for providing applicable maintenance personnel "on site" operational instructions and providing three (3) copies of operations and maintenance manuals to the DOT engineer.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price per each for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, GALVANIZED STEEL, of the height specified.

## ACCESS DOOR

**Description.** This work shall consist of removing and replacing an outdoor rated access door, frames and door hardware as shown on plans.

**Materials.** Doors shall be outdoor rated reinforced. Weather stripping shall be included to environmentally seal interior from external elements including water, insects and rodents. Door shall be accessed with and SNMP compatible door alarm switch and integrated into the IDOT network.

### Referenced Standards:

- Door and Hardware Institute/American National Standards Institute (DHI/ANSI): A115.1, Preparation of Mortise Locks in 1-3/8 IN and 1-3/4 IN Standard Steel Doors and Frames.
- National Association of Architectural Metal Manufacturers (NAAMM): Hollow Metal Manufacturers Association (HMMA).
- National Fire Protection Association (NFPA): 80, Standard for Fire Doors and Other Opening Protectives.
- Steel Door Institute (SDI): 117, Manufacturing Tolerances for Standard Steel Doors and Frames. All SDI Publications.
- Steel Door Institute/American National Standards Institute (SDI/ANSI): A250.7, Nomenclature for Standard Steel Doors and Steel Frames.
- Underwriters Laboratories, Inc. (UL): Building Materials Directory.

**Qualifications.** Manufacturer must be current member of SDI, and NAAMM (HMMA).

**Definitions:** As identified in SDI/ANSI A250.7.

**Submittals.** Submit manufacturer's specifications and technical data, including manufacturer's installation instructions and certified test reports indicating compliance with performance requirements specified herein.

**Storage.** Contractor shall deliver and store materials as defined under provisions of IDOT standard specifications, Section 106. Doors and frames must be stored under a protective covering. Doors shall be placed on

wood skids providing a minimum 4 IN air space above the ground. Doors shall not be laid flat. Set frames and doors on edge providing a minimum 1/2 IN air circulation space between each unit. Provide covering which will ensure air flow around each unit to prevent trapping moisture. If door wrapper becomes wet, remove immediately and provide dry protection equivalent to wrapper removed.

**Materials.** Door materials include

- Steel Sheet and Frames: Type 304 stainless steel.
- Hinge Edge Channel: Type 304 stainless steel.
- Lock Edge, Top and Bottom Channel: Type 304 stainless steel.
- Lock Reinforcement: Type 304 stainless steel plate.
- Inserts, Bolts, and Fasteners: Manufacturer's standard stainless steel units.
- Insulation: Urethane or polystyrene.
- Frame and Jam Anchors: 16 GA, stainless steel.
- Floor Anchors: Minimum 14 GA, stainless steel.

Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

- Next Door Company.
- Curries Company.
- Pioneer Industries.

Request for Substitution:

1. In general, exceptions to and deviations from the requirements of the Contract Documents will not be allowed. It is the Contractor's responsibility to note any deviations from Contract requirements at the time of submittal and to make any requests for deviations in writing. In general, substitutions must demonstrate that the proposed substitution is superior to the equipment or material required by the Contract Documents. No exceptions, deviations, or substitutions will be permitted without approval.
2. Data for items to be submitted for review as substitution shall be collected into one submittal for each item of material or equipment.
3. Request shall be submitted with other scheduled submittals for the material or equipment allowing time for Engineer to evaluate the additional information required to be submitted. If Contractor requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, the substitution submittal request shall be included in Submittal schedule and submitted as scheduled.

**Manufacturing.** Doors shall be fabricated in a rigid, neat appearance and free of defects. Door frame and door shall match existing conditions. Weld all joints continuously, dress exposed joints smooth and flush. Fabricate doors and frames to tolerance requirements of SDI-117. Fit doors to SDI and NFPA 80 clearances. Provide doors which are approved and labeled by FM/UL. Provide all exposed stainless steel surfaces with #4 finish.

Hollow Metal Doors: Doors at a minimum shall meet the following requirements.

- 1-3/4 IN thick.
- 16 GA minimum face sheets.
- Fabricate with flush top closures.
- Weld, fill and grind smooth all joints.
- Exterior: SDI Grade III, Model 4, seamless, insulated minimum R10.
- Fire rated: SDI Grade II, Model 4, seamless.

- Sound insulated. UL fire labeled.
- Maximum transmitted temperature: Fire doors shall have a maximum transmitted temperature end point of not more than 250 DEGF above ambient at the end of 30 minutes of standard fire test exposure. Pairs UL fire labeled without astragal.
- Interior (except fire rated): SDI Grade II, Model 4, seamless.

Hollow Metal Frames:

- Door frames: 26 GA stainless steel boxes welded to frame at back of all hardware cutouts.
- 8 GA stainless steel plate reinforcement welded to frame for hinge reinforcing.
- 12 GA stainless steel plate reinforcement welded to frame for strikes, closers and surface-mounted hardware.
- Split-type frames not acceptable.
- Conceal all fasteners.
- Frames shall be set up, all joints welded and ground smooth.
- Finish of welds to match balance of frame finish.
- Exterior (up to 4 FT wide): 16 GA.
- Exterior (over 4 FT wide): 14 GA.
- Fire rated: UL/FM labeled and comply with NFPA 80.
- Interior: 16 GA.
- Provide removable spreaders at bottom of frame.

Supports, Reinforcing and Anchors: Minimum 16 GA.

Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and DHI/ANSI A115.1. Locate finish hardware in accordance with SDI. Clean off mill scale and foreign materials, repair damaged surfaces.

After fabrication thoroughly clean.

**Installation.** Contractor shall install doors and frames in accordance with SDI and manufacturer's instructions. Place frames prior to construction of enclosing walls and ceilings. Plumb, align, and brace securely until permanently anchored. After completion of walls, remove temporary braces and spreaders. Install fire-rated frames in accordance with NFPA 80 and manufacturer's instructions. Use plastic plugs to keep silencer holes clear during construction. Immediately after erection, repair damaged areas. Install three (3) silencers on strike jamb of single door frame and two (2) on head of double door frame.

Number and location of anchors shall be in accordance with frame manufacturer's recommendation with minimum of three (3) anchors per jamb. For floor anchors, provide two (2) adjustable 3 IN wide flanged floor clips punched for anchoring. Protect frames during construction.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation including integration of the alarm into the IDOT network.

**Basis of Payment.** This work will be paid for at the contract unit price each for ACCESS DOOR.



## **JUNCTION BOX COVER REPLACEMENT**

**Description.** This work shall consist of the removal and replacement of the existing junction box cover for the existing CCTV, power and control boxes for locations as shown on the plans, and or as directed by the Engineer.

**Materials.** Material shall include the junction box cover and cover bolts. These items shall match the existing cover material.

## **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This work shall be measured for payment as each individual cover plate.

**Basis of Payment.** This work shall be paid for at the contract unit price for JUNCTION BOX COVER as each individual cover plate. Payment is full compensation for furnishing all labor, tools, and removal and replacement of the work item.

## **REMOVE AND REPLACE FIXED POSITION CCTV CAMERA FOR REVLAC**

**Description.** This work shall include the removal of an existing analog fixed camera system for gate monitoring and replacement with an IP native CCTV camera at locations shown in the Plans. General work shall consist of the following items:

- Removal of existing analog camera, mounting brackets, and related power/control enclosure.
- Removal of related video transceiver equipment at headend location in the REVLAC building associated with the gate system being monitored.
- Protection of existing fiber optic cables and power cables routed to each camera during removal process for re-use.
- Installation of a new IP camera, mounting hardware, and NEMA 4X enclosure to house communications equipment (media converters) and power supplies.
- Installation of a new media converter at video headend location in the REVLAC building associated with the gate system being monitored.
- Reconnection of and termination of existing fiber optic cable and power cables in new enclosure.
- Installation of new network cables from media converts to existing video switch in REVLAC building and integration of all required functions such as alarm monitoring and other features to make new IP camera systems interoperable with existing headend equipment.

**General Requirements.** The fixed position CCTV camera shall meet the following requirements:

- provide simultaneous analog and encoded HD video stream outputs.
- automatically switch from normal color operation under daytime illumination to increased sensitivity when available light is decreased (nighttime) by removal of the infrared cut filter that is used to achieve enhanced image color rendition. The filter can be switched manually via the alarm input through the camera menu.
- Masking out a specific area to prevent it from being viewed to comply with privacy laws and particular site requirements.
- Support increasing camera sensitivity by increasing the integration time on the CCD (e.g., lowering shutter time from 1/60s to 1/6s) accomplished by integrating the video signal from multiple consecutive video fields thereby reducing signal noise.
- automatically compensate for back-light caused by bright areas without having to define a window or area.
- camera mounting bracket and pole attachment hardware shall be coordinated with the proposed pole to account for any unique characteristics of each installation site.
- The manufacturer shall be ISO 14001 Certified. The manufacturer's quality system shall be in compliance with the I.S./ISO 9001/EN 29001, QUALITY SYSTEM.

## **Materials**

### Fixed CCTV Camera

The fixed position CCTV Camera shall be designed to perform over a wide range of environmental and lighting conditions and automatically switch from color daytime to monochrome nighttime operation. The CCTV camera shall be Bosch Dinion IP Starlight 7000HD or equal, approved by the Engineer. The equivalent camera shall comply with all the requirements stated herein and shall provide the same operation/functionality as the existing installed cameras.

The fixed position CCTV camera shall comply with the following environmental requirements:

<b>Environmental Condition</b>	<b>Requirement</b>
Operating Humidity	20% to 93%
Operating temperature	-20°C to 50°C
Storage Temperature	-40°C to 70°C

The fixed position CCTV Camera shall be designed to operate from a 24V power source or PoE. The appropriate power supply capable of accepting 120 VAC input shall be included as a part of this item.

The power requirements for the camera shall comply with the following:

<b>Electrical</b>	<b>Requirement</b>
Voltage	24 VAC Nominal or PoE
Total Load	7.2 W Max
Listing	UL Listed
FCC	Part 15, Class B

Surge Protection for power and communication cables shall comply with the latest UL and NEC requirements.

The fixed position CCTV Camera shall incorporate a solid state CDD imaging camera with the following requirements:

- The camera shall automatically switch from daylight color operation to a higher sensitivity nighttime monochrome mode when light levels fall below a user adjustable threshold level.
- The camera shall provide a selectable slow shutter (frame integration) function that increases the camera's sensitivity up to 50 times by reducing the shutter speed as well as fully automatic.
- Digital image stabilization shall be provided using electronic compensation that filters out vibrations caused by wind and other environmental conditions.
- The camera shall provide six distinct pre-programmed operational modes stored in the camera and a video motion detection function that provides four fully programmable areas.
- The camera shall accept CS-mount type and C-mount type lenses.
- The camera shall provide a lens wizard during lens back focus setup to allow focusing at maximum lens opening to ensure that the object of interest within the field of view always remains in focus.
- The camera shall provide the capability to extend the dynamic range of the camera to both provide a sharper image, simultaneously, in both the high-light and low-light areas of the scene and for increased accuracy in reproducing color in harsh lighting conditions.
- The fixed position CCTV camera shall utilize Peak White Invert technology to reduce glare from highlight area.
- The fixed position CCTV camera shall provide a built-in test pattern generator.

The camera shall comply with the following video requirements:

Camera	Requirement
Imager	1 / 2.8-inch CMOS with High Dynamic Range (110 dB WDR)
Resolution	2 MP under 1080P HD 768 x 480 432P analog (4:3)
Focus	Manual
Zoom	Manual
Iris	Manual
Auto Gain Control	On / off (0 - 40dB) selectable
Synchronization	Internal / AC line lock
Digital Zoom	16x
Signal – Noise Ratio	>54dB
White Balance	Auto Tracking White (outdoor)
Shutter Speed	1/60 to 1/10,000 sec

Min Illumination		Values in lux (50 IRE)
Day	SensUp (Off)	0.09
	SensUp(On 10X)	0.009
Night	SensUp (Off)	0.04
	SensUp(On 10X)	0.004

*Interface:* The manufacturer shall fully document and provide to the Department the communication protocol implemented by the fixed position CCTV camera to make setting adjustments and report status.

Camera interface and diagnostic software shall be provided with the fixed position CCTV camera subsystem which shall allow access to all available camera functions via a Windows based portable computer. A USB cable interface and other hardware shall be provided to interconnect the portable computer to both a fixed position CCTV camera and a CCTV monitor using the bidirectional coax cable used to transmit video from the camera. The program shall be capable of configuring and obtaining status of the fixed position CCTV camera.

*Alarm Handling:* The fixed position CCTV camera shall provide an alarm input that may be triggered by either a normally opened or normally closed contact.

The fixed position CCTV camera shall provide the capability on alarm to display up to a 17 character, programmable alarm message.

The fixed position CCTV camera shall provide a relay output that may be selected for normally opened or normally closed operation. The relay can be activated from an external alarm input to the camera, upon video motion detection, or when camera shifting to monochrome mode.

*Housing and Mount:* The camera housing and mounting hardware shall meet the following requirements:

- The camera housing shall be constructed of an aluminum casing, neoprene gaskets, UV-resistant polymer end caps, and all stainless-steel hardware. The housing viewing window shall be 3 mm (0.12 in.) thick glass.
- The camera housing shall be equipped with a incorporate a sunshield to protect against environmental extremes and glare. The heater shall be thermostatically controlled and prevent internal fogging of the housing throughout the operating temperature range of the camera.
- The camera housing mount shall have a swivel head that rotates 360° and tilts 180°. To ensure neatness of installation, the mount shall be designed to allow feed through wiring.
- The camera/lens tray shall be easily removed from the housing.
- The cylindrical camera housing shall have nominal dimensions of 17 inches long, 6 inches high and 7 inches wide.
- The camera housing shall meet IP66 and NEMA-4X enclosure protection standards.
- Manufacturer recommend mounting brackets and arms shall be provided to match existing installation methods.

#### Enclosure

The Contractor shall provide a NEMA 4X stainless-steel enclosure with each fixed CCTV camera that shall house the camera power supply, surge suppressors, media converter, and all other ancillary components necessary for interfacing the camera system with existing wiring. The Contractor shall size the enclosure to handle all components required to implement a fully operational camera site. The Contractor shall submit a shop drawing detailing all components of the system and their layout and wiring inside the enclosure for approval by the Engineer. The Contractor shall provide one fully functional enclosure for testing prior to ordering for all locations. See the *Construction Requirements* section of this specification for details.

#### Media Converter

The Contractor shall provide two media converters for each fixed CCTV camera. One shall be provided for installation in the local camera enclosure and the other for installation at the headend REVLAC building to which the camera signal is delivered. Media converts shall Moxa series PTC-101, or approved equal. Media converts shall convert Ethernet signals from copper to optical signals shall meet the following requirements.

Network Ports (100 Mbps)	(1) duplex LC single mode fiber optic* (1) RJ-45 copper port
Operating Humidity	5% to 95%
Operating temperature	-40°C to 85°C
Dimensions	Approx. 6"H x 5"D x 3"W
Input Voltage	100 to 240 VAC
Power Consumption	350 mA

\*Contractor shall be required to field verify the existing fiber optic cables installed between each fixed CCTV camera and the REVLAC building to determine cable type. Contractor shall provide multimode compatible media converters if it is determined that existing cables are multimode at some locations.

Media converters shall be provided with manufacturer recommend power supplies and surge suppression.

As an alternative to furnishing a media converter at the REVLAC building, the Contractor may elect to provide a fiber optic transceiver that can be installed in the network switches provided at the REVLAC buildings. The transceiver shall be compatible with the field installed media converter.

## **CONSTRUCTION REQUIREMENTS**

### System Mockup

Replacement of the existing fixed CCTV camera systems is a substantial technology upgrade and migration from analog to digital. Prior to removal of any existing camera infrastructure, the Contractor shall be required to test a typical new camera system at a REVLAC building designated by the Department. A system shall consist of a camera, its corresponding enclosure with all equipment, the media converter at the REVLAC building, and all cabling and ancillary equipment required to establish power and network connectivity to existing headend infrastructure.

The Contractor shall provide a testing procedure plan to the Department for review and approval. The Engineer and a Department representative will observe all testing and their approval will be required before any camera systems are replaced at field locations. If it is determined that digital video functionality cannot operate with existing headend video processing equipment at a REVLAC building, the Department may elect to have the Contractor replace existing cameras with the proposed camera's and utilize the cameras analog video output functionality.

### Installation

After obtaining approval from the Department, the Contractor shall commence removal and replacement activities related to the fixed CCTV camera systems. Cameras shall be removed and replaced at locations as shown on the Plans and as directed by the Engineer.

When removing existing fixed CCTV cameras and corresponding enclosure, the Contractor shall disconnect existing fiber optic cables and power cables and protect in place for reuse with the proposed infrastructure. Concurrently with field equipment removal, the Contractor shall remove headend analog video transceiver equipment and all cables connecting to existing video switches to remain. Any rack-mounted chassis associated with video transceivers shall be removed along with individual transceiver components. Prior to removal of any components in a REVLAC building, the Contractor shall perform site walkthrough with the Engineer to determine which components are to be removed and which to remain.

After removal of work is complete the Contractor shall install the proposed camera system components at each pole and in the corresponding REVLAC buildings. All equipment shall be mounted to maintain the functionality of the original system and in accordance with manufacturer recommendation. The Contractor shall re-terminate the fiber optic cables and power cables at each camera enclosure and in REVLAC buildings. If additional fiber strands are required to be terminated, the Contractor shall be allowed mechanically terminate strands using Engineer approved LC connector boots. The Contractor shall test all fiber strands prior to connection per the "*Fiber Optic Cable, Single Mode*" specification. Equipment to be installed in REVLAC buildings shall be mounted as determined by the Contractor and based on approval by the Engineer.

### Testing

The Contractor shall develop and submit a testing procedure to the Engineer for approval. The testing procedure shall be consistent with the procedure developed for the System Mockup and also include elements specific to field installation. The Contractor shall test the fixed CCTV camera systems in the presence of the Engineer after the camera is installed. This test shall be performed locally at the camera support structure and at the REVLAC building to verify that the camera system is functioning as intended.

The Contractor shall be required to perform the following tests after the installation of a fixed CCTV camera system. The Contractor shall use the test plans within this special provision to conduct the following tests in the presence of the Engineer.

- First Unit Factory Visual Inspection
- Site Test
- System Test
- 30-Day Burn-in Period
- Final System Acceptance and Training

### *First Unit Factory Visual Inspection*

The Contractor (or the Contractor's equipment fabricator) shall completely assemble a fixed CCTV camera system enclosure which includes all equipment, modules, components and complete all internal wiring (including labeling), then provide 5 business days' notice that this unit is ready for inspection. The Contractor shall have one set of contract plans and two sets of shop drawings on site to be redlined with any discrepancies noted. One set of redlines will be retained by the Department. The Contractor shall label all components. The Contractor may optionally perform an AC power test in the shop following successful completion of the Factory Visual Inspection.

### Site Testing

The purpose of the Site Test is to have the Contractor demonstrate to the Engineer that all fixed CCTV camera system components have been installed, connected, labeled, and configured correctly as per contract plans and as per the manufacturer's requirements, utilizing quality workmanship.

The Site Test shall be performed in conjunction with all associated equipment installed at a common site. A Site Test shall not be performed at the element or component level.

For the Site Test to be accepted, the Contractor shall demonstrate to the Engineer that:

- The installation has been performed as per the plans and as per the manufacturer's recommendations.
- All cabinet components are properly wired and demonstrate continuity and correct grounding utilizing good workmanship.
- The cabinet is attached/orientated to the pole and properly grounded.
- All conduits are secured and sealed, as required.
- All cabinet components demonstrate correct input and/or output voltages when powered/unpowered.
- All connections are tight and cannot be dislodged by incidental contact from the Engineer.
- All equipment inside the enclosure has been labeled.



### *System Test*

The System Test shall be conducted by the Department, once the cabinet is installed along with all devices to complete a fully operational fixed CCTV camera system.

The System Test demonstrates that the fixed CCTV camera system can be operated at the IDOT ComCenter utilizing the Advanced Traffic Management System (ATMS) software.

For the System Test to begin, the Contractor shall demonstrate to the Engineer that:

- The site is ready for System Testing, by notification in writing to the Engineer within 5 days of the requested start of test.
- Contractor has requested the Engineer to notify the Department when the cabinet is ready to test.

System Test Acceptance of the fixed CCTV camera system:

- Department sign off that the fixed CCTV camera system is integrated and tested for:
  - Communications connectivity from the ATMS to each fixed CCTV camera system.
  - Accurate video and/or data transmission from each site to the ATMS.
- Contractor received documentation from the Engineer of written approval from the Department verifying the communications connectivity and data transmission are within the Department's requirements.

The Contractor shall be notified in writing from the Engineer that the System Test has passed and the 30-Day Burn-In Period has immediately started. The Department shall be responsible for conducting the 30-Day Burn-in Test.

The Department will complete the System Test within 2 weeks of notification from the Engineer requesting that all ITS sites be tested.

### *30-Day Burn-in Period*

The purpose of the 30-Day Burn-in Period demonstrates that the fixed CCTV camera system and associated field devices communicate 100% of the time to the ATMS software and that video is being received during the duration of the test.

For the 30-Day Burn-in Period to be accepted, the Contractor shall demonstrate to the Engineer that:

- The Engineer or Department have not submitted any trouble tickets or written (via email) or any failure notification(s) within the 30-Day period.
  - Failure notification shall include, but not be limited to:
    - Any fixed CCTV camera system and associated power or communication error(s).
    - Any fixed CCTV camera system configuration errors.
    - Any operations anomaly that the Contractor cannot explain or rectify.
  - For every one (1) day the Contractor is required to mitigate/fix a problem, an additional one (1) day per testing will be added to the 30-Day test.
- Contractor received documentation from the Engineer of written approval (via email) from the Department verifying the 30-Day Burn-In period has been successfully completed.

### *Final System Acceptance and Training*

A representative of the Contractor shall witness the final inspection of the fixed CCTV camera system performed by the Engineer. Final acceptance of all work associated with this item will be made after:

- Contractor received written approval from the Engineer of Contractor submission to the Engineer for all Record Drawings and Warranty documents including an electronic computer file (MicroStation and PDF) including a sketch of each ITS element assembly, user/operator manuals, listing each device's location, identification number, and GPS coordinates.
  - The Contractor shall provide three hard and three electronic (PDF) copies of each of the operation and maintenance manuals to the Engineer for approval.
- Notification of Final Acceptance in writing received from the Engineer.

### Product Support

The manufacturer shall provide technical support via email, fax and toll-free telephone. The above forms of support shall be provided Monday through Friday, 8:00am to 8:00pm EST.

**Warranty.** The manufacturer shall provide a three year (3) warranty. The manufacturer shall pay inbound and outbound shipping charges during the warranty period for products returned as warranty claims. The manufacturer shall also provide an advance exchange program for warranty claims.

The warranty period shall begin on the date of final acceptance of the Project. This warranty shall include repair or replacement of all failed components via a factory authorized repair facility. All items sent to the repair facility for repair shall be returned within two weeks of the date of receipt at the facility. The repair facility location shall be in the United States. Any extended warranty coverage required to comply with the specified warranty period shall be provided as a part of this pay item at no additional cost to the State.

**Basis of Payment.** This item will be paid for at the contract unit price each for REMOVE AND REPLACE FIXED POSITION CCTV CAMERA FOR REVLAC, which shall be payment in full for all material and work as specified herein.

### **REPLACE EXISTING CCTV CAMERA LOWERING DEVICE**

**Description.** This item shall consist of removing and replacing an existing CCTV camera lowering device with a lowering device designed to support and lower a high-definition (HD) closed-circuit television (CCTV) camera, lens, housing, PTZ mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations.

**Removal.** The Contractor shall follow the manufacturer's recommendation for removal. Following removal, the Contractor shall dispose of the existing lowering device.

**Materials.** The lowering device shall consist of a conduit mount adapter, pole adapter for attachment to a pole top tenon, pole top junction box, divided support arm, suspension contact unit, camera junction box, and portable lowering tool. The divided support arm and receiver brackets shall be designed to self-align the contact unit with the pole center line during installation and insure the contact unit cannot twist under high wind conditions. For maximum arm strength, round support arms are not acceptable.

The camera-lowering device shall withstand wind forces of 120mph with a 14 percent gust factor using a 1.65 safety factor. The lowering device manufacturer, upon request, shall furnish independent laboratory testing documents certifying adherence to the stated wind force criteria utilizing, as a minimum effective projected area, the actual EPA or an EPA greater than that of the camera system to be attached. The camera-lowering device to be furnished shall be the product of manufacturers with a minimum of 3 years of experience in the successful manufacturing of camera lowering systems. The lowering device provider shall be able to identify a minimum of 3 previous projects where the purposed system has been installed successfully for over a one-year period of time each.

All pulleys for the camera lowering device and portable lowering tool shall have sealed, self-lubricated bearings, oil tight bronze bearings, or sintered oil-impregnated, bronze bushings. The lowering cable shall be a minimum 1/8-inch diameter stainless steel aircraft cable with a minimum breaking strength of 1740 pounds with (7) strands of 19 wires each.

The electrical connections between the fixed and movable lowering device components shall be designed to conduct high frequency data bits and one (1) volt peak-to-peak video signals as well as the power requirements for operation of dome environmental controls.

The interface and locking components shall be made of stainless steel and or aluminum. All external components of the lowering device shall be made of corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment.

The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or video cabling. The lowering device manufacturer shall provide a conduit mount adapter for housing the lowering cable. This adapter shall have an interface to allow the connection of a Contractor-provided 1.25 inch conduit and be located just below the cable stop block at the pole end of the divided support arm. The Contractor shall supply internal conduit in the pole as directed by the Lowering Device provider. The only cable permitted to move within the pole or lowering device during lowering or raising shall be the stainless steel lowering cable. All other cables must remain stable and secure during lowering and raising operations.

The CCTV Camera Manufacturer shall provide weights and /or counterweights as necessary to assure that the alignment of pins and connectors are proper for the camera support to be raised into position without binding. The lowering unit will have sufficient weight to disengage the camera and its control components in order that it can be lowered properly.

Suspension Contact Unit. The suspension contact unit shall have a load capacity of 600 lbs. with a 4 to 1 safety factor. There shall be a locking mechanism between the fixed and moveable components of the lowering device. The movable assembly shall have a minimum of 2 latches. This latching mechanism shall securely hold the device and its mounted equipment. The latching mechanism shall operate by alternately raising and lowering the assembly using the winch and lowering cable. When latched, all weight shall be removed from the lowering cable. The fixed unit shall have a heavy duty cast tracking guide and means to allow latching in the same position each time. All electrical and video coaxial connections between the fixed and lowerable portion of the suspension contact unit shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The contact unit housing shall be weatherproof with a gasket provided to seal the interior from dust and moisture.

The female and male socket contact halves of the contact unit shall be made of Hypalon. The female brass socket contacts and the male high conductivity brass pin contacts shall be permanently molded into the polymer body.

The current carrying male contacts shall be 1/8 inches in diameter. There shall be two male contacts that are longer than the rest which will make first and break last providing optimum grounding performance. The contacts shall be fully coordinated with the HD CCTV camera defined in pay item "CLOSED CIRCUIT TELEVISION DOME CAMERA, HD."

The current carrying female contacts shall be 1/8 inches I.D. All of the contacts shall be recessed 0.125" from the face of the contact unit. Cored holes in the socket measuring 0.25" in diameter and 0.125" deep molded into the contact unit are centered on each contact on the face of the contact unit to create rain-tight seals when mated with the male contact half.

The wire leads from both the male and female contacts shall be permanently and integrally molded in the Hypalon body. The current carrying and signal wires molded to the contact unit body shall be constructed of #18/1 AWG Hypalon jacketed wire.

The contacts shall be self-wiping with a shoulder at the base of each male contact so that it will recess into the female block, thereby giving a rain-tight seal when mated. The facility manufacturing the electrical contact unit must comply with Mil Spec Q-9858 and Mil Spec I-45208.

Portable Lowering Tool. The camera-lowering device shall be operated by use of a portable lowering tool. The tool shall consist of a lightweight metal frame and winch assembly with cable as described herein, a quick release cable connector, an adjustable safety clutch and a variable speed industrial duty electric drill motor. This tool shall be compatible with accessing the support cable through the handhole of the pole. The lowering tool shall attach to the pole with one single bolt. The tool will support itself and the load assuring lowering operations and provide a means to prevent freewheeling when loaded. The lowering tool shall be delivered to the Department upon project completion. The lowering tool shall have a reduction gear to reduce the manual effort required to operate the lifting handle to raise and lower a capacity load. The lowering tool shall be provided with an adapter for operating the lowering device by a portable drill using a clutch mechanism. The lowering tool shall be equipped with a positive breaking mechanism to secure the cable reel during raising and lowering operations and prevent freewheeling. The manufacturer shall provide a variable speed, heavy-duty reversible drill motor and a minimum of two complete lowering tools plus any additional tools required by plan notes. The lowering tool shall be made of durable and corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment.

#### Submittals

Shop drawings, product data, and certifications shall be submitted. The submitted information shall be complete and shall include information relative to all specified requirements suitable for verification of compliance.

The submittal information shall be dated, current, project specific, identified as to the project, and shall also include the following calculations and certifications as applicable to the material utilized:

- Shaft design calculations, including Registered Engineer Certification.
- Certification of intent to provide domestic steel in accordance with Article 106.01 of the Standard Specifications.
- Welding details and procedures.
- Letter of intent to provide specified weld inspection reports.
- Confirmation of coordination between anchor rod supplier and the structure manufacturer for adequacy of anchor rod assembly.
- Manufacturer's recommended installation procedures.
- Letter of intent to provide manufacturer's representative during installation and to provide specified installation certification.

All certifications shall be notarized.

**Installation.** The Contractor shall install the CCTV camera lowering device in accordance with manufacturer's instructions. Removal and installation of the lowering device on existing structures shall be included and paid for as part of REPLACE EXISTING CCTV CAMERA LOWERING DEVICE.

For Monopoles, the installation shall include all conduit and junction boxes attached to structure for the installation of the new lowering device.

The lowering device manufacturer shall furnish a factory representative to assist the Contractor with the assembly and testing of the first lowering system onto the pole assembly. The manufacturer shall furnish the applicable DOT engineer documentation certifying that the Contractor has been instructed on the installation, operation and safety features of the lowering device. The Contractor shall be responsible for providing applicable maintenance personnel "on site" operational instructions and providing three (3) copies of operations and maintenance manuals to the Engineer.

**Documentation.** In addition to the initial submittal(s) prior to procurement, the Contractor shall provide installation and operation manuals, documentation of exact equipment model and serial numbers, software/firmware version numbers, in hardcopy and PDF formats on CDROM.

**Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for REPLACE EXISTING CCTV CAMERA LOWERING DEVICE.

## **CLOSED CIRCUIT TELEVISION DOME CAMERA, HD**

**Description.** This work shall consist of furnishing and installing an integrated High-Definition Closed-Circuit Television (CCTV) Dome Camera Assembly as described herein and as indicated in the Plans.

### **Materials.**

#### General

The HD (High-Definition) CCTV Dome Color Camera shall be a rugged, non-pressurized, outdoor surveillance domed camera system. The HD CCTV Dome Camera shall be designed to perform over a wide range of environmental and lighting conditions and automatically switches from color daytime to monochrome nighttime operation. The high definition camera shall be either a Bosch Autodome IP series 7000 HD, Pelco Spectra 1080P HD Series, or a Siquira HSD820H3-E series in compliance with the requirement herein.

Camera shall use a standard Web browser interface for remote administration and configuration of camera parameters. The browser interface shall provide PTZ control including preset and pattern and on-screen display (OSD) for access to camera programming.

All equipment and materials used shall be standard components that are regularly manufactured and utilized in the manufacturer's system.

The manufacturer shall be ISO 14001 Certified. The manufacturer's quality system shall be in compliance with the I.S./ISO 9001/EN 29001, QUALITY SYSTEM. The manufacturer shall provide a three-year (3) warranty. The manufacturer shall pay inbound and outbound shipping charges during the warranty period for products returned as warranty claims. The manufacturer shall also provide an advance exchange program for warranty claims.

The warranty period shall begin on the date of final acceptance of the video distribution system. This warranty shall include repair or replacement of all failed components via a factory authorized repair facility. All items sent to the repair facility for repair shall be returned within two weeks of the date of receipt at the facility. The repair facility location shall be in the United States. Any extended warranty coverage required to comply with the specified warranty period shall be provided as a part of this pay item at no additional cost to the Department.

Physical Construction

The CCTV Dome Camera shall be provided in a NEMA 4X or IP66 certified, rugged, weather-resistant package. The CCTV Dome Camera shall also comply with the following requirements:

<b>Environmental</b>	<b>Requirement</b>
IP Rating	IP 66
Weight (max.)	10 lbs
Overall Dimensions	10" dia. x 14"
Humidity	0 to 100%
Operating temperature	-40 °C to 50 °C
Mount	1 1/2" NPT

The CCTV dome camera shall be equipped with a fan and heater controlled by a thermostat. The heater shall prevent internal fogging of the lower dome throughout the operating temperature range of the camera.

An optional rugged clear dome bubble shall be available from the CCTV camera manufacturer. The rugged dome shall be made from 3mm thick polycarbonate, designed to meet stringent strength standards without compromising optical clarity. The dome, by itself, shall withstand a 100 foot-pound impact. This energy is equivalent to that of a 10 lb. sledgehammer being dropped from a height of 10 feet. The dome, when installed in the CCTV camera, shall exceed the UL 1598 horizontal impact standard for lighting fixtures, by a factor of 10. The submittal needs to indicate compliance with this requirement.

Power

The CCTV Dome Camera shall be designed to operate from a 120V power source. The appropriate power supply, if required for the CCTV Dome Camera to operate, shall be included as a part of this item. The power requirements for the camera shall comply with the following:

Item	Requirement	
Port	RJ-45 for 100Base-TX; Auto MDI/MDI-X;	
Cabling Type	CAT5 cable or better for 100Base-TX	
Input Voltage	18 to 32 VAC; 24 VAC nominal; 22 to 27 VDC; 24 VDC nominal	
Input Power	24 VAC nominal	25 VA nominal (without heater and blower); 75 VA nominal (with heater and blower)
	24 VDC nominal	0.7 A nominal (without heater and blower); 3 A nominal (with heater and blower)
	PoE	IEEE802.3af (without heater and blower)

Camera

The camera shall provide a minimum of two simultaneous video streams with a 2.1 megapixel (MPx) 1920 x 1080 resolution, auto iris with 30X optical, and 12X digital zoom. The CCTV Dome Camera shall incorporate

Item	Requirement
Sensor Type	1/2.8-inch Type Exmor CMOS sensor
Optical Zoom	30X
Digital Zoom	12X
Maximum Resolution	1920 x 1080
Lens	f/1.6 - f/4.7, (4.3 mm - 129.0 mm optical)
Horizontal Angle of View	59° (wide) - 2° (tele)
Aspect Ratio	16:9
Light Sensitivity	Sensitivity in lux for 90% reflectance, f/1.6 (wide angle), 28 dB gain at 30 IRE (30% of signal level) with Sensitivity Boost OFF; 4X improvement to sensitivity with Sensitivity Boost ON
Color (33 ms) Color (250 ms)	0.65 lux
Mono (33 ms) Mono (250 ms)	0.07 lux
	0.20 lux
	0.015 lux
Day/Night Capabilities	Yes
IR Cut Filter	Yes
IR Trace	Curves 850 nm and 950 nm
Wide Dynamic Range	80dB
Iris Control	Auto iris with manual override
Backlight Compensation	Auto / Manual
Automatic Gain Control	Auto / Manual
Active Noise Filtering	Auto / Manual
Electronic Image Stabilization (EIS)	30X



Video

<b>Item</b>	<b>Requirement</b>
Video Encoding	H.264 in High, Main, or Base profiles and MJPEG
Video Streams	Up to 2 simultaneous streams, the second stream is variable based on the setup of the primary stream
Frame Rate	Up to 30, 25, 15, 12.5, 10, 8.333, 7.5, 6, 5,3, 2.5, 2, 1 (depending upon coding, resolution, and stream configuration)
Minimum Available Resolutions	1920x1080 1280x720 720 x 480
Supported Protocols	TCP/IP, UDP/IP (Unicast, Multicast IGMP), UPnP, DNS, DHCP, RTP, RTSP, NTP, IPv4, IPv6, SNMP v2c/v3, QoS, HTTP, HTTPS, LDAP (client), SSH, SSL, SMTP, FTP, and 802.1x (EAP)
Security Access	Password protected
Software Interface	Web browser view and setup

PTZ Mechanical

<b>Item</b>	<b>Requirement</b>
Pan Movement	360° continuous pan rotation
Pan Speed	Variable between 400° per second continuous pan to 5.0° per second
Vertical Tilt	Unobstructed tilt of +1° to -90°
Manual Control Speed	Pan speed of 0.1° to 80° per second; tilt operation shall range from 0.5° to 40° per second.
Automatic Preset Speed	Pan speed of 280° and a tilt speed of 160° per second
Presets	255 positions
Tours	2 tours
Preset Accuracy	± 0.2°
Proportional Pan/Tilt Speed	Speed decreases in proportion to the increasing depth of zoom
Motor	Continuous duty and variable speed, operating at 18 to 32 VAC, 24 VAC nominal
Window Blanking	16 blanked windows
Auto Flip	Rotates dome 180° at bottom of tilt travel
Power Consumption	Nominal 45 VA (without heater and blower running) Nominal 75 VA (with heater and blower running)

The camera shall provide a freeze frame feature that freezes a camera image as a preprogrammed preset is called, providing a live view once positioned.

Selections for on/off shall be available through the embedded Web browser.

The camera shall provide image stabilization to compensate for vibration introduced into the camera.

The camera shall support IPv4 and IPv6 configurations.

#### Still Picture Capture

The camera shall be capable of capturing a still image in JPEG format and automatically transferring this image to an FTP site. The resolution of the image shall be user selectable. The frequency of captures shall be user settable and shall as a minimum range from 1 picture every 30 seconds to 1 picture every five minutes.

#### Video Distribution System (VDS) Control System Driver

The camera and video output shall be controlled and configured through the VDS. Consequently, a software driver for the VDS is required and included as a part of the CCTV camera. The VDS control system is Cameleon ITS manufactured by 360 Surveillance, a division of FLIR. It is the Contractor's responsibility to determine if an existing software driver exists for the propose camera manufacturer. If a driver does not exist for the proposed CCTV camera, the work and cost of developing the driver shall be included in this item. Additionally, all cameras shall be provided with licenses to operate on the Departments primary and secondary servers.

### **CONSTRUCTION REQUIREMENTS**

#### Installation

The Contractor shall install the CCTV camera in accordance with manufacturer's instructions and as shown in the Plans. The camera firmware shall be the latest stable release available at the time of installation.

#### Testing

The Contractor shall test each CCTV Dome Camera Assembly in the presence of the Engineer after the camera is installed. This test may be done locally at the camera support structure.

#### Documentation

In addition to the initial submittal(s) prior to procurement, the Contractor shall provide installation and operation manuals, documentation of exact equipment model and serial numbers, software/firmware version numbers, in hardcopy and PDF formats on CD-ROM.

#### Product Support

The manufacturer shall provide technical support via email, fax and toll-free telephone. The above forms of support shall be provided Monday through Friday, 8:00am to 8:00pm EST.

**Method of Measurement.** This work will be measured for payment per each CLOSED CIRCUIT TELEVISION DOME CAMERA, HD furnished, installed and tested.

**Basis of Payment.** This work will be measured for payment per each CLOSED CIRCUIT TELEVISION DOME CAMERA, HD furnished, installed and tested.

## **TERMINATE FIBER IN CABINET**

**Description.** This work shall consist of terminating fibers in cabinets as indicated on the Plans. Termination shall consist of splicing a single strand from a fiber optic cable to an optical pigtail.

**Materials.** Pigtails and jumpers shall be per the Optical Pigtail section of the “Fiber Optic Cable, Single Mode” specification. All equipment and ancillary materials needed to make fiber optic fusion splices between fiber strands and pigtails shall be included in this work.

**General.** The Contractor shall splice together a fiber optic strand and pigtail as shown on the Plans.

**Installation.** Fiber optic splices shall be per the Splicing Requirement section of the “*Fiber Optic Cable, Single Mode*” specification. Upon completing all splicing operations at a location, the Contractor shall test all links per the Testing Requirements section of the “*Fiber Optic Cable, Single Mode*” specification. As directed by the Engineer, the Contractor at no additional cost to the Department shall replace any splice not satisfying the required objectives.

All spliced fibers and pigtails shall be trained in splice trays securely fastened inside of a splice enclosure or termination panel. Uncut fibers and buffer tubes shall be coiled neatly in the splice enclosure or termination panel. The ferrule end of the pigtail shall be connected to a patch panel module as shown on the Plans.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for TERMINATE FIBER IN CABINET.

## **BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS AND COMMUNICATION NETWORK CONFIGURATION**

**Description.** This item provides for the software development and testing needed to modify the current Control Logix program to interface with upgraded Stratix based network hardware, nodal building remote I/O, roadway remote Point I/O and RS Factory Talk View based REVLAC Server/Client located in all nodal buildings and headquarters. Also, configuration of the entire upgraded REVLAC control system Ethernet network (using sub netting and VLAN segmentation) and programming of the virtualized RS Factory Talk View based REVLAC Server/client is included this item. The existing PLC program was developed by ESP, consequently, the Contractor shall hire the Department designated and approved subcontractor, Engineered Software Products (ESP).

This item establishes an account from which funds will be distributed for the payment of the PLC, network device, REVLAC Server/client software development/configuration, testing and integration. A budgetary allowance has been established because the final cost is unknown.

This allowance will not be used to repair damage caused by the Contractor's operations. Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract.

The contact information for ESP is as follows:

Grib Murphy  
Engineered Software Products  
1075 Progress Circle  
Lawrenceville, GA 30043  
(770) 674-8861  
Email - gmurphy@espatl.com [mailto:](mailto:gmurphy@espatl.com)

## CONSTRUCTION REQUIREMENTS

**General.** The existing REVLAC PLC Control Logix software shall be modified using the Control Logix application programming software RSLogix 5000 Studio. All of the existing functionality included in the Sequence of Operations in contract plans shall be provided. ESP shall submit logic flow diagrams, with any changes to the existing logic highlighted, to the Engineer for approval prior to any programming. The PLC program shall be thoroughly documented including tag, rung and subroutine comments. The final documented code shall be submitted to the Engineer for approval in hard copy and .PDF format prior to field testing.

(1) ESP shall configure and program the virtualized REVLAC Server/client with following components:

- (1) The virtualized server rack consists redundant VDT/SCP server virtual machines which will contain the GUI, tags and the alarming required to monitor and control the entire REVLAC roadway devices. The VDT/SCP servers shall also contain the graphics to monitor and administer the entire REVLAC Ethernet communication based. The VDT/SCP servers shall also be programmed to provide diagnostic alarming for all the PLC and network hardware components as listed but not limited to the following:
  - a. REVLAC control system Ethernet network diagnostics such as network switch port failure, communication link failure between any network devices, unauthorized network access identification, power loss to network devices.
  - b. Ability to lock and unlock network device ports/ provide and stop network access from a centralized network administration workstation.
  - c. Ability to configure the network device ports for access by only a particular IP address.
  - d. Ability to configure the individual network devices to allow only network administrator to modify network device configuration (password protection security).
  - e. Diagnostic alarms for loss of communication between building PLC's and remote I/O.
  - f. Diagnostic alarms for loss of communication between all five building PLC's.
  - g. Diagnostic alarms for any major faults occurring on the PLC/IO/network hardware modules and loss of redundancy between the building PLC's.

- (2) The virtualized server rack also consists of a redundant domain controller virtual machines which provide the domain control services for the entire REVLAC Server/client system.
- (3) The virtualized server rack also consists of a Historian Server and SQL Database Server virtual machine which shall store historic REVLAC control system diagnostic alarms, network related alarms, trending data required for roadway devices and REVLAC roadway device faults/events/alarms/failures for a period of two (2) years. This stored data shall be accessible to an external hard drive to maintain records.
- (4) The engineering workstation in the headquarters shall contain the PLC programming software, REVLAC Server/client programming software and any network configuration software required to perform modification and maintenance on the REVLAC control system software or network post construction/commissioning. The engineering workstation will be mounted in the REVLAC Server rack as shown in the design plan and shall share the REVLAC server KVM console monitor.
- (5) The network configuration workstation in the headquarters should be a client workstation to the VDT/SCP VM servers providing the Ethernet network configuration tools, network graphics (showing status/faults of the REVLAC control system network) and alarming to the network administrator.
- (6) The Historian workstation in the headquarters should be a client workstation to the Historian server VM and shall contain the reporting software in order to provide regular reports regarding roadway equipment alarms/events etc. Also provide regular reporting regarding network or PLC hardware diagnostics alarms/events etc. These reports shall assist the Department maintenance team to adopt a predictive maintenance approach towards maintaining the REVLAC roadway equipment and the control system/network hardware.
- (7) The VDT/SCP client workstations located in the nodal buildings shall be a single monitor application containing the graphics and alarming required to monitor/ control the entire REVLAC PLC based control system. The VDT/SCP client workstations shall be identical in terms of its monitoring and control capability across all the nodal buildings and headquarters.
- (8) At building HQ one VDT/SCP client workstation with single monitor application will be mounted in the REVLAC Server rack as shown in the plans and shall share the REVLAC server KVM console monitor. One VDT/SCP client workstation with single monitor application will be mounted at the PLC/VDT enclosure as shown in the design plan notes.
- (9) At the building HQ operation control room one VDT/SCP client workstation with dual monitor application , one historian client workstation with single monitor application and network configuration workstation with dual monitor application shall be part of a multiscreen operator console with necessary mounting equipment and furniture.
- (10) Prior to performing any REVLAC Server/client programming, PLC programming and network configuration ESP shall conduct a minimum of ten (10) meetings and five (5) presentation workshops with the Department/Engineer to develop consensus on the following but not limited to:

- a. Graphics and alarming standards (including color codes) for the SCP/VDT server/client system deployed in the nodal buildings and the headquarters.
  - b. The data points that will need to be displayed as status/alarm/faults for the roadway equipment, PLC hardware and Ethernet network (including incoming, acknowledged and cleared status color codes).
  - c. The historical data points such as status/alarm/faults for the roadway equipment, PLC hardware and Ethernet network that need to be stored in the Historian/SQL Server.
  - d. The periodic reporting templates with specific data points that need to be published using the historian client workstation. The requirement and standards for user defined reports that will be required by the maintenance team.
  - e. The access privileges to be provided to different users of the REVLAC server/client system deployed across the nodal buildings and the headquarters.
  - f. The network configuration/ administrative capabilities along with network related graphics/alarming of the network configuration workstation.
- (11) See Appendix A and plans for local and remote I/O arrangements. The Contractor shall develop complete schematic I/O diagrams for the each building and remote I/O cabinet.
- (12) ESP shall provide detailed network architecture drawings for the entire upgraded REVLAC control system network with network device configuration details. The configuration files for all Ethernet network devices must be submitted to the Engineer for approval in hard copy and .PDF format prior to shop testing.
- (13) ESP shall provide manuals for all hardware and software provided during this upgrade to the Department. Where commercial products are employed, these manuals shall be the standard commercial maintenance manuals included with the hardware and software products. All maintenance manuals available from the manufacturer for the supplied product shall be provided to the Engineer. The final documents shall be submitted to the Engineer for approval in hard copy and .pdf format.
- (14) ESP shall provide the Engineer with two sets of programmer manuals. These manuals shall be suitable for use by the Department to develop, adjust, modify, maintain and revise the programs and parameters included within the system. Programmer manuals for all compilers, assemblers, utilities, and other support software facilities shall be provided. The final document shall be submitted to the Engineer for approval in hard copy and .pdf format.
- (15) Testing of the REVLAC system will consist of three parts:
- a. Shop Tests - The shop testing will consist of two parts, individual building shop tests and an integrated shop test. Both these tests shall be conducted at the Contractor's facilities.
  - b. Field Tests—The field testing will consist of two parts, individual building tests and an integrated system test.
  - c. 60 Day Observation Period – The new REVLAC control system shall be tested under live traffic conditions for a period of sixty days. The operation of the system shall be done by Department personnel. ESP shall be onsite during the 60 Day Observation test period to provide technical assistance as needed.

- (16) For tests 1 and 2 described above, ESP shall submit a detailed test plan to the Engineer for approval, including the following.
- a. Hardware setup – Describe the state of all hardware in the system at the start of the testing. Hardware to include PLCs, I/O, power supplies, network devices, REVLAC Server/client system etc.
  - b. Software - Describe the software/configuration to be loaded in the PLCs, REVLAC Server/client system and network devices at the start of each test. The approved logic flow diagram and network architecture drawings shall be included as an appendix to the test procedure. Documentation on the simulator needed for testing shall also be provided.
  - c. Fault condition testing - The software routines shall be tested for response to fault conditions. During each sequence tested, either force a PLC bit or lift a field wire to interrupt the normal operating sequence. Document the results of the system reaction to the fault.
  - d. Operations Verification – Commands shall be generated from the REVLAC Server/client system , the roadside control panels and the Cattron controller. The commands sent shall include normal ramp transitions and abnormal ramp / device transitions and emergency conditions.
- (17) For tests 1 and 2 described above, ESP shall perform the following tests.
- a. REVLAC control system Ethernet network diagnostics such as network switch port failure, communication link failure between any network devices, unauthorized network access identification, power loss to network devices.
  - b. Ability to lock and unlock network device ports/ provide and stop network access from a centralized network administration workstation.
  - c. Ability to configure the network device ports for access by only a particular IP address.
  - d. Ability to configure the individual network devices to allow only network administrator to modify network device configuration (password protection security).
  - e. Diagnostic alarms for loss of communication between building PLC's and remote I/O.
  - f. Diagnostic alarms for loss of communication between all five building PLC's.
  - g. Individual Device Operation from the Abnormal Events Panel with no Faults Present.
  - h. Group Device Operation from the Abnormal Events Panel with no Faults Present.
  - i. Ramp Transition from the Abnormal Events Panel with no Faults Present
  - j. Normal Ramp Transition with no Faults Present.

- k. Normal Ramp Transition with Faults Present.
- l. Abnormal Ramp Transition with Faults Present.
- m. Additional Tests at the Department's Discretion.

All tests shall detail the steps to be taken, expected results, expected duration, and plan for Maintenance and Protection of traffic. The plan shall include the steps to operate the system and the time frame for commissioning the system.

During the Shop, Field, and 60 Day Observation tests, ESP shall have specialists available with expertise in the software, communications and the control system. These specialists shall possess the knowledge required to answer questions about the demonstrated system operation raised by the Department.

Major changes to the software shall not be permitted while the system is being tested. Minor corrections of detected flaws are permitted, during a pause in testing. If serious deviations or omissions from the Special Provisions are found during the test, ESP will be notified in writing of the improper operation within ten days after the test documentation is received by the Engineer. Thereafter, ESP shall make all necessary corrections. When ESP has completed corrections and again deems that all system operations are in compliance with the requirements as defined and described in these Specifications, ESP may request a re-test. The request for a re-test shall be in writing and the re-test shall not begin any earlier than ten days after the end of the initial test.

**This item shall be bid out at a price of \$800,000.00**

**Method of Measurement.** The invoices submitted by the designated and approved subcontractor for completion of, or a portion of the subcontractor's work shall be measured at a budgeted lump sum cost as described herein.

**Basis of Payment.** This item shall be paid for at the contract unit price lump sum for the expended allowance amount for BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS.



## **STAMPED CONCRETE MEDIAN SURFACE REPAIR**

**Description.** This work shall consist of the removal and replacement of the stamped concrete along the existing concrete barrier wall in the locations as shown on the plans, and or as directed by the Engineer.

**Materials.** The pay item's used shall determine the class of concrete in accordance with Section 1020 of the Standard Specifications, with the exception that the minimum cement factor shall be 6.05 cwt. The coarse aggregate to be used shall contain no more than two percent by weight (mass) of deleterious materials. Deleterious materials shall include substances whose disintegration is accompanied by an increase in the volume which may cause spalling of the concrete. The color to be used shall be 2.5YR2/8 from the Munsell color chart or a close approximation. A color hardener will be required. Final color selection to be approved by the Engineer. Additional bedding material may be required to allow the newly poured 4 inch PCC to be flush with the median surface.

**Construction.** The existing bedding material shall be recompact prior to the placement of the PCC.

### **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This work will be measured for payment in place and the area computed in square feet (square meters). The additional bedding material shall be considered included in the measurement.

**Basis of Payment.** This work will be paid for at the contract unit price per square foot for STAMPED COLORED PCC MEDIAN SURFACE 4 INCH. Payment is full compensation for furnishing all labor, tools, removal, materials (the bedding material shall not be measured separately, but included in the cost of this pay item), and incidentals necessary to complete the contract work.

## **ROD AND CLEAN DUCT IN EXISTING CONDUIT SYSTEM**

**Description.** This work will consist of inserting a duct rod or electrical fish rod or tape of sufficient length and rigidity into an electrical conduit opening in one electrical manhole or handhole, and pushing the rod through the conduit to emerge at the next or subsequent manhole in the conduit system at the location shown on the plans. The duct rod may be inserted and removed by any standard construction method which causes no damage to the conduit system. The size of the conduit may vary from two inch (2") to four inch (4"), but there will be no differentiation in cost for the size of the conduit.

The conduit system which is to be rodded and cleaned may exist with various amounts of standing water in the manholes. The Contractor must pump the water or sufficient water from the manholes to drain the conduit and to afford compatible working conditions for the installation of the duct rods and/or cables. The pumping of the manholes will be incidental to the work of rodding and cleaning of the conduit.

Prior to removal of the duct rod, a duct cleaning attachment such as a properly sized wire brush or cleaning mandrel must be attached to the duct rod, which by removal of the duct rod will be pulled through the conduit to remove sand, grit, or other light obstructions from the duct to provide a clean, clear passage for the installation of cable. Whenever the installation of cables is not performed as an adjunct to or immediately following the cleaning of the duct, a light weight pulling line such as a 1/8" polyethylene line or conduit measuring tape must be placed and will remain in the conduit to facilitate future work. When great difficulty of either inserting the duct rod or removal of the cleaning mandrel is encountered, the duct may require further cleaning by use of a compressed air gun, or a low pressure water hose. In the case of a broken duct line, the conduit must be excavated and repaired. The existence and location of breaks in the duct line may be determined by rodding, but the excavation and repair work required will not be a part of this pay item. Repairs to the barrier wall, if required will be paid for under Median Barrier Wall Repair.

**Measurement.** This work will be measured for payment per linear foot for conduit rodded and cleaned.

**Basis of Payment.** This work will be paid for at the contract unit price linear foot for ROD AND CLEAN DUCT IN EXISTING CONDUIT SYSTEM.

### **MEDIAN BARRIER WALL REPAIR**

**Description.** This work shall consist of structurally repairing concrete median barrier wall to reestablish existing conduit pathways to REVLAC, lighting or communications equipment.

Materials. Materials shall be according to the following.

### **CONSTRUCTION REQUIREMENTS**

**General.** Median barrier wall repairs must be approved by the Engineer before beginning work. Median barrier repair shall be established through the following

1. Where median barrier wall repair has been identified in the plans.
2. Where conduits pathways are obstructed. Contractor shall identify damaged conduit by inserting a conduit mandrel into either end documenting the beginning the limits of the damaged conduit.
3. Where Junction boxes are damaged and require replacement.

Concrete Removal. The Contractor shall remove concrete according to Article 503.03 and the following.

Chipping Hammer – The chipping hammer for removing concrete shall be a light-duty pneumatic or electric tool with a 15 lb. (7 kg) maximum class or less.

Existing conduits not damaged are intended to remain in operation and be maintained through the repaired median barrier wall.

The Contractor shall have a maximum of 14 calendar days to complete each repair location with concrete, once concrete removal has started for the repair.

Surface Preparation. Prior to placing the concrete, the Contractor shall prepare the repair area and exposed reinforcement by blast cleaning. The blast cleaning shall provide a surface that is free of oil, dirt, and loose material. The area between existing median barrier wall and the repair shall be saw cut to achieve a flat surface.

Any standing water shall be removed.

All new concrete shall be placed within 3 calendar days of the surface preparation or the repair area shall be prepared again.

**Conduit Repair.** Conduits will be repaired between removal and installation efforts. Conduits must maintain existing alignments and connections. Proposed conduits must be connected to existing conduits per the standards specifications for the conduits installed. Conduits must be continuous from one end of the repair to the other end of the repair. Sharp conduit bends will not be accepted. Conduits damaged through the removal of the concrete barrier wall beyond the limits approved will be repaired at the contractor's cost.

Reinforcement. Tie bars 1 ¼" x 18" shall be installed between existing median barrier and repaired median barrier per Standard 637006-05. Tie bars shall be drilled and grouted into the existing median per Standards Specifications.

Timeframe. All repair areas shall be inspected and approved by the Engineer prior to placement of the concrete.

The concrete shall be placed and consolidated according to Article 503.07. The concrete shall not be placed when frost is present on the surface of the repair area, or the surface temperature of the repair area is less than 40 °F (4 °C). All repaired members shall be restored as close as practicable to their original dimensions.

Curing shall be done according to Article 1020.13.

If temperatures below 45°F (7°C) are forecast during the curing period, protection methods shall be used. Protection Method I according to Article 1020.13(d)(1), or Protection Method II according to Article 1020.13(d)(2) shall be used during the curing period.

The surfaces of the completed repair shall be finished according to Article 503.15.

**Incidental Items.** The Department may require temporary concrete barriers, additional maintenance of traffic, or impose restricted working time periods in order to maintain public safety and the operation of the roadway. Additional maintenance of traffic, work zone protection, and restricted working hours are considered incidental to this item.

**Method of Measurement.** Concrete median removal and repair will be measured for payment in cubic yards. Tie bars will be measured as each. Repair of the conduits installed in median barrier wall will be paid for by the conduit type to be repaired separately.

**Basis of Payment.** This work will be paid for at the contract unit price per cubic yard for CONCRETE REMOVAL (SPECIAL), CONCRETE STRUCTURES (SPECIAL). The installation of tie bars will be paid for at the contract unit price for each DRILL AND GROUT #6 TIE BARS.

When not specified to be paid for elsewhere, the work to design, install, and remove the temporary shoring and cribbing will be paid for according to Article 109.04.

#### **STEEL PLATE BEAM GUARDRAIL, ATTACHED TO STRUCTURES (SPECIAL)**

**Description.** This work shall consist of removal and replacement of damaged guardrail, end shoes, guardrail anchor bolts, replacement of missing guardrail anchor bolts for the existing guardrail attached to the existing concrete barrier wall adjacent to the restraining barrier or as shown on the plans, and as directed by the Engineer.

**Materials.** All anchor bolts shall match the diameter of existing bolts and shall be anchored into drilled holes using a chemical adhesive. All anchor bolts shall have standard washers. The guardrail shall be in accordance with article 630.02.

**Construction.** The anchor bolts shall be embedded a minimum of 10" into the barrier wall.

#### **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This work will be measured for payment per foot.

**Basis of Payment.** This work will be paid for at the contract unit price per foot for STEEL PLATE BEAM GUARDRAIL, ATTACHED TO STRUCTURES (SPECIAL). Payment is full compensation for furnishing all labor, tools, materials, and incidentals necessary to complete the contract work.

## **CHAIN LINK FENCE REMOVAL**

**Description.** This work shall consist of the removal and disposal of the existing chain link fence to the limits shown in the plans, which shall include all labor, materials, transportation, handling, and incidentals necessary to remove and dispose of all fencing indicated in the plans and as directed by the Engineer.

Disposal of the removed fence shall be in accordance with the applicable requirements of Article 202.03 of the Standard Specifications.

**Method of Measurement.** Removal of chain link fence will be measured for payment in feet along the top of the fence from center to center of end posts.

**Basis of Payment.** This work will be paid for at the contract unit price per foot for CHAIN LINK FENCE REMOVAL.

## **STORAGE OF ELECTRICAL MATERIALS**

**Description.** This work shall consist storing REVLAC components between the time they are delivered to the storage site following factory acceptance to the time that they are delivered to the installation site. This item includes the storage of materials that have an associated incremental payment release schedule or where advance testing is required prior to installation. Other materials may be stored at this facility but will not initiate payment under this item. Two types of materials are included under this item, electrical components, and barriers/swing gates.

**Electrical Components.** Electrical components include I/O panels, programable logic controllers, and associated equipment included under REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING X and REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING A and REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, REMOTE I/O CABINETS. Electrical components must be stored in a climate controlled environment as required by the manufacturer. Storage costs are inclusive of the supplemental materials to perform factory testing. Electrical Components must be stored within IDOT District 1 boundaries to qualify under this item.

**Barriers/Swing Gate.** Barrier/ Swing Gate components include the Swing Gate Arms, restraining barriers, and internally illuminated signs. Barriers and gates and associated components shall be stored in District 1. The Contractor can request that material be stored outside IDOT District 1 if alternate site offers advantageous to the testing or demonstration. For example, equipment that requires specialized equipment or heavy machinery for demonstration can request a location outside IDOT District 1. If an alternate location is selected, the Contractor shall provide travel accommodations for up to two inspectors to oversee factory acceptance testing. Travel accommodations include round trip flights (quantity 2), ground transportation, 1 night lodging for each inspector (quantity 2) and per diem meals (quantity 2). Additional travel would be required if multiple inspections are scheduled by the Contractor.

**Requirements.** The Contractor shall assume responsibility for security and weather protection as required for the duration of material storage at each storage facility. These requirements must remain in place even if the Contractor has exceeded the payment maximums detailed below.

**Method of Measurement.** This work will be measured for payment per calendar day between when the first accepted material has been accepted until the last element has been removed from the site. This item only includes the storage of materials with a payment schedule. The maximum payment under this item will include 365 days for Electric Materials and 365 days for Gates/Barriers. The timeframe for Electrical Material storage and Gate/Barrier storage may overlap provide that the requirements for storage of electrical material are met.

**Basis of Payment.** This work will be paid for at the contract unit price calendar day for STORAGE OF ELECTRICAL MATERIALS.

### **DRILL EXISTING JUNCTION BOX**

**Description.** This work shall consist consists of drilling a hole in an existing junction box or wall-mounted cabinet for the installation of a new conduit(s).

**General Requirements.** This work shall consist consists of drilling a hole in an existing junction box or wall-mounted cabinet for the installation of a new conduit(s).

**Installation.** The size of the hole must be as close as possible to the size of the conduit. Conduit openings must be fitted with the appropriate conduit fittings, nuts and accessories. The type and orientation of the conduit must be as shown in the Plans.

Field cut openings shall be uniform and smooth. All burrs and rough edges shall be filed smooth prior to the installation of the conduit(s) into the junction box. Any gaps around the conduit penetration shall be sealed against moisture or animal entry.

Cleaning the existing junction box (if required) shall be included in this item and shall be done as directed by the Engineer.

**Method of Measurement.** This work will be measured for payment per each hole that is drilled in an existing junction box. .

**Basis of Payment.** This work will be paid for at the contract unit price each for DRILL EXISTING JUNCTION BOX, which will be payment in full for performing the work described herein.

**FIBER OPTIC CABLE, SINGLE MODE**

**Description.** This work shall consist of furnishing and installing loose-tube, single-mode, fiber optic cable of the number of fibers shown in the Plans and as directed by the Engineer. The cable shall be capable of being installed via jetting in a microduct conduit system.

Other ancillary components, required to complete the fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, delineator post, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

**Materials.** Materials shall be according to the following.

The single-mode, fiber optic cable shall incorporate a loose, buffer-tube design. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 for a single sheathed, non-armored cable, and shall be new, unused and of current design and manufacture.

Fibers

The cables shall use dispersion unshifted fibers. The optical and physical characteristics of the un-cabled fibers shall include:

The single-mode fiber shall meet EIA/TIA-492CAAA, "Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers," and ITU recommendation G.652.D, "Characteristics of a single-mode optical fiber cable."

<b>Physical Construction</b>		
<b>Requirement</b>	<b>Units</b>	<b>Value</b>
Cable Diameter	mm	8.6
Buffer Tube Diameter	mm	1.5
Colored Fiber Nominal Diameter	µm	253 – 259
Mode Field Diameter (1310 nm)	µm	9.2 ± 0.4
Mode Field Diameter (1550 nm)	µm	10.4 ± 0.5
Minimum Bending Radius (Installation)	mm	170

<b>Optical Characteristics</b>				
<b>Requirement</b>			<b>Units</b>	<b>Value</b>
Cabled Fiber Attenuation		1310 nm	dB/km	< 0.4
		1550 nm		< 0.3
Point Discontinuity		1310 nm	dB	< 0.1
		1550 nm		< 0.1
Macrobend Attenuation	Turns	Mandrel OD	dB	
	1	32 ± 2 mm		< 0.05 at 1550 nm
	100	50 ± 2 mm		< 0.05 at 1310 nm
	100	50 ± 2 mm		< 0.10 at 1550 nm
	100	60 ± 2 mm		< 0.05 at 1550 nm
	100	60 ± 2 mm		< 0.05 at 1625 nm
<b>Optical Characteristics (Cont.)</b>				
Cable Cutoff Wavelength ( $X_{ccf}$ )			nm	< 1260
Zero Dispersion Wavelength ( $X_o$ )			nm	1302 < $X_o$ < 1322
Zero Dispersion Slope ( $S_o$ )			ps/(nm <sup>2</sup> •km)	< 0.089
Total Dispersion		1550 nm	ps/(nm•km)	< 3.5
		1285-1330 nm		< 17.5
		1625 nm		< 21.5
Cabled Polarization Mode Dispersion			ps/km <sup>2</sup>	< 0.2
IEEE 802.3 GbE – 1300 nm Laser Distance			m	up to 5000
Water Peak Attenuation: 1383 ± 3 nm			dB/km	< 0.4

Cable Construction

The number of fibers in each cable shall be as specified on the Plans.

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 1.5 mm maximum. Each buffer tube shall contain up to 12 fibers. The fibers shall not adhere to the inside of the buffer tube.

Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." The fibers shall be colored with ultraviolet (UV) curable inks.

Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding."

In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and shall not be subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.



Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fillers shall be placed so that they do not interrupt the consecutive positioning of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 1.5 mm in outer diameter.

The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod (optional steel central member). The purpose of the central member is to provide tensile strength and prevent buckling. The central member shall be overcoated with a thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

Each buffer tube shall contain a water-swellable yarn for water-blocking protection. The water-swellable yarn shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This yarn will preclude the need for other water-blocking material; the buffer-tube shall be gel-free. The optical fibers shall not require cleaning before placement into a splice tray or fan-out kit.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process.

The cables shall contain one ripcord under the sheath for easy sheath removal.

Tensile strength shall be provided by the central member, and additional dielectric yarns as required.

The cables shall be sheathed with medium density polyethylene (MDPE). Jacketing material shall be applied directly over the tensile strength members (as required). The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

The jacket or sheath shall be free of holes, splits, and blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code (NESC), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more co-extruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

The maximum pulling tension shall be 1335 N (300 lbf) during installation (short term) and 400 N (90 lbf) long term installed.

The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C. The installation temperature range of the cable shall be -15°C to +60°C.

#### General Cable Performance Specifications

The fiber optic cable manufacturer shall provide documentation and certify that the fiber optic cable complies with the following EIA-455-xxx Fiber Optic Test Procedures (FOTP):

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation at extreme operational temperatures (-40°C and +70°C) shall not exceed 0.15 dB/km at 1550 nm for single-mode fiber and 0.3 dB/km at 1300 nm for multimode fiber.

When tested in accordance with FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable," a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

When tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable," the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 70°C.

When tested in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cables," the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of the sample. The 220 N/cm (125 lbf/in) load shall be applied at a rate of 2.5 mm (0.1 in) per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 110 N/cm (63 lbf/in). Alternatively, it is acceptable to remove the 220 N/cm (125 lbf/in) load entirely and apply the 110 N/cm (63 lbf/in) load within five minutes at a rate of 2.5 mm (0.1 in) per minute. The 110 N/cm (63 lbf/in) load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 110 N/cm (63 lbf/in) load. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fibers and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be at least 4.4 Nm (in accordance with ICEA S-87-640)", the change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a rated tensile load of 2670N (601 lbf) and residual load of 30% of the rated installation load. The axial fiber strain shall be  $\leq 60\%$  of the fiber proof level after completion of 60 minute conditioning and while the cable is under the rated installation load. The axial fiber strain shall be  $\leq 20\%$  of the fiber proof level after completion of 10 minute conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm for single mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-37, "Low or High Temperature Bend Test for Fiber Optic Cable," the cable shall withstand four full turns around a mandrel of  $\leq 20$  times the cable diameter after conditioning for four hours at test temperatures of  $-30^{\circ}\text{C}$  and  $+60^{\circ}\text{C}$ . Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears, or other openings. The change in attenuation shall not exceed 0.30 dB at 1550 nm for single mode fiber and 0.50 dB at 1300 nm for multimode fiber.

#### Quality Assurance Provision

All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel. The cable manufacturer shall be TL 9000 registered.

#### Packaging

Top and bottom ends of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable.

The reel tag shall include the following information:

- Cable Number
- Gross Weight
- Shipped Cable Length in Meters
- Job Order Number
- Product Number
- Customer Order Number
- Date Cable was Tested
- Manufacturer Order Number
- Cable Length Markings
  - Top (inside end of cable)
  - Bottom (outside end of cable)

The reel (one flange) marking shall include:

- Manufacturer
- Country of origin
- An arrow indicating proper direction of roll when handling
- Fork lift-handling illustration
- Handling Warnings

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

- Manufacturer Cable Number
- Manufacturer Product Number
- Manufacturer Factory Order Number
- Customer Name
- Customer Cable Number
- Customer Purchase Order Number
- Mark for Information
- Ordered Length
- Maximum Billable Length
- Actual Shipped Length
- Measured Attenuation of Each Fiber

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers.

The cable shall meet all of specified requirements under the following conditions:

- Shipping/storage temperature: -58° F to +158° F (-50° C to +70° C)
- Installation temperature: -22° F to +158° F (-30° C to +70° C)
- Operating temperature: -40° F to +158° F (-40° C to +70° C)
- Relative humidity from 0% to 95%, non-condensing

### Optical Connectors

Optical Connectors shall comply with the following:

- Telcordia GR-326-CORE
- Connectors shall be type LC unless noted otherwise on the Plans or as required to be compatible with network equipment.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.

### Optical Pigtails

Fiber optic pigtails shall comply with the following:

- The pigtails shall consist of a section of single fiber, jacketed cable equipped with a factory installed optical connector on one end and bare on the other.
- The factory installed connector furnished as part of the pigtail shall meet or exceed the requirements for approved connectors specified herein.
- Attenuation of all pigtails will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Pigtails shall be one meter in length

### Optical Jumpers

The optical jumpers shall comply with the following:

- The jumpers shall consist of a section of single fiber, jacketed cable equipped with optical connectors on both ends.
- The factory installed connectors furnished as part of the jumper shall meet or exceed the requirements for approved connectors specified herein.
- Attenuation of all jumpers will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Jumpers shall be two meters in length.

### Cable Delineator Post

Cable Delineator post shall be furnished in orange color and incorporate a premium UV inhibitor package to resist harmful effects to the sun. The post shall be capable of withstanding multiple directional impacts and provide a long lasting and extremely durable product requiring little field maintenance. The post shall have a minimum 0.20" wall thickness and shall stand up straight in all weather conditions and self-right to straight upon impact. Top of post shall be permanently sealed, partially flattened, and transition to round to afford 360 degree visibility. The post materials shall include an anchor, a non-mechanical flexible joint, and a round delineator post.

## CONSTRUCTION REQUIREMENTS

**General.** Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

- A minimum of three years' experience in the installation of fiber optic cables, including fusion splicing, terminating and testing single mode fibers.
- Install two systems where fiber optic cables are outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.
- One fiber optic cable system (which may be one of the two in the preceding paragraph), which the Contractor can arrange for demonstration to the Department representatives and the Engineer.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures for the fusion splicer being used on this project and knowledge of all hardware such as breakout (furcation) kits and splice closures. The Contractor shall be capable of installing fiber optic cable in microduct systems using jetting techniques. The Contractor shall submit documented procedures to the Engineer for approval and to be used by Construction inspectors.

Personnel involved in testing shall have been trained by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval. In addition, the Contractor shall submit documentation of the testing procedures and a copy of the test equipment operation manual for approval by the Engineer.

**Installation.** Prior to installation, the Contractor shall provide a Cable-Pulling Plan. The plan shall include the following information:

- Identify where each cable will enter the underground system and the direction each pull.
- Identify locations where the cable is pulled out of a handhole, coiled in a figure eight, and pulled back into the hand hole.
- The plan shall address the physical protection of the cable during installation and during periods of downtime.
- Identify the location of slack storage locations
- Identify the locations of splices.
- Identify distances between fiber access points and crossings.

The Cable-Pulling Plan shall be provided to the Engineer for approval a minimum of 15 working days prior to the start of installation. The Engineer's approval shall be for the operation on the freeway and does not include an endorsement of the proposed procedures. The Contractor is the technical adequacy of the proposed procedures.

During cable pulling operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and pulling operations. Unless specified otherwise by the fiber optic cable manufacturer, the outside bend radius of the cable during installation shall be no less than 20 times the outside diameter of the fiber optic cable. Entry guide chutes shall be used to guide the cable into the handhole conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation-bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the cable manufacturers specifically approve the array.

If figure-eight techniques are used during cable installation, the cable shall be handled manually and stored on the ground. The cable shall be placed on tarps to prevent damage from gravel, rocks, or other abrasive surfaces. Tarps should also be used in muddy conditions to keep the cable clean. Enough area to accommodate the cable length to be stored and sufficient personnel to maintain the required minimum-bending diameter as well as avoid kinking or otherwise damaging the cable shall be provided. If the cable has been figure-eighted in preparation for a forward feed, the figure-eight must be flipped over to access the outside cable end. Provide sufficient personnel to avoid kinking the cable as the figure-eight is flipped over. When removing the cable from the figure-eight, use care to avoid kinking the cable and violating the minimum-bending diameter.

Power assisted or figure-eight eliminator equipment, which is used to eliminate manual figure-eight procedures, shall not be used unless specifically allowed by the cable manufacturer in writing.

The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. A dynamometer or in-line tensiometer shall be used to monitor tension in the pull-line near the winch. This device must be visible to the winch operator or used to control the winch. The pulling system shall have an audible alarm that sounds whenever a pre-selected tension level is reached. Tension levels shall be recorded continuously and shall be given to the engineer as well as included in the record drawing package.

The use of a breakaway link (swivel) may be used to ensure that the maximum tension of the cable is not exceeded. Breakaway links react to tension at the pulling eye and shall not be used in lieu of tension measuring devices. All pulling equipment and hardware which will contact the cable during installation must maintain the cable's minimum bend radius. Equipment including sheaves, capstans, bending shoes, and quadrant blocks shall be designed for use with fiber optic cable.

The cable shall be pulled into the conduit as a single component, absorbing the pulling force in all tension elements. The central strength member and Aramid yarn shall be attached directly to the pulling eye during cable pulling. "Basket grip" type attachments, which only attach to the cable's outer jacket, shall not be permitted. A breakaway swivel, rated at 95% of the cable manufacturer's approved maximum tensile loading, shall be used on all pulls. When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable.

To minimize the exposure of the backbone cable and to facilitate the longer lengths of fiber optic cable, the Contractor shall use a "blown cable" (pneumatically assisted) technique to place the fiber optic cable. A Compressed air cooler shall be used when ambient air temperatures reach 90°F or more.

Where cable is to be pulled through existing conduit which contains existing cables, optical or other, the existing cables shall be removed and reinstalled with the fiber optic cable as indicated on the Plans. The removal of the cable(s) shall be paid for separately. Reinstallation of the existing cables, if indicated on the Plans, along with the fiber optic cable shall be included in this item for payment.

### Tracer Wire

A tracer wire shall be installed with all fiber optic cable runs. One tracer wire shall be installed along with the fiber optic cable in each raceway. If a raceway has more than one fiber optic cable, only one tracer wire per raceway is required. If there are parallel raceways, a tracer wire is required in each raceway that contains a fiber optic cable. Tracer wire shall be installed in raceway segments which are metallic to provide a continuous tracer wire system.

The tracer wire shall be a direct burial rated, number 12 AWG (minimum) solid (.0808" diameter), steel core soft drawn high strength tracer wire. The wire shall have a minimum 380 pound average tensile break strength. The wire shall have a 30 mil high density yellow polyethylene (HDPE) jacket complying with ASTM-D-1248, and a 30 volt rating.

Connection devices used shall be as approved by the tracer wire manufacturer, except wire nuts of any type are not acceptable and shall not be used. The cost of the tracer wire shall be included in the cost of the fiber optic cable and not paid for separately.

### Splicing Requirements

All fiber optic cable splices shall be performed using a fusion splicer. Mechanical splicing of fiber optics strands shall not be permitted. After completing a fusion splice the Contractor shall recoat the fused fibers and install mechanical protection over them. All spliced fibers shall be neatly trained in splice trays housed in splice closures, splice enclosures, or termination panels.

Splicing shall be performed only at locations shown in the approved Cable-Pulling Plan. Any other splices shall be permitted only with the approval of the Engineer. Fiber optic splices at location shown in the Plans will be paid for under separate pay items. End-of-reel splices will not be paid for separately. All splice locations shall be identified in the Record Drawings. Cable runs which dead-end at a handhole or communications vault shall be dead ended in an underground splice closure.

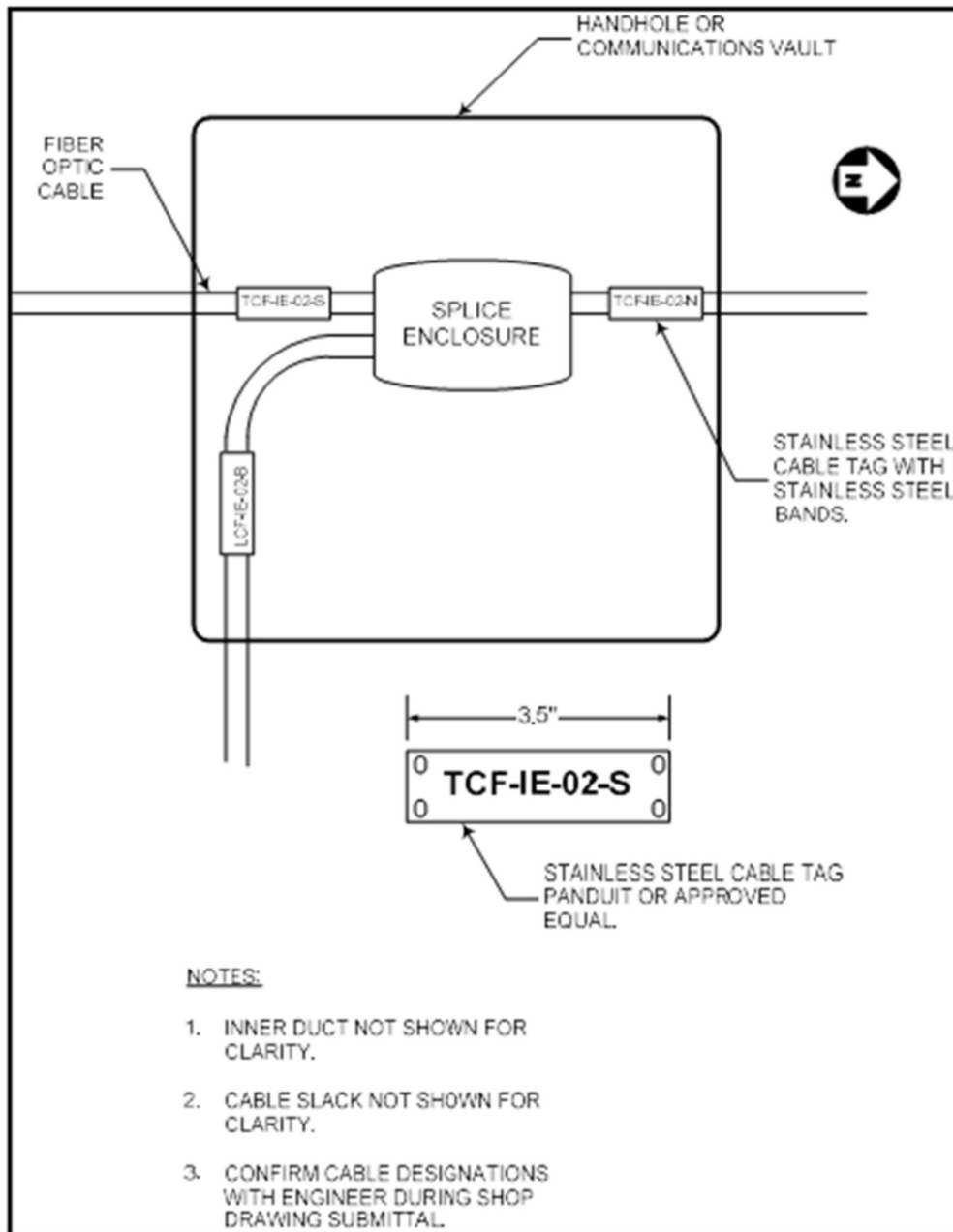


### Slack Storage of Fiber Optic Cables

Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in handholes or in the raised base adapters of ground mounted cabinets in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be 100 feet for each cable at each splice location, above or below ground. Fiber optic cable slack shall be 50 feet for each cable at access points, above or below ground, where splicing is not involved. If the innerduct is cut, the ends of the innerduct should extend beyond the first vertical rack so they can be secured at that point. This slack shall be measured for payment.

Fiber optic cable shall be tagged inside handholes with yellow tape containing the text: "CAUTION – FIBER OPTIC CABLE." In addition, permanent tags, as approved by the Engineer, shall be attached to all cable in a hand hole or other break-out environment. These tags shall be stainless steel, nominally 0.75" by 1.72", and permanently embossed. These tags shall be attached with stainless steel straps, and shall identify the cable number, the number of fibers, and the specific fiber count. Tags and straps shall be Panduit or approved equal. The Contractor shall label the destination of each trunk cable onto the cable in each handhole, vault, or cable termination panel.

See figure below for labeling diagram:



### Installation of Delineator Posts

Delineator posts shall be installed to provide warning of the presence of underground fiber optic cable. The post shall be installed at the following locations:

- Device Cabinets
- Communications Vaults
- Conduit bends greater than 30 degrees
- On both ends of a bored run under roadway
- Every 500'

The Contractor shall take care not drive post through conduit or other utilities that may be in the vicinity. The installation of the post is included as part of the installation of the fiber optic cable and will not be paid for separately.

**Submittals.** The Contractor shall examine the proposed cable plant design. At least one month prior to starting installation of the fiber optic cable plant, the Contractor shall prepare and submit to the Engineer for review and approval, ten (10) copies of the Contractor's "Installation Practices for Outdoor Fiber Optic Cable Systems" manual. This manual shall address the Contractor's proposed practices covering all aspects of the fiber optic cable plant. This submittal shall include all proposed procedures, list of installation equipment, and splicing and test equipment. Test and quality control procedures shall be detailed as well as procedures for corrective action.

### Operations and Maintenance Documentation

After the fiber optic cable plant has been installed, ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- Final copies of all approved test procedures
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
- Complete parts list including names of vendors.

### Testing Requirements

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and un-terminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an Optical Time Domain Reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber. **Mechanical splice or bare fiber adapters are not acceptable.**

The Contractor shall provide the date, time and location of any tests required by this specification to the Engineer at least 5 working (7 calendar) days before performing the test. Included with the notification shall be a record drawing of the installed fiber optic cable system. The drawings shall indicate actual installed routing of the cable, the locations of splices, and locations of cable slack with slack quantities identified.

Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A Certified Technician utilizing an Optical Time Domain Reflectometer (OTDR) and Optical Source/Power Meter shall conduct the installation test. The test equipment used shall have been calibrated within the last two years. Documentation shall be provided. The Technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers.

All testing shall be witnessed by the Department's Engineer and a copy of the test results (CD ROM or USB Drive) shall be submitted on the same day of the test. Hardcopies shall be submitted as herein with copies on CD ROM.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as two bound copies and three CD ROM copies, and shall include the following:

Cable & Fiber Identification:

- Cable ID
- Operator Name
- Cable Location - beginning and end point
- Date & Time
- Fiber ID, including tube and fiber color
- Setup Parameters
- Wavelength
- Range (OTDR)
- Pulse width (OTDR)
- Scale (OTDR)
- Refractory index (OTDR)
- Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR Test results
- Measured Length (Cable Marking)
- Total Fiber Trace
- Total Length (OTDR)
- Splice Loss/Gain
- Optical Source/Power Meter Total Attenuation (dB/km)
- Events > 0.10 dB

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
<b>Maximum Loss</b>									
<b>Minimum Loss</b>									

The OTDR test results file format must be Bellcore/Telcordia compliant according to GR196-CORE Issue 2, OTDR Data Standard, GR 196, Revision 1.0, GR 196, Revision 1.1, GR 196, Revision 2.0 (SR-4731) in a “.SOR” file format. A copy of the test equipment manufacturer’s software to read the test files, OTDR and power, shall be provided to the Department.

These results shall also be provided in tabular form, see sample below:

OTDR Summary					
Cable Designation:	<i>TCF-ED-000</i>	OTDR Location:	<i>Pump Sta. 03</i>	Date:	<i>10/11/17</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)		
			1310 nm	1550 nm	
<i>1</i>	<i>Splice</i>	<i>23500 ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Splice</i>	<i>25000 ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Splice</i>	<i>25000 ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Splice</i>	<i>26000 ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 db. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.5 dB/km at both 1310 and 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to the state, both labor and materials. Elevated attenuation due to exceeding the pulling tension, or any other installation operation, during installation shall require the replacement of the cable run at no additional cost to the State, including labor and materials.

**Method of Measurement.** This work will be measured for payment in feet in place. Cable will be measured horizontally and vertically between the changes in direction, including the cable in the vertical conduit riser and any extra cable as specified in Article 871.04. The cable length in the foundations of a controller cabinet and a vertical pole will be accounted as 3 ft. (1 m) each

**Basis of Payment.** This work will be paid for at the contract unit price per foot for FIBER OPTIC CABLE, SINGLE MODE of the number of fibers and type specified.

#### **FIBER OPTIC TERMINATION PANEL, 12F OR 24F**

**Description.** This work shall consist of furnishing and installing a fiber optic termination panel for use in CCTV camera cabinets of the type and size as specified on the Plans and described herein.

All fiber termination panels for PLC related fiber are included with PLC related pay items.

**Materials.** The fiber optic termination panel shall:

- a) Shall be capable of being mounted on din rails or wall mounted.
- b) Shall allow termination of a fiber patch cord to interconnect outside plant fibers to fiber optic communication equipment.
- c) Shall be supplied with optical splice holder and factory preterminated color coded pigtailed.
- d) Shall be made from solid steel construction, shall be powder coated, and feature top or bottom cable entry w/dust resistant grommets.
- e) Shall be supplied with a 12-port single-mode adapter panel utilizing type LC modules.
- f) have approximate dimensions of (6.5" x 5.5" x 2")

## CONSTRUCTION REQUIREMENTS

**General.** The fiber optic termination panel shall be installed at locations as shown on the Plans. The termination panel shall be mounted in cabinets per the Plans or as directed by the Engineer.

Fiber optic jumpers shall be installed between patch panels and network equipment as shown on the plans. All interconnecting cables shall be installed in a neat and workmanlike manner. Cables shall be supported between devices.

All cables shall be identified at both ends per EIA/TIA Standard TIA-606-B for labeling telecommunication components.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for FIBER OPTIC TERMINATION PANEL, 12F OR 24F.

## ETHERNET SWITCH

**Description.** This work shall consist of furnishing, installing, integrating, and testing an environmentally hardened Layer III Ethernet switch for ITS related equipment. The switch shall be a Cisco IE-3400-8T2S-E or approved equivalent. The corresponding power supply shall be PWR-IE65W-PC-AC. The Contractor shall provide Ethernet switches with all necessary hardware and software to make the switches operational and be compatible with the Department's existing network. The Contractor shall be responsible for programming and integrating all new switches in coordination with the Department to have the new switches integrated into the existing network.

All ethernet switches associated with PLC communications are included with PLC related pay items.

**Materials.** Materials shall be according to the following.

### Layer III (Network) Switch

#### (A) Management Capabilities

- (1) Switches shall support full-duplex Ethernet
- (2) Switches shall be capable of Layer 2 LAN Base services
- (3) Switches shall have American Standard Code for Information Interchange (ASCII) based configuration files for offline editing and bulk configuration
- (4) Switches shall be managed using Simple Network Management Protocol (SNMP) Version 3.
- (5) Switches must be able to use Secure File Transfer Protocol (SFTP) to transfer configuration file to and from a central server.

- (6) Switches shall be compliant with IEEE 802.1 and 802.3. Specifically, the switch must comply with the following IEEE 802.1 standards:
    - (a) IEEE 802.1D - Media Access Control (MAC) Bridges, including Rapid Spanning Tree Protocol (RSTP).
    - (b) IEEE 802.1Q - Virtual Local Area Network (VLAN) tagging and Multiple Spanning Tree Protocol (MSTP).
    - (c) IEEE 802.1X (Port Based Network Access Protocol).
  - (7) Switches shall perform multicast filtering using Internet Group Management Protocol (IGMP) snooping.
  - (8) Switches shall support Address Resolution Protocol (ARP)
  - (9) Switches shall support the following Layer 3 capabilities:
    - (a) Internet Protocol Version 4 (IPv4);
    - (b) Internet Protocol Version 6 (IPv6);
    - (c) Open Shortest Path First (OSPF);
    - (d) Generic Routing Encapsulation (GRE);
    - (e) Inter-VLAN Internet Protocol (IP) routing for full Layer 3 routing between two or more VLANs;
    - (f) Virtual Router Redundancy Protocol (VRRP);
    - (g) IP multicast routing utilizing Protocol Independent Multicast (PIM) and Internet Group Management Protocol, Version 2 (IGMPv2). Support for PIM sparse mode (PIM-SM) and PIM dense mode (PIM-DM);
    - (h) Quality of Service (QoS);
    - (i) Security utilizing Access Control Lists (ACLs).
- (B) Power Requirements
- (1) Input Voltage to Power Supply Modules: 100 to 240 VAC
  - (2) Output Voltage from Power Supply Modules: 24 to 54 VDC
  - (3) Redundant Power Supplies
- (C) Environmental Requirements
- (1) Operating Temperature: -40° to +75°C
  - (2) Humidity: 10 to 95% (non-condensing)
  - (3) Resistant to electromagnetic interference (EMI)



(D) Network Port Requirements

- (1) Switches shall have the following minimum port configurations:
  - (a) (8) 10/100/1000 Mbps copper Ethernet ports, RJ-45 connector
  - (b) (2) 100/1000 Mbps SFP ports with SM transceivers, LC connector
- (2) Contractor shall ensure the launch power of the optical ports is great enough such that when coupled with the receiver sensitivity of the connecting device, the optical budget of the link is not exceeded. The transceivers shall be capable of 1 Gbps transmission rates.
- (3) All ports shall have Diagnostic light-emitting diodes (LED). These indicators shall include link, activity, and power LEDs.

### CONSTRUCTION REQUIREMENTS

**General.** The Contractor shall locate shelf space or other suitable mounting location in the building or cabinet or as identified on the Plans. The Contractor shall secure the Ethernet Switch as appropriate and approved by the Engineer.

**Installation.** The Contractor shall install all necessary patch cords, optical transceivers, connectors, power supplies, communication transformers, or auxiliary equipment necessary to complete the communication circuits. The Contractor shall connect the switch to the field devices as indicated on the Plans.

#### Configuration

When requested by the Contractor, the Engineer will provide the necessary IP address assignments and port assignments, including the necessary port provisioning. The Contractor shall be responsible for all network programming of the switches and communicating elements within the building or cabinet.

The Contractor shall configure switch ports for VLANS as shown on the Plans or directed by the Engineer. The Contractor shall configure trunking ports between switches and access ports between switches and equipment. VLAN Trunk Protocol (VTP) shall be set to transparent mode on all switches. Port Security shall be configured to only allow the MAC addresses of equipment connected to the switch to pass traffic. RSTP shall be configured to prevent bridging loops and provide redundant paths.

On Layer 3 switches, the Contractor shall configure gateway IP addresses for all subnets that connect to the switch. OSPF routing shall be configured and the routes to those subnets being advertised to adjacent switches confirmed. The Contractor shall configure ACLs and work with the Department to determine IP Ranges, ports, and other settings to be used in configuring the ACLs.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** This work will be paid for at the contract unit price each for LAYER III (NETWORK) SWITCH.

## **SWING GATE REMOVAL**

**Description.** This work shall consist of the removal of existing Swing Gate units from their designated locations on existing foundations in the concrete barrier walls and the removal, salvage, transportation and storage of the eighteen (18) chevron sign supports for future use. The Department will salvage up to twenty-four (24) gates, eight (8) gate controllers, and all chevron signs. Salvaged equipment will be identified prior to removal by the Department. The Contractor shall transport and handle as applicable the swing gate arm and controllers in conformance with the manufacturer's recommendations. The Contractor shall make arrangements to transfer the swing gate arm to the State's storage facility located within District 1 on weekdays between the hours of 8:00 a.m. and 4:00 p.m., excluding State holidays applicable to the Department.

Removed equipment, not salvaged, shall be disposed of by the Contractor.

The salvage value of the removed gates shall be included in the unit bid price.

## **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This item shall be measured for payment as each, for each gate, gate mechanical systems, gate controller cabinets or housings, auxiliary signs, and attached chevrons removed.

**Basis of Payment.** This work shall be paid at the contract unit price each for SWING GATE REMOVAL, which shall be payment in full for the work, complete, as specified herein regardless of location, rotation, or gate arm length.

## **RESTRAINING BARRIER REMOVAL**

**Description.** This work shall consist of the removal of existing Restraining Barrier units from their designated locations on existing foundations in the concrete barrier walls. In addition, remove the associated auxiliary ("X", "Open/Closed") signs for salvage to the department and CCTV cameras for reinstallation on new barriers. Restraining Barrier units shall be removed under this contract and disposed of as directed by the Engineer.

The Contractor shall transport and handle as applicable the salvaged auxiliary signs and CCTV cameras in conformance with the manufacturer's recommendations. The Contractor shall make arrangements to transfer the equipment to the State's storage facility located within District 1 on weekdays between the hours of 8:00 a.m. and 4:00 p.m., excluding State holidays applicable to the Department.

The removal work shall include all Restraining Barrier removal from the concrete barriers, packaging, transportation and handling to the disposal site.

**Method of Measurement.** This item shall be measured for payment as each, for each unit removed and shipped to the disposal site, and auxiliary signs and CCTV cameras removed and salvaged.

**Basis of Payment.** This work shall be paid at the contract unit price each for RESTRAINING BARRIER REMOVAL, which shall be payment in full for the work, complete, as specified herein regardless of location, or unit width.

## SWING GATES

**Description.** This work shall consist of the procurement of Swing Gate units and installation of the units at their designated locations on existing foundations in concrete barrier walls. The installation work shall include all transportation and handling from the Swing Gate Vendor, temporary storage of the units as necessary, transportation and handling of the units to the installation location, all field Installation work as specified and in accordance with the Swing Gate Vendor's installation requirements, all adjustments required for the Swing Gate Vendor's installation certification, and adjustments necessary as the result of operational testing requirements as specified.

- (a) Each Swing Gate shall consist of an aluminum reflectorized arm attached to a mechanical pivoting device used as part of a coordinated system to semi-automatically open or close the six access ramps into the Reversible Lanes of the Kennedy Expressway. The swing gate shall be integrated into the Traffic Redirection and Access Control System. The Swing Gates shall be used to alert drivers that the ramp is closed or is being closed and to physically deny access to the ramps when traffic in the Reversible Lanes is flowing counter to the flow at the entrance ramp or when the Reversible Lanes are closed.
- (b) The Swing Gates shall be obtained as a pay item. They shall be complete operational units with all specified features and construction and shall be delivered in accordance with the established schedule as specified herein. All Swing Gate assemblies shall be Model Number HW-4B as manufactured by B & B Roadway Security Solutions, or approved equivalent(herein referred to as "Swing Gate Vendor"). Unless otherwise indicated. All swing gate assemblies shall be of uniform design and construction except for gate arm length and rotational direction of the unit. For each specific swing gate assembly, the gate arm length, gate angle and orientation of the unit shall be as generally shown on the Contract Drawings.

- (c) The Swing Gate Vendor shall furnish the swing gates as complete operable assemblies in the quantities as shown on the Contract Drawings. The work shall include but not be limited to furnishing all labor, material, and equipment required to design, detail fabricate assemble, paint, shop test, and deliver the swing gate assemblies described herein plus the Installation support specified and required to assure proper installation.
- (d) All swing gates shall be operated remotely by a remote I/O panel, furnished, installed and paid for under a separate pay item. The swing gate control panel shall include all necessary terminations for interfacing with this panel.
- (a) Each swing gate assembly shall include but not be limited to the following:
  - (1) Gate Actuator Transmission - A mechanical power device used to transfer motor torque to the pivot motion of the gate arm.
  - (2) Crank Arm Assembly - A pair of offset arms interconnected by a self-aligning rod to connect the output shaft of the transmission to the inner shaft of the gate arm capstan.
  - (3) Gate Arm Capstan and Mounting Bracket - A "shafts within a shaft" assembly (consisting of an Inner shaft, support stanchion, and outer shaft) which supports and pivots the gate arm. The connection between the inner and outer shaft contains shear pins.
  - (4) Support Frame - A structural weldment to support the drive components and transfer the loads from the gate arm to the barrier wall.
  - (5) Weatherproof Housing - An enclosure to protect and secure the mechanical and electrical components of the swing gate.
  - (6) Remote I/O panel (separate pay item). The remote I/O panel shall be installed inside the gate housing by the gate manufacturer, as shown on the Contract drawings.
  - (7) Swing Gate Arms (separate pay item) - A series of various length, open web style, reflectorized material covered aluminum trusses that attaches to the capstan. The gate arms retract into the barrier wall when the ramp is open and pivot to extend into the access ramp to warn drivers that the ramp is closed.
  - (8) Flexible Gate Tip (separate pay item) - The last three feet of the gate arm has a tip which is fabricated from materials designed to minimize vehicular and gate arm damage.
  - (9) Actuator Drive Motor - Connected to the transmission, provides the torque required to pivot the gate arm.
  - (10) Local Controls - A series of electrical and electronic devices used to monitor the status, operation, and motion of the swing gate. The local controls shall be coordinated with the overall control system for the Traffic Redirection and Access Control System.

- (11) Manual Operating Controls - Both mechanical and electrical devices used to manually position the gate arms during failure of the controls, power, or in emergency situations.
- (12) The swing gate drive and transmission unit, structural frame, housing, and controls shall be heavy-duty units designed specifically for freeway service. The swing gates shall be horizontal rotation units with bottom extension capstan. The units shall be an adaptation of a proven, standard design of the Swing Gate Vendor, and shall be a generically similar model, which has been in production and used on federally funded highway projects for at least five years. Equipment of a fundamentally different design, being incompatible with ongoing construction and the overall configuration of the Traffic Redirection and Access Control System, will not be acceptable.
- (13) The gate actuator shall operate smoothly within the range of weather conditions described herein. At no time shall there be any evidence of binding or chattering motion during rotation either with, or without, the gate arm assembled to the actuator.
- (14) The swing gates shall be designed to operate outdoors, in the climatic conditions of the City of Chicago, within a temperature range of -40°F to +120°F. Swing gate operation shall be unaffected by other environmental conditions such as dirt, dust, wind, rain, snow, salt spray, ice, or sleet. The swing gate assembly shall be designed to operate as described herein and to overcome a wind load of 80 miles per hour (MPH), a 1.3 gust factor (approximately 22 pounds per square foot), and a 0.25 Inch thick layer of Ice covering the entire gate arm.
- (15) Each Swing Gate unit shall be equipped with all features and elements herein specified and new items as recommended by the Swing Gate Vendor to achieve the specified performance.

**Materials.** Swing gates shall be manufactured according with equipment that conforms to the following requirements.

- (a) Gate Actuator Transmission and Crank Arm Assemblies.
  - (1) The gate actuator shall include but not be limited to a worm gear transmission with a double extended output shaft, reduction gears, and input shaft. The drive motor shall direct couple to the input shaft of the transmission. One of the output shafts of the transmission shall be connected to the swing gate x crank arm assembly. The second output shaft shall be used for manual cranking of the gate arm as described in Sub-Section Materials (x) - Manual Operating Requirements (Hand Cranking).

- (2) The gate actuator transmission shall transfer the torque to the gate arm capstan via a linkage of the crank arm assembly, which shall consist of two crank arms, and an adjustable connecting rod having self-aligning ball ends. The crank arm assembly shall be factory pre-set for the specific gate location and gate arm angle. All linkage components shall be heavy-duty and shall permit field adjustment of the rotation of the gate arm from -5 degrees to 95 degrees of rotation.
  - (3) The gate actuator transmission shall be a totally enclosed unit designed and built for the required service. Gears shall conform to the requirements of AGMA and shall be oil bath lubricated with lightweight oil as applicable for the design temperatures. The transmission housing shall include, but not be limited to an oil fill plug and an oil drain plug. These items shall be located for easy access, from the ramp side access door during routine inspection and maintenance of the mechanism, without removing the housing or other components.
  - (4) The connecting rod shall be fabricated from ASTM A311 Class B high strength steel.
  - (5) The gate actuator shall incorporate sine wave motion to accelerate the gate arm smoothly from zero to maximum velocity at mid-stroke and then decelerate smoothly to zero velocity at full stroke. The drive shall be designed to rotate the gate arm through 90 degrees within 15 seconds and shall be capable of reversing of the direction of rotation from any point.
- (b) Gate Arm Capstan and Mounting Bracket.
- (1) The gate arm capstan shall be composed of two rotating shafts and one stationary support stanchion (tube) in a "shaft within a shaft" design.
  - (2) The inner rotating shaft shall transfer the torque and rotary motion from the gate actuator crank arm to the outer rotating shaft which supports the gate arm. The upper end of the inner shaft shall extend through a flange bearing which is bolted to a support plate integral with the frame. Above the crank x arm connection, the bearing shall be connected to the shaft with a Nyloc type set-screw. Spare setscrews shall be provided in the box provided for spare shear pins. Self-lubricating, oil impregnated, radial bronze bushings shall be used to maintain concentric alignment of the inner shaft relative to a stationary support tube. The upper end of the shaft shall extend past the bearing to provide for the gate position sensors as described in Sub-section (h), Control Device Requirements.

- (3) The torque and rotary motion shall be transmitted between the inner and outer shafts through a shear connection consisting of two adjacent circular plates of identical metallurgical composition located at the bottom of both shafts. The plates shall be linked by shear pins. The shear pinholes in the plates shall match each other in only one position. Alignment holes shall be provided in both plates to assist shear pin replacement. The adjacent faces of the shear plates shall be ground to a smooth finish and coated with Teflon pipe thread compound or similar material, as approved by the Engineer, to minimize friction and corrosion between the plates.
- (4) The inner rotating shaft shall be fabricated from ASTM-A193-87 solid alloy steel, turned, ground, polished, and machined as required, with a nominal outside diameter of not less than two inches. The upper end shall be connected to the crank arm using a key and two double set-screws placed 90 degrees apart (one cone point and one set point over top the cone point). The assembly to support the shear pins shall incorporate keys, rings, or other method approved by the Engineer, at the lower end of the inner shaft.
- (5) The stationary support tube shall be rigidly attached to the swing gate frame and incorporate a "keeper collar" to support both the support tube and the outer rotating shaft. The keeper collar shall be bolted through the support tube and into the frame of the Swing gate. Self-lubricating, oil impregnated, radial bronze bushings shall be located on the exterior at both ends of the support tube to maintain concentric alignment of the outer shaft and the support tube. A self-lubricating, oil impregnated, bronze thrust bushing shall be located inside the keeper collar where the outer rotating shaft is supported, to maintain a smooth surface upon which the outer shaft shall ride.
- (6) The stationary support tube shall be fabricated from ASTM-A519 steel alloy, machined as required, with a nominal outside diameter of not less than 4.5 inches and a wall thickness of not less than 0.5 inches; it shall be rigidly bolted to the frame of the swing gate using ASTM A-325 bolts, nuts and washers.
- (7) The outer rotating shaft shall be supported from the keeper collar of the support tube and shall extend to the shear plate of the inner rotating shaft. The gate arm mounting bracket shall attach to the exterior of the outer rotating shaft as described below.
- (8) The outer rotating shaft shall be fabricated from ASTM-A519 steel alloy seamless tubing, machined as required with a nominal outside diameter of not less than six inches and a wall thickness of not less than 0.5 inches. A circular steel plate shall be fabricated from ASTM A656 GR80, welded to the lower end of the outer rotating shaft and have the shear pin mounting holes drilled and reamed. The shear pinholes shall match the holes for the inner shaft in only one position. Another circular steel plate (ASTM A656 GR80) shall be welded to the upper end of the outer shaft to transfer all axial loads into the swing gate frame via the thrust bearing.





- (9) The gate arm mounting bracket shall be fabricated from ASTM A36 steel not less than 0.25 inches thick. The bracket shall be fabricated in two halves and shall be hot dip galvanized after complete fabrication. The halves shall be bolted together with a minimum of eight, 0.5 inch diameter, ASTM A325 bolts. Type 1 or 2. The bracket shall be clamped to the outer shaft of the capstan. The frictional force developed in the clamped connection shall be sufficient to hold the gate arm in position and resist all live and dead loads imposed on the gate arm. A Teflon gasket shall be provided and installed at the end of the bracket, where the aluminum gate arm assembly attaches to the bracket, to isolate the dissimilar metals.
  - (10) An adjustable disc shall be attached to the swing gate inner rotating shaft. Adjustable position sensing limit switches shall be used to stop the drive motor at the gate arm extended and retracted positions (ramp closed and ramp open) as described in Sub-section (h) Control Device Requirements.
  - (11) A second adjustable disc shall be attached to the swing gate outer rotating shaft. Adjustable position sensing limit switches shall be furnished and installed to provide a control input for monitoring the gate position to -10 degrees of fully extended and +10 degrees of fully retracted by the remote control system as described in Sub-section (h) Control Device Requirements.
- (c) Gate Arm Return Device.
- (1) A minimum of two shear pins shall be installed to develop a shear plane between the inner and outer shaft of each unit. The shear pins shall be sized to fail at the design strength of material for the gate arm, before damage can occur to the gate actuator as a result of a vehicle striking its gate arm, as described below.
  - (2) The shear pins shall be designed for easy rapid, reinstallation or replacement by one person with no welding or special tools required. All shear pin holes shall contain hardened steel bushings with shoulders of the bushings installed in the opposite sides of the plates from the shear point. The shear pins shall be grooved to achieve a shear point diameter of not more than one-half the diameter of the pin. Each pin shall be notched at one end and locked in shear position by a keeper plate.
  - (3) The Swing Gate Vendor shall provide certification and calculations, as part of the shop drawings, to show that the shear pins meet the following design criteria:
    - i. Resist the live and dead loads imposed on the unit during operation.
    - ii. Allowable shear of the pins to be sized for the design strength of the gate arms as defined in Subsection (g) Swing Gate Arms.
    - iii. Impact of a 1400 pound vehicle traveling at 35 miles per hour shall cause the pins to shear below the yield strength of the gate arms.

- (4) Three additional sets of extra shear pins shall be provided for each swing gate unit. The shear pins shall be stored in a rigid, non-metallic, resealable container located inside the housing. The container shall be permanently and plainly labeled and mounted on the inside of the swing gate housing.
- (5) A positive, field adjustable, mechanical stop shall be incorporated into the design of the gate arm rotating shaft to prevent the gate from rotating past its normal ramp-closed position under all conditions. The adjustable stop shall be a two-piece collar type design, bolted together to form a compression type fitting around the outside of the rotating outer shaft, and include a fixed plate welded to the structural frame. The two-piece collar shall also incorporate two set-screws, 90 degrees apart, drilled and tapped through the collar and into the outer shaft. The outer shaft shall have pre-set holes drilled at 5 degree Increments around the shaft (from 45 to 90 degrees), which shall match one of the set screws and provide positive adjustment and locking of the stop. This stop shall be an Integral part of the swing gate assembly and shall not be a part of, nor a function of, the brake assembly.
- (6) A permanent non-adjustable stop shall be incorporated into the design as a fail-safe mechanism to prevent over-rotation of the gate arm past 90 degrees. The stop shall be a fixed, two-piece, positive stop, with one piece welded to the structural frame and the other piece welded to the outer shaft of the capstan. All units shall have the stop located in the same relative position. A single stop, capable of providing the functions, may be provided subject to approval by the Engineer.

(d) Support Frame.

- (1) The frames shall be rigid structural weldments designed to withstand all operating loads imposed upon them by the swing gates and shall transfer the loads into the barrier walls via the anchor bolts.
- (2) The support frame for the swing gate assembly shall be fabricated from ASTM A36 structural steel shapes and plates using standard structural shapes to the maximum extent possible. All steel used in frame fabrication, including the component mounting plates, shall be at least 0.375 inches thick.
- (3) The configuration of all frames shall provide a rigid frame support for mounting additional items as described in Housing and Operational Warning Signs.
- (4) The frames shall be drilled to match the anchor bolt patterns shown on the Contract Drawings with slotted anchor bolt holes, one inch diameter by two Inches long, to allow for field positioning. The anchor bolt pattern shall match the existing anchor bolt pattern.

- (5) Ease all exposed edges to a radius of 1/32 inch or more. Corners, seams, and joints shall be welded continuously and shall comply with requirements specified in Sub-section y-Welding. Welding flux shall be removed immediately, and all exposed welds and surfaces shall be cleaned and ground to remove all scale, burrs, and sharp edges. Joints that may be exposed to the weather shall be fabricated to prevent the accumulation of water, dirt, and ice.
- (6) The frames shall be complete with all mounting requirements for installation of the gate actuators, controls, housing, and remote I/O panel. Mounting plates shall be accurately drilled to match the components mounted. Torch-cut holes are not acceptable. The frames shall be hot dip galvanized after fabrication.
- (7) The frame shall incorporate removable lifting attachments lugs) for use during initial installation and for subsequent maintenance of the swing gate assembly.
- (8) The lifting lugs shall be located on the top of the swing gate housing, as generally shown on the Contract Drawings, and shall be either stainless steel or galvanized to protect the lifting attachments from the elements. The threads of the lifting lugs shall penetrate the housing and engage threaded members welded to the support frame.
- (9) The lifting lugs shall be removed after installation and stored inside the swing gate housing in a rigid, non-metallic, re-sealable container, mounted to the inside of the swing gate housing.
- (10) Stainless steel bolts with watertight gasketed washers shall be provided with each unit to seal the lifting lug housing penetrations and to achieve an uncluttered appearance upon removal of the lifting lugs.
- (11) A stainless steel bottom plate, not less than 12 gauge thickness, shall fit against the bottom of the support frame to cover the opening in the top of the barrier wall at the location of the swing gate insert. Within the confines of the support frame the bottom plate shall cover the entire top area of the swing gate insert, not already covered by the swing gate cover plate, and extend to the capstan end of the frame. Vertical lugs, welded to the upper side of the bottom plate, shall be used to secure the plate against the bottom of the support frame angles by bolting through the lugs and the vertical legs of the angles on three sides of the frame. The bottom of the support frame will vary between 0.875 and 1.75 Inches above the top of the swing gate insert frame. Provide an adjustable 12 gauge stainless steel skirt, extending the full width of the housing, to close the gap between the bottom plate and the top of swing gate insert. This skirt shall be located along the one edge of the bottom plate which has no support frame angle to fit against. The bottom plate and skirt shall be designed to exclude vermin, .to prevent the accumulation of ice, snow, and water within the housing, and to provide safety and security. The bottom plate shall fit as closely as possible around the gate arm capstan. The Swing Gate Vendor shall submit design details for review.

(12) A stainless steel plate (full depth, shelf), not less than 12 gauge thickness, shall be installed 36" above the bottom plate, and secured to the support frame to separate the remote I/O panel components above from the equipment below respective shelf. Separate openings shall be provided in the shelf for the 120V ac control wiring and fiber optic cable coming from the conduits embedded in barrier and for the control wiring between the remote I/O panel and the gate motor control. The penetrations shall have no sharp edges and shall be 1 ½" diameter each.

(e) Housing:

- (1) The housing for the swing gate unit shall be fabricated to accurately fit over the support frame and bolt to the frame to form a weatherproof enclosure to prevent the accumulation of dust, dirt, water, ice, snow and prevent the entrance of vermin. The housing shall be removable and incorporate a positive locating design to facilitate positioning of the housing on the frame. Access doors shall be provided on three sides of the housing to provide maintenance access to each component within the enclosure. The housing shall be 60" x 60" x 18".
- (2) Housings shall be fabricated from Type 302, or approved equal, stainless steel sheets of not less than 12 gauge thickness. Welding flux shall be removed immediately, and all exposed welds and surfaces shall be cleaned to remove all scale, burrs and sharp edges. All exterior welds and surfaces shall be ground smooth and blended to remove all roughness.
- (3) Each housing shall have two large gasketed doors on the roadway side of the housing and one access door at each end of the housing to provide access for routine maintenance and for servicing of the swing gate assembly. The doors shall be fabricated from the same material as the housing, with a stamped raised frame/flange for rigidity, and be neoprene gasketed. Housing openings and doors shall be reinforced to eliminate deflection. The center support frame between the two doors shall be removable to provide access for removal of the remote I/O panel, the actuator transmission and crank arm assemblies. An interior LED top panel light shall be installed with a door actuated switch, such that when the roadway side doors are open, the LED light will be on.
- (4) Doors shall be hung using bronze slip-off hinges with stainless steel hinge pins and incorporate a three point door latch with provision for padlocking, and hold-open linkage. The two access doors on the roadway side of the unit shall be provided with heavy duty brass padlocks; all padlocks shall be keyed alike, and each swing gate unit shall be provided with two keys. The two access doors at each end of the unit shall be opened from the inside of the unit. With access doors closed no portion of the housing including its latches and locks, may extend beyond the face of the barrier wall. In their open position, access doors may extend past the face of the barrier wall.

- (5) Each housing shall have a port opening fitted with a hinged cast stainless steel cover held normally closed by gravity. The port opening shall be aligned with the extended output shaft of the transmission to permit inserting the shaft of a hand crank through the opening and onto the end of the extended output shaft. Brackets shall be provided. Within the housing, upon which to store the crank when not in use.
- (6) Housing for the first 3 gates at each ramp shall have a 3/4" diameter opening on the approaching traffic direction side for connection to the chevron sign, as shown on the Contract drawings.
- (7) The roof of housing shall be pitched and shall be covered with a slanting solar shield top to prevent build-up or ponding of water.
- (8) Each housing shall completely enclose the support frame and anchors bolts. The two end doors shall provide access to the anchor bolts for installation and maintenance of the unit.
- (9) Identification.

The Contractor shall furnish and install the identification labels on each gate housing immediately upon setting and anchoring of the unit. The location of the labels shall be as directed by the Engineer.

Each housing shall bear a unique, four digit, alphanumeric, identification code based upon its location on the expressway. The code for each housing, and its position on the ramp, shall begin with the ramp identifier and be followed by a sequential number assigned to each housing as shown on the Contract Drawings. The following ramp identifiers shall be used:

Code	Ramp Location
IE	Inbound Edens
IW	Inbound Kennedy West Leg
IS	Inbound Slip Ramp
OS	Outbound Slip Ramp
OM	Outbound Kennedy Main Line
OO	Outbound Ontario Street

The letters and numerals shall be composed of individual, black series 'D' as described in the Federal Highway Administration's "Standard Alphabets for Highway Signs", screened onto silver-white, pressure sensitive, reflective, sheeting as described under Section T 602.01 "Reflective Sheeting" in the Illinois Department of Transportation's publication "Standard Specifications for Traffic Control Items" adopted January 1, 2017. Prior to application of the sheeting, the receiving surface shall be cleaned and dried as directed by the supplier of the Reflective Sheeting.

(f) Actuator Drive Motors.

- (1) The drive motors shall be flange mounted to their transmission cases. The motors shall be double extended shaft type, suitable for harsh environment use, as specified herein. An electric, solenoid released, motor brake shall be mounted to the other end of the motor.
- (2) Motors shall be squirrel cage induction type, 460 volts, 3-phase, 60 Hertz, High Slip, High Torque (NEMA design D), Totally Enclosed Non Ventilated, and shall have Class F insulation. Horsepower rating shall be not less than twice that calculated by the Swing Gate Vendor to meet specified design parameters. Motors shall be capable of operating the driven equipment over the full range of operating load conditions without exceeding the nameplate rating. Motors shall be flange mounted, attached to the transmission with at least four bolts, and shall be of the Instant reversing type to permit reversing the movement direction at any point of travel.
- (3) The ratings, characteristics, materials, and construction of electric motors shall be in accordance with the latest applicable standards of ANSI, IEEE, and NEMA. The manufacturer's certification of the preceding shall be provided as a part of the submittal data.
- (4) Submittal data shall include complete manufacturer's specifications and descriptive bulletins for all equipment, size, capacity, description and make of motor. Motor data shall include the following:
  - Manufacturer
  - Nameplate Rated Horsepower
  - Rated Voltage
  - Full Load RPM
  - Full Load Current
  - NEMA Design Letter
  - NEC Code Letter or Inrush Current
  - Insulation Class
  - Service Factor
  - Recommended Starting Restrictions, including Allowable Starts Per Hour
  - Design Load Calculations
- (5) The motor shall be equipped with an electric solenoid actuated type brake which shall automatically release when the gate arm starts to move out of position under power and shall automatically set when the gate arm reaches the opened or closed position. The brake shall have the same operating voltage rating as the drive motor. A means shall be provided to mechanically release the brake, In the case of control power failure, to permit use of the hand crank for manual operation. The solenoid brake shall be sized to hold the gate arm in position under the forces produced by the wind loads.

- (6) Motor bearings shall be designed to withstand all axial thrust from the driven equipment.
- (g) Controls – General.
- (1) The local controls for the swing gate mechanism shall be coordinated with the PLC manufacturer and supplier of the remote PLC cabinets. Each swing gate shall be complete with local controls consisting of, but not limited to the following:
    - i. Main Motor Circuit Protector with Auxiliary Contacts
    - ii. Control Power Transformer
    - iii. Motor Overloads with Auxiliary Contacts
    - iv. Reversing Starter - minimum NEMA size 1
    - v. Spring clamp style Terminal Blocks for both AC Voltages
    - vi. 120 Volt AC Coil, Remote Control Relays
    - vii. Limit Switches - Cam Actuated
    - viii. Limit Switches
    - ix. Proximity Switch - two piece magnet actuated
    - x. "Remote Control/Local Manual Control" Maintained Contact Selector Switch
    - xi. "Manual Open/Remote Control/Manual Close" Spring Return Selector Switch
    - xii. "ON/OFF Maintained Contact Rotary Pilot Switch
    - xiii. Circuit Breaker for the 120 VAC Control Power.
    - xiv. LED's for control indication.
  - (2) All electrical components furnished shall be NEMA rated, U.L listed, readily available products of a national, USA manufacturer. Similar components shall be of the same manufacturer.
  - (3) The entire local control system is to be serviceable from the roadway side of the unit. The local controls shall be enclosed within the swing gate housing and contained within a separate, self-supporting, single lever latch type NEMA 4X, enclosure. The enclosure shall not attach to the swing gate housing, but shall be attached to the swing gate housing support frame. All selector switches shall be mounted on the hinged door of the NEMA 4X enclosure which shall mount inside of the swing gate housing. Switches shall be NEMA 4/13 type and Installed with suitable gasketing to retain the NEMA 4 rating.
  - (4) The local controls shall permit valid automatic operations to resume after manual positioning of the gate arm or switching from manual to automatic operation without requiring on-site resetting of the gate arm.

- (5) All wiring shall be through the use of spring clamp style terminal blocks and all control wires shall terminate in these blocks. Each terminal shall be clearly labeled (number or alpha-numeric), and all wires shall be color coded based on their connected voltage. The wire numbers for the Interconnection points to the remote control system shall be the same as shown on the Contract Drawings. The wiring diagram shall identify all colors and wire numbers. Wire all auxiliary contacts to the terminal block to permit transmission of the selector switch settings to the remote control system.
  - (6) Where number of wires are trained through a box or wired to a hinged cover, they shall be grouped by circuit where applicable, bundled using appropriate cable ties, and supported to minimize pressure or strain on the cable insulation.
  - (7) Wire all selector switches, limit switches, auxiliary contacts, etc., including spare devices, to the terminal block.
- (h) Motor Circuit Protector:
- (1) The local controls at each swing gate shall include a three-pole motor circuit protector (MCP) for the Incoming three-phase 480 volts rated as per manufacturer's recommendation.
  - (2) Located inside of swing gate housing shall be a three-pole incoming MCP power circuit breaker with a normally open (N.O.) auxiliary contact to close on a "Trip" or "OPEN" position. Contacts shall be rated not less than 0.5 amperes at 120 VAC.
  - (3) Motor circuit protectors shall be manually operated and have a magnetic trip level adjustment. Trip ratings shown on the Contract Drawings are approximate and the trip rating provided shall be as recommended by the device manufacturer for the characteristics of the motor.
  - (4) Motor circuit protectors shall be rated for an available fault current of 65,000 RMS symmetrical amperes.
- (i) Control Power Transformer: Control power transformers shall be not less than 500 VA continuous duty and rated at 480V - 60 Hz primary to 120V single phase secondary. The control power transformer shall have a primary fuse and a circuit breaker secondary sized adequately for the starter and all connected control devices. Control transformers shall be NEMA type AA, dry, with a temperature rise not to exceed 55 degrees C above a 40 degrees C ambient temperature at continuous rated load. Data submitted for approval shall include starter coil load data and total VA rating of control transformer.



(j) Reversing Starter:

- (1) Provide a reversing starter that is mechanically and electrically interlocked and rated for 480 Volts, 3 phase power, in a minimum NEMA size 1 configuration.
- (2) Starters shall be sized for the motor to be connected, but shall not be smaller than NEMA size 1. Starter size shall be carefully coordinated based on the motor characteristics of the motor to be connected and the manufacturer's starting ratings.
- (3) Starters shall be electrically operated, electrically held, with arc-extinguishing characteristics and renewable silver-ta-silver contacts. Each starter shall have an overload relay.
- (4) As a minimum each starter shall be equipped with two SPDT auxiliary contacts, with the N.C. contacts wired in as coil clearing contacts, In addition to the forward and reverse seal-In contacts. Provide two additional DPDT auxiliary contacts, one in each direction, as spares.
- (5) Provide an automatic reset non-compensated thermal overload relay with 480 V, 5 amp continuous duty contact rating. Provide additional auxiliary electrically isolated contacts rated at 120 VAC, 5 amp continuous duty, one normally closed in motor control circuit and one normally open for monitoring by the Programmable Logic Controller. Relay shall have three type B heater elements sized as required for the motor HP rating.
- (6) Motor control circuit shall operate at 120 volts derived from control transformer.

(k) Terminal Blocks:

- (1) Terminal blocks shall be heavy duty corrosion resistant spring clamp style type rated at 600 volts AC. AC voltages shall be connected to color coded terminal blocks, separated and electrically isolated from each other. AC terminal housing shall be gray.
- (2) Terminal block housing shall be manufactured from nylon capable of long term exposure of -40 degrees F to 180 degrees F, and all terminals shall be capable of terminating #22 through #4 AWG stranded or solid wire.
- (3) The current carrying metal body characteristics shall be as follows:
  - i. Modular design and construction.
  - ii. Manufactured from a minimum of 85% copper alloy.
  - iii. 100% nickel plated.
  - iv. Have wire guides on base body.
  - v. Achieve "gas tight termination, as wire is clamped into "serrated" metal body.
  - vi. Have center bridgeable
  - vii. Have no less than 3 milli-ohms of contact resistance.

- (4) The terminal blocks shall be as manufactured by Phoenix Contact or approved equal.
- (l) 120 Volt Coil, Remote Control Relays (CR-1, CR-2, CR-3):
- (1) Provide electrically held, heavy duty relays rated at 300 V with a minimum of two normally open (N.O.) and two normally closed (N.C.) independent electrically isolated contacts. The relay shall be hermetically sealed, with convertible, high reliability contact rating of not less than 5 amperes resistive. Contact ratings shall be NEMA A300 AC, as per Contract Drawings.
  - (2) Control Relay (CR-1), Located in the gate control enclosure. Interface AC relay to allow remote ramp opening of the gate (PLC control or manual control from the Remote Control Building).
  - (3) Control Relay (CR-2), Located in the gate control enclosure. Interface AC relay to allow remote ramp closing of the gate (PLC control or manual control from the Remote Control Building).
  - (4) Control Relay (CR-3), Located in the gate control enclosure. Interface AC relay to allow remote PLC control of chevron sign. Shall be installed in each swing gate unit and connected in only selected swing gates.
  - (5) Relays shall be as manufactured by Allen Bradley catalog #700-P or as approved by the Engineer.
- (m) Limit Switches - Cam Actuated (LS-5, LS-6, & spare LS-7, LS-8):
- (1) The gate cam actuated limit switch shall be a unit assembly containing a minimum of 4 individual switches each having one SPDT set of contacts. Contacts shall be totally enclosed and shall have a U.L rating of not less than 15 amperes at 120 volts AC. Each individual switch shall be controlled by an independent cam, which shall be adjustable with a single set screw. The limit switch body, cams and shaft shall be of corrosion resistant non-ferrous materials.
  - (2) The multiple cam position sensor assembly shall be operated from the drive transmission. Two of the switches normally closed (N.C.) (LS-5 & LS-6) shall function as motor overtravel limit switches. The other two switches shall be spares. Switches which are of different voltage type shall be isolated through the use of a spacer Inserted between the switches.
  - (3) Each switch shall be operated by an independent cam. The cams shall be position adjustable through 360 degrees of rotation. The signals from these position sensors shall de-energize the starting coils to the motor.

- (4) Cam Limit Switches shall be installed as shown on the Contract Drawings and as herein specified:
  - (5) Limit Switch LS-5 with one normally closed (N.C.) contact located on the retract cam position opens and disconnects power to the retract starting coil when the drive travels past the retract position (indicates a broken chain on the cam).
  - (6) Limit Switch LS-6, with one N.C. contact located on the extend cam position opens and disconnects power to the extend starting coil when the drive travels past the extend position (indicates a broken chain on the cam).
- (n) Standard Enclosed Limit Switches (LS-1A-1B, LS-2A-2B, LS-3, LS-4, LS-9):
- (1) Standard Enclosed Limit Switches shall be NEMA 4 as required for outdoor installation (-40 to +180 degrees F). Limit switches shall be heavy duty, Industrial type, oil and water tight, with a minimum 10 amps, 120 volt AAC rating, and rated for one million operations. No electronic switches shall be used.
  - (2) Standard Enclosed Limit Switches shall be installed as shown on the Contract Drawings and as herein specified:
  - (3) Standard Limit Switch LS-1, with one normally open (N.O.) (LS-1A) and one normally closed (N.C.) (LS-1B) independent electrically isolated contacts, located on gate arm inner rotating shaft. LS-1A contact is held closed when the gate is NOT in the retract position. When the gate arm moves to the retracted position (ramp open), the held closed N.O. LS-1A contact opens and disconnects power to the retract starting coil. And the held open N.C. LS-1B contact closes signaling the Programmable Logic Controller that the Crank Arm is in the retracted (ramp open) position.
  - (4) Standard Limit Switch LS-2, with one N.O.(LS-2A) and one N.C.(LS-2B) independent electrically Isolated contacts, located on gate arm inner rotating shaft. LS-2A contact is held closed when the gate is NOT in the extent position. When the gate arm moves to the extended position (ramp closed), the held closed N.O. LS-2A contact opens and disconnects power to the extend starting coil. And the held open N.C. LS-2B contact closes signaling the PLC that the Crank Arm is in the extended (ramp closed) position.
  - (5) Standard Limit Switch LS-3, with one N.C. contact, located on the gate arm outer rotating shaft. LS-3 is held open when the gate arm is NOT in the retracted position. When the gate arm moves to the retracted position, the held open LS-3 contact closes and signals the PLC that the gate arm is in the retracted position (Input to PLC constant from +10 degrees of fully retracted).
  - (6) Standard Limit Switch LS-4, with one N.C. contact, located on the gate arm outer rotating shaft. LS-4 is held open when the gate arm is NOT in the extended position. When the gate arm moves to the extended position, the held open LS-4 contact closes and signals the PLC that the gate arm is in the extended position (Input to PLC constant from -10 degrees of fully extended).

- (7) Standard limit Switch LS-9, with two N.C. Independent electrically isolated contacts (LS-9A & LS-9B), located at the hand crank opening. When the hand crank is inserted, LS-9A opens and disables the motor control circuit and LS-9B opens and disconnects signal to the PLC.
  - (8) Standard limit Switches shall be as manufactured by Allen Bradley Bulletin 802M or approved equal.
- (o) Shear Pin Monitor Proximity Switch (PRX-1):
- (1) Electrical continuity, two piece magnet actuated reed proximity switch, shall be provided between the two flanges of the gate arm rotation shaft as a means of monitoring the status of the shear pins. If the shear pins break, permitting relative rotation between the two flanges, the continuity shall be broken causing a 120 VAC signal to be Interrupted to the remote control system.
  - (2) Proximity Switch (PRX-1), Mounted between gate arm inner and outer rotating shafts. PLC Input - Shear Pin Detection.
- (p) Remote/Local Control Selector Switch (SS-1):
- (1) Selector switch shall be NEMA 4/13 heavy duty type, two position maintained contact, rated at 600 volts AC. Provide and wire auxiliary contacts to the terminal block to permit transmission of the selector switch position to the remote control system.
  - (2) Selector Switch (SS-1), located on door of swing gate local control enclosure. Two position selector switch Intended to be used for maintenance and local gate control. To allow the gate to be switched to local control (LOCAL MANUAL CONTROL), or to remote building control
- (q) Control Switch (SS-2):
- (1) Control switch shall be NEMA 4/13 heavy duty type, three position spring return to center, rated at 600 volts AC.
  - (2) Selector Switch (SS-2), located on door of swing gate local control enclosure. Three position, spring return to center, selector switch that allows (MANUAL OPEN), (MANUAL CLOSE), when SS-1 is in the -LOCAL MANUAL CONTROL-position.
- (r) Rotary ON/OFF Pilot Switch (SS-3):
- (1) Rotary Pilot switch shall be NEMA 4/13 heavy duty type, two position maintained contact, rated at 600 volts AC.
  - (2) Rotary Pilot Switch (SS-3), located on door of Swing gate local control enclosure. Two position selector switch to turn AC control power ON and OFF.

- (s) Circuit Breaker for 120 VAC control power (CB-3):
- (t) A two-pole, 5 amperes, 240 volt circuit breaker shall be provided on the secondary power feed, for the control power transformer TR1.
- (u) LED's:
  - (1) Provide high intensity, long life (10 year average) solid state LED cartridges with built-in resistors/rectifiers rated for 120 VAC. Mount LED's in a grouped configuration into the NEMA 4 cabinet as shown on the Contract Drawings.
- (v) Wiring for Power and Control. All wire shall be minimum number 14 AWG stranded copper, type MTW, 600 V insulation.
- (w) Manual Operating Requirements (Hand Cranking).
  - (1) A hand crank shall be furnished with each swing gate to provide a means for manual operation of the gate arm in the event of a power or control failure, maintenance, or emergency operations. The hand crank shall connect to an extended output shaft from the transmission and shall require approximately 36 complete rotations to crank the gate arm 90 degrees. The crank arm shall not require more than 30 pounds of force per rotation. The following steps shall be required to position the hand crank for use:
    - (2) Open the housing access door.
    - (3) Open the port cover for crank arm.
    - (4) From outside the housing, insert the shaft of the crank through the port and onto the end of the transmission shaft. Automatically disconnects motor control circuit from operating remotely (LS-9 Opens).
    - (5) Mechanically releases brake.
    - (6) Crank the arm to the required position, until extended or retracted LED lights up, or until physical stop is reached.
    - (7) Remove the crank arm. Automatically re-energizes the control circuit (LS-9 Closes) and engages the brake.
    - (8) Replace the crank arm inside the housing, and close the access door.
- (x) Welding
  - (1) All welding of structural shapes and components shall comply with the methods and procedures defined in the AWS and as modified by the AASHTO Standard Specification.
  - (2) Circumferential welds, including top flange welds, shall be fully penetration welds.
  - (3) Longitudinal welds shall have a minimum of 60% penetration.
  - (4) The welds shall be smooth and thoroughly cleaned of flux and spatter and shall conform to standards of the American Welding Society.

## CONSTRUCTION REQUIREMENTS

**General.** The installation work shall include the procurement of swing gates and their control panels and all transportation and handling from the Swing Gate Vendor, temporary storage of the units as necessary, transportation, shipping cost and handling of the units to the installation location, all field Installation work as specified and in accordance with the Swing Gate Vendor's installation requirements, all adjustments required for the Swing Gate Vendor's installation certification, and adjustments necessary as the result of operational testing requirements as specified.

**Submittals.** The Swing Gate Vendor, shall submit the following for approval.

- (a) Material cut sheets of all proposed electrical and mechanical equipment.
- (b) Testing procedures and with test results for each new gates.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** SWING GATE, NEW will be paid for at the contract unit price per each for new swing gate furnished and installed in accordance with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications. The contract cost shall include all shipping, and testing. Storage costs are covered separately. The SWING GATE, NEW does not include the arms of varying lengths, as they will be paid for separately.

- 75 Percent of Contract price upon delivery of each unit manufactured new, tested in full and certified ready for shipment.
- 25 Percent of Contract Price of fully installed, operating and upon successful completion of local systems test.

## SWING GATE ARMS

**Description.** This work shall consist of the procurement of a Swing Gate Arm for each of the swing gates, as specified herein.

### (a) Gate Arms

- (1) Gate arms shall consist of an assembly of standardized design, standard length segmented truss structures connectors, brackets and a three-foot long flexible gate tip. Gate arm truss assemblies, as shown on the Contract Drawings and as specified shall include both the gate arm truss segments and the gate tips.
- (2) Each gate arm truss segment shall be 12 inches high and configured as generally shown on the Contract Drawings. The truss segments shall form a welded structural fabrication of 6061-T6 extruded seamless aluminum tubing having a minimum allowable yield strength of 40,000 pounds per square inch (psi). The segments shall be constructed to prevent accumulation of water within the structural tubes. The minimum allowable size of the materials shall be as shown on the Contract Drawings.
- (3) The truss segments shall be interchangeable to permit assembling the gate arms to the specified lengths. The segments shall be provided with the reflective sheeting on both sides of the truss and the stripes properly oriented to allow either side to face the traffic. Refer to Sub-section (b), Reflective Material for Gate Arms, for the type and orientation material to be used.
- (4) Each assembled gate arm shall be designed to resist the loads described herein and meet the following additional requirements:
- (5) The free end of the assembled gate arm shall not sag more than 0.75 inches, below horizontal, under its own weight.
- (6) The longest gate arm assembly, excluding the flexible gate tip, shall not deflect more than 36 inches, horizontally.
- (7) The free end of the longest gate arm assembly shall not sag more than two inches, below horizontal, when covered with ice.
- (8) The maximum allowable design stress of the gate arm shall be calculated as 60 percent of the yield strength of the material (6061-T6 extruded seamless aluminum tubing has a yield strength of 40,000 psi; therefore, the design stress of the arm shall not exceed 24,000 psi).
- (9) The gate arms shall be free of harmful harmonics and standing wave vibrations. Should any such harmonics and vibrations develop, the Swing Gate Vendor shall make all necessary corrections at his own cost.

- (10) A gate arm truss shall be connected to its mounting bracket via an aluminum connector assembly as generally shown on the Contract Drawings. The connector shall be fabricated from the same material as the gate arm truss segment and shall be bolted to the mounting bracket with stainless steel bolts, nuts and washers as described below. The attachment bracket may be shimmed, if required, to adjust for deflection caused by the weight of the gate arm assembly. The Swing Gate Vendor shall supply a shim pack, as needed, for each arm assembly. Shimming of a gate arm is limited by the physical constraints of the gate arm recess formed in the barrier wall. Whether shimmed or not, all gate arms shall completely retract into the barrier wall recess.
  - (11) The use of exterior supports or attachments (such as guy wires) to remove sag from the gate or for any other reason is unacceptable.
  - (12) Gate arms shall be connected, with an aluminum insert of the same material as the gate arm, as shown on the Contract Drawings. The Insert shall be bolted to the truss segments with stainless steel bolts, nuts, and washers as described below.
- (b) (13) The Contractor shall furnish and Install the identification labels on each arm immediately upon setting of the unit. The type and location of the labels shall match existing or as directed by the Engineer. Each gate arm shall bear a two digit sequential identification code based upon its location on the ramp as shown on the Contract Drawings. Reflective Material for Gate Arms.
- (1) Both sides of each gate arm, including both the truss and the flexible end, shall be covered with retroreflective sheeting. All sheeting requirements shall meet or exceed the standards as defined in AASHTO M 268-84, Retroreflective Sheeting for Traffic Control.
  - (2) The sheeting shall be a minimum of Type III High Intensity with pre-coated, pressure sensitive, adhesive (Class 1), diagonal alternating red and sliver white stripes as shown on the Contract Drawings, angling down at 45° from left to right. The sheeting shall be oriented to take advantage of the directional reflectivity of the material as defined by the supplier of the reflective sheeting.
  - (3) The material for this application shall be Scotch Lite D Reflective Sheeting Diamond Grade Series 3970G as manufactured by 3M, or approved equal. The sheeting shall be pre-stripped of appropriate size and width to match the application surface. The retro-reflective sheeting shall be installed strictly according to the manufacturer's instructions. Provide special attention to surface preparation and mounting of sheeting for proper bonding and adhesion.



**Method of Measurement.** This item shall be measured (counted), each, for each unit procured and shipped to the Contractor.

**Basis of Payment.** SWING GATE ARM, (X') will be paid for at the contract unit price per each for each new swing gate arm of 'X' feet furnished and installed in accordance with the following payment schedule. Other payment shall be in accordance with the Standard Specifications. The contract cost shall include all shipping, and testing. Storage costs are covered separately.

X is defined as lengths of 2', 4', 5', 6', 7', 8', 9', 10', 11', 12', 13', 14', 15', 16', 17', 18', 19', 20', 21', 22', 23'

- 50 Percent of Contract price upon delivery of each unit manufactured new, tested in full and certified ready for shipment.
- 25 Percent of Contract price upon installation including power connection and successful local test.
- 25 Percent of Contract price when fully installed and successively tested remotely with the entire system.

## **FLEXIBLE GATE TIPS**

**Description.** This work shall consist of the procurement of a Flexible Gate Tip for each of the gate arms as specified herein.

### **(a) Gate Tips**

- (1) The last three feet of the free, unsupported, end of each gate arm assembly shall have a flexible gate tip (gate tip) section bolted to the end truss segment. The gate tip shall be Model # FGE-X-OM2, as supplied by W.E Carlson Corporation, Elk Grove, IL, or approved equal.
- (2) The gate tip shall be constructed using an internal -Z' shaped stay pattern of 1.5 inch by 0.125 inch ribbed fiberglass. The covering over the stay pattern shall be a 25 ounce polyvinyl sheeting sewn around the stays. The perimeter of the gate tip shall have one inch diameter, round, closed cell foam sewn into its top, front, and bottom edges and enclosed with the 25 ounce polyvinyl. The gate tip shall be supported and connected to the gate arm truss segment with two, back to back, structural aluminum angles, each 1.5 by 2.0 by 0.25 Inches. Spacers may be required to support the gate tip between the support angles. Refer to the Contract Drawings for additional information.
- (3) The gate tip shall be capable of repeatedly withstanding glancing blows, without fracturing or shattering, from vehicles weighing up to 4500 pounds and traveling at speeds up to 55 miles per hour. This capability shall be demonstrated based upon the tests as mutually agreed upon between the Swing Gate Vendor and the Engineer.

- (4) The gate tip shall be rigidly mounted to the gate arm, as shown on the Contract Drawings and shall resist the design loads.
- (5) The gate tip shall resist the stated wind pressure and remain in a vertical position without twisting about the horizontal axis. Deflection about the vertical axis is permissible, but the gate tip shall not have a noticeable deflection under normal operating conditions.
- (6) The gate tip shall deflect in the direction of travel of the vehicles striking it; when no longer in contact with the striking vehicles, it shall automatically return to its original position. It shall also be sufficiently soft and flexible to minimize damage to vehicles.
- (7) The gate tip shall be unaffected by dirt, rain, sleet, snow, salt spray, ice, extremes of weather temperatures, and solar radiation and shall pose no threat to the environment. The gate tip shall not become brittle, crack, or be affected by the effects of UV radiation. Gate tips shall be designed to have a useful service life of not less than five years.
- (8) The gate tip shall have a series of diagonal reflective strips sewn to both faces. The diagonal striping shall extend the length of the face as shown on the Contract Drawings. Refer to Sub-section (b) Reflective Material for Gate Arms for the type of reflective material to be used.
- (9) Flexible gate tips shall be connected to the end truss segment using the connector assembly as shown on the Contract Drawings. The assembly, truss segment, and gate tips shall be bolted together with 0.5 Inch diameter stainless steel bolts, nuts, and washers. One washer shall be placed under the bolt head and a lock washer shall be placed under the nut. The nuts and bolts shall be hand tightened until snug and further tightened with a wrench a minimum of 1/2 turn of the nut.

**Method of Measurement.** This item shall be measured (counted), each, for each unit procured and shipped to the Contractor.

**Basis of Payment.** FLEXIBLE GATE TIPS, will be paid for at the contract unit price per each for each new flexible gate tip furnished and installed in accordance with the following payment schedule. Other payment shall be in accordance with the Standard Specifications. The contract cost shall include all shipping, and testing.

- 80 Percent of Contract price upon delivery of each unit manufactured new, tested in full and certified ready for shipment.
- 20 Percent of contract price when fully installed and in operation.

## RESTRAINING BARRIER FOUNDATION

**Description.** This work shall consist of the inspection, design, removal, and installation of a foundation to support the proposed restraining barrier.

**Inspection.** The Contractor shall inspect the existing restraining barrier foundation to establish if the foundation can remain in place or structural repairs are required. An inspection report shall be submitted to the Engineer outlining condition of the foundation and recommended repairs. If no repairs are required, the inspection report shall be sealed by an Illinois Licensed Structural Engineer.

**Design.** The design of the structural repairs will be required if structurally repairs are deemed appropriate by an Illinois licensed Structural Engineer during the inspection phase. The Contractor shall submit engineering drawings outlining the removal, installation, and restoration of barrier wall foundations. The structural repair submittal must include maintenance of traffic. The design shall follow IDOT Standard Specifications Division 500 applicable to the foundation. Drawings shall be submitted at the preliminary and final stages. Final drawings must be sealed by a licensed Illinois Structural Engineer.

The design of the proposed foundation must fit within the footprint of the existing foundation. Anticipated level of effort is as follows. The existing foundation design is shown in the plans a For Reference Only.

- Existing steel caissons are anticipated to remain in place
- Existing 6' x 16' footing is anticipated to remain in place
- Existing Concrete wall vertical 6' (wide) x 16' (long) x variable depth shall be modified to accommodate the following
  - New anchor bolts, nuts, and washers
  - Removed concrete and steel reinforcement to install required new elements.
  - New stainless steel angles
- The proposed foundation shall match existing elevation of the roadway and barrier wall elevations.
- Existing conduits in the bottom of the wall shall be maintained (see below).
- The steel plate beam will be removed and replaced and paid for separately.

**Installation.**

**Concrete Removal.** The Contractor shall remove concrete according to Article 503.03 and the following.

**Chipping Hammer** – The chipping hammer for removing concrete shall be a light-duty pneumatic or electric tool with a 15 lb. (7 kg) maximum class or less.

Existing conduits not damaged are intended to remain in operation and be maintained through the repaired median barrier wall.

The Contractor shall have a maximum of 14 calendar days to complete each repair location with concrete, once concrete removal has started for the repair.

**Surface Preparation.** Prior to placing the concrete, the Contractor shall prepare the repair area and exposed reinforcement by blast cleaning. The blast cleaning shall provide a surface that is free of oil, dirt, and loose material. The area between existing median barrier wall and the repair shall be saw cut to achieve a flat surface.

Any standing water shall be removed.

All new concrete shall be placed within 3 calendar days of the surface preparation or the repair area shall be prepared again.

**Maintaining Existing Conduits/Cables.** Active fiber optic, electrical, intelligent transportation system and lighting conduits may pass through each barrier foundation. The design shall seek to maintain the existing conduits through the removal and installation process. If conduit removal is required to construct the restraining barrier foundation, the conduits and associated cables must be restored. If approved by the engineer, inactive cables do not have to be restored. All active cables will require temporary mitigation to maintain functionality during repairs. Conduit and cable removal and installation, including any temporary mitigations will be considered incidental to this item.

**Restoration:** Contractor must restore shoulder, pavement, and retaining wall to the satisfaction of the Engineer.

**Method of Measurement.** This work will be measured for payment as each. The Contractor shall bid this item based on the costs to repair the restraining barrier foundation as outlined in this special provision. The method measurement is based on the results of the inspection and level of installation work completed. The level of effort associated with this item cannot alter the contract end date or delay the start of liquidated damages.

**Basis of Payment.** RESTRAINING BARRIER FOUNDATION will be paid for at the contract unit price per each new foundation inspected, designed, and repaired.

If the foundation is deemed to be structurally sound and can support to support the proposed restraining barrier.

- 10% of the Contract price upon approval of inspection and structural certification of the existing foundation.
- No further payment will be made on foundations to remain

If the foundation is to be structurally repaired.

- 10 Percent of the Contract price upon approval of inspection and submittal of the inspection report
- 15 Percent of Contract price following approval of foundation design.
- 75 Percent of Contract Price upon the completion of the foundation repair.

## **RESTRAINING BARRIER**

**Description.** This work shall consist of the design, manufacture, testing and installation of new vehicle arresting (restraining) barriers to replace the existing barriers on the current REVLAC system.

The Vehicle Arresting Barrier is used to prohibit motor vehicles from entering a closed highway. The Vehicle Arresting Barrier must safely decelerate and stop a vehicle in accordance with NCHRP 350 guidelines, The Restraining Barriers shall be designed to safely stop vehicles weighing between 1,800 and 15,000 pounds, moving at a velocity of 55 miles per hour, without exceeding the deceleration rates (gravitational units, G's) and stopping distances shown in the following table.

(a) Vehicle Weight (Pounds)	(b) Vehicle Velocity (MPH)	(c) Stopping Distance (Feet)	(d) Deceleration Maximum Rate G's
(e) 1,800	(f) 55	(g) 29.8	(h) 10.8
(i) 4,500	(j) 55	(k) 64.8	(l) 2.8
(m) 15,000	(n) 55	(o) 174.7	(p) 0.86

The table is based on a released accelerator and no application of the vehicle's brakes at the moment of impact.

The Vehicle Arresting Barrier includes, but is not limited to the following:

- Vehicle restraining mechanism
- Structural frame
- Lifting mechanism
- Local controls

(a) Functional Requirements.

- (1) The Vehicle Arresting Barrier includes a vehicle restraining mechanism to decelerate and stop errant vehicles. The restraining mechanisms consist of, as a minimum, two energy-absorbing devices on either side of a restraining net. The devices travel with the lifting-lowering mechanism to open or close a road and have bi-directional vehicle stopping ability. The restraining net has high strength impact capacity and has a reflective stop sign attached to both sides of the net. The net entraps the vehicle and transfers the force of the impact to the energy-absorbing devices.
- (2) Each Restraining Barrier shall consist of a vehicle restraining mechanism, a structural frame with a lifting-lowering mechanism, and local control devices. The new barriers shall be installed at the same location and use the existing foundations and anchor bolt system.
- (3) Unless otherwise indicated, all Restraining Barriers shall be of uniform design and construction except for the adaptive requirements of each location (span of the net and height and span of the structure) as generally shown on the Contract Drawings. The restraining barrier shall incorporate a vehicle restraining mechanism which has an established FHWA approval for vehicle arresting application on Federal highway projects. The application of the restraining barrier for this project shall be consistent with the use for which it received FHWA approval.

- (4) The structure used to support the restraining and lifting-lowering mechanisms must be capable of withstanding all operating loads placed upon them, to include load transferred by the impact and deceleration of a bus, by the lifting-lowering mechanism, and by loads generated by environmental conditions.
- (5) The Barrier Vendor shall furnish the Restraining Barriers as complete operable assemblies in the quantities shown on the Contract Drawings. The work shall include, but not be limited to, furnishing all labor, material, and equipment required to design, engineer, detail, fabricate, assemble, paint, shop test, and deliver the Restraining Barriers described herein plus the installation support specified and required to assure a proper installation. Material storage, after fabrication, testing and inspection, prior to delivery to the installation site, is described separately.
- (6) The lifting-lowering mechanism is an electro-mechanical device used to lift and lower the restraining mechanism. This mechanism consists of two carriages, one on each side of the support structure, two drive sprockets, and other necessary appurtenances required to achieve a fully operational system.
- (7) When lowered, the carriage transfers the kinetic energy from the restraining device to the energy absorber and subsequently into the base plate of the structural frame.
- (8) The barrier must be capable of both remote and local control. Manual controls are provided to locally position the restraining net during failure of remote control, or in maintenance or emergency conditions. Controls consist of raise, stop and lower functions.
- (9) The Restraining Barriers shall be designed as heavy-duty units, designed specifically for expressway service, incorporating FHWA-Approved, energy absorbing vehicle restraining mechanisms of the type specified herein. Each unit shall span a specific entry ramp of the Reversible Lanes and shall be located as shown on the Contract Drawings. Restraining mechanisms shall be the standard design of the Barrier Vendor and shall be based on the standard design of a model which has been in production for at least five years.
- (10) The Lifting-lowering Mechanism shall operate smoothly within the range of weather conditions described herein. At no time shall there be any evidence of binding or "chattering" motion during operation of the lifting-lowering mechanism or the drive units.

- (11) The Restraining Barrier shall be designed to operate outdoors, in the climatic conditions of the City of Chicago, within a temperature range of -30°F to +120°F. Restraining Barrier operation shall be unaffected by other environmental conditions such as dirt, dust, wind, rain, snow, salt spray, ice, or sleet. The Restraining Barrier shall be designed to operate as described herein and to withstand a wind load of 80 miles per hour (MPH), at a 1.3 gust factor (approximately 22 pounds per square foot) on the horizontal truss as defined in AASHTO for like sign truss structures, and a layer of ice 0.25 inches thick covering both sides of the restraining net.
  - (12) Each barrier shall be provided with provisions for mounting fiber optic red "X" lane use control signs located on the horizontal support truss facing the mainline traffic.
  - (13) Each Restraining Barrier shall be equipped with all features and elements recommended by the Barrier Vendor to achieve the specified performance.
  - (14) The restraining mechanism shall be bi-directional, i.e., capable of stopping vehicles moving through the system in either direction and shall produce a constant restraining force throughout the distance of travel.
  - (15) The barrier must be capable of both remote and local control. All local barrier controls shall be relay based, use of PLC is not allowed for local control. Manual controls are provided to locally position the restraining net during failure of remote control, or in maintenance or emergency conditions. Controls consist of raise, stop and lower functions and to interface to a remote operation system. Failure of Power Supply requires use of a manual hand crank. Hand crank operation requires two workers. Remote control will be supplied by others.
- (b) The Barrier Vendor shall submit shop drawings of the equipment, including erection drawings, in such detail as to demonstrate to the Engineer the equipment's conformance to clearances and the anchor bolt patterns shown on the Contract Drawings. The Barrier Vendor shall also submit structural fabrication drawings, each bearing the stamp of a Professional Engineer registered as a structural engineer either by the State of Illinois or by the Engineer's home state in which the registration was obtained by state administered examination.
- (c) The Barrier Vendor shall verify the anchor bolt patterns installed by others under separate contracts and shall make all adjustments to the restraining barrier equipment required to match the field conditions with the specific site conditions for each unit supplied under this contract.



**Materials.** Materials shall be according to the following.

(a) Vehicle Restraining Mechanism:

- (1) The vehicle restraining mechanism shall include a restraining net, stretched across the entry ramp into the Reversible Lanes, and two identical energy absorbing devices. Each end of the net shall be connected to two of the energy absorbing devices, one near the top and one near the bottom of the net.
- (2) The restraining net shall be the Barrier Vendor's standard Highway Safety Net. The net shall consist of a minimum of five horizontal runs of stranded wire rope interlaced through a section of galvanized chain link fence or shall consist of a minimum of five horizontal runs of wire rope and wire rope vertical members spaced at approximately 1.5' +/- on centers. The restraining net shall be provided with removable connectors and with vertical stays and tensioning devices to maintain proper net tension and deployment. The Barrier Vendor shall submit complete details of the restraining net construction including sizes, materials, and rated capacities of all components used. The restraining net shall be compatible with the energy absorbing devices, be FHWA-Approved, and be approved by the Engineer.
- (3) The vehicle restraining mechanism, for each of the vehicles in the specified range, shall be capable of withstanding both: a) the impact forces developed by the vehicle striking the net, and b) the forces required to decelerate and stop the vehicle.
- (4) The net shall have a reflective material of eight-inch-wide, alternating red and white, diagonal stripes adhered to a semi-rigid, conformable, panel fastened to the net. The panel shall be capable of repeated impact without splintering, fracturing, or permanently deforming. The panel shall not alter the performance characteristics of the vehicle restraining mechanism.
- (5) The net shall be lowered between of the roadway surface and the bottom of the net a distance as determined by the testing report done in accordance with NCHRP 350. The top of the net shall be not less than 45 inches above the roadway surface when the net is in the lowered position. The net shall be level across the roadway in the lowered position. The net shall incorporate a turnbuckles or other suitable tension adjusting devices to conveniently maintain the net taut across the span with not more than one inch of vertical sag across the top of the net in the lowered position.
- (6) The net and its attachment to the energy absorbing devices shall maintain the net perpendicular to the road surface.

- (7) The following additional requirements shall be incorporated into the design of the barrier restraining mechanism:
- i. The leading end of the energy absorbing device shall attach to one end of the restraining net with a removable connection.
  - ii. The mounting of the energy absorbing device shall not degrade its FHWA-Approved operating characteristics.
  - iii. The mounting of the energy absorbing device shall facilitate its replacement as a complete unit and shall facilitate replacement only of the energy absorbing tape contained within its cartridge. In either case, replacement shall be from the ramp side of the unit.
  - iv. Two sets of any tools required to replace the energy absorbing devices shall be provided in a tool box mounted inside the housing of each Restraining Barrier.
- (b) Restraining Barrier Structural Frame:
- (1) The structural frame of the Restraining Barrier shall be a rigid structural weldment capable of withstanding all operating loads imposed upon it during initial impact by a vehicle, during deceleration of the vehicle, by the lifting-lowering mechanism, and by the specified wind loads as defined herein and in the Functional Requirements, paragraph (a)(11). These capabilities shall be bi-directional in accordance with the intended function and design criteria specified herein. The frame shall transfer all loads into the foundations.
  - (2) Using standard structural steel shapes to the maximum extent possible, the frame shall be fabricated of steel conforming to the requirements of ASTM A500 Grade B or A36. The clear height of the frame shall be as shown on the Contract Drawings and it shall be mounted in the barrier wall generally as shown on the Contract Drawings.
  - (3) Each unit shall be complete with stainless steel cover plates conforming to the contour of the barrier wall and generally covering the opening in the barrier wall as shown on the Contract Drawings.
  - (4) The frame shall not require replacement of any components as a result of a vehicle colliding with or captured by the vehicle restraining mechanism.
  - (5) The frame shall consist of two vertical structures and a horizontal structure which ties the vertical structures together and spans the entry ramp.
  - (6) The frame structure shall be designed and fabricated per ISO 9001 Certification standards and sound engineering principles. The frame shall be arranged generally as shown on the Contract Drawings.
  - (7) The horizontal structure shall be designed to permit the restraining net to be raised within it, and totally enclose the net on five sides including the top, sides, and ends.

- (8) Positive locking and positioning devices for the lifting-lowering mechanism shall be incorporated into the design of the structural frame. The locking device shall serve to locate the lifting-lowering mechanism carriage when it is lowered and shall be designed to transfer the vehicle impact and deceleration loads from the barrier restraining mechanism and net to the base plate of the structural frame. The locking device shall be designed to prevent the accumulation of snow, ice, and dirt from interfering with the positive locking of the carriage to the structural frame.
- (9) The base plate of the structural frame shall be drilled or punched to accurately match the anchor bolt pattern of the foundations as constructed under a previous contract and generally as shown on the Contract Drawings. Anchor bolt holes shall be 1 /16 inches larger in diameter than the 1.50 inch anchor bolts. Anchor bolt projections, locations and capacities shall be coordinated and certified by the Barrier Vendor.
- (10) The frame shall be complete with all mounting and support attachments required for the raising and lowering mechanism, and drive unit. The local controls shall be housed in a separate enclosure described herein. The mounting attachments shall be accurately drilled or punched to match the components to be mounted. Torch-cut holes are unacceptable.
- (11) On the structural frame of the Restraining Barrier, the Barrier Vendor shall provide support mountings for the Lane Use Control Signs, and CCTV Cameras which are supplied by others. The mountings shall be an integral part of the structure as generally shown on the Contract Drawings.
- (12) Sign-support mounting assemblies, centered above the roadway shall be welded to the structural frame on both sides of each Restraining Barrier as indicated on the Contract Drawings. Lane Use Control Signs, to warn drivers when the ramp is closed, will be furnished and attached by others to the mounting assemblies. The Barrier Vendor shall furnish terminal strips and plugs as required to facilitate the signs' installation and integration with the Restraining Barrier and its controls.
- (13) The CCTV cameras shall be located at the top of the structure as generally shown on the Contract Drawings. Each Restraining Barrier truss shall have mounting brackets attached to the exterior of the structure for the mounting of the cameras as indicated on the Contract Drawings. The Barrier Vendor is not required to furnish the cameras, but is required to furnish the mounting holes, terminal strips, and plugs required to facilitate the mounting and integration of the cameras to the Restraining Barrier and controls.

- (14) Round all exposed edges, including sharp edges exposed by opened access doors, to a minimum radius of 1/32 inch. Corners, seams, and joints shall be welded continuously and comply with requirements specified in Sub-section p - Welding. Welding flux shall be removed immediately, and exposed welds and surfaces shall be ground smooth and blended so that no roughness shows after finishing. Joints that may be exposed to the weather shall be fabricated to prevent the accumulation of dirt, water, and ice. All structural weldments shall be stress relieved after welding and prior to final assembly.
- (15) Removable, ten-gauge or heavier, stainless steel (Type A-304), cover plates shall be provided for each unit to enclose the opening in the barrier wall generally as shown on the Contract Drawings. The cover plates shall be anchored in place using stainless steel, hex head bolts, nuts, and lock washers and shall be mounted flush with the vertical face of the barrier wall. All holes shall be accurately drilled or punched to match the holes in the mounting angles. Torch cutting of mounting holes in the cover plates is unacceptable.
- (c) Housing:
- (1) A rigid weatherproof housing, fabricated from 10 gauge or thicker steel shall completely enclose the support structure. The housing shall be attached either directly to the structure or to intermediate support girts with stainless steel nuts, bolts and washers, as approved by the Engineer.
  - (2) The vertical and horizontal structures, guiding the movement of the lifting-lowering mechanism carriages, shall be enclosed to prevent the accumulation of dirt, dust, water, snow and ice on the net and lifting-lowering mechanism. The size of the slots in which the restraining net travels, as the restraining mechanism is raised and lowered, shall be minimized and shall be protected from snow, ice, water, salt spray and dirt penetration by overlapping neoprene strip seals or by other means as approved by the Engineer. Openings shall be provided in the seals at the location of the energy absorbing devices in the fully lowered carriage position. The openings shall be the minimum size necessary to permit unencumbered operation (tape pull-out) of the energy absorbing devices.
  - (3) Large access doors shall be provided in the housings for convenient replacement of cartridges and tapes, for routine maintenance and for servicing the controls, drives, energy absorption devices, and drive unit. Handles, hinges, and latches shall be provided on all doors.

- (4) All access doors, located within eight feet of the roadway surface or requiring frequent opening, shall be mounted using stainless steel hinges and shall have three-point door latches with provisions for padlocking. Each of these doors shall be provided with a heavy-duty brass padlock and keyed alike. Six keys shall be provided for each Restraining Barrier. All doors shall be fabricated from the same material as the housing, have a stamped raised frame and/or flange for rigidity, and be provided with neoprene gaskets. All door openings and doors shall be reinforced to minimize deflection and doors shall close tightly against the gaskets.
  - (5) All penetrations in the housing, for the mounting of the CCTV Cameras and Signs, shall be sealed. The housing shall resist the effects of dirt, snow, ice, rain, wind, and salt at any penetrations for the mounting brackets.
- (d) Mechanical Requirements:
- (1) The lifting-lowering mechanism shall consist of two carriages (one mounted on each side of the support structure); two lifting chains; two counterweights; two drive systems including motors. Gear reducers, torque-tubes, and drive sprockets; and all other necessary appurtenances required to achieve a fully operational system.
  - (2) The vehicle restraining mechanism shall be mounted to the lifting—lowering mechanism. The design of the lifting-lowering mechanism shall be integrated with the design of the restraining net and support structure to lower the bottom of the restraining net to within seven inches above the road surface.
  - (3) All external shafts and fasteners must be corrosion resistant.
  - (4) Barrier transmission is chain-driven. The transmission mechanism is removable as a single unit. All shafts protruding from gear boxes containing oil are equipped with dual oil seals. Each transmission sub-assembly is interchangeable with all other such units.
  - (5) All bearings are designed for one million cycles of operation.
  - (6) Lubrication is not required at any point more often than once every six months
  - (7) The mechanism shall be designed to fully lift or lower the net within 30 seconds using the primary drive units and within three minutes using the auxiliary drive motor.
  - (8) Carriages shall be fabricated as rigid structural frames from ASTM A500 Grade B or A36 steel. The guide system design shall provide for ease of guide maintenance and replacement and for smooth, low friction, trouble free movement of carriages.

- (9) The lifting-lowering mechanism shall be designed to prevent the carriages from free-falling under any circumstance including, but not limited to a) failure of the lifting chain and/or the connection to the output shaft of the reducer, or b) failure of the counterweight cable.
- (10) The Barrier Vendor shall incorporate the following design requirements for the lifting chains and counterweight wire rope into the design of the lifting-lowering mechanism:
- (11) Lifting chains, driven and idler sprockets, and sheaves shall be fabricated from nickel plated, chrome plated, or WP plated steel. Lifting chains shall be drive roller type. Wire rope shall be manufactured from Type 302 stainless steel having a carbon content of 0.09 to 0.15 and shall be a stranded assembly coated with a friction-limiting, non-corrosive lubricant. Wire rope shall be 7 x 19 wire strand, suitable for hoisting service, manufactured and listed for compliance with military specification MIL-W-834ZOB, Type 1. Composition B. There shall be no deviation from this requirement. Wire rope shall have no strand joints or strand splices.
- (12) Lifting chains and wire ropes shall have a rated capacity of not more than 20 percent of the manufacturers' published breaking strength. Applied loads, including impact, shall not exceed the rated capacities. Wire rope terminals shall be stainless steel compatible with the wire rope and as recommended by the wire rope manufacturer. The terminals, attachments, swaging, etc., capable of developing 100 percent of the catalog rated strength of the rope, shall meet the requirements of military specification MIL-T-781 and shall be so listed.
- (13) Each chain shall ride across a torque sprocket at the top of the frame and across an idler sprocket or a drive sprocket at the bottom.
- (14) Each chain shall have one end fastened to the top and its other end to the bottom of its carriage on both sides of the frame; thus, each carriage shall have powered motion in both up and down travel.
- (15) Spring type chain tension devices shall be attached to idler sprockets to maintain constant chain tension and eliminate slack.
- (16) Mount all idler sprockets and sheaves on shafts which, in turn are mounted in anti-friction ball or roller bearings. All bearings shall be selected for an L-10 rating of not less than 30,000 hours and provided with grease lubrication fittings.
- (17) Wire rope sheave tread diameters shall be not less than 24 times the wire rope diameter. The sheave grooves shall be shaped and sized to minimize rope abrasion and distortion under load.

- (18) Shop drawings and product data for wire ropes shall be submitted to the Engineer for approval and shall include, but not be limited to the following:
- i. Catalog data to confirm sizing, stranding, and other specified requirements such as military specification listings.
  - ii. The cable manufacturer's certification of compliance with all specification requirements.
  - iii. Documentation of arrangements to provide a sample of the support cable to an independent laboratory as selected by the Engineer for testing to the military specifications listed herein, with results to be sent directly to the Engineer, all included incidental to this item.
  - iv. Copies of recent test reports, made on identical cable, indicating compliance with military specification requirements. The test reports shall include the following as a minimum:
    1. Breaking Strength test
    2. Endurance test
    3. Stretch test
    4. Test load
    5. Chemical Composition
- (19) Each lifting chain shall be driven directly by the sprocket on the output shaft of the drive units. The chain drive shall be electronically synchronized to the other to ensure simultaneous movement of both carriages.
- (20) Maximum angular deflection of the chains to the drive torque shall be two degrees.
- (21) All bearings shall be selected for an L-10 rating of not less than 30,000 hours and provided with grease lubrication fittings.
- (22) Attached to each carriage shall be a counterweight, which shall be attached to a wire rope, routed over sheaves at the top of the structure, and guided inside of the vertical support members. The counterweight shall be sized to prevent the unit from "free falling" and result in the lifting-lowering mechanisms having "zero weight".
- (23) Each lifting mechanism shall be powered from a single drive unit located on the vertical support structure, and above the top of the barrier wall.

- (24) Each drive unit shall have a primary motor direct coupled to a gear reducer. Each drive train shall be self-locking through the use of a high-ratio, worm gear, speed reducer to prevent the restraining mechanism and carriages from lowering by gravity when power is removed from the drive unit. Each reducer shall be equipped with a double extended input shaft, reduction gears, and output shaft. The input and output shafts of the reducer shall be plated with corrosion resistant metal.
  - (25) The primary drive units shall be sized to operate normally without the benefits of the counterweights.
  - (26) The speed reducer shall be a totally enclosed unit designed and built for the required service. Gears shall conform to the requirements of AGMA and be oil bath lubricated with the appropriate oil as applicable for the design temperatures. The speed reducer housing shall include, but not be limited to, an oil level sight-glass, an oil fill plug, and an oil drain plug. These items shall be located for easy access from the ramp side during routine inspection and maintenance of the mechanism without removing the housing or other components.
- (e) Reflective Material for Restraining Net:
- (1) Retroreflective sheeting shall be used on both sides of the restraining barrier net as shown on the Contract Drawings. All sheeting shall meet the requirements for Type ZZ Sheeting as defined in Article 1091.03.
  - (2) The retro sheeting shall meet the requirements for Type ZZ Sheeting as defined in Article 1091.03 with diagonal alternating red and silver white stripes as shown on the Contract Drawings, angling down at 45° from the left to the right. The sheeting shall be oriented to take advantage of the directional reflectivity of the material as defined by the supplier of the retroreflective sheeting.
  - (3) This material shall meet the requirements for Type ZZ Sheeting as defined in Article 1091.03. The retroreflective sheeting shall be installed strictly according to the manufacturer's instructions. Special attention to surface preparation and mounting of sheeting for proper bonding and adhesion shall be rigidly followed.



(f) Electrical Requirements:

(1) Motors:

- i. The Drive Motors shall be a 460 volt, 3-phase, 60 Hertz. high slip, high torque (NEMA design D), totally enclosed, non-ventilated, squirrel cage induction type motor with Class F insulation. The horsepower rating shall be greater than 1.0 times that required, as calculated by the Barrier Vendor, to operate the lifting—lowering mechanism with the counterweights disconnected. Motors shall be capable of operating the driven equipment over the full range of operating load conditions without exceeding the nameplate rating. Motors shall be flange mounted, attached to the transmission with at least four bolts, and be of the instant reversing type to permit raising or lowering the Vehicle Restraining Mechanism (hereinafter named 'Net") at any point of travel.
- ii. The ratings, characteristics, materials, and construction of electric motors shall be in accordance with the latest applicable standards of ANSI, IEEE, and NEMA. The motor manufacturers' certifications of compliance with these standards shall be provided as a part of the submittal data.
- iii. Submittals shall include complete manufacturer's specifications and descriptive bulletins for all equipment and shall include the following data as applicable:
  - Manufacturer
  - Nameplate Rated Horsepower
  - Rated Voltage
  - Full Load RPM
  - Full Load Current
  - NEMA Design Letter
  - NEC Code Letter or Inrush Current
  - Insulation Class
  - Service Factor
  - Recommended Starting Restrictions, including Allowable Starts per Hour
  - Design Load Calculations
  - Motor dimensions and mountings
- iv. If equipped with a brake, the brake shall be an electric solenoid actuated type brake which shall automatically release on removal of the 480 VAC power. The brake shall be rated the same as the name plate rating of the drive motor. The solenoid brake shall be sized to hold the barrier in position under the forces produced by the wind loads as described above.
- v. Motor bearings shall be designed to withstand all axial thrust from the driven equipment.

(2) Controls - General:

- i. The local control system for the Restraining Barrier shall be coordinated with the PLC manufacturer and supplier of the remote PLC cabinets. Each restraining barrier shall be complete with local controls consisting of, but not limited to, the following items:
  - Main Circuit Breakers
  - Control Power Transformers
  - Full voltage reversing starters - minimum NEMA size 1
  - Motor overload protections
  - Brake Contactors as needed
  - Terminal Blocks
  - Control Relays
  - Position Limit Switches
  - Over-travel Limit Switches
  - Chain-Break Detection Limit Switches
  - Crash Detector Limit Switches
  - Local control switches
- (3) All electrical components furnished shall be NEMA rated, UL listed, and readily available products of a national, USA manufacturer. Similar components shall be of the same manufacturer.
- (4) The entire local control system shall be serviceable from the ramp side of the unit. The local controls shall be contained within a separate, self-supporting, single lever latch type NEMA 4X, stainless steel enclosure. The enclosure shall not attach to the restraining barrier housing, but shall be mounted on the top of the restraining barrier's concrete foundation. All selector switches shall be mounted on the inner mounting panel in the NEMA 4X enclosure (cabinet).
- (5) The local controls shall permit automatic operation to resume after auxiliary positioning of the lifting-lowering mechanism, or after switching from local manual control to remote control, without requiring on-site resetting of the lifting-lowering mechanism.
- (6) All wiring shall be through the use of spring clamp style terminal blocks and all control wires shall terminate in these blocks. Each terminal shall be clearly labeled (numbered or alpha-numeric) and each wire shall be color coded based on its connected voltage. The wire numbers for the interconnection points to the remote control system shall be the same as shown on the Contract Drawings. The vendor's wiring diagram shall identify all colors and wire numbers. Wire all auxiliary contacts to the terminal block to permit transmission of the selector switch settings to the remote control system.
- (7) Where a number of wires are trained through a box or wired to a hinged cover they shall be grouped by circuit where applicable, bundled using appropriate cable ties and supported to minimize pressure or strain on the cable insulation.

- (8) Wire all selector switches, limit switches, auxiliary contacts, etc., including spare devices, to the terminal block.
- (g) Circuit Protection:
- (1) Circuit Breakers:
    - i. Two and three pole breakers shall be rated 480 volts minimum. The circuit breakers shall be pad lock lockable.
    - ii. Single pole breakers shall be rated 240 volt minimum
    - iii. The motor circuit breakers shall have a normally open (N.O.) auxiliary contact to close on a "TRIP" or "OPEN" position. Contacts shall be rated not less than 0.5 amperes at 120 VAC.
    - iv. The circuit breakers shall be rated for an available fault current of 22,000 RMS symmetrical amperes.
  - (2) Supplemental Protectors: Provide single pole UL listed or recognized miniature thermal magnetic circuit breakers. Provide breakers that are track mountable with a positive trip-free holding mechanism and a 10 kA interrupting rating.
  - (3) Control Fuses: Provide ferrule end type, ceramic or fiberglass body, midget type, rated 250 VAC, 10 kA interrupting, UL listed for control circuit application. Automotive type, glass body fuses are not acceptable. Provide fuse blocks to house the control fuses. Provide terminal block style with isolating feature, and rail mounted, rated 600 VAC, 30 A maximum for midget type fuses. Provide a hinge type cover for isolating and automatic fuse extraction from circuit when cover is lifted.
- (h) Control Power Transformer : The control power transformer shall be continuous duty and rated at 480V - 60 Hz primary to 120V single phase secondary. The control power transformer shall have a primary fuse and a circuit breaker secondary and shall be sized adequately for the starter and all connected control devices. Data submitted for approval shall include starter coil load data and total VA rating of control transformer.
- (i) Reversing Starter:
- (1) Starters shall be sized for the motor to be connected, but shall not be smaller than NEMA size 1. Starter size shall be carefully coordinated based on the motor characteristics of the motor to be connected and the manufacturer's starting ratings.
  - (2) Starters shall be electrically operated, electrically held, with arc-extinguishing characteristics. Starters shall be operated with a 120 VAC coils with surge suppressors.
  - (3) As a minimum each starter shall be equipped with two SPDT auxiliary contacts, with the NC contacts wired in as coil clearing contacts, in addition to the forward and reverse seal-in contacts. Provide two additional DPDT auxiliary contacts, one in each direction, as spares.

- (4) Provide starters with an automatic reset non-compensated, thermal overload relay with a 480 V, continuous duty contact rating. Provide additional auxiliary electrically isolated contacts rated at 120 V, 5-amp continuous duty, one normally closed in motor control circuit and one normally open for alarm contacts. Relay shall be a NEMA 8600 with three, type B, heater elements sized as required for the motor HP rating.
- (j) Contactors: All contactors shall be NEMA rated with a minimum rating of 480 volts. Coil voltage shall be 120 VAC and shall include surge suppressors. Furnish each contactor with two auxiliary contacts. Each contactor shall break all power contacts.
- (k) Terminal Blocks (TB):
  - (1) Terminal blocks shall be spring clamp style rated at 600 volts AC & DC. AC and DC voltages shall be connected to color coded terminal blocks, separated and electrically isolated from each other. AC terminal housing shall be gray and DC terminals shall be blue in color.
  - (2) Terminal block housing shall be manufactured from nylon capable of long term exposure from - 40°F to 180°F and be capable of terminating #22 through #6 AWG stranded or solid wire. Provide snap-in shock protection cover with cable shoe connection on all terminals.
  - (3) The current carrying metal body characteristics shall be as follows:
  - (4) Modular design and construction.
  - (5) Manufactured from a minimum of 85% copper alloy with locking screws manufactured from stress relieved brass.
  - (6) 100% nickel plated.
  - (7) Wire guides on base body.
  - (8) Achieve "gas tight" termination, as wire is clamped into "serrated" metal body.
  - (9) Center bridgeability.
  - (10) No less than 3 milli-ohms of contact resistance.
  - (11) The terminal blocks shall be as manufactured by Phoenix Contact or approved equal.
- (l) Control Relays:
  - (1) Provide electrically held, heavy duty relays rated at 300 Volts, with a minimum of two normally open (N.O.) and two normally closed (N.C.) independent electrically isolated contacts. The relay shall have convertible, high reliability contact ratings of not less than 5 amperes resistive. Contact ratings shall be NEMA A300 AC, connected as per Contract Drawings. Control Relays shall be located in the restraining barrier control enclosure.
  - (2) Coil voltage shall be 120 VAC or as shown on plans and shall include surge suppressors.

- (3) Coordinate with remote control manufacturer for the size, type and quantity of relays required.
- (m) Timers: Provide solid state multifunction timers. Timers will be rated for 120 VAC. Timers will be Allen Bradley 700-H, Square D RE7, Cutler Hammer TR series or approved equal.
- (n) Limit Switches: Limit switch sets, arranged to operate on both sides of the span, shall be provided to sense the position of each carriage, tension of chains and crash detection.
- (1) Lever Arm Limit Switches:
- i. Lever arm limit Switches shall be NEMA 4 as required for outdoor installation (-40° to +180°F). Limit switches shall be heavy duty, industrial type, oil and water tight, with a minimum 10 amps, 120 VAC rating and rated for one million operations. The two contacts for each limit switch shall be independent and electrically isolated from each other. No electronic switches are to be used. All limit switches shall automatically reset upon correction of any control power failure.
  - ii. All limits shall be DPDT, U.L. listed and a minimum ten ampere rated. The limit switches shall be adjustable to permit field adjustment of the “raised” and “lowered” positions.
  - iii. Coordinate limits switches with PLC manufacturer.
  - iv. Lever Arm Limit Switches shall be as manufactured by Allen Bradley Bulletin 802MC or approved equal.
- (2) Chain-Break Limit Switches
- i. Standard Enclosed Limit Switches shall be NEMA 4 as required for outdoor installation (-40° to + 180°F). Limit switches shall be heavy duty, industrial type, all and water tight, with a minimum 10 amps, 120 volt AC rating, and rated for one million operations. No electronic switches are to be used. All limit switches shall automatically reset upon correction of any control power failure.
  - ii. Tension sensing limit switches shall be furnished to determine drive chain tension. The sensing limit switches shall be on both ends of the restraining barrier. Failure of integrity of the chains shall initiate a change of limit switches state.
- (3) Rotating Cam Limit:
- i. Cam limit shall have a minimum of 2 spare unused cams with contacts.
  - ii. Cam limit shall be rotating type and furnished in in a NEMA 4X stainless steel enclosure. Limit shall include any necessary gear reducers and couplings.
  - iii. Contacts shall be DPDT snap action type switches with a minimum 10 amp rating at 120 VAC.

- (4) Crash Detector Limit Switches: A position limit switch shall be provided at each end of the restraining net to indicate contact with and movement of the restraining net due to vehicle impact. As part of his submittals and prior to fabrication of any equipment, the Manufacturer shall describe in detail his method of sensing restraining net movement. The method employed shall not interfere with convenient replacement of the energy absorbing restraining devices. The use of electrical continuity to detect movement is unacceptable. When the restraining net is struck by a vehicle, an electrical contact shall be closed. All limit switches shall automatically reset upon correction of any control power failure.
- (o) Pushbuttons, selector switches and Indicator lights.
- (1) Indicating Lights: Use 30.5 mm push-to-test industrial heavy-duty, oil tight NEMA 13, 120 V transformer type, with LED bulbs. Lens colors are as indicated on plans.
  - (2) Pushbuttons: Furnish single button operator with one normally open (1 N.O.) and one normally closed (1 N.C.) momentary contact, 30.5 mm corrosion resistant, heavy duty, oil tight pushbuttons.
  - (3) Selector Switches: Supply selector switches with a lever operator knob, one N.O. and one N.C. contact in each position. Provide switches that are 30.5 mm corrosion resistant, heavy duty, and oil tight. Provide key switch operator where required.
  - (4) Key Operated Selector Switch: Supply selector switches with a keyed operator, no equivalent with one N.O. and one N.C. contact in each position. All keys shall be keyed the same. Coordinate the key removal position with the Engineer. Provide switches that are 30.5 mm corrosion resistant, heavy duty, and oil tight.
  - (5) Contact Blocks: Provide contact blocks rated at 10 A, NEMA Class A300. Blocks are to be clear to allow visual inspection and are oil-tight.
- (p) Welding
- (1) All welding of structural shapes and components shall comply with the methods and procedures defined in the AWS and as modified by the AASHTO Standard Specification.
  - (2) Circumferential welds, including top flange welds, shall be fully penetration welds.
  - (3) Longitudinal welds shall have a minimum of 60% penetration.
  - (4) The welds shall be smooth and thoroughly cleaned of flux and spatter and shall conform to standards of the American Welding Society.

## CONSTRUCTION REQUIREMENTS

**General.** All materials and all components used in the installation of the Restraining Barrier and associated equipment shall be new, of good workmanship and quality, and their application shall be in compliance with the recommendations of their suppliers, including the Barrier Vendor. Use of salvage or short-dimension material, even though new, is unacceptable. The requirements of Section 106 of the Standard Specifications shall also apply.

The equipment is designed for ease of maintenance. All component parts are readily accessible for inspection and maintenance. Test points are provided for checking essential voltages and waveforms.

The Barrier vendor shall closely coordinate design with other disciplines to ensure compatibility of equipment.

### **Manufacture:**

#### (a) Mechanical:

- (1) All external screws, nuts, and locking washers must be corrosion resistant; no self-tapping screws shall be used unless specifically approved by the Engineer.
- (2) All parts are made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum, brass or properly coated steel (galvanized or painted).
- (3) All materials used in construction are protected from fungus growth and moisture deterioration.
- (4) Dissimilar metals are separated by an inert dielectric material.

#### (b) Electrical:

- (1) All junction and pull boxes shall be NEMA 4X stainless steel.
- (2) Control cabinet box shall be NEMA 4X stainless steel.
- (3) All conduit shall be PVC coated rigid galvanized steel.
- (4) Provide interconnection wiring between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, connect them to terminal blocks. Conductors are to be UL listed type THWN-MTW. The minimum field installed control wire within the control cabinet is No. 14 AWG.

- (5) Install all interior wiring neatly and carefully, and terminate on UL approved terminal blocks as per manufacturer's instructions. Use plastic duct (open slot type) for routing all internal wiring in the control panels. Internal wiring in the factory prewired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.
  - (6) Permanently identify individual conductors. The marking will be done on a sleeve not less than ½ inch long. Mark each sleeve with permanent and waterproof identification
- (c) Corrosion Protection.
- (1) Aluminum components shall not be treated with corrosion inhibitors.
  - (2) The exterior surfaces of all steel materials and the interior surfaces of tubing used in structural frames shall be hot-dip galvanized in accordance with ASTM A123..
  - (3) Any steel components, which cannot be flame-spray coated without affecting the functioning of the unit, shall be coated with a rust inhibitor. The Barrier Vendor shall submit details of his proposed coating methods and materials to the Engineer for approval before fabrication of the affected components.
  - (4) The Barrier Vendor's names and data plates, machined ways, and other machined surfaces, bright metal work, lubrication points, oilers, and sumps shall be protected against entry of coatings, dirt, or cleaning agents during coating application.
- (d) Painting.
- (1) Aluminum and stainless steel components shall not be painted.
- (e) Hot Dipped Galvanizing.
- (1) Structural steel supports shall be hot dipped galvanized according to AASHTO M 111 after fabrication is completed
- (f) Welding:
- (1) Refer to Sub-Section P - Welding, for the general requirements.
  - (2) All welding of structural shapes and components shall comply with the methods and procedures defined in the AWS and as modified by the AASHTO Standard Specifications.



**Submittals and Certifications.** The following specific submittals and certifications shall be furnished by the Barrier Vendor, to the Engineer for review and approval.

- (g) The Barrier Vendor's drawing submittal package shall also include the following specific items:
- (1) Specified standard Guarantees.
  - (2) Shop Drawings and sufficient details of all electrical and mechanical components to permit an adequate review of the Barrier Vendor's design for compliance with these specifications.
  - (3) Material and component bulletins, performance data and certifications of compliance with these specifications for all mechanical and electrical materials, components and devices.
  - (4) Complete descriptions, illustrations, and wiring diagrams of the local controls.
  - (5) Complete Motor Data.
  - (6) Welding Details and procedures.
  - (7) Letter of intent to provide specified welding inspection reports.
  - (8) Structural design calculations, for the structural frame and any load bearing or load transferring components, bearing the stamp of a Professional Engineer registered as a structural engineer either by the State of Illinois or by the engineer's home state in which the registration was obtained by state administered examination.
  - (9) Letter of intent to provide manufacturer's representative during installation and to provide specified installation certification.
  - (10) Barrier Vendor's recommended installation and testing requirements.
  - (11) Letter of intent to provide spare parts availability for 10 years and training of authorized repair agents.
  - (12) Operating and Maintenance Manuals.
  - (13) Certification that Barrier Vendor has verified the drawings and dimensions of the foundations and that the Restraining Barrier units will properly fit at the specified locations.
  - (14) Certification that the energy absorbing devices are mounted in accordance with FHWA-Approved methods.

**Installation.**

- (a) Inspection: Prior to installing the Restraining Barriers, the Contractor shall verify the field conditions and confirm that the foundations and anchor bolts are in compliance with the Contract Drawings. Inspection of the existing foundations, including an inspection report for each foundation location, will be done in accordance with the requirements set forth in the Special Provision for Restraining Barrier Foundation. Structural repairs, if required, will be performed as part of the work under the pay item for Restraining Barrier Foundation. The Contractor shall install each Restraining Barrier unit, with the Barrier Vendor's technical assistance, on a ramp by ramp basis, in accordance with the Barrier Vendor's installation requirements and as approved by the Engineer.
- (b) The Contractor shall install each Restraining Barrier level, plumb, and true, at the location specified on the Contract Drawings. The Contractor shall check each location prior to installation with a rigid template which fits over the anchor bolts, check the top of the foundation for a level and smooth surface, and check the dimensional accuracy of the anchor bolt placement. The holes for the template shall be the same size, pattern, and orientation as for the base plate of the Restraining Barrier.
- (c) Where the foundation for the Restraining Barrier has not been installed level and true or according to the Contract Drawings, the Contractor shall employ the following remedies:
- (d) For top of foundation out of level by more than 1/4" and less than 3/4", shims may be used to elevate the low points. Shims shall be stainless steel, of varying thickness with holes which shall drop over the top of the anchor bolt and cannot be removed or work free. The use of open slotted shims shall not be allowed.
- (e) For top of foundation out of level by more than 3/4" and less than 1", double nuts shall be used in lieu of shims. Flat washers shall be installed below and above the base plate. Lock washers shall be installed on top of the top flat washer.
- (f) For top of foundation wall out of level by more than 1', the remedy shall be as designated by the Engineer.
- (g) No grouting of the bases shall be allowed.
- (h) The Contractor, after setting and leveling the Restraining Barriers on their foundations, shall torque the anchor bolt nuts as recommended by the Barrier Vendor or as required by ASTM—A-325. Procedures and materials shall be approved by the Barrier Vendor and Engineer prior to setting of the first Restraining Barrier.
- (i) After each Restraining Barrier is completely installed and its anchor bolt nuts are torqued to the recommended limits, the cover plates furnished by the Barrier Vendor shall be installed and bolted in place as generally shown on the Contract Drawings.

(j) Identification.

- (2) The Contractor shall furnish and Install the identification labels on each Restraining Barrier immediately upon setting and anchoring of the unit. The location of the labels shall be as directed by the Engineer.
- (3) Each Restraining Barrier assembly shall bear a unique, four digit, alphanumeric, identification code based upon its location on the expressway. The code for each Restraining Barrier, and its position on the ramp, shall begin with the ramp identifier and be followed by a sequential number assigned to each Restraining Barrier as shown on the Contract Drawings. The following ramp identifiers shall be used:

Code	Ramp Location
IE	Inbound Edens
IW	Inbound Kennedy West Leg
IS	Inbound Slip Ramp
OS	Outbound Slip Ramp
OM	Outbound Kennedy Main Line
OO	Outbound Ontario Street

- (4) The letters and numerals shall be composed of individual, black series 'D' as described in the Federal Highway Administration's "Standard Alphabets for Highway Signs", screened onto silver-white, pressure sensitive, reflective, nine inch by eight inch sheeting per the requirements for Type ZZ Retroreflective Sheeting in Article 1091.03. Prior to application of the sheeting, the receiving surface shall be cleaned and dried as directed by the supplier of the Reflective Sheeting.

(k) Corrosion Protection.

- (1) Aluminum components shall not be treated with corrosion inhibitors.
  - a. The exterior surfaces of all steel materials and the interior surfaces of tubing used in structural frames shall be hot-dip galvanized in accordance with ASTM A123.
- (2) Any steel components, which cannot be flame-spray coated without affecting the functioning of the unit, shall be coated with a rust inhibitor. The Barrier Vendor shall submit details of his proposed coating methods and materials to the Engineer for approval before fabrication of the affected components.
- (3) The Barrier Vendor's names and data plates, machined ways, and other machined surfaces, bright metal work, lubrication points, oilers, and sumps shall be protected against entry of coatings, dirt, or cleaning agents during coating application.

(l) Painting.

- (1) Aluminum and stainless steel components shall not be painted.

(m) Hot Dipped Galvanizing.

- (1) Refer to Appendix I, Section 3, Sub-section 13 - Hot Dipped Galvanizing; for the general requirements

(n) Welding:

- (1) Refer to Sub-section w - Welding, for the general requirements.
- (2) All welding of structural shapes and components shall comply with the methods and procedures defined in the AWS and as modified by the AASHTO Standard Specifications.

**Testing.**

(a) Shop Testing – General.

- (1) The Barrier Vendor shall test each and every unit according to the specific requirements herein and the general requirements.
- (2) First Barrier Shop Testing - A rigorous and extensive series of test requirements to fully prove the design, operation and reliability of the unit. The first Barrier Test shall be witnessed by the Engineer and shall be conducted at a suitable facility provided by the Barrier Vendor.
- (3) Production Quality Control Shop Testing - A series of basic tests to certify that the production units meet the requirements of the specifications and the quality standards of the accepted first barrier type. The Production Quality Control Test for the first barrier shall be witnessed by the Engineer.
- (4) The Barrier Vendor shall be responsible for the travel, lodging, and associated costs for up to three State Inspectors for up to two days, who will inspect the mechanical, electrical, structural, and control elements of the first Restraining Barrier, inspect the manufacturing process, witness the in-plant Tests, approve any necessary changes that the Barrier Vendor proposes as necessary to achieve proper operation as a result of the Test, and to accept or reject the Tests. The Inspectors will also verify performance of mechanical, structural, electrical, and control revisions required from submittal reviews. All travel, if over 400 miles, shall be by commercial airlines on regularly scheduled flights. The Barrier Vendor shall provide all ground transportation, at the test site, for the State Inspectors for the duration of the Tests.

- (5) Testing shall not start until approval of the testing procedures by the Engineer. All shop testing documentation shall be entered upon the approved forms or appended to the forms as appropriate. The Barrier Vendor shall provide advance notification of the intended Test, a minimum of six weeks prior to the Test. The Barrier Vendor shall confirm the Test Date at least two weeks prior to the Test Date.
  - (6) Failures shall be understood to include, but not be limited to, any occurrence of the Restraining Barrier and/or Its components to improperly operate as intended and/or specified. All failures or deficiencies identified during Testing shall be corrected before acceptance of the unit and all production units shall be modified, in an identical manner, prior to shipment. The Barrier Vendor shall, if necessary upon failure of the Tests, repeat the tests; all costs associated with the repeat of the tests, Including the travel, lodging and associated costs for the State Inspectors shall be paid by the Barrier Vendor at no additional cost to the State.
  - (7) Acceptance of any test reports shall not be construed as acceptance of the device, testing, or approval for payment.
  - (8) The testing of the Restraining Barrier shall be incidental to the Contract Price for Restraining Barrier - Material Only and no additional payment shall be made for Testing, Production Quality Control Testing, shipping, or necessary equipment or design revisions required for acceptance of the Restraining Barriers.
- (b) Production Quality Control Shop Testing:
- (1) The Barrier Vendor shall shop test each and every production unit, certify each unit for proper operation and conformance to the specifications, and certify that all modifications required as a result of the Testing have been incorporated into the production units.
  - (2) Each unit shall be assembled to the extent necessary to perform basic shop testing, verify that the lifting-lowering mechanism operates smoothly and freely relative to the Restraining Barrier Structural Frame, verify that the drive system operates smoothly, verify that all parts fit up properly, and verify that the overall quality meets or exceeds the standards of the Barrier Vendor. It shall not be necessary to fully assemble and operate each unit via the local controls, unless required by the Barrier Vendor, but he shall certify that each unit has been checked and meets the requirements stated or implied herein.
  - (3) As a minimum, the Production Quality Control Shop Testing shall verify proper adjustment and positioning of all mechanical and control devices, specifically the lifting-lowering mechanism, drive unit, housing, and alignment of the structural frame.

- (4) All deficiencies, as a result of the testing, shall be corrected and identified in the test report and certified as corrected.
  - (5) The Production Quality Control Shop Testing shall not require witness by the Engineer or his designated representative, but shall require certified test reports to be submitted for each unit. The Barrier Vendor shall submit a separate test report for each Restraining Barrier tested. Each report shall be identified by the serial number and identification number of the unit. As a minimum, the test report shall identify the date of the test, the tests conducted, and certify that the unit operates as intended and specified. The Test Reports shall be sent directly to the Engineer prior to shipment of each unit.
  - (6) At the conclusion of the tests, all temporary wires, jumpers, controls interface, measuring devices, etc., shall be removed and the unit prepared for shipment.
- (c) Field Operational Testing :
- (1) Field Operational Testing for each Restraining Barrier shall not proceed until all components for the Restraining Barrier are installed, and properly adjusted, and verified by the Barrier Vendor's representative. Field Operational Testing shall proceed on a ramp-by-ramp basis. The Contractor shall provide qualified personnel to receive on-site training, from the Barrier Vendor, during the Contractor's installation and testing of the first Restraining Barrier.
  - (2) The Contractor shall field operationally test each Restraining Barrier, using the local control panel, to demonstrate proper field installation and functional operation. Testing shall comply with the general requirements stated herein.
  - (3) The Field Operational Testing shall be conducted with the technical assistance of the Barrier Vendor's representatives, and in accordance with the Field Operational Testing procedures as approved by the Engineer.
  - (4) The field operational tests shall verify proper functioning and adjustment of all electrical and mechanical control devices, specifically, but not limited to the following items:
    - i. The lifting-lowering mechanisms
    - ii. Primary and auxiliary drive motors
    - iii. Limit switches
    - iv. Alignment of restraining net
    - v. Mechanical stops
    - vi. Alarms and I/O interfaces

- (5) All mechanical and electrical equipment provided and/or installed under this section shall be adjusted and tested. All deficiencies identified during testing shall be corrected and identified in the test report. The entire testing procedure shall be restarted from the beginning and continue until a Field Operational Test is completed and the Barrier Vendor certifies that the unit is properly installed and operating. Materials, equipment, and work provided by the Contractor which are discovered during Field Operational Testing to require adjustment, repair, or replacement shall be the Contractor's responsibility. Such deficiencies in materials and equipment furnished by the Barrier Vendor, shall be the Barrier Vendor's responsibility to correct.
- (6) The Contractor shall install and test the first Restraining Barrier, according to the Barrier Vendor's installation and testing requirements, while witnessed by the Barrier Vendor's representative and the Engineer. The first Restraining Barrier installed shall be operated through its intended full operation in the presence of both the Barrier Vendor's representative and the Engineer.
- (7) Test reports shall be submitted to the Engineer, by the Contractor.
- (8) Upon completion of the field operational test for each Restraining Barrier, the Contractor shall prepare and submit a report of the completed testing. The Contractor shall obtain the Barrier Vendor's certification of the test results and submit the report to the Engineer, for record, on a ramp by ramp basis. The sample test forms included at the end of Part Iii illustrate only the minimum requirements for test reporting. Each report shall contain, as a minimum, the following information:
  - a. Ramp identification
    - i. Restraining Barrier identification number
    - ii. Restraining Barrier serial number
  - b. Barrier Vendor's Certification that the Contractor's installation and testing complies with the proper procedures.
  - c. Contractor's certification of compliance with the Barrier Vendor's installation and testing procedures.
  - d. Any deficiencies discovered, including descriptions and certification of corrective actions taken.
  - e. Acceptance of test reports shall not be construed as acceptance of the device or approval for payment.
- (9) These testing requirements are incidental to the work and no direct payment shall be made for Field Operational Testing. All necessary test equipment shall be furnished and maintained by the Contractor. The cost of these requirements shall be included in the costs of the various bid items included in the work, as applicable.

(d) Barrier Vendor's Technical Field Services during Installation:

- (1) The Barrier Vendor shall provide the services of competent, technical field service personnel, acceptable to the Engineer, to perform the services described herein during installation of the restraining barriers. The provision of these services may require multiple visits to the job site over a period of approximately two years and shall be coordinated with the Installation Contractor and the Engineer. Field personnel shall be thoroughly familiar with the design, fabrication, and operation of the Restraining Barrier equipment. All costs associated with the provision of these services shall be considered incidental to the Replacement of Restraining Barrier and will not be paid for separately.
- (2) The following minimum services shall be provided by the Barrier Vendor to support the installation and testing of the Restraining Barriers:
- (3) On-site advisory support and witness of the Field Operational Testing, as described in this specification.
- (4) Field modifications to the Restraining Barriers as necessary to correct deficiencies that were undetected or uncorrected during shop testing and to achieve proper operation as specified.
- (5) Written certification, on a ramp by ramp basis, that each Restraining Barrier has been installed, tested, and modified as necessary, in accordance with the Barrier Vendor's recommendations.

(e) Recommended Installation Requirements:

- (1) The Barrier Vendor shall submit his recommended installation and Field Operational Testing procedures to the Engineer for review and approval.
- (2) The Barrier Vendor shall provide written instruction manuals to the installation Contractor, defining the proper procedures and methods to install and test each unit to the Barrier Vendor's requirements as approved by the Engineer.
- (3) The first Restraining Barrier installed shall undergo Field Operational Testing through its intended full operation in the presence of the Barrier Vendor's representative and the Engineer and, with the Engineer's approval, shall be designated as the benchmark unit and the proper installation and operation of all subsequent units shall be judged based on this unit. The Barrier Vendor need not be represented during installation and testing of the remaining five Restraining Barriers unless special problems or needs arise for which the Barrier Vendor has not adequately trained the Contractor to respond or if equipment deficiencies are discovered.
- (4) All equipment adjustments, modifications, and/or installation revisions required, as a result of factors under the Barrier Vendor's control or not corrected during Shop Testing, to obtain proper operation of the unit shall be made at the Barrier Vendor's expense and recorded as a part of the field operational testing reports.



- (5) After installation, each unit shall undergo the Barrier Vendor's approved Field Operational Testing procedures. The testing reports shall be certified by both the Contractor and the Barrier Vendor and the Contractor shall submit the reports, on a ramp by ramp basis, to the Engineer for record purposes. Each report shall contain, as a minimum, the following information:
- i. Ramp identification
  - ii. Restraining Barrier identification number
  - iii. Restraining Barrier serial number
  - iv. Barrier Vendor's Certification that the Contractor's installation and testing complies with the proper procedures
  - v. Contractor's certification of compliance with the Barrier Vendor's installation and testing procedures
  - vi. Any deficiencies discovered, including descriptions and certification of corrective actions taken
  - vii. All costs associated with providing the required installation and field operational testing supervision and certification by the Barrier Vendor shall be considered incidental to the Contract Price for Restraining Barrier - Materials only and will not be paid for separately.
- (f) Operations and Maintenance:
- (1) Routine maintenance instructions, operating procedures and wiring schematics complete with appropriate diagrams, shall be provided to guide the State's maintenance personnel in performance of the activities shown below. The Barrier Vendor shall submit the proposed instructions and format to the Engineer for approval. Instructions shall be engraved into plastic labeling plates or laminated sheets and mounted to a frame on the inside of the access doors of the local control cabinet. As a minimum, the following information shall be provided:
    - i. Procedures for replacing tape cartridges (Plastic Labeling Plates)
    - ii. Procedure to lock equipment out into a zero-energy state condition. (Plastic Labeling Plates)
    - iii. Procedures for placement and operation of equipment in manual and automatic operational modes. (Plastic Labeling Plates)
    - iv. Lubrication and oil change procedures. (Laminated Sheets)
    - v. Other routine maintenance procedures. (Laminated Sheets)
    - vi. Wiring Schematics (Laminated Sheets)

- (2) The mechanical and electrical components of the Restraining Barrier shall be arranged to permit all routine maintenance to be performed from the downstream side of the Restraining Barrier. All lubrication fittings not accessible from the downstream side shall be piped to an accessible location on the downstream side. No special tools or equipment shall be required to maintain or repair the units.
  - (3) The Barrier Vendor shall furnish the proper lubrication (including oil, grease, hydraulic fluid, etc.) required for testing, trouble shooting, and start-up. If lubrication must be drained for shipping or storage, the Barrier Vendor shall furnish a fresh supply of lubrication for field installation.
  - (4) Local Authorized Service: As part of the submittal process, the Barrier Vendor shall submit a procedure for qualifying local service and repair Contractors which, upon completion of the training, shall be certified as the Barrier Vendor's Authorized Repair Agents. Upon successful completion of the training, the Contractors shall have the written authority to perform warranty work and repair work on the equipment furnished. The procedure shall be submitted to the Engineer for approval. The actual training and qualifying of local service and repair Contractors shall be considered separate from the instructional training provided to the State designated representatives, with all costs borne by the Contractors seeking qualification.
- (g) Spare Part Requirement:
- (1) The Barrier Vendor shall certify that a stock of spare parts will be maintained by the Barrier Vendor for a period of at least ten years after final acceptance of the system. Spare parts shall be incidental to the Contract Price for Restraining Barrier and no additional compensation shall be allowed the Barrier Vendor for compliance with this requirement.
- (h) Final Acceptance
- (1) Only after the Restraining Barrier Units have been delivered, field operationally tested, initial operations stock delivered, and the Record Drawings reviewed and accepted by the Engineer, the Barrier Vendor may request Final Acceptance of the work by the Engineer.
  - (2) Items which the Barrier Vendor must complete to the State's satisfaction before Final Acceptance can be granted include, but are not limited to, the following:
    - i. Certified State Acceptance of Delivery for the Restraining Barrier Units.
    - ii. Certification that all Restraining Barriers have been properly installed and field operationally tested.
    - iii. Delivery of all initial Operations Stock to the State designated District 1 location.

- iv. Submittal of guarantees and warranties.
- v. Certification that all equipment has been modified or adjusted based upon the benchmark unit.
- vi. Bound copies of operating and maintenance instructions and all other submittal data.
- vii. Receipt of written acceptance of all work from the State. The written acceptance shall be included as part of the request for final payment.

(i) Guarantees:

- (1) All equipment shall be furnished complete with the manufacturer's published standard trade guarantee / warranty, or a guarantee / warranty for 6 months, whichever is greater, applicable to the Illinois Department of Transportation from the date of final acceptance. Such guarantee shall accompany submittal shop drawings and product data.

**Method of Measurement.** This work will be measured for payment as each, where each is defined as one complete installation.

**Basis of Payment.** REPLACEMENT OF RESTRAINING BARRIER will be paid for at the contract unit price per each for new resistance barrier furnished and installed in accordance with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications. The contract cost shall include all shipping, and testing.

- 75 Percent of Contract price upon delivery of each unit manufactured new, tested in full and certified ready for installation.
- 25 Percent of Contract Price upon successful completion of Field Operational Testing.

## AUXILIARY SIGNS

**Description.** This work shall consist of the procurement of Auxiliary Signs and installation of the units at their designated locations as shown on the drawings on existing foundations in concrete barrier walls or poles. Auxiliary Signs procured and installed under this contract shall be the following type as specified in the Aux Sign Material Specification:

*Operational Warning Sign "GATES CLOSING"*

*Operational Warning Sign "STAY IN YOUR LANE"*

*Ramp Closed Sign "X" (on Barrier)*

*Ramp "Closed/Open" Sign (at gore)*

*Chevron Sign ">>>"*

**Materials.**

(a) GENERAL:

- (1) This Section is intended to define the scope and the minimum acceptable standards of functionality, quality, and workmanship for the work. The scope of work under this Section shall generally be all LED Auxiliary Signs and Chevrons work required for the project as specified and/or as shown on the plans.
- (2) The Contractor shall be responsible for coordinating and monitoring the schedule of the installation of the LED Auxiliary Signs and Chevrons.
- (3) Summary: This Section defines the electrical and mechanical characteristics and requirements for the LED Auxiliary Signs and Chevrons.
- (4) LED Signs, located ahead of the entry ramp to the Reversible Lanes, are to provide advance information and warnings to drivers when a ramp is being closed.
- (5) The Contractor shall furnish the types and arrangements of LED Signs as complete, operable units in the quantities as shown on the Contract Drawings. The work shall include, but not be limited to, furnishing all labor, materials, and equipment required to design, detail, submit shop drawings for approval, fabricate, assemble, paint, shop test, deliver, and install the Signs described herein.
- (6) The Contractor shall take complete responsibility for the LED Signs, including purchasing the signs from the Manufacturer, verifying that the signs are manufactured in accordance with the specifications, ensuring that the Manufacturer complies with all the requirements of this specification, and receiving and storing the Signs until time of sign installation.
- (7) The Signs shall be the product of an established LED Sign manufacturer having at least five years' experience in the design and manufacture of LED traffic signs for freeway applications.
- (8) Each LED Sign shall include, but not be limited to the following components: single sided sign display face; LED module, including cable, lenses, and message, power transformers, control relays, dimmers and photocells, face defroster and thermostat, internal wiring and terminal blocks, weatherproof housing, sun shield, frame and door panel, mounting hardware, and all other accessories recommended by the Manufacturer for proper operation under the specified conditions and indicated arrangements. Unless otherwise indicated, each type of LED Sign shall be identical. For each specific LED Sign, the size, message, and mounting requirements shall be as shown on the Contract Drawings. The LED module, housing and frame shall be the product of the same Manufacturer.

- (9) The LED Sign assemblies shall be heavy-duty units designed or selected specifically for freeway service. The LED Signs shall be clearly legible under all lighting conditions with a 60 degree cone of vision. All signs shall be standard designs of the Manufacturer and shall be generically similar to models that have been in production for at least five years. Shop drawings shall be approved by the Engineer prior to start of fabrication.
  - (10) The LED Signs shall be capable of continuous outdoor operation within a temperature range of minus 40F to plus 165F. LED Sign operation shall be unaffected by the Chicago, Illinois, environmental conditions such as heat, cold, sun, fog, rain, snow, ice, or sleet as well as the vibration caused by vehicular traffic. The signs and mountings shall be designed to withstand a wind load of 35 pounds per square foot.
  - (11) Each LED Sign shall be shipped as a complete unit and shall be crated to protect the unit from damage. Except for the removal and re-installation of mounting brackets and the wiring of the unit, no other mechanical or electrical assembly shall be required to install each complete LED Sign.
- (b) Functional Description:
- (1) The Signs shall be capable of displaying one (1) message, except for the gore sign. This message shall be amber, except that the ramp closed "X" sign shall be red. The ramp "Open/Closed" sign at the gore shall be dual colored with red for closed and green for open. The message shall be displayed on one side and shall be formed by dual rows of LED's.
  - (2) All messages shall be clearly legible, attracting attention under any lighting conditions. At full intensity the signal shall be highly visible anywhere within an 18 degree cone centered about the optic axis. The signs shall have double rows of LED pixels arranged on a flat black background to form the required message. All letters shall be 6" high nominal. The signs shall consist of a weatherproof housing and door, T-1 3/4 (5 millimeters) LED's with a 100,000 hours expected lifetime, and transformers. All LED's shall have high optical power emitting radiation on the order of 1.5 to 2.3 candelas when operating at 20 milliamps DC.
  - (3) The signs shall be wired from 120 VAC to power the sign and heater. A 125 VAC control relays shall be provided to activate the 120 VAC sign.
  - (4) An adjustable thermostat shall be provided to activate the face defroster. The thermostat shall be adjustable from +50 F to -40 F.
  - (5) A photocell shall be provided to activate the dim mode for improved nighttime readability. There shall be an adjustment to control the level of dimming in the dim mode. If the display is too bright when in dim mode an adjustment shall be able to decrease the intensity to the desired level.

(c) Sign Enclosures:

- (1) Enclosures shall be constructed of thick extruded aluminum, not less than 0.125 inches thick with aluminum structural framing and mounting members integrally welded into the Enclosures. Construction shall meet the requirements for NEMA 4 enclosures. All components shall be readily accessible for maintenance when access doors are opened. All corners and seams of the enclosures shall be heli-arc welded to provide a weatherproof seal around the entire case. All fasteners and hardware shall be corrosion-resistant stainless steel. All enclosures shall be constructed for weatherproof, severe service conditions with drainage holes and vents to prevent the build-up of moisture within the enclosures.
- (2) Access doors shall be attached with continuous stainless steel hinges and pin and shall have a 3/16" x 1" weatherproof and dust-tight neoprene gaskets and a three point locking system which secures the door at the top, center and bottom. The signs shall have #3 stainless steel 1/4 turn link-locks per door. One padlock with two keys shall be supplied with each sign. All locks shall be keyed alike.
- (3) The 0.125" extruded aluminum doors shall have one side removable to gain access to the sign face. The sign face shall be 0.080 aluminum and have the entire LED assembly mounted to it. Each door shall be fitted with a sun hood of 0.063 aluminum. The sign face shall be protected by a 3/16" thick laminated, tinted safety glass with a face defroster (heater). The heater tape shall be provided on the inside surface to keep the face clear of snow. The control of the heater shall be via one of the 120 VAC control relays, energized via the PLC.
- (4) The sign housing and face shall be washed and rinsed, acid-etched and rinsed and primed with zinc-chromate primer. The interior sign housing and sign face shall be painted with two coats of federal standard color #6307 (Hanford Grey).
- (5) The housing shall be pre-drilled top and bottom to accommodate a Pelco model AB-116 'astro-brac' mounting bracket.
- (6) Mounting hubs for the electrical connections and supports shall be of cast aluminum alloy with 1.5 inch standard pipe threads. The hubs shall be mounted on gaskets and secured to the sign enclosures with three, 5/16 x 1 inch, stainless steel, hex head bolts and nuts.
- (7) Each Chevron sign shall be supplied with visors to reduce sun glare.

(d) Message Module:

- (1) The LED message module shall consist of a rigid aluminum message plate with high intensity LED's and LED drive electronics.
- (2) Five types of LED message modules, in quantities as shown on the drawings, shall be provided as follows:
  - a. Operational Warning Sign "GATES CLOSING"
  - b. Operational Warning Sign "STAY IN YOUR LANE"
  - c. Ramp Closed Sign "X"
  - d. Ramp "Open/Closed" sign
  - e. Chevron (three per each ramp) ">>>"
- (3) The LED's shall be mounted in the panel via mounting fixing clips. The door panels shall be flat black to maximize legibility when the LED's are activated. All electrical connections shall be made via barrier type terminal strips.

(e) Controls and Wiring:

- (1) All wiring shall be in accordance with the requirements of the National Electric Code and individual wires color coded. All Electrical components shall be modular, interchangeable, plug-in type construction and shall be of standard components. Connection of field wires shall be made via barrier type terminal blocks.
- (2) On and off control of signs shall be provided by a 120 volt AC signals from the programmable logic controllers (PLC's) located in the Ramp building via the remote output module in the swing gate. Each sign shall be equipped with a relay controlled by a 120 volt AC signal to switch the power on and off.
- (3) On and off control of the face defroster heater tape shall be provided by a thermostat in each sign.
- (4) The relays shall be electrically held, heavy duty, rated at 300 volts with a minimum of two normally open (N.O.) and two normally closed (N.C.) independent electrically isolated contacts. The relays shall be hermetically sealed, with convertible, high reliability contact rates not less than 5 ampere resistive. Contact ratings shall be NEMA A300 AC as per Contract Drawings. Relays shall be as manufactured by Allen Bradley, catalog #700-N, or as approved by the Engineer.
- (5) Full range dimmers, controlled by photocells, shall be provided for all signs to automatically switch the brightness of the messages for daytime and nighttime operation. Each dimmer shall be provided with a means of convenient manual adjustment, within the sign housing, to obtain the desired reduction of brightness for nighttime operation.
- (6) The sign shall have 120VAC, 1Ph input terminals, and 125VAC control power terminals separated by a barrier, to accept field power and control wiring.

## CONSTRUCTION REQUIREMENTS

**General.** The installation work shall include, all transportation and handling from the Auxiliary Sign Vendor, temporary storage of the units as necessary, transportation and handling of the units to the installation location, all field Installation work as specified and in accordance with the Auxiliary Sign Vendor's installation requirements, all adjustments required for the Auxiliary Sign Vendor's installation certification, and adjustments necessary as the result of operational testing requirements as specified. Remove all existing aux signs and install new signs. Reuse existing wiring and make connections as required for a functions power and control installation for the Operational WARNING Signs. Provide new wiring from the first three swing gates on each ramp for the Chevrons mounted on the barrier ahead of swing gate control panel and make final connections

### Installation:

- a) The Contractor shall install the signs as complete operable units in the quantities as shown on the Contract Drawings. Each Sign installed shall include, but not be limited to, the major components as listed above. The Contractor shall submit shop drawings of the sign supporting structures for approval by the Engineer prior to start of fabrication.
- b) Operational Warning (OW) Signs: Stub posts, base plates installed on existing foundations are to be provided under this contract. The Contractor shall provide all support structures and hardware required, as shown on the Contract Drawings, to mount the OW-Signs to the base plates provided.
- c) Chevron Signs. The Contractor shall re-install all support structures and provide hardware required, as shown on the Contract Drawings, to mount the Chevron Signs to the top of the concrete barrier, ahead of the swing gate housings.
- d) Prior to starting installation, the Contractor shall verify the field conditions and confirm that adjacent roadways, and swing gate housings are in compliance with the Contract Drawings and reference drawings provided. Any and all deviations shall be called to the Engineer's attention, in writing, prior to starting installation.
- e) Before the Sign installation at each location, the Contractor and the Engineer shall jointly inspect the equipment and components at the job site. This inspection shall determine compliance with the specifications and with the Manufacturer's approved data and shop drawings. Any and all deviations shall be called to the Engineer's attention, in writing, prior to starting installation. The Contractor shall notify the Engineer ten days before the start of such inspections.
- f) The Contractor shall do all cutting, drilling, and patching of new and existing work as is necessary for installation of the Signs according to the Drawings and Specifications. All existing construction that is disturbed in the process of new construction shall be repaired or replaced in its original condition.



- g) The cutting and drilling of structural steel members and cutting through of reinforcing steel, pavement, or footings shall be permitted only with prior approval by the Engineer. When cutting is necessary, it shall be done in a careful manner and under the strict supervision of the Contractor's superintendent as directed by the Engineer.
- h) The Sign equipment shall be installed in strict accordance with the Manufacturer's installation instructions.
- i) The Contractor shall install the Sign supporting structures level, plumb, and true, at the locations specified on the Contract Drawings.
- j) The Contractor shall optimally orient the signs' vertical and horizontal axes to minimize ambient lighting conflicts and maximize visual sight distance by drivers in the left two lanes as well as properly adjust each full range dimmer.

**Method of Measurement.** This item shall be measured (counted), each, for each unit procured, installed, and certified by the Auxiliary Sign Vendor as having been properly installed, wired, and the loose components assembled to the unit. Note that the Auxiliary Signs must be electrically connected to allow Field Operational Testing as specified prior to testing and the Auxiliary Signs Vendor's certification. Note also that the Auxiliary Signs Vendor's certification is specified to occur on a ramp by ramp basis.

**Basis of Payment.** This work shall be paid at the contract unit price each for:

*AUXILIARY SIGN (procurement, installed and wired) TYPES:*

*OPERATIONAL WARNING SIGN "GATES CLOSING"*

*OPERATIONAL WARNING SIGN "STAY IN YOUR LANE"*

*RAMP CLOSED SIGN "X"*

*RAMP "OPEN/CLOSED" SIGN*

*CHEVRON SIGN ">>>"*

which shall be payment in full for the work, complete, as specified herein regardless of location or auxiliary sign type.

## **BUILDING MECHANICAL HVAC WORK**

**Description.** This work shall consist of furnishing and performing all operations necessary for the complete installation and execution of the BUILDING MECHANICAL HVAC WORK, as shown on the Plans and hereinafter specified, complete and operational in every respect.

The general scope of work under this item includes, but is not limited to:

- (a) Removal of existing, and installation of new, roof mounted packaged air conditioning units including installation of roof curb adapters to match existing roof opening, and all controls, as indicated and specified.
- (b) Removal of existing roof mounted supply and exhaust fans, and installation of new replacement fans, on existing roof curbs, as indicated.
- (c) Removal of existing unit heaters, and installation of new unit heaters, supports and controls, as indicated.
- (d) Installation of new split system direct expansion air conditioning systems, including all supports, controls, and interconnection refrigerant piping systems, as indicated, to serve as back up cooling for Nodal Buildings.

Apparatus, appliances, material or work not shown on the Plans, but mentioned in these special provisions, or vice versa, or any incidental accessories necessary to make the Nodal Building Mechanical HVAC electrical work complete and ready for operation, even though not specified or shown on the plans, shall be furnished and installed by the Contractor under this pay item.

### **Equipment.**

## **PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS**

### **General.**

**Outdoor, rooftop mounted, electrically controlled, cooling unit utilizing (a) hermetic scroll compressor(s) for cooling duty.**

- (a) Factory assembled, single piece cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
- (b) Unit shall use Puron refrigerant.
- (c) Unit shall be installed in accordance with the manufacturer's instructions.
- (d) Unit must be selected and installed in compliance with local, state, and federal codes.

### Quality Assurance

- (a) AHRI Compliance: Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs. Comply with AHRI 270-1995 for testing and rating sound performance for RTUs.
- (b) AMCA Compliance: Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311. Damper leakage tested according to AMCA 500-D. Operating Limits: Classify according to AMCA 99.
- (c) ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- (d) NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- (e) UL Compliance: Comply with UL 1995.
- (f) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **Materials.**

#### (a) Unit Cabinet

- (1) Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
- (2) Interior cabinet surfaces shall be insulated with a minimum 1/2-inch-thick, minimum 1 1/2 lb. density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
- (3) Condensate Drain Pans: Fabricate using stainless-steel 0.025-inch-thick, a minimum of 2 inches deep, sloped, and complying with ASHRAE 62.1 for design and construction of drain pans.

#### (b) Fans

- (1) Direct-Driven Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized-or painted-steel fan scrolls. Blower fan shall be double-inlet type with forward-curved blades and have permanently lubricated bearings.
- (2) Condenser-Coil Fan: Direct-driven propeller type fan, totally enclosed motor, permanently lubricated bearings, and shall be dynamically balanced.
- (3) Motor Sizes: Premium efficiency. Minimum size as indicated. Comply with "Common Motor Requirements for HVAC Equipment" section.

(c) Coils

- (1) Refrigerant Coils: Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with joints brazed. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

(d) Refrigerant Circuit Components

- (1) Compressor: Fully hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater. Compressor motors shall be cooled by refrigerant piping passing through motor windings.

(e) Electrical Power Connection

- (1) RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

(f) Controls

- (2) Electronic Controller: Wall mounted controller shall have volatile-memory backup, with the following features: Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
- (3) Supply Fan Operation: Occupied/Unoccupied Periods: Cycle fan to maintain space temperature setpoint.

(g) Accessories

- (4) Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
- (5) Non-fused disconnect switch shall be factory-installed, internally mounted. NEC and UL approved non-fused switch shall provide unit power shutoff and shall be accessible from outside the unit.

(h) Roof Curb (Vertical)

- (6) Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards. Provide 1-inch-thick curb insulation and adhesive complying with NFPA 90A or NFPA 90B.

## **WALL AND CEILING UNIT HEATERS**

### **General.**

- (a) Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- (b) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **Materials.**

#### (a) Unit Cabinet

- (1) Cabinet shall be made of 18-gauge die formed furniture grade steel. Individual adjustable louvers with 30-degree downward stops shall be furnished to provide desired control of discharge air. All metal surfaces of the enclosure shall be phosphate coated to resist corrosion and finished in a durable polyester powder coat finish.
- (2) Mounting: Mounting brackets designed for wall swivel mounting shall be furnished as shown on the heating schedule.

#### (b) Coil

- (1) Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

#### (b) Fan and Motor

- (1) Fan: Aluminum, directly connected to fan motor, designed specifically for unit heater application.
- (2) Motor: Totally enclosed, designed for continuous heavy-duty all-angle operation and equipped with built-in thermal overload protection, with stainless steel louvers. Comply with "Common Motor Requirements for HVAC Equipment" section.

(c) Controls

- (1) Unit-mounted thermostat. Low-voltage relay with transformer kit.
- (2) Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.
- (3) Alarm Contacts: Low temperature alarm contact shall be provided for connecting to a PLC Control System for remote alarming. Contacts shall be rated 120 VAC, 10 amps minimum.

(d) Accessories

- (1) Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.

## **HVAC POWER VENTILATORS (REF)**

### **General.**

- (a) Fan shall be a tiered aluminum, low profile, roof mounted, direct driven, centrifugal exhaust ventilator.

### Quality Assurance.

- (a) AMCA Compliance: Fan shall bear the AMCA certified ratings seal for sound and air performance.
- (b) UL Compliance: Comply with UL 705.

### **Materials.**

(b) Housing

- (1) Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. Fan shall be enclosed in a tiered extruded aluminum housing. Aluminum base shall have continuously welded curb bap corners for maximum leak protection.

(c) Fan Wheels

- (1) Wheel shall be centrifugal backward-inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency.

(d) Motor

- (1) Motor shall be heavy duty type with permanently lubricated sealed bearings, mounted on a minimum 12-gauge steel power assembly, isolated from the unit structure with rubber vibration isolators, and furnished at the specified voltage, phase and enclosure.

(e) Accessories

- (1) Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
- (2) Motorized Backdraft Damper: Motorized dampers feature an extruded aluminum frame, aluminum blades and aluminum hinge pins with nylon bushings. Motors are shipped loose for field installation. Available voltages include 110, 220, or 440 voltages.

**FORWARD-CURVED CENTRIFUGAL FANS (RSF)**

**General.**

- (a) Fan shall be tiered aluminum hooded, roof mounted, belt driven, centrifugal filtered supply fan.

**Quality Assurance.**

- (a) A AMCA Compliance: Fan shall bear the AMCA certified ratings seal for sound and air performance.
- (b) UL Compliance: Comply with UL 705.

**Materials.**

(a) Housing

- (1) Fan shall be of bolted construction utilizing corrosion resistant fasteners. Hood shall be tiered extruded aluminum, bolted to a minimum 16-gauge steel fan base with prepunched mounting holes. Units shall be provided with an insulated aluminum top cover and 1" washable permanent aluminum filter.

(b) Fan Wheels

- (1) Wheel shall be steel, centrifugal forward curved type. Wheel shall utilize an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.

- (c) Motor
  - (1) Motor shall be NEMA Design B with Class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure. Internal blower and motor assembly shall be mounted on rubber vibration isolators.
- (d) Bearings
  - (1) Bearings shall be ball type selected for minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
- (e) Belts and Drives
  - (1) Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.
- (f) Accessories
  - (1) Disconnect Switch Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
  - (1) Motorized Intake Backdraft Damper: Extruded aluminum blades and aluminum hinge pins and nylon bushings. Intake backdraft damper features a spring return for closing. Maximum operating temperature 200°F. Motors are non-overloading type available in 110 or 220 voltage.

## **SPLIT-SYSTEM AIR-CONDITIONERS (ACU, CU)**

### **General.**

- (a) Ductless single-split air conditioner.

### Quality Assurance

- (b) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- (c) ASHRAE Compliance: Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
- (d) ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- (e) ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.



**Materials.**

(a) Indoor Unit: Wall-Mounted Evaporator-Fan Components

(1) Cabinet

- i. Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.

(2) Refrigerant Coil

- i. Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

(3) Fan

- i. Direct drive, centrifugal.

(4) Fan Motors

- i. Multitapped, multispeed with internal thermal protection and permanent lubrication. Enclosure Type: Totally enclosed, fan cooled. NEMA Premium (TM) efficient motors as defined in NEMA MG 1. Controllers, Electrical Devices, and Wiring. Mount unit-mounted disconnect switches on exterior of unit.

(5) Condensate Drain Pans

- i. Stainless steel, fabricated with one or two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection. Extend drain pan downstream from leaving face to comply with ASHRAE 62.1. Depth: A minimum of 1 inch deep. Provide drain connection located at lowest point of pan and sized to prevent overflow.

(6) Air Filtration Section

- i. Comply with NFPA 90A. Minimum MERV according to ASHRAE 52.2.

(b) Outdoor Units: Air-Cooled, Compressor-Condenser

(1) Casing

- i. Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

(2) Compressor

- i. Hermetically sealed scroll type compressor with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

(3) Refrigerant Coil

- i. Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

(4) Fan

- i. Aluminum-propeller type, directly connected to motor. Motor: Permanently lubricated, with integral thermal-overload protection.

(c) Accessories

- (1) Thermostat: Low voltage with subbase to control compressor and evaporator fan or wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

- (2) Controls features: Compressor time delay; 24-hour time control of system stop and start; Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed; Fan-speed selection including auto setting. Automatic-reset timer to prevent rapid cycling of compressor.

- (3) Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

- (4) Drain Hose: For condensate.

- (5) Alarm Contacts: High temperature alarm contact shall be provided for connecting to a PLC Control System for remote alarming. Contacts shall be rated 120 VAC, 10 amps minimum.

(d) Electrical Power Connection

- (1) Power: Indoor, wall mounted unit (ACU) to be powered by outdoor, roof mounted unit (CU).

## **COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

### **General.**

- (a) Comply with NEMA MG 1 unless otherwise indicated.

### Motor Characteristics.

- (a) Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level.
- (b) Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

### Polyphase Motors.

- (a) Description: NEMA MG 1, Design B, medium induction motor.
- (b) Efficiency: Premium efficient, as defined in NEMA MG 1.
- (c) Service Factor: 1.15.
- (d) Multispeed Motors: Variable torque. For motors with 2:1 speed ratio, consequent pole, single winding. For motors with other than 2:1 speed ratio, separate winding for each speed.
- (e) Rotor: Random-wound, squirrel cage.
- (f) Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- (g) Temperature Rise: Match insulation rating.
- (h) Insulation: Class F.
- (i) Code Letter Designation: Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- (j) Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

### Single-Phase Motors.

- (a) Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application: Permanent-split capacitor.
- (b) Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- (c) Motors 1/20 HP and Smaller: Shaded-pole type.
- (d) Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

### THERMOSTAT CONTROLS

- (a) Alarm Contacts: Low and high temperature alarm contacts shall be provided for connecting to a PLC Control System for remote alarming. Contacts shall be rated 120 VAC, 10 amps minimum.

### SHEET METAL DUCTWORK REQUIREMENTS

- (a) Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- (b) Galvanized Sheet Steel: Comply with ASTM A653/A653M. Galvanized Coating Designation: G90. Finishes for Surfaces Exposed to View: Mill phosphatized.

### GENERAL PROCEDURES FOR TESTING AND BALANCING

- (a) Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
- (b) Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- (c) Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

- (d) Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- (e) Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- (f) Verify that motor starters are equipped with properly sized thermal protection.
- (g) Check dampers for proper position to achieve desired airflow path.
- (h) Check condensate drains for proper connections and functioning.
- (i) Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
- (j) Measure total airflow. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
- (k) Measure fan static pressures as follows: Measure static pressure directly at the fan outlet or through the flexible connection.

### **CONSTRUCTION REQUIREMENTS**

#### **General.**

- (a) The Contractor shall perform all Work with trained mechanics of the particular trade involved in a neat and workmanlike manner as approved by the Engineer.
- (b) Materials and installation shall comply with codes, laws and ordinances of Federal, State, and local governing bodies having jurisdiction. Should any work performed by the Contractor be deemed by the Engineer non-compliant with the applicable building codes, State and Federal laws, local ordinances, industry standards and utility company regulations, changes for compliance shall be completed by the Contractor at no additional cost to the Department.
- (c) In the event of any conflict between building codes, State and Federal laws, local ordinances, utility company regulations, and the contract documents, the most stringent code shall govern.
- (d) All equipment and materials acquired for this Project shall conform to the latest adopting ordinances, acts, laws, rules and regulations of the following organizations:
  - (1) Chicago Mechanical Code
  - (2) American National Standards Institute (ANSI)
  - (3) National Fire Protection Association (NFPA)
  - (4) Underwriters Laboratories Inc. (UL)
  - (5) Occupational Safety and Health Administration (OSHA)

- (e) Unless otherwise specified herein in these Special Provisions, all equipment and materials acquired and installed under this contract must comply with all applicable requirements of the latest edition of the Standard Specifications.
- (f) The Contractor shall perform all Work in cooperation with other trades and schedule to allow speedy and efficient completion of the Project.
- (g) The Contractor shall furnish other trades with advance information on locations and sizes of frames, boxes, sleeves and openings needed for the Work, and furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.
- (h) Where there is evidence that work of one (1) trade will interfere with the work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings and installation drawings.
- (i) Work installed before coordinating with other trades so as to cause interferences with the work of such other trades shall be changed as directed by the Engineer to correct such condition without additional cost to the Department.
- (j) All equipment shall be installed with workspace clearances as required by applicable codes, and to permit maintenance and replacement of components. The Contractor shall adjust the location of equipment to accommodate the installation in accordance with field conditions encountered.
- (k) Equipment furnished shall have the manufacturer's name, address, and model number and rating on the manufacturer's nameplate securely affixed in a conspicuous place. The nameplate of a distributing agent is not acceptable. Code ratings, labels or other data, including any that are die-stamped into the surface of the equipment, shall be placed in a visible location.

**Installation.**

(a) Equipment Noise Limitation

- (1) The Contractor shall check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.
- (2) The Contractor shall remove and replace any individual electrical item or device that is found to produce a sound energy output exceeding that of other identical devices installed on this Project.

(b) Transmission of Vibration

- (1) Mechanical equipment, supports and systems shall not be mounted to or supported by elements subject to vibration except by methods that shall prevent transmission of vibration thereof.

(c) Protection

- (1) The Contractor shall protect building openings, duct and equipment openings during construction against the entrance of foreign matter by means of covers, plugs or caps.
- (2) The Contractor shall cover materials, equipment and devices furnished or installed under this Contract or otherwise protect against damage, before, during, and after installation.
- (3) Fixtures, materials, equipment, or devices damaged prior to final acceptance of the Work shall be restored to their original condition or replaced.
- (4) Equipment shall be inherently safe and moving parts shall be secured appropriately.

(d) Equipment Bases

- (1) The Contractor shall furnish and install bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, channels, etc., for installation of equipment and apparatus that is roof or wall mounted.

(e) Hangers

- (1) The Contractor shall furnish and install adequate supports for all equipment, either suspended from the construction above, or by means of struts to the construction below.
- (2) The Contractor shall furnish and install straps, clamps, threaded rods, turnbuckles and anchors and all miscellaneous specialties for the attachment of hangers and supports to the structure.

(f) Sleeves

- (1) The Contractor shall furnish and install sleeves where piping passes through walls as required by the Plans, and/or as directed by the Engineer.
- (2) Sleeves shall be 18-gauge galvanized sheet metal or plastic, as approved by code, of sufficient length to finish flush with finished surfaces at both ends of sleeves. Sleeves shall be not less than one (1) inch larger than outside diameter of piping.

- (3) Where piping passes through roof or exterior walls, the Contractor shall caulk sleeves with non-hardening sealant at both ends to ensure waterproofing.
- (4) Sleeves shall be set true to line level plumb and position and shall be so maintained during construction.

(g) Painting

- (1) All mechanical equipment not specified for factory finish painting under other Special Provision Items shall be painted as specified herein.

(h) Patching

- (1) The Contractor shall provide all cutting and patching of building materials required for the installation of the Work herein specified. No structural members shall be cut without the approval of the Engineer. Roof deck is considered a structural member. Approved cutting shall be done with concrete saws or core drills.
- (2) Patching shall be provided by mechanics of the particular trade involved and done in a neat and workmanlike manner.

(i) Cleaning

- (1) All rubbish and debris shall be collected, removed from the jobsite, and disposed of legally on daily basis. The Contractor shall ensure the installation environment is free of any construction debris, packing materials or any other debris that may cause a safety/trip hazard. All floors shall be kept in a broom clean condition.
- (2) Cleaned shall mean the thorough removal of, but not limited to, dust, dirt, oil, grease, cement, plaster, welding spatters and paint spatters. All cleaning agents and methods shall be in accordance with the electrical equipment manufacturers' recommendations and subject to approval of the Engineer.

**Submittals.**

(a) Action Submittals

(1) Product Data:

- i. For each rooftop unit (RTU).
- ii. For each unit heater (UH).
- iii. For each type of air device.
- iv. For each split-system air conditioner (ACU) and associated condensing unit (CU).
- v. For each supply fan (RSF).
- vi. For each exhaust fan (REF).



(2) Shop Drawings:

- i. For each rooftop unit (RTU), unit heater (UH), supply and exhaust fan (RSF, REF) provide the following:
  - i. Include plans, elevations, sections and details.
  - ii. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - iii. Include diagrams for power, signal, and control wiring.

(b) Closeout Submittals

(1) Provide operation and maintenance data for each of the following:

- i. Rooftop, packaged air conditioning unit (RTU).
- ii. Unit heaters (UH).
- iii. Split system air conditioner and condensing unit (ACU, CU).
- iv. Supply fan (RSF).
- v. Exhaust fan (REF).

(c) Warranty

- (1) Special Warranty: Manufacturer agrees to repair or replace components of equipment that fail in materials or workmanship within specified warranty period.

### **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This work will not be measured for payment.

**Basis of Payment.** This work will be paid at Contract price per lump sum for MECHANICAL HVAC WORK, BUILDING A; MECHANICAL HVAC WORK, BUILDING C; MECHANICAL HVAC WORK, BUILDING D; MECHANICAL HVAC WORK, BUILDING E; for the indicated building, performed in accordance with the Plans and Special Provisions.

**ELECTRICAL WORK, 'BUILDING X'**

**Description.** This work shall consist of furnishing and performing all operations necessary for the complete installation and execution of the building ELECTRICAL WORK, BUILDING 'X' shown on the Plans and hereinafter specified, complete and operational in every respect. This work shall consist of non-PLC control related electrical items located in each building.

Apparatus, appliances, material or work not shown on the Plans, but mentioned in these special provisions, or vice versa, or any incidental accessories necessary to make the building electrical work complete and ready for operation, even though not specified or shown on the plans shall be furnished and installed by the Contractor under this pay item.

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, finishing, testing, and making fully operational the electrical components and systems for the REVLAC remote buildings. All additional special provisions provide further information, requirements, and guidelines that are applicable to the work paid for under the bid items addressed by this special provision.

Comply with all local codes, all laws applying to electrical installations in effect and with the regulations of the latest National Electrical Code, where such regulations do not conflict with the laws in effect and with the requirements of the utility company.

It is the intention of the contract plans to call for completely finished work, fully tested and ready for reliable and consistent operation. Furnish, deliver, and install any apparatus, appliance, materials, or work not shown on the plans but mentioned in the special provisions or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, to be furnished, delivered, and installed without additional expense to the department.

**Scope.** The work under this item includes, but is not limited to:

- (a) Removal and disposal of existing battery charger, inverter, and batteries at each building.
- (b) Furnishing and installation of new panelboards for UPS Power supply.
- (c) Removal and replacement of existing building lighting at each building
- (d) Removal of abandoned gate heater panelboards and contactors.
- (e) HVAC electrical connections, disconnects, conduit and cables.
- (f) Conduit, junction boxes, switches, disconnects and wiring required for installation and modification of lighting, power supplies, HVAC, panelboards, heating panels and auxiliary equipment that require electrical connections.
- (g) Removal, salvage and disposal of existing control equipment.

**Materials.** The Contractor shall provide all new materials that conform to the standards of the Underwriters Laboratories, Inc., in every case where such a standard has been established for the particular type of materials in question. The Contractor shall submit to the Engineer for approval, prior to purchase of any materials or equipment required to be furnished and installed, a complete list of all such materials and equipment including manufacturer's catalog (part and/or model) numbers, catalog data sheets, illustrations, and shop drawings.

- (a) In addition to the standard specifications, all equipment shall be furnished and installed in accordance with the applicable requirements of the following:
  - (1) NFPA 70, National Electrical Code
  - (2) NFPA 79, Electrical Standard for Industrial Machinery
- (b) Ensure that equipment and its installation present a neat and attractive appearance. Use new heavy-duty industrial design, equivalent to the best grade of the particular type of equipment made by the leading manufacturers of such equipment.
- (c) Furnish new equipment that is compatible with all other associated equipment in the system. Ensure that all items furnished perform the function indicated on the approved drawings and as required by the design.
- (d) Provide the department a written warranty for operation of the bridge and for all of the components furnished under this work, to cover a period of one year after Substantial Completion as described in article "Control of the Work". Have normal manufacturer warranties extended to cover parts and labor for this period.
- (e) The main components of the building electrical work are as described below. All other ancillary items required for a fully functional and complete installation are included as part of the work under this Special Provision. Materials and installations shall conform to the applicable Codes and Standards.
- (f) The following equipment shall be furnished and installed by the Contractor:
  - (1) All Power Conduit Runs, Fittings, and Bushings
  - (2) All Wires and Cables – 600 Volt
  - (3) All Enclosures for Electrical Equipment and Fittings
  - (4) All Pull Boxes and Junction Boxes
  - (5) All Outlet Boxes
  - (6) All Wiring Devices
  - (7) All Transformers
  - (8) All Panelboards
  - (9) All Disconnect Switches
  - (10) All Building Lighting Fixtures
  - (11) All Electrical Identification
  - (12) All Power Cable Runs
  - (13) All Electric Service Connections
  - (14) Grounding System Modifications
  - (15) All Automatic and Manual Bypass Switches
  - (16) Electrical Testing

Conduit, Fittings, and Bushings

- (a) Galvanized Rigid Steel (GRS) Conduit. GRS conduit shall be heavy wall type, hot-dipped galvanized with zinc-coated threads, and must be Underwriters' Laboratory (UL) labeled. GRS conduit and couplings shall be threaded, rigid steel, hot-dipped galvanized. The GRS conduit shall meet the requirements of Section 810 of the Standard Specifications.
- (b) PVC Coated GRS Conduit. PVC coated rigid steel conduit, including elbows and couplings, shall meet the requirements of Section 810 of the Standard Specifications.
- (c) Flexible Conduit. Plastic-coated, flexible metal conduit shall be in accordance with UL 360, type UA with PVC outer jacket and integral ground conductor. Flexible conduit installed in wet locations, exterior locations, and at motors shall be liquid-tight type and shall meet the requirement of Section 810 of the Standard Specifications. Flexible liquid-tight conduit shall be galvanized steel with a UL listed moisture and oil-proof plastic coated jacket.
- (d) Conduit Bushings. Conduit bushings shall be malleable iron body with 150 degrees C insulating ring. Insulating material shall be self-extinguishing, locked in place, and non-removable.
- (e) Conduit Fittings. All conduit fittings shall be of the types specified and in accordance with UL 514 for normal application and UL 886 for use with plastic-coated flexible metal conduit.

Wires and Cables-600 Volts Wires and cables shall be soft copper, properly refined, and shall have minimum conductivity of 98 percent. All conductors shall conform to the latest NEC, and shall bear Underwriters' Laboratory label.

- (a) Conductors for power and lighting shall not be less than size 12 AWG,
- (b) Wires for signal and control systems shall be stranded size 14 AWG, unless otherwise indicated on the Plans or in other items of these special provisions.
- (c) Wires and cables shall be delivered to the job site in original packing or on factory reels. All wires and cables shall bear tagging or marking on the finish at regular intervals consisting of manufacturer's name as well as the insulation type, voltage rating, UL listing and date of manufacturing.
- (d) Wire and cable shall have factory color-coded insulation and shall be installed and connected as follows:
  - (1) Color coding for voltage system of 150 volts and less shall be:
    - i. "A" Phase: Black
    - ii. "B" Phase: Red
    - iii. "C" Phase: Blue
    - iv. Neutral: White
    - v. Ground: Green

(2) Color coding for voltage system of over 150 volts and less than 600 volts shall be as follows:

- i. "A" Phase: Brown
- ii. "B" Phase: Orange
- iii. "C" Phase: Yellow
- iv. Neutral: White
- v. Ground: Green

(3) Green shall be used for grounding only.

- (e) The insulation shall be applied tightly to the conductor and shall be free stripping.
- (f) Branch circuit wiring shall be solid copper size 12 AWG unless otherwise specified.
- (g) Wires size 10 AWG and larger shall be stranded copper unless otherwise specified.
- (h) Wires type THHN/THWN thermo-plastic insulated, rated 90°C dry and 90°C wet shall be used for lighting, power, and other wiring applications not otherwise specified.
- (i) Wires type SF-2 silicone insulated glass braid jacket, size 12 AWG (minimum size), 200°C-rated shall be used for fixture wiring and for recessed incandescent fixtures.
- (j) Single conductor cables installed outdoors in exposed conduit installations shall be ethylene-propylene-rubber (EPR) insulated with a Hypalon jacket. The cables shall be UL listed as Type RHH/RHW-2/USE-2, VW-1, 600-volt rated at conductor temperatures not exceeding 90°C in wet or dry locations. The cable shall be manufactured in accordance with ICEA Standard S-68-516 and UL Standards 44 and 854. The insulation shall be Type II EPR in accordance with ICEA S-68-516. The jacket shall be Chlorosulfonated Polyethylene in accordance with ICEA S-68-516.
- (k) Ground cables shall be soft drawn, annealed, stranded copper with green insulation in required sizes and quantities for all equipment grounding.
- (l) The 600-volt insulated wires and cables shall be factory tested prior to shipment in accordance with ICEA standards for the insulation specified.
- (m) Samples and reports on the results of shop tests for all wire and cables, descriptive literature for splices and terminations shall be submitted to the Engineer.

#### Connectors

- (a) Compression connectors shall be long barrel, tin-plated copper, and closed end compression type. The barrel for each cable lug shall be sized for the exact cable size specified.
- (b) Copper-Aluminum connectors are not acceptable. Mechanical or set-screw types are not acceptable. The cables shall be terminated with the die type compression tools.
- (c) Conductors size 2 AWG and larger shall terminate in two (2)-hole solderless lugs.
- (d) Conductors size 8 AWG through size 3 AWG inclusive shall terminate in one (1)-hole lugs.

Enclosures for Electrical Equipment and Fittings Enclosures for electrical equipment shall conform to the area classification noted on the Plans.

- (a) Text NEMA Type 12 enclosures shall be used in indoor dry areas.
- (b) NEMA Type 4X enclosures shall be used for all outdoor panels and junction boxes.

Pull Boxes and Junction Boxes Pull boxes and junction boxes shall meet the requirements of Section 813 of the Standard Specifications, except as modified on the Plans and as required by this Special Provision.

- (a) Outdoor boxes shall be JIC NEMA Type 4X, minimum 16 gauge, 316 stainless steel with stainless steel hinged cover and fasteners, unless otherwise noted on the Plans.
- (b) Indoor boxes shall be NEMA Type 12 gasketed, 14 gauge, continuously welded seam, galvanized box and cover. Each cover shall be secured with round, recessed, pan head, or flat head stainless steel screws.

Outlet Boxes

- (a) Outlet boxes in interior areas, installed concealed shall be galvanized, pressed steel, knockout type, punched or partially punched.
- (b) Exposed boxes for switches, receptacles, etc., inside the building shall be the solid box type. Outlet boxes shall conform to UL 514 standard.

Wiring Devices All wiring devices shall be installed in cast FS boxes with FS covers.

- (a) Switches. Toggle switches shall be rated 20 amperes, 120/277 volts, single-pole, and shall conform to Federal Specification W-C-596. The handle of each switch shall be brown or ivory.
- (b) Receptacles. Convenience outlets for general use shall be duplex, 3 wire, 20 amperes, 125 volts, NEMA 5-20R grounding type. Outlets shall be brown or ivory as approved by the Engineer.
- (c) UPS receptacles shall be orange in color, duplex, 3 wire, 20 amperes, 125 volts, isolated ground type.

Transformers: Transformers shall be designed, manufactured, and tested in accordance with the latest applicable ANSI, NEMA, and IEEE standards. All transformers must be UL listed.

- (a) Transformers shall be individually mounted dry-type, two-winding, self-cooled, with ratings and voltages as indicated on the Plans.
- (b) Transformers shall be designed for continuous operation at rated kVA for 24 hours a day, 365 days a year, with normal life expectancy as defined in ANSI C57.96.
- (c) Transformers rated 3 kVA to 30 kVA shall have Class F insulation for 185 degrees C total temperature (based on 115 degrees C rise). Transformers rated 30 kVA and above shall have Class H insulation for 220 degrees C total temperature (based on 150 degrees C rise).
- (d) Transformers shall be furnished with a minimum of two 5 percent taps below and two 5 percent taps above rated voltage, at full capacity rating.

- (e) The transformer core must be constructed with high grade, non-aging, grain-oriented silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Maximum magnetic flux densities must be substantially below the saturation point. The transformer core volume must allow efficient transformer operation at 10 percent above the highest tap voltage. The core laminations must be tightly clamped and compressed. Coils must be wound of electrical grade aluminum with continuous wound construction.
- (f) On units rated below 30 kVA, the core and coil assembly must be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock resistant seal. On units rated 30 kVA and above, the core and coil assembly must be impregnated with a non-hygroscopic, thermo-setting varnish and cured to reduce hot spots and seal out moisture. The assembly must be installed on vibration-absorbing pads and securely bolted to the base to minimize sound transmission.
- (g) Transformer enclosures must be made of heavy gauge steel and must be degreased, cleaned, primed, and finished with ANSI 61 grey weather-resistant enamel. All transformers must be equipped with a wiring component suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure must not exceed 90 degrees C. The core of the transformer must be visibly grounded to the enclosure.
- (h) On units rated below 30 kVA, the enclosure construction must be totally enclosed, non-ventilated, NEMA 3R, with lifting eyes. On units rated 30 kVA and above, the enclosure construction must be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings must be protected against falling dirt. On outdoor units, provide suitable weather shields over ventilation openings.
- (i) Units rated 10-50 kVA must not exceed a sound level of 45 dB

#### Panelboards

- (a) Each panelboard shall have voltage characteristics, bus size, main lugs only or main circuit breakers, surface mounted or recessed mounted cabinet, and number and size of branch circuit breakers as shown on the Plans. In general, panelboards shall be enclosed in 14 gauge (minimum) steel cabinet of dead front type, having steel trim, and door with continuous piano concealed hinges and cylinder type locks including two (2) keys thereof. Each panelboard shall be UL rated for short circuit rating as specified. Series integrated ratings are not acceptable.
- (b) Cabinets. Cabinets shall comply with applicable NEMA standards and shall be suitable for flush or surface mounting in locations as shown on the Plans. The cabinets shall provide a minimum of six (6) inches clear space for wiring gutters at top, bottom, and sides. Each cabinet shall be a minimum of 20 inches wide. Each cabinet shall be large enough to accommodate external cables and any special lug bus required to connect to oversized cable due to voltage drop.
- (c) Doors and Trims. Doors shall have concealed hinges. Trims shall be fastened with self-adjusting clamps. Double doors shall be provided where necessary, or as indicated on the Plans.

- (d) All busses shall be hard drawn electrolytic copper having 98 percent conductivity and sized on a basis of 1000 amperes maximum per square inch of cross sectional area.
- (e) Circuit Breakers. Circuit breakers shall be of "bolt on" type, and shall have a minimum interrupting rating of 65,000 amperes at 240 volts AC.
  - (1) Circuit breakers for all panels shall be thermal-magnetic with each pole providing inverse time delay and instantaneous circuit protection.
  - (2) Circuit breakers shall be back connected to bus bars, molded case heavy-duty type.
  - (3) Branch circuit breakers shall be single or multiple-pole with capacities and trip ratings as specified or as shown on the Plans.
  - (4) Each branch circuit breaker shall be identified by a card holder or designating button mounted adjacent to the circuit breaker to properly identify each circuit.
- (f) Each panelboard shall be furnished with a full-length ground bus drilled and tapped to accommodate a ground cable for each circuit breaker. Cable terminals shall be provided.
- (g) Neutral cables, where called for, shall be grouped and arranged on a common bus and each terminal shall be stamped to indicate number of breakers with which it is associated.
- (h) Panelboards Interior. Each panel interior shall be provided with adjustable brackets to permit leveling and aligning in cabinets. All lugs and terminators shall be copper. Aluminum copper connectors are not acceptable. Interchangeable locking devices shall be provided to lock breakers in an "Off" or "On" position.

#### Disconnect Switches

- (a) Disconnect switches shall be rated at 600 volts for use on 480 VAC and 250 volts for use on 240/208/120 VAC circuits.
- (b) Each disconnect switch shall be heavy duty, fusible or non-fusible as shown on the Plans. When fusible disconnect switches are required, they must be complete with the required fuses.
- (c) Disconnect switches shall have an external handle that can be padlocked in the "OFF" position. Handle operation shall be quick-make, quick-break, tease-proof mechanism.
- (d) Indoor disconnect switches shall be rated NEMA 12.
- (e) Outdoor disconnect switches shall be rated NEMA 4X.

#### Lighting Fixtures

- (a) Interior and exterior lighting fixtures shall be complete with all necessary mounting hardware, fittings, starters, reflectors, etc., and shall be ready for installation.
- (b) Light Emitting Diode (LED) Fixtures. LED fixtures shall be of the type called for on the Plans.
- (c) The Contractor shall provide auxiliary supports for proper fixture mounting and installation.



### Electrical Identification

- (a) Interior and exterior lighting fixtures shall be complete with all necessary mounting hardware, fittings, starters, reflectors, etc., and shall be ready for installation.
- (b) The Contractor shall provide white with black core laminated phenolic nameplates with 3/8-inch lettering etched through outer covering. Each nameplate shall be fastened with stainless steel screws to each piece of equipment.
- (c) All major electrical equipment shall be identified, this includes disconnect switches, panels, switches, etc. Disconnect switches serving feeders and over-current protective devices mounted in a switchboard shall be so identified. Embossed self-adhering plastic tape labels shall not be used.
- (d) Cable/wire markers shall be installed on both ends of all conductors. All wire and feeder cables shall be labeled with wire markers in all junction boxes, pull boxes, control panels, panel-boards, switchboards, etc. Cable and wire markers shall be per TIA-606 Standard for labeling telecommunication equipment. The markers shall be attached to all cables where entering or leaving a conduit run. Cable designation and circuit use shall appear on the tag.

### **CONSTRUCTION REQUIREMENTS**

**General.** The Contractor shall closely coordinate his/her work and submittals with the Engineer. Shop drawing submittals shall include, but not limited to, the following items:

- (a) Power Cables
- (b) Receptacles and Switches
- (c) Panelboards
- (d) Uninterruptible Power Supply Systems
- (e) Transformers
- (f) Disconnect Switches

Shop drawings shall consist of a complete list of materials including manufacturer's descriptive and technical literature, model cuts, drawings, installation instructions, mounting details, single line and control schematic diagrams of equipment, where applicable.

### Demolition

- (a) Existing electrical equipment and associated cabling shall be removed as shown on the Plans. Electrical demolition shall utilize means and methods selected to avoid damage to existing elements to remain or adjoining construction.
- (b) Removed cables, conduits, and boxes shall become the property of the Contractor and shall be disposed of in accordance with the Standard Specifications.

Pre-Installation Requirements.

- (a) Equipment and material shall be delivered to the job site or storage facility in its original containers, and shall be suitably sheltered from any adverse element and mechanical injury. The equipment and material shall be readily accessible for inspection until installed. Items subject to moisture damage shall be stored in dry heated spaces. Manufacturer's directions shall be followed in the delivery, handling, storage, protection, installation and operation of all equipment and materials.
- (b) The Contractor shall coordinate with the Engineer the movement of heavy machinery, equipment and heavy parts thereof brought into or onto the building or premises.
- (c) The Contractor shall secure and pay for all required permits, governmental fees, taxes and licenses necessary for the proper execution and completion of the Work.
- (d) The Contractor shall notify the Engineer of any proposed materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities.

**Installation.**

- (a) The Contractor shall perform all Work with trained labor of the particular trade involved in a neat and workmanlike manner as approved by the Engineer.
- (b) Materials and installation shall comply with codes, laws and ordinances of Federal, State, and local governing bodies having jurisdiction. Should any work performed by the Contractor be deemed by the Engineer non-compliant with the applicable building codes, State and Federal laws, local ordinances, industry standards and utility company regulations, changes for compliance shall be completed by the Contractor at no additional cost to the Department.
- (c) In the event of any conflict between building codes, State and Federal laws, local ordinances, utility company regulations, and the contract documents, the most stringent code shall govern.
- (d) All equipment and materials acquired for this Project shall conform to any acts, laws, rules and regulations of the following organizations:
  - (1) National Electrical Code
  - (2) National Electrical Safety Code (NESC/ANSI C2)
  - (3) American National Standards Institute (ANSI)
  - (4) National Fire Protection Association (NFPA)
  - (5) Institute of Electrical and Electronics Engineers (IEEE)
  - (6) Insulated Cable Engineers Association (ICEA)
  - (7) National Electrical Manufacturers Association (NEMA)
  - (8) Illuminating Engineering Society of North America (IESNA)
  - (9) Underwriters Laboratories Inc. (UL)
  - (10) Occupational Safety and Health Administration (OSHA)

- (e) Unless otherwise specified herein in these Special Provisions, all equipment and materials acquired and installed under this contract must comply with all applicable requirements of the latest edition of the Standard Specifications.
- (f) The Contractor shall perform all Work in cooperation with other trades and schedule to allow speedy and efficient completion of the Project.
- (g) The Contractor shall furnish other trades with advance information on locations and sizes of frames, boxes, sleeves and openings needed for the Work, and also furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.
- (h) Where there is evidence that work of one (1) trade will interfere with the work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings and installation drawings.
- (i) Work installed before coordinating with other trades so as to cause interferences with the work of such other trades shall be changed as directed by the Engineer to correct such condition without additional cost to the Department.
- (j) Minor changes in the locations of outlets, fixtures and equipment shall be made prior to rough-in at the direction of the Engineer and at no additional cost to the Department.
- (k) The Contractor shall cooperate with other trades and coordinate the Work to eliminate conflicts with other work.
- (l) Locations of electrical outlets, lighting panels, cabinets, equipment, etc. are approximate and exact locations shall be determined by the Contractor at the Project site.
- (m) The Contractor shall protect the materials and work of other trades from damage during installation of the Work provided under this Contract.
- (n) All equipment shall be installed with workspace clearances as required by applicable codes, and to permit maintenance and replacement of components. The Contractor shall adjust the location of equipment to accommodate the installation in accordance with field conditions encountered.
- (o) Equipment furnished shall have the manufacturer's name, address, and model number and rating on the manufacturer's nameplate securely affixed in a conspicuous place. The nameplate of a distributing agent is not acceptable. Code ratings, labels or other data, including any that are die-stamped into the surface of the equipment, shall be placed in a visible location.

#### Equipment Noise Limitation

- (a) Noise levels of electrical devices and equipment shall be within acceptable limits as established by NEMA or other valid noise rating agencies.
- (b) The Contractor shall check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.
- (c) Transformers shall be designed and rated for "quiet" operation.

The Contractor shall remove and replace any individual electrical item or device that is found to produce a sound energy output exceeding that of other identical devices installed on this Project.

#### Transmission of Vibration

- (a) Electrical equipment, conduit, and fittings shall not be mounted to or supported by elements subject to vibration except by methods that shall prevent transmission of vibration thereof.
- (b) Where flexible conduit lengths are utilized as a mean of isolating equipment and conduit systems vibration, care shall be exercised to assure continuity of ground throughout. Flexible conduit lengths shall be kept to a minimum.

#### Protection

- (a) The Contractor shall protect conduit and cable tray openings against the entrance of foreign matter by means of plugs or caps.
- (b) The Contractor shall cover fixtures, materials, equipment and devices furnished or installed under this Contract or otherwise protect against damage, before, during, and after installation.
- (c) Fixtures, materials, equipment, or devices damaged prior to final acceptance of the Work shall be restored to their original condition or replaced.
- (d) Equipment shall be inherently safe and moving parts shall be secured appropriately.

#### Equipment Bases

- (a) The Contractor shall furnish and install concrete pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, channels, etc., for installation of electrical equipment and apparatus that is floor-mounted.
- (b) Concrete pads shall be six (6) inches high, unless otherwise indicated on the Plans, complete with steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, dowels in floor to tie base to floor shall be provided. These pads shall be extended at least four (4) inches beyond the equipment outline on all four (4) sides, unless otherwise indicated on the drawings.

### Hangers

- (a) The Contractor shall furnish and install adequate supports for all equipment, either suspended from the construction above, or by means of struts to the construction below.
- (b) The Contractor shall furnish and install straps, clamps, threaded rods, turnbuckles and anchors and all miscellaneous specialties for the attachment of hangers and supports to the structure. Conduit hangers for single conduit threaded rod supports shall be a maximum of seven (7) feet long. Threaded rod supports shall be sized in accordance with the hanger manufacturer's requirements.

### Sleeves

- (a) The Contractor shall furnish and install sleeves where conduits pass through walls as required by the Plans, and/or as directed by the Engineer.
- (b) Sleeves shall be 18-gauge galvanized sheet metal or plastic, as approved by code, of sufficient length to finish flush with finished surfaces at both ends of sleeves. Sleeves shall be not less than one (1) inch larger than outside diameter of conduit.
- (c) Where conduits pass through floors on grade or exterior walls, the Contractor shall caulk sleeves with non-hardening sealant at both ends to ensure waterproofing around the conduit.
- (d) Sleeves shall be set true to line level plumb and position and shall be so maintained during construction.
- (e) Where sleeves are provided in poured concrete, the Contractor shall inspect each sleeve during and after concrete is poured to ensure proper position and to correct any deviation.

Painting: All electrical equipment not specified for factory finish painting under other Special Provision Items shall be painted as specified herein.

Patching: The Contractor shall provide all cutting and patching of building materials required for the installation of the Work herein specified.

- (a) No structural members shall be cut without the approval of the Engineer.
- (b) Roof deck is considered a structural member.
- (c) Approved cutting shall be done with concrete saws or core drills.
- (d) Patching shall be provided by labor of the particular trade involved and done in a neat and workmanlike manner.

### Cleaning

- (a) All rubbish and debris shall be collected, removed from the jobsite, and disposed of legally on daily basis. The Contractor shall ensure the installation environment is free of any construction debris, packing materials or any other debris that may cause a safety/trip hazard. All floors shall be kept in a broom clean condition.
- (b) In addition to using preventative measures, such as, keeping conduits capped, keeping gaskets intact and covers/doors closed on boxes and enclosures, and covering equipment as needed; the Contractor shall clean the inside of the conduits as required before pulling wires and cables.

- (c) The Contractor shall clean the interiors of equipment enclosures, lighting fixtures, light standards and panels as needed before installing field mounted equipment and devices. The Contractor shall clean the interiors and exteriors of all enclosures, fixtures, and panels as needed or as directed by the Engineer.
- (d) After completion of the electrical installations, the entire system shall be thoroughly cleaned to remove all foreign materials from the conduits, boxes and enclosures, equipment, lighting fixtures, light standards, panels, cords, etc.
- (e) Cleaned shall mean the thorough removal of, but not limited to, dust, dirt, oil, grease, cement, plaster, welding spatters and paint spatters. All cleaning agents and methods shall be in accordance with the electrical equipment manufacturers' recommendations and subject to approval of the Engineer.

### Conduit

- (a) The conduit system shall be installed complete with all accessories, fittings, and boxes, in an approved and workmanlike manner to provide proper raceways for electrical conductors. Conduit shall be installed concealed or exposed as shown.
- (b) Conduit installed inside building shall be rigid galvanized steel, unless otherwise indicated.
- (c) Underground conduit shall be HDPE or PVC schedule 40 or 80, unless otherwise indicated.
- (d) Exposed conduit runs shall be installed true, plumb, parallel with or at right angles to adjacent structural members, and must present an orderly, neat and workmanlike appearance.
- (e) Field bends shall be carefully made to prevent conduit damage or reduction in internal areas. Field bends shall be made with proper tools for the size and type of conduit being used. The bending radius shall be not less than six (6) times the nominal diameter of the conduit, with carefully matched bends on parallel runs to present a neat appearance. The number of crossovers shall be kept to a minimum. In addition to the above requirements, all cables installed in conduits requiring bends shall adhere to the allowable bend radius per the cable manufacturer specifications and any additional requirements per the device manufacturer for which the cable is used.
- (f) All conduit cut on the job shall be carefully reamed after threading to remove burrs. All field cut threads shall be tapered. No running threads shall be permitted. All field cut threads on steel conduit shall be given a coat of zinc dust in oil, or other approved compound.
- (g) All threaded joints shall be watertight and ensure a low resistance ground path in the conduit system.

- (h) All conduits shall be carefully cleaned before and after installation and all inside surfaces shall be free of imperfections likely to injure the cable. After installation of complete runs, all conduits shall be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Any conduits through which the mandrel will not pass shall be removed and replaced. After snaking, the ends of the dead-ended conduits shall be protected with standard malleable metal caps to prevent the entrance of water or other foreign matter.
- (i) Lines of nylon or polypropylene, propelled by carbon dioxide or compressed air, shall be used to snake or pull wire and cable into conduits. Flat steel tapes or sparks tapes may be used where GRS conduit runs are shorter than 50 feet. Steel cables are not acceptable.
- (j) Where conduits are connected to boxes or equipment enclosures, drilled holes or full size knockout openings shall provide electrical continuity for grounding and shall be assured by the use of bonding type locknuts. Where connections are at eccentric knockouts, jumper type grounding bushings and wire jumpers shall be installed.
- (k) At pull boxes and junction boxes that have any box dimension in excess of 18 inches and having a total of more than four (4) conduit terminations, jumper-type grounding bushings shall be installed on conduit ends and jumper wires shall be installed to bond all conduits and to bond conduits to boxes.
- (l) Conduit bends that are crushed or deformed in any way shall not be installed.
- (m) Conduit systems shall be installed, with fittings, double locknuts and bushings, and made up tight to ensure ground continuity throughout the system.
- (n) Conduit connections to NEMA Type 3R, NEMA Type 4, and NEMA Type 4X enclosures shall terminate in a threaded hub with an insulated throat to provide a positive seal, an electrical ground and a water tight connection.
- (o) As far as practicable, conduit shall be pitched slightly to drain to the outlet boxes, or otherwise installed to avoid trapping of condensate. Where necessary to secure drainage, a breather-drain fitting shall be installed in the boxes or fittings at low points.
- (p) Conduit shall not run through columns or beams unless so specifically detailed on the installation drawings.
- (q) Where installed in the concrete slab, the conduit shall be placed in the center of slab and no closer than three (3) diameters from adjacent conduits. The maximum outside diameter of conduits in slab shall be no greater than 1/3 of slab thickness. The conduit shall be installed in the middle 1/3 of the slab.
- (r) Where installed in pads or concrete islands the conduit shall be placed in the locations shown on the Plans.
- (s) Joints for conduit installed in pads, concrete slabs and islands shall be made watertight. Tape is not acceptable.
- (t) Conduit openings shall be temporarily plugged with metal caps to exclude water, concrete, plaster, and other foreign material.

- (u) Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during the placing of concrete. The Contractor shall be held responsible for proper position of conduits and shall rearrange any conduit that may be displaced while concrete is placed. In addition to the above requirement, all embedded conduits shall be clearly labeled at both ends for clear and proper conduit run identification.
- (v) Conduits run in floor slabs or islands shall be a minimum of one (1) inch in size, and as shown on the Plans.
- (w) All wiring systems shall be "pullable" and use of "BX" is prohibited.
- (x) Conduits entering free standing panels, and free standing control cubicles shall be fitted with jumper type insulated grounding bushings, bonded together and to the structure of the enclosure by a continuous bonding wire.
- (y) Conduits and concrete type boxes, masonry boxes, and other flush mounted boxes shall be installed concealed in masonry walls, plaster walls, dry wall and concrete walls.
- (z) All concealed conduits shall be placed in walls, floors, or islands at the proper time, in accordance with the progress of the structural work.
- (aa) When work is not in progress, open ends of conduit and fittings shall be securely closed so that no water, earth or other substance will enter.
- (bb) Pull cords shall be installed in empty conduits. All conduits with cables installed shall have a pull cord installed in the event of the need for future use.
- (cc) Conduit shall be terminated at the conduit connection points of electric motors, devices, and equipment. Terminations of conduits at such locations shall permit direct wire connections to the motors, electrical devices, or other equipment.
- (dd) Conduit connections shall be made with rigid conduit if the equipment is fixed and not subject to adjustment, mechanical movement, or vibration. Rigid conduit connections shall have union fittings, to permit removal of equipment without cutting or breaking the conduit.
- (ee) Conduit connections shall be made with approved flexible metallic conduit if the equipment is subject to adjustment, mechanical movement, or vibration. Flexible conduit connections shall be watertight.
- (ff) The minimum size conduit shall be 3/4 inch, unless otherwise indicated.

Wires and Cables-600 Volts

- (a) All cable and wire shall be installed in conduit.
- (b) Conduits shall be swabbed to remove any debris or accumulated moisture before cables or wires are pulled in.
- (c) No splices shall be permitted between terminals, except at approved junction or terminal box points, as required by Code for pull lengths.
- (d) Cable and wire runs shall be looped through pull boxes without cutting and splicing where possible.



### Splices and Terminations

- (a) No splicing shall be permitted except in junction boxes.
- (b) Terminations shall be made with compression type connectors and lugs. The lug manufacturer's recommended tools shall be used.
- (c) Mechanical type fittings are not acceptable. Lugs shall be one (1) or two (2) hole, color keyed. Lug bolting shall include flat washer, beveled washer, and a locknut.
- (d) Each cable splice shall be covered with either a cold shrink connector insulator or heat shrink connector insulator. The insulator material shall be rated for 1000 volts and shall be rated for direct burial installation.
- (e) All splices and pigtail connections for indoor lighting and receptacle wire for cable sizes 10 AWG and smaller may be made up with pre-insulated spring connectors, wire nuts, or approved equal.
- (f) Splices for cable sizes 8 AWG and larger shall be butt splice type consisting of long barrel copper only type compression connector. Each connector shall have internal cable stops and color-coded for proper die size and number of crimps.

### Pull Boxes and Junction Boxes

- (a) Pull boxes and junction boxes shall be installed as shown on the Plans, and shall be supported independently from the conduit system.
- (b) The Contractor shall add pull boxes where needed even though not shown on the Plans to ensure that finished cable will not be damaged.

### Outlet Boxes

- (a) Outlet boxes shall generally be four (4) inches square or octagonal as indicated on the Plans.
- (b) In masonry walls, where conduit is installed concealed, each outlet box shall be square cut masonry boxes.
- (c) In concrete walls and floor slabs, where conduit is installed concealed, boxes shall be suitable and constructed for installation in concrete.
- (d) In exposed work, surface outlet boxes shall be used for switches and receptacles. The NEMA Type shall be as described in this Section.
- (e) Outlet boxes for use with rigid conduit shall be of the threaded hub, malleable iron cast metal type, with malleable iron cast covers and gaskets.
- (f) Where 1-1/4-inch conduit is required, the box size shall be a minimum of 4-11/16 inches square.
- (g) All ceiling outlets shall have adequate supports and shall be equipped with adequate devices to carry and mount the light fixtures, provided fixtures do not weigh more than five (5) pounds.

- (h) Orientation of outlet boxes for single and multiple gang light switches and convenience receptacles shall be such that the devices shall be installed in accordance with the wiring device installation.
- (i) An outlet box shall be provided at each location requiring one.
  - (1) Outlet box locations as shown on the Plans shall be considered as approximate only.
  - (2) Exact locations shall be determined from the Plans or from field instructions. The Contractor shall coordinate box locations with the work of other trades.
  - (3) Each outlet box shall be installed true and plumb, so that the covers or plates shall be level, and at uniform elevations for the type of outlets contained.
  - (4) A plaster ring shall be installed for each outlet to provide horizontal mounting.
  - (5) Each outlet box shall be supported independently from the conduit system.
  - (6) Boxes for toggle switches and pilot lights at doorways shall be located at the strike side of the door.
- (j) There shall be no more openings made in any box than are required for the conduits entering same. Depths of boxes shall be such as to allow for easy wire pulling and proper installation of wiring devices. Where extra openings occur, proper closures shall be installed.
- (k) Switches and receptacles shall be ganged in a common box only as indicated on the Plans.

#### Device Boxes

- (a) Fixtures that weigh more than five (5) pounds shall be supported independently of the outlet box.
- (b) Surface mounted wall bracket fixtures (concealed conduit) shall have four (4) inch square sheet steel box with plaster ring as required for the fixture.
- (c) Ceiling outlets and wall bracket outlets (exposed conduit) in dry locations shall have four (4) inch sheet steel octagon box with 3/8-inch fixture stud.
- (d) Outlet boxes on exposed conduit run in wet or damp locations shall have four (4) inch cast box with threaded hubs and gasketed covers.

#### Wiring Devices

- (a) All wiring devices shall be installed in cast FS boxes with FS covers.
- (b) The Contractor shall install equipment in strict accordance with approved shop drawings and equipment manufacturer's recommendations.
- (c) The Contractor shall adjust the location of equipment to accommodate Work in accordance with field conditions encountered.
- (d) The Contractor shall install each convenience receptacle with grounding pole on bottom when mounted vertically or on right when mounted horizontally.

- (e) The Contractor shall install plates on all switch and receptacle outlets and shall install blank plates on all boxes without wiring devices.
- (f) The Contractor shall install devices and plates level.
- (g) Each switch shall be mounted four (4) feet above finished floor and each receptacle shall be installed 1 foot six(6) inches above finished floor, unless otherwise shown on the Plans.
- (h) The Contractor shall test complete wiring device installations to assure proper operation.

#### Transformers

- (a) Transformers shall be installed in accordance with the manufacturer's written instructions.
- (b) Where shown on the Plans, vibration mounts shall be provided.

#### Panelboards

- (a) Surface mounted panelboards shall be supported and mounted away from walls with "C" shaped galvanized steel channel.
- (b) Minimum separation between equipment and wall shall be one (1) inch.
- (c) Panelboards shall be installed clear of all openings with swinging or moving doors, partitions or access panels.
- (d) Each panelboard and control equipment enclosure shall be mounted with top a maximum of 6 feet - 6 inches above finished floor unless shown otherwise on the Plans.
- (e) Each cabinet shall be thoroughly cleaned and bonderized before painting. Painting shall consist of enamel or lacquer over a rust inhibitor, ANSI 61 light gray color.

#### Disconnect Switches

- (a) Unless indicated otherwise on the Plans, disconnect switches shall be installed with the operating handle center line at 5'-0" above finished floor.
- (b) Disconnect switches must be mounted to the building structure using proper anchors and support materials. In no case must the conduit be the support.

#### Building Lighting Fixtures

- (a) Each light fixture shall be complete with necessary driver, fittings, sockets, etc.
- (b) Fixtures shall be wired with colored wires to indicate the polarity.
- (c) Each lighting fixture shall be rigidly supported from the building construction and shall include, but not be limited to, suspension hanger devices and miscellaneous steel, brackets, as required for fixture support.
- (d) Suspended fixtures shall be hung on ball and cushion swivel flexible fixture hangers which shall be furnished by the Contractor and shall be adjusted as necessary during installation to ensure that fixtures in the same room or area are a uniform height from the floor. Mounting height shall be as specified, detailed, or noted on the Plans.

Electrical Identification

- (a) The Contractor shall provide identification markings on each circuit breaker, disconnect switch, and panel.
- (b) The identification markings shall include feeder name, number, phase, and item identification of equipment controlled.
- (c) The Contractor shall provide white with black core laminated phenolic nameplates with 3/8-inch lettering, minimum, etched through outer covering. Each nameplate shall be fastened with stainless steel screws to each piece of equipment.
- (d) All major electrical equipment shall be identified, which shall include disconnect switches, panels, switches, etc. Disconnect switches serving feeders and over-current protective devices mounted in a switchboard shall be so identified.
- (e) Embossed self-adhering plastic tape labels shall not be accepted.
- (f) The Contractor shall provide a typewritten directory with frame and plastic face of circuits in lighting and power panels, and shall provide panel identification in black alkyd paint stenciled inscriptions on inside of door, directly above centerline of directory frame, or on vertical and horizontal centerline of doors without directory frames.
- (g) The Contractor shall provide on-device nameplates for local toggle switches, toggle switch type manual starters, pilot lights, and other electrical items whose function is not readily apparent, engraved suitable inscriptions on laminate phenolic nameplates describing equipment controlled or indicated. Each nameplate shall be fastened with a minimum of two (2) self-tapping stainless steel screws. This shall not change NEMA rating of enclosure.
- (h) For wire, cable and bus identification, each wire and each cable shall be labeled at terminals and at all accessible points in equipment, panel-boards, manholes, hand-holes, and pull boxes. Cable/wire markers of wrap-around self-adhesive type, with factory or mechanically printed numbers, letters, and symbols shall be used.
- (i) All conductors shall be tagged in cabinets at time wires are pulled in and tested and markers shall not be removed for any reason. Cable/wire markers shall be installed on both ends of all conductors.
- (j) Cable and wire markers must be per TIA-606 Standard for labeling telecommunication equipment. The markers shall be attached to all cables where entering or leaving a conduit run. Cable designation and circuit use shall appear on the tag.

Grounding System Modifications

- (a) New power and lighting systems shall be permanently and effectively grounded in accordance with the latest issue of the National Electrical Code. The items covered shall include but not be limited to panels, motor frames, lighting fixtures and associated switches and other exposed, non-current carrying parts of the electrical equipment and as shown on the Plans.
- (b) Grounding conductors shall be protected from mechanical damage, and shall be supported in an approved manner. Where ground conductors are run in conduit or other raceway, the ground conductor shall be bonded to the conduit or raceway at each end.
- (c) The equipment ground conductor shall be distinct and separate from the system neutral ground conductor and shall not be used as a load current-carrying conductor. The conductor shall be electrically and mechanically continuous from the distribution equipment ground bus to the equipment to be grounded. The conductor shall provide a low impedance path for line-to-ground fault currents and bond all non-current carrying enclosures together including raceways, fixtures, receptacles, panels, controls, motors, disconnect switches, and exterior lighting standards.
- (d) Where building type conductors are installed in a raceway, the equipment ground conductor shall have a minimum size conductor of 12 AWG copper. Where green insulation is not available, on large size cable, black insulation shall be used and shall be identified with green colored tape at each junction box or device enclosure.
- (e) All metallic conduits, including rigid electrical metallic tubing and flexible conduits shall be connected at each end to the equipment ground conductor utilizing a conduit grounding bushing, O-Z type BL, or approved equal.
- (f) Switchboards, panelboards and panels shall be provided with an equipment ground bus (including lug or screw terminals) and shall be securely bonded to the enclosure.
- (g) Junction boxes and other enclosures (sizes above five (5) inches by five (5) inches) shall utilize an equipment ground bus or lug as required to securely bond the equipment ground conductor to the enclosure.
- (h) Light fixtures, receptacles and motors shall be securely connected to the equipment ground conductor.
- (i) Bolts, nuts, and washers utilized to connect the ground conductor to motors, equipment or enclosures shall be bronze, cadmium plated steel, or other non-corrosive material.

- (j) The system neutrals, for grounded transformers, shall be a white insulated current-carrying conductor over which unbalanced neutral load currents may flow. The neutral conductor shall originate at the grounded secondary of each transformer. The secondary ground of each transformer shall be bonded to the enclosure and then be connected to the electrical power system ground via a ground conductor run with the power conductors.
- (k) Grounding conductors, other than bus bars, shall be stranded copper wire with type XHHW green, 600 volt rated insulation, sized and installed in accordance with Code requirements, and as noted on the Plans.
- (l) Buried ground cable shall be solid bare tinned copper.
- (m) Ground rods shall be 3/4-inch diameter solid stainless steel, ten (10) feet long, unless noted otherwise.
  - (1) The maximum resistance of a driven ground rod shall not exceed five (5) ohms. If this resistance rating cannot be obtained with a single ground rod, a sufficient number of additional rods shall be installed, not closer than six (6) feet on centers.
  - (2) All connections to the ground rod shall be made inside a ground well.
  - (3) The ground well shall not be placed in pavement.
  - (4) Exothermic weld connections shall be made to the ground rod.
  - (5) Ground rods shall be located in the ground loop outside the building perimeter. Stainless steel ground rods shall be formed of an austenitic stainless steel of the 18 percent chromium, 8 percent nickel type (UL 467-2004, section 9.2.6).

Testing The Contractor, at his/her own expense, shall perform testing as specified herein of all materials, equipment, and systems installed and/or provided by him/her. All necessary test equipment shall be furnished and maintained by the Contractor.

- (a) Before making final connections, check the insulation resistance of all cables of 3-phase circuits that operate above 150 volts.
- (b) Check wiring for proper phase sequencing including buses, feeder cables and transformers, and assure proper connections at motors for proper rotation.
- (c) Check all control circuits for proper functioning of all devices and check all switches, contactors, limit switches, circuit breakers, and the like for proper operation.
- (d) Verify resistance to ground of new grounding electrodes.

Final System Acceptance and Training Final acceptance of all work associated with this pay item will be made after:

- (a) Successful completion of the project final walk-through.
- (b) Submission and written approval by the Engineer of all Record Drawings and Warranty documents including an electronic computer file (Microstation and PDF) including a sketch of each major electrical and communication element assembly, and user/operator manuals to the Engineer.

(c) The Contractor shall provide operation and maintenance manuals of all installed equipment to the Engineer for approval as defined in the Training and Manuals special provision.

(d) Notification of Final Acceptance will be sent to the Contractor in writing by the Engineer.

**Warranty** The building electrical systems with associated components shall be warranted and guaranteed against defects and/or failure in design, materials and workmanship within the warranty period stated elsewhere in this special provision.

(a) The Contractor shall submit the warranty terms as part of each material item's shop drawing submittal for approval.

(b) The warranty shall provide that, in the event of a malfunction during the warranty period, the defective system component shall be replaced with a new component by the manufacturer or his/her representative within five (5) working days.

(c) Any component that, in the opinion of the Engineer, fails three (3) times prior to the expiration of the warranty shall be judged as unsuitable and shall be replaced by the device manufacturer or representative with a new component of the same type at no additional cost to the Department. The unsuitable component shall be permanently removed from the project.

(d) A failure shall also be defined as the field device becoming unable to comply with all applicable standards.

**Method of Measurement.** This work will not be measured for payment.

**Basis of Payment.** This work will be paid for at the contract lump sum price per each for ELECTRICAL WORK, BUILDING A; ELECTRICAL WORK, BUILDING C; ELECTRICAL WORK, BUILDING D; ELECTRICAL WORK, BUILDING E; for the indicated building, performed in accordance with the plans and special provisions.

This work includes the furnishing, installation and testing of non-PLC related control equipment, conduit, cable and miscellaneous equipment in each building and labor, tools, testing equipment, materials, and incidentals necessary to complete the contract work.

## **GENERATOR, BUILDING 'X'**

**Description.** This work shall consist of furnishing, installing and testing a new backup generator for REVLAC buildings A, C, D and E, as shown on the Plans and hereinafter specified, complete and operational in every respect.

The general scope of work under this item includes, but is not limited to:

- (a) New pad mounted diesel engine generator set with subbase fuel tank at each building.
- (b) All conduit and conductors for power and control from buildings to generator including coring/sealing of the REVLAC building wall.
- (c) Testing and adjusting existing automatic transfer switches.
- (d) New automatic transfer switch, Building C only.
- (e) New main breaker in building for generator, Building C only.
- (f) New main surge suppressor, Building C only.
- (g) Removing Service 2 connection from automatic transfer switch at Building D and connecting to Building C power feed.

**Materials.** All other ancillary items required for a fully functional and complete installation are included as part of the work under this Special Provision. Materials and installations shall conform to the applicable Codes and Standards. The engine generator and automatic transfer switch all major items of auxiliary equipment shall be manufactured by U.S. manufacturers currently engaged in the production of such equipment. The engine and the generator shall be furnished by the same manufacturer

**Engine-Generator Set.** The engine generator set shall be capable of delivering the kW rating specified at sea level and capable of delivering the kW rating specified at the installed location after consideration of applicable de-rating factors.

- (a) The unit shall be factory assembled, tested by the engine-generator set manufacturer, and shall be shipped to the job site by his/her authorized dealer having a service facility within proximity of project location.
- (b) The engine-generator set shall be sized such that the engine shall be capable of driving the generator at the rating specified after de-rating for the range of temperatures expected during operation. The generator shall be designed to have a rated capacity with 50 percent solid state loads.
- (c) The engine-generator set shall be direct-coupled unit. Belt or gear-driven units are not acceptable.
- (d) Engine. The engine shall be a water-cooled inline or V-type, four-stroke cycle, compression ignition diesel internal combustion engine. Two (2) stroke cycle engines are not acceptable. The engine shall be equipped with filters for fuel, lube oil, and intake air; lube oil cooler; and gear-driven water pump.



- (1) The engine governor shall be isochronous frequency regulation from no load to full rated load. Engine safety shut-off switches for high water temperature, low oil pressure, over-speed and over-crank shall be provided with pre-alarm type switches for low oil pressure warning, high water temperature warning, low coolant level, and low water temperature.
  - (2) Gas pressure regulators and gas solenoid valves shall be engine-mounted and shall be connected to the engine with flexible gas connection which shall be a minimum of 18 inches long and shall be as recommended by the engine generator equipment manufacturer. The solenoid valve coil shall be rated for the generator starting battery voltage.
  - (3) The generator shall include a thermostatically controlled block heater sized for temperatures approaching 0°F.
- (e) Generator. The generator shall be sized by the manufacturer for standby service with a maximum temperature rise of 105°C, and shall have the kVA rating shown on the Plans at 0.8 power factor. The generator shall be 277/480 volts, 3-phase, 4-wire, 60 Hertz, at 1800 RPM. The generator shall be capable of supplying 110 percent of rated nameplate KW for two (2) hours out of 24 hours.
- (1) The load shall be a maximum of 50 percent solid state. The generator shall be sized to allow for heating effects of non-linear loads of 50 percent of its service rating. The specified KW shall be for continuous electrical service during interruption of normal utility source with 50 percent solid state type load. These ratings must be substantiated by the manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.
  - (2) The generator shall be a three-phase, single bearing, synchronous type built to NEMA standards. Class F insulation shall be used on the stator and rotor, and no materials that will support fungus growth shall be used. The generator shall incorporate reactive droop compensation for parallel operation and shall include a re-settable thermal protector for exciter/regulator protection against extended low power factor loads.
  - (3) A generator-mounted volts-per-hertz-type exciter/regulator shall be provided to match the characteristics of the engine-generator set. Voltage regulation shall include three-phase sensing, and shall be plus or minus 0.5 percent from no load to full load. Readily accessible voltage droop, voltage level, and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus or minus five (5) percent. Solid-state regulator module shall be shock-mounted and epoxy-encapsulated for protection against vibration and atmospheric deterioration.
  - (4) The generator shall incorporate permanent magnet generator (PMG) excitation to sustain 250 percent short circuit current, and provide immunity to SCR loads which may exceed 50 percent of total system load.

- (f) Cooling System. The engine-generator set shall be provided with a radiator mounted on the unit and shall be sized to maintain rated engine-generator set capacity with an ambient temperature of 40°C. The radiator shall be equipped with ethylene glycol anti-freeze for protection down to -40°C.
- (g) Exhaust System. An exhaust silencer shall be provided which shall include required flexible exhaust fittings, properly sized and installed in accordance with equipment manufacturer's recommendation. The silencer shall be mounted independently so that its weight is not supported by engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed maximum limitations specified by the engine-generator set manufacturer. Silencer shall be critical hospital grade. Acceptable manufacturers shall be Maxim or approved equal.
- (1) The Contractor shall provide calcium silicate piping insulation on the exhaust piping, including fittings and flanges, per ASTM C533.
  - (2) The exhaust piping insulation shall be finished with an aluminum jacket.
- (h) Automatic Starting System. The Contractor shall provide a DC electric starting system with positive engagement drive. Motor voltage shall be as recommended by the engine-generator set manufacturer.
- (1) Fully automatic engine-generator set start-stop controls in generator control panel shall be provided. The controls shall provide safety shutdown for low oil pressure, high water temperature, over-speed, and over-crank. A manual reset and two (2) auxiliary normally open/normally closed, Form C contacts for activating accessory items shall be provided. The controls shall include 4-cycle cranking as herein specified.
  - (2) A lead acid storage battery set of heavy-duty engine-generator starting type shall be provided. Battery voltage shall be compatible with starting system. Battery set shall be of sufficient capacity to provide for five (5) successive starts without recharging, consisting of ten (10) seconds per start at a temperature of 10°C. All necessary battery cables and clamps shall be provided. Battery set shall be provided with fill caps. Battery set shall be located on a mounting base at side of engine and provided with a thermostatically controlled heater.
  - (3) A current limiting battery charger shall be furnished to automatically recharge batteries. The charger shall be compatible with the battery set, and shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, DC ammeter, and fused AC input. Amperage output shall be no less than five (5) amperes. Battery charger shall be rated for 120 volts, AC input. Battery charger shall be installed in the engine-generator set enclosure.
  - (4) Unit-mounted thermal circulation type jacket water heaters incorporating a thermostatic switch shall be furnished to maintain engine jacket water at 32°C with an ambient temperature of 8°C. A second thermostatic switch shall be furnished to ensure the jacket water temperature does not exceed 50°C. Each jacket water heater shall be rated for 120 volts, single-phase AC input.

- (i) Generator Control Panel. The Contractor shall provide a generator-mounted NEMA Type 12 dead front, 14-gauge steel control panel. The control panel shall be installed with shock-absorbing mounts and shall contain, but not be limited to, one (1) voltmeter, one (1) ammeter, and one (1) frequency meter. The following equipment shall also be provided by the Contractor:
- (1) One (1) ammeter-voltmeter selector switch with "OFF" position.
  - (2) Automatic starting controls system.
  - (3) Voltage level adjustment rheostat.
  - (4) Five (5) sets of dry contacts, normally open/normally closed, Form C, shall be provided for remote alarms and for louver operation. All contacts shall be wired to terminal blocks.
  - (5) The control panel shall be provided with a set of individual alarm circuits and with a common reset alarm switch for the following:
    - i. Low water temperature pre-alarm
    - ii. High water temperature pre-alarm
    - iii. High water temperature shutdown
    - iv. Low oil pressure pre-alarm
    - v. Low oil pressure shutdown
    - vi. Over-speed shutdown
    - vii. Over-cranking shutdown
    - viii. Function switch not in automatic
    - ix. Low coolant level
    - x. Oil pressure gauge
    - xi. Water temperature
    - xii. Elapsed time meter
    - xiii. Ground bus
    - xiv. Current transformers as required
    - xv. Potential transformers as required
  - (6) Indicating lights shall be provided for low oil pressure, high water temperature, over-speed and over-crank.
  - (7) Four-position function switch marked "auto", "manual", "off-reset", and "stop".
  - (8) A flashing light shall be included to indicate function switch is not in "automatic position".
- (j) Generator Main Circuit Breaker. A molded case type circuit breaker shall be installed on the output of the generator to operate both manually for normal switching functions and automatically during overload and short circuit conditions. The circuit breaker shall have an interrupting capacity of 22,000 amperes at 480 volts.

- (k) Enclosure. The engine-generator shall be installed in a weather protective and sound attenuating enclosure. The enclosure shall be constructed of 16 gauge (minimum) steel with lockable access doors. The enclosure shall provide sound attenuation such that the measured sound pressure level at a distance of 23 feet from the enclosure does not exceed 80 db. The enclosure shall incorporate a UL listed subbase fuel tank with a minimum capacity of 200 gallons.

**Automatic Transfer Switches**

- (a) Automatic transfer switches shall be suitable for 277/480 volt, 3-phase, 4-wire service. Each switch shall be complete with accessories and must be listed under UL Standard 1008.
- (b) The transfer switch shall be of the double throw type, operated via an electrically operated, mechanically held mechanism. The transfer time of the switch must be six (6) cycles minimum. The normal and alternate source contacts must be mechanically interlocked. They must not permit a neutral position as a result of any failure of a coil or other component.
- (c) Switches shall be installed in a NEMA 4X enclosure and installed on a concrete foundation. The foundation must extend six (6) inches above grade and extend a minimum of two (2) inches beyond the switch dimensions in each direction.
- (d) Main Contacts. The main contacts and current carrying parts shall be insulated for 600V.
- (e) Switched Poles. The switch shall be provided with three (4) switched poles.
- (f) Interrupting Capacity. Minimum 3,000 percent of continuous rating.
- (g) Withstand Current Rating. The main contacts must not be less than 20 times the continuous rating for a minimum period of 3 cycles as established by certified test reports.
- (h) Current Rating. The current rating shall be a 24-hour continuous rating for the switch in a non-ventilated enclosure for all classes of loads. Temperature rise shall conform to NEMA standards.
- (i) Sequence of operation:
  - (1) When the voltage of any phase of the normal source is reduced to 80 percent of the rated voltage or after normal source failure for 1 second, a pilot contact must be closed to initiate transfer to the alternate source of power. When an engine generator is the alternate source of power, this contact must start the engine generator.

- (2) When the alternate source of power is delivering 90 percent of the rated voltage and 95 percent of the rated frequency, the load must be transferred to the alternate source. In the event that the normal source of voltage is restored to 90 percent prior to the alternate source reaching 90 percent of voltage and 95 percent of the rated frequency, the transfer must not occur. When an engine generator set is the alternate source of power, transfer to the normal source must be delayed for a period of 0 to 30 minutes (adjustable). The engine generator must be allowed to run in an unloaded condition for a minimum of five (5) minutes (adjustable). After the cool down period, the engine generator set must shut down automatically.
  - (3) Should the alternate source of power fail while carrying the load, retransfer to the normal source must occur immediately upon restoration of all phases of the normal source.
  - (4) When an engine generator set is provided, the ATS must have all necessary timers, controls, indicators, etc. for the proper control of the engine generator.
- (j) Each automatic transfer switch shall be the product of one (1) manufacturer and be completely factory-interconnected and tested so that only the service and load connections are required for field installation. Interconnections within the automatic transfer switch, bypass switch and isolation switch shall be by silver-plated copper bus bar.

**Surge Suppressor.** Incoming service surge suppressors shall be furnished and installed as shown in plans and specified herein. The incoming main surge protective devices shall meet the following minimum criteria:

- (a) Installed in a NEMA 12 enclosure
- (b) L-L, L-N, L-G and N-G protection modes
- (c) 10 year warranty
- (d) U.L. 1449 listed
- (e) Peak surge current rating per phase of 480 kA.
- (f) Indicator LEDs for normal and fault conditions for each phase.
- (g) Audible alarm with enable/disable switch.

### **CONSTRUCTION REQUIREMENTS**

**General.** The installation shall conform to the general construction requirements of ELECTRICAL WORK, BUILDING 'X'. The Contractor shall closely coordinate his/her work with other trades. The bonding and grounding of the generators and transfer switch shall be in accordance to NEC 250 for a separately derived system.

#### **Engine-Generator Set**

- (a) The Contractor shall make arrangement with the equipment manufacturer for a qualified factory trained Service Engineer to provide technical direction for installation and final adjustments of equipment. This work shall be provided by the Contractor at no additional cost to the Department. The Service Engineer shall certify that equipment has been installed in accordance with equipment manufacturer's recommendations. The Service Engineer shall be available as long as his/her services are requested, but in any case he/she shall be required for a minimum of two (2) full eight (8)-hour working days.
- (b) Semi-flexible couplings shall be provided between generator and engine and protective guards shall be provided over moving parts. Steel spring dampening vibration isolators shall be provided between rail base and floor.
- (c) The generator control panel shall be installed with shock-absorbing mounts. Main circuit breaker shall be mounted close to engine generator unit.
- (d) The engine generator set equipment shall be installed complete and operational. Final adjustments to equipment shall include verification of proper mechanical operation, verification of instrument operation and setting of circuit breakers, relays and devices.

#### **Building C Electrical Service**

- (a) The Contractor shall coordinate with COMED and verify which utility meter is connected to Source 2 in Building D's main power panel/ATS.
- (b) Source 2 shall be disconnected from this power panel and connected to the existing power cables that currently supply power to Building C.
- (c) The Contractor shall coordinate any service outages with Engineer for approval.

#### **Automatic Transfer Switches - New**

- (a) The Contractor shall make arrangement with the equipment manufacturer for a qualified factory trained Service Engineer to provide technical direction for installation and final adjustments of equipment. This work shall be provided by the Contractor at no additional cost to the Department. The Service Engineer shall certify that equipment has been installed in accordance with equipment manufacturer's recommendations. The service engineer shall be available as long as his/her services are requested, but in any case he/she shall be required for a minimum of one (1) full eight (8)-hour working day for each automatic transfer switch.

- (b) Final adjustments to the equipment shall include, but shall not be limited to, verification of the proper mechanical operation, verification of the instrument operation and setting of the protective relays and devices.

**Automatic Transfer Switches – Existing.** The Contractor shall inspect, verify and test the existing ATS switches in buildings A, D and E for proper operation. Each existing ATS and generator according to the following guidelines.

- (a) When the voltage of any phase of the normal source is reduced to 80 percent of the rated voltage or after normal source failure for 1 second, a pilot contact must be closed to initiate transfer to the alternate source of power. When an engine generator is the alternate source of power, this contact must start the engine generator.
- (b) When the alternate source of power is delivering 90 percent of the rated voltage and 95 percent of the rated frequency, the load must be transferred to the alternate source. In the event that the normal source of voltage is restored to 90 percent prior to the alternate source reaching 90 percent of voltage and 95 percent of the rated frequency, the transfer must not occur. When an engine generator set is the alternate source of power, transfer to the normal source must be delayed for a period of 0 to 30 minutes (adjustable). The engine generator must be allowed to run in an unloaded condition for a minimum of five (5) minutes (adjustable). After the cool down period, the engine generator set must shut down automatically.
- (c) Should the alternate source of power fail while carrying the load, retransfer to the normal source must occur immediately upon restoration of all phases of the normal source.

**Submittals.** Shop drawings shall consist of a complete list of materials including manufacturer's descriptive and technical literature, model cuts, drawings, installation instructions, mounting details, single line and control schematic diagrams of equipment, where applicable.

- (a) Engine-Generator Set. Product data and model cuts information shall also be submitted for the Engine and the Generator. A complete list of materials including manufacturer's descriptive and technical literature, model cuts, drawings, and installation instruction. Shop drawings shall include, but shall not be limited to, the following.
- (1) Plan, front view, and rear elevations of engine generator which shall include outline of control panel, battery, battery charger, radiator, enclosure with subbase tank, entrance and exit conduits, piping and other accessories.
  - (2) Plan, front view, and rear elevations of engine generator which shall include outline of control panel, battery, battery charger, radiator, enclosure with subbase tank, entrance and exit conduits, piping and other accessories.
  - (3) Mounting-base details. All dimensions for rough-in work at site shall be provided. The shop drawing shall show channel iron mounting base that shall be provided as part of this Special Provision.
  - (4) The shop drawings shall show details of bus, connections, terminals, etc., including complete ground bus arrangement and ground connections.

- (5) Single line diagram of equipment, control schematic diagrams, and relay and metering schematic diagrams shall be provided. The engine data shall include manufacturer of engine, number of cylinders, piston displacement, piston speed, brake mean effective horsepower, etc.
- (6) Connection diagrams for internal and external wiring of equipment and control console shall be included.
- (7) Interconnection diagrams shall show wiring to equipment. The terminal block points shall be clearly identified for external wiring that shall be routed in or out of equipment. The wiring diagrams shall provide adequate space at terminal blocks for addition of cable and wire designations for external wiring to be routed in or out of equipment.
- (8) Bills of material shall include all items with model cuts describing electrical and physical characteristics of each item.
- (9) The Contractor shall submit, for record and distribution, prior to shipment of equipment, copies of each of following for the natural gas engine generator assembly.
  - i. All shop drawings as finally reviewed and any factory assembly modifications
  - ii. Recommended installation and storage instructions with any special instructions
- (10) Instruction manuals shall include the descriptive bulletins and operation leaflets for diesel engine generator set, protective relays, operating switches and maintenance procedures for circuit breakers, and other components furnished with equipment:
  - i. Each instruction manual shall be in a three (3) ring hard binder with tabbed sections. Binder cover shall have project name and equipment name. Lettering shall be block type and shall be a minimum height of 1/2 inch.
  - ii. Each instruction manual shall contain the as-built drawings (including wiring diagrams, schematics and parts exploded views, etc.), complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
  - iii. As-built drawings larger than 8-1/2 inch by 11 inch shall be fan folded.
- (11) Spare parts bulletins shall be included with model cuts for each item.
- (12) Certified test reports shall include assembly and sub-assembly test and inspection reports.
- (13) The Contractor shall submit sufficient copies of any shop drawings and other data sheets that were revised or modified during installation. These will be inserted in previously submitted instruction manuals.



- (b) Automatic Transfer Switches ATS. A complete list of materials including manufacturer's descriptive and technical literature, model cuts, drawings, and installation instruction. Shop drawings shall include, but shall not be limited to, the following:
- (1) Plan, front and rear elevations, section views and mounting details of the ATS switches. Shop drawings shall show the internal barriers.
  - (2) Shop drawings shall include, but shall not be limited to, the steel wide flange and channel iron mounting base details. Dimensions for rough-in work at the site shall be provided. The shop drawings shall show the channel iron mounting base which shall be provided as part of this Special Provision and shipped separately to meet the pouring schedules.
  - (3) The drawings shall show the details of bus, connections, terminals, etc., including, but not limited to, the complete ground bus arrangement and enclosure ground connections.
  - (4) Single-line diagram of equipment, control schematic diagrams, and relay diagrams shall be provided.
  - (5) Wiring Diagrams.
    - i. Connection diagrams for the wiring of equipment shall be included.
    - ii. Interconnection diagrams shall show the wiring to equipment. The terminal block points shall be clearly identified for the external wiring which shall be routed in or out of the cubicles. The wiring diagrams shall provide adequate space for the addition of cable and wire designations for the external wiring to be routed in or out of the equipment at the terminal blocks.
  - (6) Bill of material shall include items with model cuts describing the electrical and physical characteristics of each item.
  - (7) Recommended installation and storage instructions with any special instructions shall be provided.
  - (8) Instruction booklets shall include, but shall not be limited to, descriptive bulletins and operation leaflets for the protective relays, control relays, operating switches and maintenance procedures. Copies of Instruction Manuals shall be placed in the final maintenance manuals. See Training and Manuals Special Provision.
    - i. The as-built drawings larger than 8-1/2 inch by 11 inch shall be fan-folded.
    - ii. Each instruction manual shall contain the as-built drawings, complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
    - iii. Spare parts bulletins shall be included with model cuts for each item.

- iv. Certified test reports shall include assembly and subassembly test and inspection reports. The Contractor shall submit ten copies of any shop drawings and other data sheets that were revised or modified during installation. These will be inserted in the previously submitted instruction manuals.

**WARRANTY.** The generator and ATS systems and associated components shall be warranted and guaranteed against defects and/or failure in design, materials and workmanship within the warranty period stated elsewhere in this special provision.

- (a) The Contractor shall submit the warranty terms as part of each material item's shop drawing submittal for approval.
- (b) The Contractor shall provide a warranty within the warranty period stated elsewhere in this special provision on components, complete engine-generator and instrumentation panel, and labor. Multiple warranties for individual components (engine, generator, controls, etc.) will not be acceptable. The Contractor shall promptly repair or replace all defective equipment at no cost to the Department during the warranty period.
- (c) The Contractor shall provide on-site service within 24 hours of notice from the Department. During repair of any individual equipment item, the Contractor shall provide loaner equipment, at no cost to the Department, for failures that cause loss of system use or of significant accessory function. Such service shall continue, at no charge to the Department, within the warranty period.

**Method of Measurement.** This work will not be measured for payment as each.

**Basis of Payment.** This work will be paid for at the contract lump sum price per each for GENERATOR, BUILDING A; GENERATOR, BUILDING C; GENERATOR, BUILDING D; GENERATOR, BUILDING E; for the indicated building, performed in accordance with the plans and special provisions.

This work includes the furnishing, installation and testing of new backup generators, automatic transfer switches (where applicable), power and control conduits and conductors from generator to the building and labor, tools, testing equipment, materials, and incidentals necessary to complete the contract work.

GENERATOR, BUILDING C work includes new automatic transfer switch, main breaker and surge suppression as described within.

GENERATOR, BUILDING C work includes the electrical service modifications at Building D for powering Building C.

The foundation for the generator will be paid for as CONCRETE STRUCTURES AND REINFORCEMENT BARS as shown on the plan.

## **UNINTERRUPTIBLE POWER SUPPLY**

**Description.** This work consists of furnishing, installation, connection, and testing of a static uninterruptible power supply, indicated in this section as UPS.

- (a) System Capacity: Unless stated otherwise, the parameters listed are under full rated output load at a minimum of 0.9 power factor, with batteries fully charged and floating on the DC bus and with a nominal input voltage. Overall 37.5 kVA redundant, at 40 °C.
- (b) Battery Capacity: Discharge time to end voltage: 15 minutes, at 25 °C (77 °F). Battery shall be capable of delivering 125 percent of full rated output load at initial start-up.
- (c) System Bus Bracing: Braced for amperes symmetrical interrupting capacity as shown on drawings.
- (d) AC Input.
  - (1) Voltage 208 volts line-to-line.
  - (2) Number of phases: 3-phase, 3-wire, plus ground.
  - (3) Voltage Range: Plus 10 percent, minus 15 percent, without affecting battery float voltage or output voltage.
  - (4) Frequency: 60 Hz, plus or minus 5 percent.
  - (5) Total harmonic current distortion (THD) reflected into the primary line: 5 percent maximum
- (e) AC Output
  - (1) Voltage 208 volts line-to-line, 120 volts line-to-neutral.
  - (2) Number of phases: 3-phase, 4-wire, plus ground.
  - (3) Voltage regulation:
    - i. Balanced load: Plus or minus 1.0 percent.
    - ii. 100 percent load imbalance, phase-to-phase: Plus or minus 3 percent.
  - (4) Frequency: 60 Hz.
  - (5) Frequency regulation: Plus or minus 0.05 percent.
  - (6) Harmonic content (RMS voltage): 5 percent maximum total harmonic distortion with 100% nonlinear load.
  - (7) Load power factor operating range: 1.0 to 0.8 lagging.
  - (8) Phase displacement:
  - (9) Balanced load: Plus or minus 1 degree of bypass input.
    - i. Overload capability (at full voltage) (excluding battery):
    - ii. 125 percent load for 10 minutes.
    - iii. 150 percent load for 1 minute.
- (f) Voltage Transient Response. 100 percent load step: Plus or minus 5 percent.

## **Materials.**

### **UPS.**

General Description: UPS module shall consist of a rectifier/charger unit and a 3-phase inverter module unit with their associated transformers, synchronizing equipment, input and output circuit breakers, and accessories as required for operation.

Rectifier/Charger Unit: Rectifier/charger unit shall be solid state and shall provide direct current to the DC bus.

- (a) Input Circuit Breaker: Rectifier/charger unit shall be provided with an input circuit breaker. The circuit breaker shall be sized to accept simultaneously the full-rated load and the battery recharge current.
- (b) Sizing: Rectifier/charger unit shall be sized for the following two simultaneous operating conditions:
  - (1) Supplying the full rated load current to the inverter.
  - (2) Recharging a fully-discharged battery to 95 percent of rated ampere-hour capacity within ten times the discharge time after normal AC power is restored, with the input protective device closed.
- (c) Inverter Unit: Inverter unit shall be a solid-state device capable of accepting power from the DC bus and providing AC power within specified limits.
  - (1) Output Overload: The inverter shall be able to sustain an overload as specified across its output terminals.
  - (2) Synchronism: The inverter shall normally operate in phase-lock and synchronism with the bypass source.
  - (3) Modular Construction: Each control logic printed circuit board shall be electrically and physically packaged on an individual plug-in module with separate indication and adjustments.
  - (4) Output Circuit Breaker: The output circuit breaker shall be capable of shunt tripping and shall have interrupting capacity as specified. Circuit breaker shall have provision for locking in the "off" position.
  - (5) Output Transformer: The inverter output transformer shall be similar to the input transformer and shall be capable of handling up to K-13 nonlinear loads as described in IEEE C57.110.

- (d) External Protection: UPS module shall have built-in self-protection against undervoltage, overvoltage, overcurrent and surges introduced on the AC input source and/or the bypass source. The UPS system shall sustain input surges without damage in accordance with IEEE C62.41.1 and IEEE C62.41.2. The UPS shall also have built-in self-protection against overvoltage and voltage surges introduced at the output terminals by paralleled sources, load switching, or circuit breaker operation in the critical load distribution system.
- (e) Internal Protection: UPS module shall be self-protected against overcurrent, sudden changes in output load and short circuits at the output terminals. UPS module shall be provided with output reverse power detection which shall cause that module to be disconnected from the critical load bus when output reverse power is present. UPS module shall have built-in protection against permanent damage to itself and the connected load for predictable types of failure within itself and the connected load. At the end of battery discharge limit, the module shall shut down without damage to internal components.

#### **Maintenance Bypass**

A maintenance bypass switch shall be provided as an integral part of the UPS and located within the UPS module. The maintenance bypass switch shall provide the capability to continuously support the load from the bypass AC power source while the UPS is isolated for maintenance. The maintenance bypass switch shall be housed in an isolated compartment inside the UPS cabinet. Switch shall contain a maintenance bypass protective device and a module isolation protective device.

The maintenance bypass switch shall provide the capability of transferring the load from the UPS static bypass transfer switch to maintenance bypass and then back to the UPS static bypass transfer switch with no interruption to the load.

#### **Module Control Panel**

The UPS module shall be provided with a LCD control/indicator panel. Meters, controls, alarms, system diagnostics, mimic screen showing one-line diagram of the system, and indicators for operation of the UPS shall be on this panel.

(a) Module Meters:

- (1) Meters shall have 1 percent accuracy.
- (2) The following functions shall be monitored and displayed:
  - i. Input voltage, phase-to-phase (all three phases).
  - ii. Input current, all three phases.
  - iii. Input frequency.
  - iv. Battery voltage.
  - v. Battery current (charge/discharge).
  - vi. Output voltage, phase-to-phase and phase-to-neutral (all three phases).
  - vii. Output current, all three phases.
  - viii. Output frequency.
  - ix. Output kilowatts.
  - x. Elapsed time meter to indicate hours of operation, 6 digits.
  - xi. Bypass voltage, phase-to-phase and phase-to-neutral (all three phases).
  - xii. Output kilovars.
  - xiii. Output kilowatt hours, with 15-minute interval.

(b) Module Controls:

- (1) Module shall have the following controls:
- (2) Alarm test/reset function.
- (3) Module input protective device trip function.
- (4) Module output protective device trip function.
- (5) Battery protective device trip function.
- (6) Emergency Power Off (EPO) pushbutton, with guard.
- (7) Control power off switch.
- (8) Static bypass transfer switch enable/disable selector switch.

(c) Module Alarm Indicators:

(d) Module shall have indicators for the following alarm items. Any one of these conditions shall turn on an audible alarm and the appropriate summary indicator.

(e) Each new alarm shall register without affecting any previous alarm.

- (1) Input AC power source failure.
- (2) Input protective device open.
- (3) Output protective device open.
- (4) Overload.
- (5) Overload shutdown.
- (6) DC overvoltage.
- (7) DC ground fault.

- (8) Low battery.
- (9) Battery discharged.
- (10) Battery protective device open.
- (11) Cooling fan failure.
- (12) Equipment overtemperature.
- (13) Control power failure.
- (14) Charger off.
- (15) Inverter off.
- (16) Emergency off.
- (17) UPS on battery.
- (18) Load on static bypass.
- (19) Static bypass transfer switch disabled.
- (20) Inverter output overvoltage, undervoltage, overfrequency, and underfrequency.
- (21) Bypass source overvoltage, undervoltage, overfrequency, and underfrequency.
- (22) Bypass source to inverter out of synchronization.
- (23) Inverter transformer overtemperature.

### **Battery System**

- (a) General: A storage battery with sufficient ampere-hour rating to maintain UPS output at full capacity for the specified duration shall be provided for each UPS module.
- (b) Battery Type: Lead acid.
- (c) Battery Construction: The battery shall be of the valve-regulated, sealed, non-gassing, recombinant type.
- (d) Battery Cabinet: The batteries shall be furnished in a battery cabinet matching the UPS. The battery cabinet shall be provided with smoke and high temperature alarms.
- (e) Battery Cables: Battery-to-battery connections shall be stranded cable with proper cable supports.
- (f) Battery Disconnect: Each battery cabinet or rack shall have a fused disconnect switch or circuit breaker, lockable in the "off" position, provided in a NEMA 1 enclosure.
- (g) Electrolyte Spill Containment and Neutralization: Provide spill control and neutralization means integral to the battery cabinet or battery rack assembly. Provide spare neutralization materials in a manufacturer's cabinet.

### **Acceptance Checks and Tests**

An authorized representative of the UPS manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the Engineer. The manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:

(a) Visual Inspection and Tests:

- (1) Compare equipment nameplate data with specifications and approved shop drawings.
- (2) Inspect physical, electrical, and mechanical condition.
- (3) Verify appropriate anchorage, required area clearances, and correct alignment.
- (4) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
- (5) Verify grounding connections.
- (6) Vacuum-clean enclosure interior. Clean enclosure exterior.
- (7) Verify the correct operation of all alarms and indicating devices.
- (8) Attach a phase rotation meter to the UPS input, output, and bypass buses, and observe proper phase sequences.
- (9) Check and test controls for proper operation.
- (10) Check doors for proper alignment and operation.
- (11) Check and test each protective device for proper mechanical and electrical operation.

**Method of Measurement.** This item shall be measured (counted), each, for each unit procured, installed and certified by the UPS Vendor as having been properly installed, wired, and the loose components assembled to the unit. Note that the UPS must be electrically connected to allow Field Operational Testing as specified prior to testing and the UPS Vendor's certification. Note also that the UPS Vendor's certification is specified to occur on a building by building basis.

**Basis of Payment.** This work shall be paid at the contract unit price each for UNINTERRUPTIBLE POWER SUPPLY, which shall be payment in full for the work, complete, as specified herein regardless of location.



## REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE

**Description.** This work shall include furnishing and installing programmable logic (PLC) equipment, REVLAC Server/client hardware/software(licensing), and industrial control hardware to replace and upgrade the existing control systems as shown on the plans. The Contractor shall furnish and install new and completely assembled remote input/output (I/O) cabinets for local interface to swing gates, barrier and signs and the development of new electrical schematics for each nodal building system.

The existing PLC processors are being replaced as part of a previous project. All PLC control hardware will utilize the Rockwell Automation Control Logix platform, no substitutions. All REVLAC Server/client infrastructure components will utilize the virtualized RS Factory Talk View application-based server/client architecture as shown on the plans. This work shall include all hardware and software (licensing) necessary to upgrade each nodal building and headquarters' PLC, REVLAC Server/client equipment and the associated remote I/O cabinets installed at gates, barriers and signs as shown in plans.

All software packages shall include all necessary licenses for running the REVLAC Server/Client system and programming and monitoring the PLC system.

Prior to shop programming/configuration of the hardware by ESP, the Engineer shall verify hardware inventory, which includes part number, description, etc. Engineer shall also approve information submittals provided by the contractor. The Contractor shall fabricate the roadway remote I/O enclosures in accordance with enclosure layout/power ladder drawings submitted to the engineer.

**Materials.** All materials shall conform to the standards of the Underwriters Laboratories, Inc. (U.L.) in every case where such a standard has been established for the particular type of material in questions. Materials shall meet the following requirements.

(a) Programmable Logic Controller (PLC).

- (1) All local PLC I/O cards, power supplies, communication cards and racks shall be based on the A-B Control Logix platform as shown in the plans.
- (2) The remote I/O cabinets shall use the A-B point I/O platform as shown in the plans.
- (3) All PLC components shall be compatible with the existing PLC Processor racks installed in previous contract.
- (4) PLC and Point I/O card terminators shall utilize spring clamp style connections.

(b) Control Panels and Cabinets

- (1) Remote I/O cabinets shall be NEMA 4X stainless steel enclosures. Wall mounted enclosures must be a minimum of 14 gauge 304 stainless steel. Free standing enclosures must be a minimum of 12-gauge stainless steel. Provide enclosures with heavy duty latch for a padlock. Provide enclosures with data pockets and a continuous hinge. Provide back panels on all enclosures and side panels if required.
- (2) New enclosures installed inside nodal buildings or headquarters shall be NEMA 12 or as noted in plans. Wall mounted enclosures must be a minimum of 14-gauge sheet steel. Free standing enclosures must be a minimum of 12-gauge sheet steel. Provide enclosures with data pockets, 3 point latches and a continuous hinge. Provide back panels on all enclosures and side panels if required.
- (3) Install all electrical equipment in each cabinet on sheet steel back or side panels. The components will be front connected, front wired and removable from the front. Arrange the equipment in a systematic and neat arrangement that allows for ease of maintenance.
- (4) Provide all control cabinets with a door operated LED light and a convenience receptacle.

(c) Terminal Blocks. Terminal blocks shall be provided for any conductor that enters or leaves a cabinet or junction box

- (1) Terminal blocks shall be spring clamp style terminal blocks for conductors 10 AWG and smaller. Use terminal blocks rated at a minimum 600 Volts, 30 A. Provide terminal blocks with a minimum of three (3) conductors with field side of terminal blocks utilizing two (2) conductors. Use terminal blocks fabricated from Allen Bradley, Wago, Phoenix or approved equal.
- (2) Use manufacturer accessories for jumpers, end barriers, clamps and wire markers. All terminal block markers will be printed. Hand marked terminals will not be accepted

(d) Electrical Identification.

- (1) Cabinets. Provide legend nameplates for all major pieces of equipment named on the plans, and for all control devices.
- (2) Nameplates shall be plastic laminated engraved mounted with stainless steel screws for each device. Mark devices as indicated on electrical schematics, for fuses and breakers, include the amperage or fuse part number. Use white nameplates with black lettering.
- (3) Nameplates for equipment identification shall be a minimum letter height of 3/16 inch with a 1/16-inch minimum thickness plastic nameplates.

- (4) All surfaces shall be degreased and cleaned prior to attaching nameplates. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using stainless steel screws or approved manufacturer's recommended adhesive. Secure nameplates to inside of recessed panelboard doors in finished locations.
- (e) Control Cabinet wiring
- (1) No aluminum or solid copper conductors shall be allowed.
  - (2) Minimum size conductor for control circuits in PLC and control cabinet wiring shall be #16 AWG.
  - (3) Minimum size conductor for power circuits and 120 VAC distribution circuits shall be 12 AWG.
  - (4) Internal cabinet control wiring shall be THWN-MTW, 600 VAC unless otherwise noted.
- (f) Relays and Contactors
- (1) Industrial Control. Industrials control relays shall have contacts rated a minimum of 10 amps. Relays will be Allen Bradley 700-P, Square D 8501 type X, Cutler Hammer D26 series or approved equal.
  - (2) Ice Cube. Ice cube type control relays shall be plug in type rated for 120 VAC with a minimum contact rating of 10 A. All relays shall have a LED indicating lamp across the coil. All ice cube relays shall include a din rail mountable base. Ice cube relays will be manufactured by Allen Bradley, IDEC, Square D, Cutler Hammer or approved equal.
  - (3) Timers. Timers shall be solid state multifunction timers. Timers shall be rated 120 VAC. Timers shall be Allen Bradley 700-FS, Square D RE, Cutler Hammer TR series or approved equal.
  - (4) Contactors. For load carrying circuits, contactors sized and designed for the load shall be used, Minimum rating shall be 20 amps be used. For lighting loads, provide contactors with a minimum of 20 A tungsten contacts. All contactors shall include auxiliary contacts for indication. Contactors shall be Allen Bradley, Square D, Cutler Hammer or approved equal.
- (g) Circuit Protection
- (1) Supplemental Protectors. Protectors shall be single pole UL listed or recognized miniature thermal magnetic circuit breakers rated for the voltage and amperage shown in plans. Provide breakers that are track mountable with a positive trip-free holding mechanism and a 10 kA interrupting rating.

- (2) Provide ferrule end type, ceramic or fiberglass body, midget type, rated 250 VAC, 10 kA interrupting, UL listed for control circuit application. Automotive type, glass body fuses are not acceptable. Provide fuse blocks to house the control fuses. Provide terminal block style with isolating feature, and rail mounted, rated 600 VAC, 30 A maximum for midget type fuses. Provide a hinge type cover for isolating and automatic fuse extraction from circuit when cover is lifted.
- (h) DC Power Supplies. DC power supplies shall be switching style with a minimum 5 amps output rating or as shown in plans, whichever is greater. The power supply shall be rated for 120 VAC input and a 24 VDC output or as shown on plans
- (i) Patch Panels. The fiber patch panels in the roadway remote I/O enclosures shall be compatible with single mode OS1 and OS2 fiber cables
  - (1) Standards: UL Listed 1863 (Communications-Circuit Accessories), CE
  - (2) Operating temperature: -40°C to 75°C
  - (3) Storage/transport temperature: -40°C to 80°C
  - (4) Relative humidity (non-condensing): 10% to 95%
  - (5) Insertion Loss:  $\leq 2$ dB (Single mode)
  - (6) Plug/Unplug Durability: 1000 times
- (j) REVLAC Server/Client Hardware.
  - (1) The REVLAC server hardware shall be the Stratus Technology FT Server P2810-1S with 1-socket, 2.2 GHz 10-core processor, 300GB 15K RPM 2.5-inch disk drive, 12Gb SAS.
  - (2) The REVLAC client workstations, historian client workstation and network configuration workstations shall have the following minimum specifications
    - a. One I7 processors 3.6MB
    - b. 1TB Hard Drive space
    - c. Two 10/100/1000 Intel NIC Cards for Ethernet Teaming
    - d. Single Quadro P1000,4GB Graphics Card
    - e. 24" Ultra HD 4K Monitor
    - f. Wired Keyboard and Mouse
    - g. Windows10 Professional Operating System

(3) The REVLAC engineering workstation shall have the following minimum specifications

- a. Intel Xeon processor 2.6GHz Min
- b. 32GB Ram
- c. 1TB Hard Drive space in a Raid 1 Configuration
- d. Raid Hard Drive Controller
- e. HD1 Hard Drive 3.5' 1TB SATA Hard Drive
- f. HD2 Hard Drive 3.5' 1TB SATA Hard Drive
- g. 16x DVD +/- RW Drive
- h. Single Quadro P1000,4GB Graphics Card
- i. Two 10/100/1000 Intel NIC Cards for Ethernet Teaming
- j. 24" Ultra HD 4K Monitor
- k. Wired Keyboard and Mouse
- l. Windows10 Professional Operating system

(k) PLC Programming and REVLAC Server/client system software. The suggested PLC software and REVLAC Server/client software components are detailed in the plans. The necessary VM Ware (Virtualization) software components and the operating system software required to virtualize the server shall be procured by the contractor. The contractor shall use Rockwell Factory Talk template licensing for REVLAC Server/client system.

### **CONSTRUCTION REQUIREMENTS**

**General.** All work shall comply with all local codes, all laws applying to electrical installations in effect and with the regulations of the latest edition of the National Electrical Code, where such regulations do not conflict with the laws in effect and with the requirements of the utility company.

(2) Protection of Electrical Equipment

- a. Protect electrical equipment from water damage, especially from rain, snow, condensation, and water dripping or splashing on equipment and wiring, at all times during shipment, storage and construction (prior to final acceptance). Provide temporary electrical connections to equipment heaters, or provide temporary heaters, as required to prevent damage from moisture.
- b. Thoroughly dry out and put through a special dielectric tests as directed by the engineer at no cost to the department, or replace if not tested to the satisfaction of the engineer, any apparatus that has been subjected to possible injury by water or dampness (including the interiors of motor control equipment, submarine cable ends, or any other electrical devices).

- (3) Coordination of Electrical Work. The plans are diagrammatic in showing certain physical relationships which must be arranged within the electrical work, and which must interface with other work including utilities and mechanical work. Coordinate as necessary between trades to allow for proper installation of all electrical work and to eliminate conflicts. Locate operating and control equipment to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance, as per the latest NEC requirements.
- (4) Field Measurements and Surveys. Prior to development of submittals, conduct field surveys to verify construction dimensions. Identify field dimensions on submittals that have been field verified. Conduct field measurements and surveys as required to supplement information provided to provide a complete and satisfactory fitting and fully operational installation.

### **Manufacturing.**

- (a) Electrical Identification
  - (1) Degrease and clean surfaces to receive nameplates and tape labels. Install nameplates and tape labels parallel to equipment lines. Secure nameplates to equipment fronts using a minimum of two stainless steel screws or approved manufacturer's recommended adhesive. Secure nameplates to inside of recessed panelboard doors in finished locations.
  - (2) Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
  - (3) Wire numbering shall be as indicated on the electrical control schematics and shall be continuous for each circuit from cabinet to cabinet. Unique wire numbers in each cabinet for the same circuit is not allowed.

**Submittals.** The Contractor shall provide the Engineer a list of procurement materials as described in the plans for approval prior to procurement.

Information submitted shall include, but not limited to the following:

- (a) Electrical equipment, hardware, drawings, testing plans, and documentation for all electrical items described in the contract documents shall be submitted for approval
- (b) PLC/VDT cabinet layout drawing with upgraded remote I/O racks (four nodal buildings and headquarters).
- (c) Upgraded PLC/VDT enclosure power ladder drawings (four nodal buildings and headquarters).
- (d) Upgraded I/O wiring drawings for all Control Logix remote I/O located in the PLC/VDT enclosures (four nodal buildings and headquarters) detailing interconnection with field instrumentation.

- (e) Enclosure layout drawings of each roadway remote Point I/O enclosures associated with swing gates, restraining barriers, road side panels and DMS's (controlled/monitored from all five nodal buildings).
- (f) Power ladder drawings for each roadway remote Point I/O enclosures associated with swing gates, restraining barriers, road side panels and DMS's (controlled/monitored from all five nodal buildings).
- (g) Upgraded I/O wiring drawings for all roadway remote I/O enclosures associated with swing gates, restraining barriers, road side panels and DMS's (controlled/monitored from all five nodal buildings) detailing interconnection with field instrumentation.
- (h) Upgraded wiring schematics for the local controls and interface with control system I/O for the swing gate, restraining barrier, DMS signs, roadside panels and any other roadway equipment.
- (i) REVLAC virtualized Server system rack drawings detailing all hardware, equipment, power ladder and software(licensing) components required including installation details in the headquarter building.
- (j) REVLAC client workstations drawings (four nodal buildings and headquarters) detailing all hardware, equipment and software(licensing) components required including installation details.
- (k) REVLAC historian client workstation, engineering workstation and network configuration workstation drawings detailing all hardware, equipment and software(licensing) components required including installation details.
- (l) Complete Manufacturer's specifications and descriptive bulletins for all equipment listed in the bill of materials.
- (m) Detailed REVLAC control system PLC upgrade phasing plan.
- (n) Detailed project schedule clearly explaining projected dates and durations for any possible traffic disruptions.
- (o) Working plans and shop drawings as prescribed in the contract documents and in this special provision shall be submitted for approval. Clearly mark manufacturer's standard drawings that indicate dimensions and/or options for more than one piece of equipment to clearly indicate what data applies.
- (p) Submittal approval shall be on an "all or none" basis. Provide complete resubmittals even if some items on the original submittals may not have been marked deficient. Provide sufficient time in project schedule to allow for the possibility of repetitious submittals without creating delays to the project. The department will not bear any responsibilities for delays caused by repetitious submittals.

**Installation.** Installation of PLC/VDT cabinet remote I/O, REVLAC Sever/client equipment, roadway remote I/O cabinets shall be paid for separately under REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, 'LOCATION X'.

**Method of Measurement.** REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING A; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING C; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING D; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING E; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, HEADQUARTERS will be measured each, where each is defined as all hardware for the associated location.

REVLAC CONTROL SYSTEM, COMMUNICATION, AND NETWORK HARDWARE, REMOTE I/O CABINET will be measured each, where each is defined as all hardware furnished, installed, wired and tested in a cabinet.

**Basis of Payment.** REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING A; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING C; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING D; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, BUILDING E; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, HEADQUARTERS will be paid for at the contract unit price per each for all hardware furnished and delivered in accordance with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications. The contract cost shall include all shipping, testing and any storage costs.

- (a) 75 Percent of Contract price upon delivery of all hardware for each location.
- (b) 10 Percent of Contract Price upon successful completion of Shop Operational Testing.
- (c) Remaining after fully installed and successful completion of systems test for each building.

REVLAC CONTROL SYSTEM HARDWARE, REMOTE I/O CABINETS will be paid for at the contract unit price per each for all hardware furnished and delivered in accordance with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications. The contract cost shall include all shipping, testing and any storage costs.

- (a) 75 Percent of Contract price upon delivery of all hardware for each location.
- (b) 10 Percent of Contract Price upon successful completion of Shop Operational Testing.
- (c) Remaining after fully installed and successful completion of systems test for each building.



## **REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE**

**Description.** This work shall include furnishing and installing all hardware required to upgrade the existing REVLAC PLC based control system Ethernet network and the CCTV camera Ethernet network including all network switches, network routers, power supplies, network ports and network configuration software/license etc. as described in the bills of material (for all four nodal building and headquarters PLC/VDT enclosures and server rack) located in the plans is included in this special provision.

All fiber optic cable/conduit material required to interface the nodal building (all five nodal buildings) Control Logix PLC racks to the roadway remote Point I/O racks are also included in this special provision. Fiber optic cable/conduit required to between the nodal buildings to the Control Logix PLC racks to the roadway remote Point I/O racks will paid under FIBER OPTIC CABLE, 12 FIBERS.

**Materials.** Since the upgraded control system consists of Allen Bradley Control Logix processor racks interfaced with Control Logix remote I/O components and roadway remote Point I/O component. The upgraded Ethernet network hardware equipment for the PLC control system (for all five nodal buildings and associated roadway cabinets) shall all be Allen Bradley Stratix network switches (Layer II managed switches)/routers, no substitutions. The bills of material provided in the plans are intended to list the major items needed for the REVLAC PLC based control system Ethernet network upgrade. All ancillary items, i.e. CAT6 cables internal to the enclosures, wire, terminals, wire markers etc., have not been listed. The provided Ethernet network hardware for the CCTV camera systems shall consist of Cisco network switches to be furnished at REVLAC buildings A, C, and D. Building E CCTV camera network will be upgraded under IDOT Contract 62D79. The components to be furnished at each building for the CCTV camera network are as follows:

Part Number	Description	Qty
<b>Group Name: Core Switches</b>		
C9500-24Y4C-A	Catalyst 9500 24x1/10/25G and 4-port 40/100G, Advantage	2
S9500UK9-168	UNIVERSAL	2
C9K-PWR-650WAC-R	650W AC Config 4 Power Supply front to back cooling	2
CAB-9K12A-NA	Power Cord, 125VAC 13A NEMA 5-15 Plug, North America	4
C9K-F1-SSD-BLANK	Cisco pluggable SSD storage	2
C9K-PWR-650WAC-R/2	650W AC Config 4 Power Supply front to back cooling	2
<b>Group Name: Distribution Switches</b>		
C9300-48T-A	Catalyst 9300 48-port data only, Network Advantage	2
PWR-C1-715WAC	715W AC Config 1 Power Supply	2
PWR-C1-715WAC/2	715W AC Config 1 Secondary Power Supply	2
CAB-TA-NA	North America AC Type A Power Cable	4
C9300-NM-8X	Catalyst 9300 8 x 10GE Network Module	2
STACK-T1-50CM	50CM Type 1 Stacking Cable	2
CAB-SPWR-30CM	Catalyst Stack Power Cable 30 CM	2
<b>Group Name: Device Connectivity with SFPs</b>		
SFP-H10GB-CU1M=	10GBASE-CU SFP+ Cable 1 Meter	1
QSFP-H40G-CU1M=	40GBASE-CR4 Passive Copper Cable, 1m	2
SFP-H10GB-CU5M=	10GBASE-CU SFP+ Cable 5 Meter	4
GLC-ZX-SMD=	1000BASE-ZX SFP transceiver module, SMF, 1550nm, DOM	4
SFP-10G-BX40U-I=	10GBASE-BX SFP+ transceiver module, SMF, DOM	4
GLC-LH-SMD=	1000BASE-LH SFP transceiver module, SMF	24

The Contractor shall provide catalog cuts for review and approval. Question regarding the equipment list shall be submitted in writing. Upon approval of the catalog cuts, the Contractor shall deliver the equipment to a location within District 1 for configuration by the Network Administrator. After the equipment is configured, the Contractor shall pickup equipment and install the equipment in the field.

## CONSTRUCTION REQUIREMENTS

**Submittals.** The Contractor shall provide the Engineer a list of procurement materials as described in the plans for approval prior to procurement. Additional information submitted shall include, but not limited to the following:

- (a) Fiber Optic Cable/conduit routing drawings detailing the physical interface of the Control Logix PLC racks (all four nodal buildings) with all the roadway remote Point I/O racks. This will include details such as patch panel schedules, fiber strand color being used etc.
- (b) Fiber Optic Cable/conduit routing drawings detailing the physical interface of the Control Logix PLC racks between all five nodal buildings. This will include details such as patch panel schedules, fiber strand color being used etc.
- (c) REVLAC control system Ethernet communication architecture drawings showing the physical layout of the entire Ethernet network and communication cabling between devices within the enclosures.
- (d) Complete Manufacturer's specifications and descriptive bulletins for all equipment listed in the bill of materials.
- (e) Complete REVLAC Control system Ethernet network architecture drawing showing segmented VLAN routing configuration, sub-netting, IP configuration and gateway details. This must include network configuration details for the REVLAC Server/client system with network card teaming.
- (f) Complete manufacturers specifications of the single mode fiber cable (including the type of connectors) being deployed between the nodal buildings, also between nodal buildings and the roadway remote I/O.

Prior to shop programming/configuration of the Ethernet network hardware by ESP, the Engineer shall verify hardware inventory, which includes part number, description, etc. Engineer shall also approve information submittals provided by the Contractor.

**Method of Measurement.** REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING A; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING C; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING D; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING E; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, HEADQUARTERS will be measured each, where each is defined as all hardware/software for the associated location. Fiber optic cables between the nodal buildings and Point I/O racks will be paid for separately.

**Basis of Payment.** REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING A; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING C; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING D; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, BUILDING E; REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE, HEADQUARTERS; will be paid for at the contract unit price per each for all hardware furnished and delivered in accordance with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications. The contract cost shall include all shipping, testing and any storage costs.

- (a) 75 Percent of Contract price upon delivery of all hardware for each location.
- (b) 10 Percent of Contract Price upon successful completion of Shop Operational Testing.
- (c) Remaining after fully installed and successful completion of systems test for each building.

**REVLAC CONTROL AND COMMUNICATION, SPARE PARTS**

**Description.** This work consists of furnishing spare parts necessary to support the new control and communication installed as part of this contract.

**CONSTRUCTION REQUIREMENTS**

**General.** The Contractor shall provide a hardware inventory, which includes part number, description, etc. to the Engineer for approval. Upon approval, the Contractor shall retain possession of the spare parts which shall be used by ESP to configure and program during the shop testing phase of this project. Once the shop testing of this upgrade project has been completely approved by the Engineer, then the Contractor shall deliver the spare parts to a location designated by the Department, within District 1.

Furnish the following PLC and Communication spare parts:

ITEM	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	QTY.
1	POWER SUPPLY 120VAC TO 24VDC 5A	ROCKWELL	1606-XLE120EN	5
2	10 SLOT CONTROLLOGIX CHASSIS	ROCKWELL	1756-A10	5
3	CONTROLLOGIX 5575 CONTROLLER WITH 32 MBYTES MEMORY	ROCKWELL	1756-L75	3
4	CONTROLLOGIX, 85-265 VAC POWER SUPPLY (10AMP@5V)	ROCKWELL	1756-PA72	4
5	ETHERNET 10-100M INTERFACE MODULE	ROCKWELL	1756-EN2TR	5
6	ETHERNET 10-100M INTERFACE MODULE	ROCKWELL	1756-EN2T	5
7	CONTROLLOGIX 120V AC INPUT MODULE	ROCKWELL	1756-IA16	5
8	CONTROLLOGIX 120/240V AC OUTPUT MODULE	ROCKWELL	1756-OA16	5
9	CONTROLLOGIX INPUT/OUTPUT TERMINAL BLOCK	ROCKWELL	1756-TBNH	10
10	STRATIX 5700 NETWORK SWITCH	STRATIX	1783-BMS10CGP	5
11	STRATIX 5700 NETWORK SWITCH	STRATIX	1783-BMS06SGA	2
12	STRATIX 5410 NETWORK SWITCH	STRATIX	1783-IMS28RAC	1
13	STRATIX FIBER SFP 1000MBIT CONNECTIVITY OVER SINGLE MODE FIBER	STRATIX	1783-SFP1GLX	14
14	ETHERNET/IP TWISTED PAIR MEDIA I/P ADAPTER	ROCKWELL	1734-AENT	5
15	POINT I/O FIELD POTENTIAL DISTRIBUTOR MODULE	ROCKWELL	1734-FPD	5
16	POINT I/O 120V AC 4 CHANNEL INPUT MODULE	ROCKWELL	1734-IA4	18
17	POINT I/O DIGITAL CONTACT OUTPUT MODULE 24DC	ROCKWELL	1734-OW4	12
18	POINT I/O MODULE BASE	ROCKWELL	1734-TB	30
19	12 PORT FIBER PATCH PANEL	DINSPACE	SNAP-12ST-SC-SM	5

Furnish the following miscellaneous controls spare parts:

- (a) A minimum four limits or proximity switches of each type installed, including limit lever arms.
- (b) A minimum of one operating coil for every ten of each size contactor or starter installed.
- (c) A minimum of one relay for every five of each kind and size of control, timing, or overload relay installed.
- (d) A minimum of three heaters for every ten thermal overload relays of each size.
- (e) A minimum of ten spare fuses of each size and type used throughout the project.
- (f) A minimum of ten spare indicator lamps of every type used. Include lamp extractor(s).
- (g) 2 Complete Remote I/O cabinets
- (h) Other spare parts as called out in individual sections.

Provide spare parts in sealed, uniform-sized cartons, with typed and clearly varnished labels to indicate their contents, and store them in a lockable box. Also, provide a directory of permanent type describing the parts. The directory must state the name of each part, the manufacturer's number, and the rating of the device for which the part is a spare. Mark spare parts to correspond with their respective item numbers as indicated on the elementary wiring diagram. Plastic laminate and store in the same cabinet the schematic diagrams for the control console.

**Method of Measurement.** This work will not be measured for payment.

**Basis of Payment.** This work shall be paid for at the contract unit price lump sum for REVLAC CONTROL AND COMMUNICATION SPARE PARTS, which price shall be payment in full for the work as specified herein.

### **REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALLATION**

**Description.** This item consists of all work necessary to remove and install new PLC, control and network equipment for each nodal building and headquarters. Much of this work will be performed during the staged lane closures.

Apparatus, appliances, material or work not shown on the Plans, but mentioned in these special provisions, or vice versa, or any incidental accessories necessary to make each location's PLC system complete and ready for operation, even though not specified or shown on the plans shall be furnished and installed by the Contractor under this pay item.

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, finishing, testing, and making fully operational the electrical control and communication components and systems for the REVLAC system. All additional special provisions provide further information, requirements, and guidelines that are applicable to the work paid for under the bid items addressed by this special provision.

Comply with all local codes, all laws applying to electrical installations in effect and with the regulations of the latest National Electrical Code, where such regulations do not conflict with the laws in effect and with the requirements of the utility company.

It is the intention of the contract plans to call for completely finished work, fully tested and ready for reliable and consistent operation. Furnish, deliver, and install any apparatus, appliance, materials, or work not shown on the plans but mentioned in the special provisions or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, to be furnished, delivered, and installed without additional expense to the department.

**Scope.** The work under this item includes, but is not limited to:

- (a) Removal, disposal and installation of PLC hardware in each location's PLC/ VDT enclosures. This includes all mounting, conductors and terminations and any conduit or brackets necessary for a complete installation.
- (b) Removal, disposal and installation of new communication and network systems at each location. This includes all mounting, conductors and terminations and any conduit or brackets necessary for a complete installation.
- (c) Removal, disposal and installation of new REVLAC Server/client system at each location. This includes all mounting, installation of the Server rack, engineering workstation, client workstations, historian client workstation and network configuration workstation with associated network /power cabling.
- (d) Temporary installations for phasing the installation of new equipment.
- (e) Installation of Remote I/O cabinets for swing gates, barriers and signs. This includes the mounting of the cabinet and all conduit, conductors and terminations to interconnect each device.
- (f) Related Provisions. Unless otherwise noted, all work under this special provision shall conform to requirements of the following special provisions.
  - (1) REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE
  - (2) REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE
  - (3) BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS AND COMMUNICATION NETWORK CONFIGURATION

**Material.** Provide all new materials that conform to the standards of the Underwriters Laboratories, Inc., in every case where such a standard has been established for the particular type of materials in question. Submit to the engineer for approval, prior to purchase of any materials or equipment required to be furnished and installed, a complete list of all such materials and equipment including manufacturer's catalog (part and/or model) numbers, catalog data sheets, illustrations, and shop drawings.

- (a) Unless otherwise noted, materials shall conform to requirements in ELECTRICAL WORK; REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE, MATERIAL AND; REVLAC CONTROL AND COMMUNICATION SYSTEMS, INSTALL
- (b) Control conductors
  - (1) No aluminum or solid copper conductors shall be allowed.
  - (2) Minimum size conductor for control circuits in PLC and control cabinet wiring shall be #16 AWG.
  - (3) Minimum size conductor for power circuits and 120 VAC distribution circuits shall be 12 AWG.
  - (4) Internal cabinet control wiring shall be THWN-MTW, 600 VAC unless otherwise noted

(c) Electrical Identification

- (1) Nameplates shall be plastic laminated engraved mounted with stainless steel screws for each device. Mark devices as indicated on electrical schematics, for fuses and breakers, include the amperage or fuse part number. Use white nameplates with black lettering.
- (2) Nameplates for equipment identification shall be a minimum letter height of 3/16 inch with a 1/16-inch minimum thickness plastic nameplates.
- (3) All surfaces shall be degreased and cleaned prior to attaching nameplates. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using stainless steel screws or approved manufacturer's recommended adhesive. Secure nameplates to inside of recessed panelboard doors in finished locations.

(d) Mounting Hardware

- (1) Mounting brackets and hardware used for installation of remote I/O cabinets shall be stainless steel.
- (2) Mounting brackets and hardware in PLC cabinet shall be stainless steel or galvanized steel, unless otherwise noted.

## CONSTRUCTION REQUIREMENTS

**General.** The Contractor shall perform a phased removal of the existing REVLAC control system/network hardware and installation of the upgraded control system/network hardware (at all locations) in accordance with the suggested REVLAC control system upgrade phasing plan provided in the plan documents. Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract. Contractor shall remove existing analog video switches and interface components and replace with new network hardware.

**Installation.** It is the Contractor's responsibility to provide all of the materials for a completely functional system.

(a) Building PLC/VDT Enclosures

- (1) During removal, installation, modifications and installation of wiring and control components, the Contractor shall protect other equipment adjacent and below from debris caused by drilling, wire stripping or other work that could damage equipment.
- (2) Existing conduit and conductors shall be extended and modified to connect to new systems as necessary.
- (3) All conduit, conductors and equipment will be clearly labeled. Each conductor shall be tagged on each end. All terminal blocks shall be permanently labeled.



(b) REVLAC Server/client System:

- (1) Existing graphical user interfaces shall be removed and disposed of during the phased outage for the associated building.
- (2) The contractor shall ensure that during the phased installation of the REVLAC Server/client system, regular operation of the REVLAC control system should not be compromised. The contractor shall provide required mounting supports for the REVLAC workstation equipment.
- (3) The Contractor shall provide temporary mounting as necessary to support phased operation.
- (4) All communication cabling shall be tagged at each end including labeling of all Server/client devices.

(c) Remote I/O Cabinets

- (1) Each remote I/O cabinet shall be mounted to the new or refurbished swing gate enclosure, barrier control panel or DMS sign cabinet as shown in plans.
- (2) A four-inch raceway nipple or conduit shall be installed to pass control and fiber optic cable from swing gate enclosure to remote I/O cabinet.
- (3) The cabinet door shall open facing the ramp.
- (4) The contractor shall terminate communication and control cables from buildings in the remote I/O cabinet. 480-volt power cables shall terminate in the roadway equipment enclosure.
- (5) The Contractor shall install new control conductors from local swing gate, barrier or DMS control enclosures to remote I/O cabinets as shown in plans.
- (6) All mounting hardware and brackets shall be stainless steel.

(d) Video Distribution System

- (1) Remove existing video switches, analog fiber transceivers, and other components related to the fixed video camera system monitoring the control gates.
- (2) Install CCTV camera system network hardware and switches
- (3) Splice and patch fiber optic cables as required to establish new network connections to all cameras at locations shown on the Plans and as directed by the Engineer.

**Submittal.** The Contractor shall submit a comprehensive phasing plan for each stage of control system replacement, including a detailed project schedule for approval by the Engineer.

- (a) The phasing plan shall include a detailed scope of work and schedule.

**Method of Measurement.** REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING A; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING C; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING D; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING E; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, HEADQUARTERS; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, REMOTE I/O CABINETS will be measured each, where each is defined as all hardware for the associated location.

REMOTE I/O CABINETS; will be measured each, where each is defined as all hardware furnished, installed, wired and tested in a cabinet.

**Basis of Payment.** REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING A; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING C; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING D; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, BUILDING E; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, HEADQUARTERS; REVLAC CONTROL AND COMMUNICATION SYSTEMS INSTALL, REMOTE I/O CABINETS will be paid for at the contract unit price per each for installing new control and communications as described within and in plans.

This work shall include all conduit, wiring, mounting devices and hardware for a complete functioning system at each location and cabinet.

### **REVLAC CONTROL SYSTEM PHASED TESTING AND COMMISSIONING**

**Description.** This item provides for all work required by the Contractor to support shop testing, field testing and sixty (60) day observation period to be performed by ESP.

Contractor Support During Integrated Shop Testing: Testing, as described in the BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS AND COMMUNICATION NETWORK CONFIGURATION special provision, will consist of individual building/integrated shop testing, field testing, and 60-day observation period. The Contractor shall provide facilities for the individual building/integrated shop test. The Contractor shall provide a facility large enough to allow ESP and the Department to conduct simulation testing/configuration of the entire REVLAC control system hardware/PLC controls sequence. This facility shall include all necessary amenities to facilitate testing, including having adequate off street parking. All costs associated with providing space for the individual building/integrated shop test shall be included in this pay item.

Contractor Support for PLC Field Testing and Installation. The Contractor shall be responsible for the maintenance of traffic during all field testing described in the BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS AND COMMUNICATION NETWORK CONFIGURATION special provision. Prior to testing, the Contractor shall submit a schedule for any required temporary ramp closures. Disruption to traffic shall be kept to a minimum. The Contractor shall be onsite during the 60 Day Observation test period to provide technical assistance as needed. The Contractor shall have a representative present to conduct testing and to document the test results. A certified copy of each test result shall be submitted by the Contractor to the Engineer within two weeks following the completion of the test.

### **CONSTRUCTION REQUIREMENTS**

**Method of Measurement.** This work will not be measured for payment.

**Basis of Payment.** This work will be paid for at the contract lump sum for REVLAC CONTROL SYSTEM PHASED TESTING AND COMMISSIONING, which price shall be payment in full for the work as specified herein with the following payment schedule. Other payment shall be in accordance with Article 109 of the Standard Specifications.

- (a) 25 Percent of Contract price upon approved acceptance of Integrated Shop Test.
- (b) 10 Percent of Contract Price upon approved acceptance of Building A Field Test.
- (c) 10 Percent of Contract Price upon approved acceptance of Building C Field Test.
- (d) 10 Percent of Contract Price upon approved acceptance of Building D Field Test.
- (e) 10 Percent of Contract Price upon approved acceptance of Building E Field Test.
- (f) Remaining upon approved acceptance of Integrated Field Test.

## TRAINING AND MANUALS

**Description.** This work shall consist of operator and maintenance training, manuals and schematics for the new REVLAC systems. Operator training shall include preliminary sessions necessary to instruct operators to changes in operations as the new system is installed in phases. All training material shall be supplied in both hard copy and electronic (.pdf) copy versions. Operator and maintenance manuals shall be furnished in both hard copy and electronic (.pdf) copy versions.

- (1) Separate and multiple training sessions shall be provided for both operator and maintenance personnel.
- (2) Separate manuals shall be provided for both operator and maintenance personnel.
- (3) Related Provisions. Unless otherwise noted, all work under this special provision shall conform to requirements of the following special provisions.
  - a. REVLAC CONTROL SYSTEM HARDWARE AND SOFTWARE
  - b. REVLAC COMMUNICATION AND NETWORK HARDWARE AND SOFTWARE
  - c. REVLAC CONTROL AND COMMUNICATION SYSTEM INSTALLATION
  - d. BUDGETARY ALLOWANCE FOR UPGRADE OF PLC CONTROLS AND COMMUNICATION NETWORK CONFIGURATION

**Materials.** Training manuals shall be assembled in white three-ring binders, unless otherwise noted. All binders shall be D-ring style with a maximum three-inch diameter. Plastic dividers and tabs shall be inserted to divide each chapter. The paper shall have a reinforced edge for protection around binder holes.

Intermediate Operator Training Manuals: Furnish multiple copies of intermediate training materials with operator instructions for operating intermediate changes to the system for each stage.

- (a) Intermediate Operator instructions shall include detailed instructions on normal and abnormal operation. Instructions shall include any special or temporary instructions required because of construction.
- (b) One copy in a 3 ring binders shall be furnished stored at the headquarters, and each remote building. Each binder shall be updated during each stages intermediate training.
  - (1) Ten paper stapled copies and one .pdf copy shall be furnished for each stage intermediate training session.

Final Operation Manuals: Furnish eight hard copy operations manuals and four .pdf copies on CD, DVD or USB Drive to the Department to be used for operator reference and the training of future operators. Include the following sections, and/or chapters in the operator's manual at a minimum.

- (a) TABLE OF CONTENTS. Identify the title of each chapter.
- (b) SYSTEM OVERVIEW. Provide a general overview description of the entire system, including a description of the changes made as part of this contract and an overall system layout.
- (c) SYSTEM OPERATION – HEADQUARTERS. Provide detailed instruction for operation from the system headquarters. Include photos and screen shots of new operator screens and stations. Instructions shall include instructions and procedures for both normal and abnormal events. Include instructions for Remote Catron unit.
- (d) SYSTEM OPERATION – REMOTE BUILDINGS. Provide detailed instruction for operation from the remote buildings. Include photos and screen shots of new operator screens and stations. Instructions shall include instructions and procedures for both normal and abnormal events.
- (e) ALARMS. This chapter shall include a complete list of all alarms with definitions for each alarm. Provide a condensed version of each alarm with description that can be copied and used for quick reference. Also include a detailed description for each alarm, that includes procedures that will direct the operator on how to proceed if the alarm occurs.
- (f) ABNORMAL OPERATIONS. This chapter shall provide procedures for operating the system in the event of a critical alarm that requires an abnormal operation.
- (g) EMERGENCY CALL LIST. Include a list of local municipality emergency contacts, phone numbers and addresses, department contacts and numbers and the Contractor's emergency call number. Consult the Department for the key contacts.

Maintenance Manuals: Maintenance manuals shall be divided into multiple volumes as described below and based on the amount of material that is manageable in the maximum size binder allowed. Furnish eight hard copy maintenance manuals and four .pdf copies on CD, DVD or USB drive to the Department for reference and the training of future maintenance technicians.

- (a) One additional VOLUME 3 – SCHEMATICS shall be furnished and left at each building and Headquarters during Construction to assist with repairs should problems arise. This volume shall be updated after each stage with any changes made during construction.
- (b) Each Volume shall include a Table of Contents that includes materials included in other volumes.

- (c) VOLUME 1 – System Description
- (1) SYSTEM OVERVIEW. This chapter shall provide a general overview description of the entire system, including a description of the changes made as part of this contract and an overall system layout.
  - (2) THEORY OF OPERATION. This chapter shall provide detailed descriptions on the systems control elements and their primary functions. This section shall include elements such as the PLC, Communications, network, CCTV and SCADA systems.
  - (3) BUILDING X. Provide a chapter for each building and headquarters that describes the operation and equipment served for this building. Each building chapter will include equipment bill of materials, network drawings, photos and screen shots of new operator screens and stations and building specific alarms.
  - (4) ALARMS. This chapter shall include a complete list of all alarms with definitions for each alarm. Provide a condensed version of each alarm with description that can be copied and used for quick reference. Also include a detailed description for each alarm, that includes procedures that will direct the operator on how to proceed if the alarm occurs
  - (5) ABNORMAL OPERATIONS. This chapter shall provide procedures for operating the system in the event of a critical alarm that requires an abnormal operation.
  - (6) ALARM AND DATA PRINTING AND COPYING INSTRUCTIONS. Include instructions for printing and copying alarms to USB drive.
  - (7) PERIODIC REPORTING. This chapter shall include instructions for the operator at headquarters to provide the maintenance team with historic logging reports (of alarms/faults/status) from the historian client workstation.
  - (8) MOTOR MEGGER READINGS. Include all motor readings in a table with a column for as-built and a column to be used yearly for the next 20 years.
  - (9) EMERGENCY CALL LIST. Include a list of local municipality emergency contacts, phone numbers and addresses, department contacts and numbers and the Contractor's emergency call number. Consult the Department for the key contacts to be put on the list.
- (d) VOLUME 2 – PLC PROGRAM. This volume shall include a hard copy printout of each of the PLC programs and screen shots of each screen on the graphical user interfaces. Each PLC processor program shall be divided into its own separate chapter with cross references and address descriptions.

- (e) VOLUME 3 – ELECTRICAL SCHEMATICS. A complete set of 11” x 17” electrical schematics shall be provided in a hard covered 3-ring tabloid size binder.
  - (1) Each buildings PLC system shall be place in a separate binder. The Headquarters’ PLC chapter shall include all system and network interconnect and communication drawings.
  - (2) Each building’s electrical schematics shall include: all power and single line diagrams; local and remote I/O schematics; local operator stations, control cabinet layout drawings with Bill of Material.
- (f) VOLUME 4 – ELECTRICAL CONTROL MATERIALS. Volume 4 shall include a complete electrical parts list that describes every electrical control component furnished and installed.
  - (1) A complete spare parts list shall be included in its own chapter. Include quantities furnished, part numbers and manufacturers.
  - (2) Divide the parts into chapters with similar components. Include a cover sheet for each chapter with all part descriptions, their numbers and manufacturer included.
- (g) VOLUME 5 – EQUIPMENT MANUALS. Volume 5 shall include shop drawings and maintenance manuals of equipment furnished and installed as part of this contract.
  - (1) Equipment shall include swing gates, impact barriers, CCTV, generators, HVAC and other miscellaneous equipment.
  - (2) The manual shall include lubrication charts, with recommended lubricants.
  - (3) The manual shall include a chart with a maintenance schedule for each piece of equipment.

### **CONSTRUCTION REQUIREMENTS**

**General.** Separate training sessions shall be provided for maintenance and operation personnel. For final operation and maintenance training, each trainee shall be furnished a syllabus, a copy of the operator instructions, a pad of paper and pen.

Intermediate Operator Training: After each stage or major change to the controls and operation, the operators shall be trained to use the new system. This training shall include updating instructions, hands-on training and on-site assistance after training.

- (a) For the change the change at the Headquarters’ operator station and interface, the Contractor shall train each operator that will include at least two hands-on operations. This training shall be done over three-night time closures. The Contractor shall provide an instructor for every operation over the next 14 days to oversee the operation and answer any questions.
- (b) After each lane closure, the Contractor shall provide a four-hour training session that explains the changes to the system and shall provide an instructor for every operation over the next 7 days to oversee the operation and answer any questions.

Final Operator Training The training shall include both classroom type training and hands-on training. Classroom type operator training shall take place over two 8-hour sessions. Design each session for up to six people. Hands-on training shall be performed over five nighttime closures.

- (a) INTRODUCTION. Each session shall start with a brief description of the work performed and an overview of the entire system.
- (b) OPERATOR INSTRUCTIONS. Explain the operation of the new REVLAC controls using the instructions as an aide. The instructions shall include normal and abnormal operations.
- (c) ALARMS – The training shall demonstrate how to interpret and acknowledge each alarm. During the training, the instructor shall describe each alarm, its definition and if is considered minor or major.
- (d) TRAINEE OPENINGS. Each trainee will be required to operate the system at least three times: two under normal operations and one with an abnormal condition. Record each operation with time, date, operator, and a witness for a record of the training.

Maintenance Training. Provide Maintenance training in two (2) 8-hour sessions. Design one (1) session for the classroom and one (1) session for the field for up to eight (8) people. The field session shall be done during a night time lane closure.

- (a) INTRODUCTION. Each session shall start with a brief description of the work performed and an overview of the entire system.
- (b) OPERATOR INSTRUCTIONS. Explain the operation of the new REVLAC controls using the instructions as an aide. The instructions shall include normal and abnormal operations.
- (c) ALARMS AND SYSTEM FAILURES. The training shall demonstrate how to interpret and acknowledge each alarm. During the training, the instructor shall describe each alarm, its definition and if is considered minor or major. The instructor shall explain procedures for both minor and major alarms.
- (d) MECHANICAL. Include an overview of the mechanical systems on the new impact barriers and swing gates. Provide a lubrication schedule and instructions on how to properly lubricate each item.
- (e) ELECTRICAL. Explain how to read and use the electrical schematics to locate problems.
- (f) PLC. Provide a brief description of a PLC and how to interpret a rung of logic. Include a demonstration on how to access the online programming.
- (g) SYSTEM TOUR. Prior to the tour, demonstrate the operation from the headquarters. Tour the systems at headquarters, and each remote building.
- (h) MECHANICAL. Demonstrate how to lubricate, maintain and repair the mechanical systems.



- (i) ELECTRICAL. Demonstrate where and how to isolate power, adjust limits, connect to the PLC and print reports.
- (j) TROUBLESHOOTING AIDES. Explain and demonstrate control system aides such as indicator lights, alarms and data logs. Create at least four scenarios that prevent operation and have the trainees use the aides to identify and repair the problem.

**Submittals.** Submit PDF sample copies of each manual and a training syllabus for approval prior to any training.

- (a) Provide fourteen days advance notice for all training sessions.
- (b) Submit intermediate training instructions a minimum ten days in advance of training sessions.
- (c) Submit final training, operator and maintenance manuals for review

**Method of Measurement.** This work will not be measured for payment.

**Basis of Payment.** This work will be paid for at the contract unit price lump sum for TRAINING AND MANUALS.

## **BLENDED FINELY DIVIDED MINERALS (BDE)**

Effective: April 1, 2021

Revise the second paragraph of Article 1010.01 of the Standard Specifications to read:

“Different sources or types of finely divided minerals shall not be mixed or used alternately in the same item of construction, except as a blended finely divided mineral product according to Article 1010.06.”

Add the following article to Section 1010 of the Standard Specifications:

**“1010.06 Blended Finely Divided Minerals.** Blended finely divided minerals shall be the product resulting from the blending or intergrinding of two or three finely divided minerals. Blended finely divided minerals shall be according to ASTM C 1697, except as follows.

- (a) Blending shall be accomplished by mechanically or pneumatically intermixing the constituent finely divided minerals into a uniform mixture that is then discharged into a silo for storage or tanker for transportation.
- (b) The blended finely divided mineral product will be classified according to its predominant constituent or the manufacturer’s designation and shall meet the chemical requirements of its classification. The other finely divided mineral constituent(s) will not be required to conform to their individual standards.”

## COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017

Revised: April 1, 2019

Revise Article 107.40(b) of the Standard Specifications to read:

“(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows.

- (1) Minor Delay. A minor delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.
- (2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.
- (3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days.”

Revise Article 107.40(c) of the Standard Specifications to read:

“(c) Payment. Payment for Minor, Major, and Reduced Rate of Production Delays will be made as follows.

- (1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

- (2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to two weeks plus the cost of move-out to either the Contractor’s yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

- (3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13.”

Revise Article 108.04(b) of the Standard Specifications to read:

“(b) No working day will be charged under the following conditions.

- (1) When adverse weather prevents work on the controlling item.
- (2) When job conditions due to recent weather prevent work on the controlling item.
- (3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.
- (4) When delays caused by utility or railroad adjustments prevent work on the controlling item.
- (5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.
- (6) When any condition over which the Contractor has no control prevents work on the controlling item.”

Revise Article 109.09(f) of the Standard Specifications to read:

“(f) Basis of Payment. After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited.”

Add the following to Section 109 of the Standard Specifications.

**“109.13 Payment for Contract Delay.** Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

- (a) Escalated Material and/or Labor Costs. When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.
- (b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.
  - (1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to \$5,000,000	One Project Superintendent
Over \$ 5,000,000 - up to \$25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over \$25,000,000 - up to \$50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over \$50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

(c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid for according to Article 109.04.

When an extended traffic control adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay under this provision, the Contractor shall assign subrogation rights to the Department for the Department's efforts of recovery from any other party for monies paid by the Department as a result of any claim under this provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this provision."

**CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)**

Effective: June 1, 2010

Revised: November 1, 2014

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term "equipment" refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown below. Equipment that is of a model year older than the year given for that equipment's respective horsepower range shall be retrofitted:

Effective Dates	Horsepower Range	Model Year
June 1, 2010 <sup>1/</sup>	600-749	2002
	750 and up	2006
June 1, 2011 <sup>2/</sup>	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006
June 1, 2012 <sup>2/</sup>	50-99	2004
	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006

1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.

2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/cleandiesel/verification/verif-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>); or
- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

### **Diesel Retrofit Deficiency Deduction**

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

### **DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (DBE)**

Effective: September 1, 2000

Revised: March 2, 2019

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (a) Withholding progress payments;
- (b) Assessing sanctions;
- (c) Liquidated damages; and/or
- (d) Disqualifying the Contractor from future bidding as non-responsible.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates, in the absence of unlawful discrimination and in an arena of fair and open competition, DBE companies can be expected to perform **5.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work. A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents enough DBE participation has been obtained to meet the goal or,
- (b) The bidder documents a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217) 785-4611, or by visiting the Department's website at:

<http://www.idot.illinois.gov/doing-business/certifications/disadvantaged-business-enterprise-certification/il-ucp-directory/index>.



BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement and failure of the bidder to comply will render the bid not responsive.

The bidder shall submit a DBE Utilization Plan (form SBE 2026), and a DBE Participation Statement (form SBE 2025) for each DBE company proposed for the performance of work to achieve the contract goal, with the bid. If the Utilization Plan indicates the contract goal will not be met, documentation of good faith efforts shall also be submitted. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor is selected over a DBE for work on the contract. The required forms and documentation must be submitted as a single .pdf file using the "Integrated Contractor Exchange (iCX)" application within the Department's "EBids System".

The Department will not accept a Utilization Plan if it does not meet the bidding procedures set forth herein and the bid will be declared not responsive. In the event the bid is declared not responsive, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty and may deny authorization to bid the project if re-advertised for bids.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan is approved. All information submitted by the bidder must be complete, accurate and adequately document enough DBE participation has been obtained or document the good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. This means the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts the bidder has made. Mere *pro forma* efforts, in other words efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases and will be considered by the Department.
  - (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.

- (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Contractor might otherwise prefer to perform these work items with its own forces.
- (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
- (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.  
  
b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable. In accordance with the above Bidding Procedures, the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.
- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
- (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
- (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.

- (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.
- (b) If the Department determines the bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided it is otherwise eligible for award. If the Department determines the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification will also include a statement of reasons for the adverse determination. If the Utilization Plan is not approved because it is deficient as a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no more than a five calendar day period to cure the deficiency.
- (c) The bidder may request administrative reconsideration of an adverse determination by emailing the Department at "[DOT.DBE.UP@illinois.gov](mailto:DOT.DBE.UP@illinois.gov)" within the five calendar days after the receipt of the notification of the determination. The determination shall become final if a request is not made on or before the fifth calendar day. A request may provide additional written documentation or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be reviewed by the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for reconsideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

**CALCULATING DBE PARTICIPATION.** The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
  - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
  - (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission is receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
  - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
  - (2) 100 percent goal credit for the cost of materials of supplies obtained from a DBE manufacturer.
  - (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a DBE regular dealer or DBE manufacturer.

**CONTRACT COMPLIANCE.** Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the DBE Participation Commitment Statement.

- (a) **NO AMENDMENT.** No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be emailed to the Department at [DOT.DBE.UP@illinois.gov](mailto:DOT.DBE.UP@illinois.gov).
- (b) **CHANGES TO WORK.** Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A or AER 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, a new Request for Approval of Subcontractor will not be required. However, the Contractor must document efforts to assure the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.
- (c) **SUBCONTRACT.** The Contractor must provide copies of DBE subcontracts to the Department upon request. Subcontractors shall ensure that all lower tier subcontracts or agreements with DBEs to supply labor or materials be performed in accordance with this Special Provision.
- (d) **ALTERNATIVE WORK METHODS.** In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals. Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:

- (1) The replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
  - (2) The DBE is aware its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
  - (3) The DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.
- (e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in this Special Provision. The Contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the Contractor obtains the Department's written consent as provided in subsection (a) of this part. Unless Department consent is provided for termination of a DBE subcontractor, the Contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the DBE in the Utilization Plan.

As stated above, the Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the Contractor;

- (3) The listed DBE subcontractor fails or refuses to meet the Contractor's reasonable, nondiscriminatory bond requirements;
- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1200 or applicable state law.
- (6) The Contractor has determined the listed DBE subcontractor is not a responsible contractor;
- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides written notice to the Contractor of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE subcontractor is unable to complete its work on the contract;
- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the Contractor can self-perform the work for which the DBE contractor was engaged or so that the Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated or fails to complete its work on the Contract for any reason, the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal. The good faith efforts shall be documented by the Contractor. If the Department requests documentation under this provision, the Contractor shall submit the documentation within seven days, which may be extended for an additional seven days if necessary at the request of the Contractor. The Department will provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated.

- (f) FINAL PAYMENT. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than 30 calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Resident Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the DBE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.
- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.
- (h) RECONSIDERATION. Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of "Good Faith Effort Procedures" of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.



**PORTLAND CEMENT CONCRETE – HAUL TIME (BDE)**

Effective: July 1, 2020

Revise Article 1020.11(a)(7) of the Standard Specifications to read:

“(7) Haul Time. Haul time shall begin when the delivery ticket is stamped. The delivery ticket shall be stamped no later than five minutes after the addition of the mixing water to the cement, or after the addition of the cement to the aggregate when the combined aggregates contain free moisture in excess of two percent by weight (mass). If more than one batch is required for charging a truck using a stationary mixer, the time of haul shall start with mixing of the first batch. Haul time shall end when the truck is emptied for incorporation of the concrete into the work. The maximum haul time shall be as follows.

Concrete Temperature at Point of Discharge, °F (°C)	Maximum Haul Time <sup>1/</sup> (minutes)	
	Truck Mixer or Truck Agitator	Nonagitator Truck
50 - 64 (10 - 17.5)	90	45
> 64 (> 17.5) - without retarder	60	30
> 64 (> 17.5) - with retarder	90	45

1/ To encourage start-up testing for mix adjustments at the plant, the first two trucks will be allowed an additional 15 minutes haul time whenever such testing is performed.

For a mixture which is not mixed on the jobsite, a delivery ticket shall be required for each load. The following information shall be recorded on each delivery ticket: (1) ticket number; (2) name of producer and plant location; (3) contract number; (4) name of Contractor; (5) stamped date and time batched; (6) truck number; (7) quantity batched; (8) amount of admixture(s) in the batch; (9) amount of water in the batch; and (10) Department mix design number.

For concrete mixed in jobsite stationary mixers, the above delivery ticket may be waived, but a method of verifying the haul time shall be established to the satisfaction of the Engineer.”

**SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)**

Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

**“109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.**  
 The Contractor shall report all payments made to the following parties:

- (a) first tier subcontractors;
- (b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;
- (c) material suppliers or trucking firms that are part of the Contractor’s submitted DBE utilization plan.

The report shall be made through the Department’s on-line subcontractor payment reporting system within 21 days of making the payment.”

**SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)**

Effective: November 2, 2017

Revised: April 1, 2019

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

“This mobilization payment shall be made at least seven days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than \$10,000	25%
\$10,000 to less than \$20,000	20%
\$20,000 to less than \$40,000	18%
\$40,000 to less than \$60,000	16%
\$60,000 to less than \$80,000	14%
\$80,000 to less than \$100,000	12%
\$100,000 to less than \$250,000	10%
\$250,000 to less than \$500,000	9%
\$500,000 to \$750,000	8%
Over \$750,000	7%”

## **TRAFFIC SPOTTERS (BDE)**

Effective: January 1, 2019

Revise Article 701.13 of the Standard Specifications to read:

**“701.13 Flaggers and Spotters.** Flaggers shall be certified by an agency approved by the Department. While on the job site, each flagger shall have in his/her possession a current driver’s license and a current flagger certification I.D. card. For non-drivers, the Illinois Identification Card issued by the Secretary of State will meet the requirement for a current driver’s license. This certification requirement may be waived by the Engineer for emergency situations that arise due to actions beyond the Contractor’s control where flagging is needed to maintain safe traffic control on a temporary basis. Spotters are defined as certified flaggers that provide support to workers by monitoring traffic.

Flaggers and spotters shall be stationed to the satisfaction of the Engineer and be equipped with a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 or ANSI/ISEA 107-2010 for Conspicuity Class 2 garments. Flaggers shall be equipped with a stop/slow traffic control sign. Spotters shall be equipped with a loud warning device. The warning sound shall be identifiable by workers so they can take evasive action when necessary. Other types of garments may be substituted for the vest as long as the garments have a manufacturer’s tag identifying them as meeting the ANSI Class 2 requirement. The longitudinal placement of the flagger may be increased up to 100 ft (30 m) from that shown on the plans to improve the visibility of the flagger. Flaggers shall not encroach on the open lane of traffic unless traffic has been stopped. Spotters shall not encroach on the open lane of traffic, nor interact with or control the flow of traffic.

For nighttime flagging, flaggers shall be illuminated by an overhead light source providing a minimum vertical illuminance of 10 fc (108 lux) measured 1 ft (300 mm) out from the flagger’s chest. The bottom of any luminaire shall be a minimum of 10 ft (3 m) above the pavement. Luminaire(s) shall be shielded to minimize glare to approaching traffic and trespass light to adjoining properties. Nighttime flaggers shall be equipped with fluorescent orange or fluorescent orange and fluorescent yellow/green apparel meeting the requirements of ANSI/ISEA 107-2004 or ANSI/ISEA 107-2010 for Conspicuity Class 3 garments.

Flaggers and spotters shall be provided per the traffic control plan and as follows.

- (a) Two-Lane Highways. Two flaggers will be required for each separate operation where two-way traffic is maintained over one lane of pavement. Work operations controlled by flaggers shall be no more than 1 mile (1600 m) in length. Flaggers shall be in sight of each other or in direct communication at all times. Direct communication shall be obtained by using portable two-way radios or walkie-talkies.

The Engineer will determine when a side road or entrance shall be closed to traffic. A flagger will be required at each side road or entrance remaining open to traffic within the operation where two-way traffic is maintained on one lane of pavement. The flagger shall be positioned as shown on the plans or as directed by the Engineer.

- (b) Multi-Lane Highways. At all times where traffic is restricted to less than the normal number of lanes on a multilane pavement with a posted speed limit greater than 40 mph and the workers are present, but not separated from the traffic by physical barriers, a flagger or spotter shall be furnished as shown on the plans. Flaggers shall warn and direct traffic. Spotters shall monitor traffic conditions and warn workers of errant approaching vehicles or other hazardous conditions as they occur. One flagger will be required for each separate activity of an operation that requires frequent encroachment in a lane open to traffic. One spotter will be required for each separate activity with workers near the edge of the open lane or with their backs facing traffic.

Flaggers will not be required when no work is being performed, unless there is a lane closure on two-lane, two-way pavement.”

### **TRAINING SPECIAL PROVISIONS (BDE)**

Effective: October 15, 1975

Revised: September 2, 2021

This Training Special Provision supersedes Section 7b of the Special Provision entitled “Specific Equal Employment Opportunity Responsibilities,” and is in implementation of 23 U.S.C. 140(a).

As part of the Contractor’s equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under this contract will be **8**. In the event the Contractor subcontracts a portion of the contract work, it shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also ensure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the Contractor’s needs and the availability of journeymen in the various classifications within the reasonable area of recruitment. Prior to commencing construction, the Contractor shall submit to the Illinois Department of Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee it employs on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority trainees and women (e.g. by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps it has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he or she has successfully completed a training course leading to journeyman status or in which he or she has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Illinois Department of Transportation and the Federal Highway Administration. The Illinois Department of Transportation and the Federal Highway Administration shall approve a program, if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved by not necessarily sponsored by the U.S. Department of Labor Employment Training Administration shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Illinois Department of Transportation and the Federal Highway Administration. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirement of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program.

It is not required that all trainees be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program he will follow in providing the training. The Contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The Contractor shall provide for the maintenance of records and furnish periodic reports documenting its performance under this Training Special Provision.

For contracts with an awarded contract value of \$500,000 or more, the Contractor is required to comply with the Illinois Works Apprenticeship Initiative (30 ILCS 559/20-20 to 20-25) and all applicable administrative rules to the extent permitted by Section 20-20(g). For federally funded projects, the number of trainees to be trained under this contract, as stated in the Training Special Provisions, will be the established goal for the Illinois Works Apprenticeship Initiative 30 ILCS 559/20-20(g). The Contractor shall make a good faith effort to meet this goal. For federally funded projects, the Illinois Works Apprenticeship Initiative will be implemented using the FHWA approved OJT procedures. The Contractor must comply with the recordkeeping and reporting obligations of the Illinois Works Apprenticeship Initiative for the life of the project, including the certification as to whether the trainee/apprentice labor hour goals were met.

Method of Measurement. The unit of measurement is in hours.

Basis of Payment. This work will be paid for at the contract unit price of 80 cents per hour for TRAINEES. The estimated total number of hours, unit price, and total price have been included in the schedule of prices.

## **IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION**

Effective: August 1, 2012

Revised: February 2, 2017

In addition to the Contractor's equal employment opportunity (EEO) affirmative action efforts undertaken as required by this Contract, the Contractor is encouraged to participate in the incentive program described below to provide additional on-the-job training to certified graduates of the IDOT pre-apprenticeship training program, as outlined in this Special Provision.

IDOT funds, and various Illinois community colleges operate, pre-apprenticeship training programs throughout the State to provide training and skill-improvement opportunities to promote the increased employment of minority groups, disadvantaged persons and women in all aspects of the highway construction industry. The intent of this IDOT Pre-Apprenticeship Training Program Graduate (TPG) special provision (Special Provision) is to place these certified program graduates on the project site for this Contract in order to provide the graduates with meaningful on-the-job training. Pursuant to this Special Provision, the Contractor must make every reasonable effort to recruit and employ certified TPG trainees to the extent such individuals are available within a practicable distance of the project site.

Specifically, participation of the Contractor or its subcontractor in the Program entitles the participant to reimbursement for graduates' hourly wages at \$15.00 per hour per utilized TPG trainee, subject to the terms of this Special Provision. Reimbursement payment will be made even though the Contractor or subcontractor may also receive additional training program funds from other non-IDOT sources for other non-TPG trainees on the Contract, provided such other source does not specifically prohibit the Contractor or subcontractor from receiving reimbursement from another entity through another program, such as IDOT through the TPG program. With regard to any IDOT funded construction training program other than TPG, however, additional reimbursement for other IDOT programs will not be made beyond the TPG Program described in this Special Provision when the TPG Program is utilized.

No payment will be made to the Contractor if the Contractor or subcontractor fails to provide the required on-site training to TPG trainees, as solely determined by IDOT. A TPG trainee must begin training on the project as soon as the start of work that utilizes the relevant trade skill and the TPG trainee must remain on the project site through completion of the Contract, so long as training opportunities continue to exist in the relevant work classification. Should a TPG trainee's employment end in advance of the completion of the Contract, the Contractor must promptly notify the IDOT District EEO Officer for the Contract that the TPG's involvement in the Contract has ended. The Contractor must supply a written report for the reason the TPG trainee involvement terminated, the hours completed by the TPG trainee on the Contract, and the number of hours for which the incentive payment provided under this Special Provision will be, or has been claimed for the separated TPG trainee.

Finally, the Contractor must maintain all records it creates as a result of participation in the Program on the Contract, and furnish periodic written reports to the IDOT District EEO Officer that document its contractual performance under and compliance with this Special Provision. Finally, through participation in the Program and reimbursement of wages, the Contractor is not relieved of, and IDOT has not waived, the requirements of any federal or state labor or employment law applicable to TPG workers, including compliance with the Illinois Prevailing Wage Act.

**Method of Measurement:** The unit of measurement is in hours.

**Basis of Payment:** This work will be paid for at the contract unit price of \$15.00 per hour for each utilized certified TPG Program trainee (TRAINEES TRAINING PROGRAM GRADUATE). The estimated total number of hours, unit price, and total price must be included in the schedule of prices for the Contract submitted by Contractor prior to beginning work. The initial number of TPG trainees for which the incentive is available for this contract is 8.

The Department has contracted with several educational institutions to provide screening, tutoring and pre-training to individuals interested in working as a TPG trainee in various areas of common construction trade work. Only individuals who have successfully completed a Pre-Apprenticeship Training Program at these IDOT approved institutions are eligible to be TPG trainees. To obtain a list of institutions that can connect the Contractor with eligible TPG trainees, the Contractor may contact: HCCTP TPG Program Coordinator, Office of Business and Workforce Diversity (IDOT OBWD), Room 319, Illinois Department of Transportation, 2300 S. Dirksen Parkway, Springfield, Illinois 62764. Prior to commencing construction with the utilization of a TPG trainee, the Contractor must submit documentation to the IDOT District EEO Officer for the Contract that provides the names and contact information of the TPG trainee(s) to be trained in each selected work classification, proof that that the TPG trainee(s) has successfully completed a Pre-Apprenticeship Training Program, proof that the TPG is in an Apprenticeship Training Program approved by the U.S. Department of Labor Bureau of Apprenticeship Training, and the start date for training in each of the applicable work classifications.

To receive payment, the Contractor must provide training opportunities aimed at developing a full journeyworker in the type of trade or job classification involved. During the course of performance of the Contract, the Contractor may seek approval from the IDOT District EEO Officer to employ additional eligible TPG trainees. In the event the Contractor subcontracts a portion of the contracted work, it must determine how many, if any, of the TPGs will be trained by the subcontractor. Though a subcontractor may conduct training, the Contractor retains the responsibility for meeting all requirements imposed by this Special Provision. The Contractor must also include this Special Provision in any subcontract where payment for contracted work performed by a TPG trainee will be passed on to a subcontractor.

Training through the Program is intended to move TPGs toward journeyman status, which is the primary objective of this Special Provision. Accordingly, the Contractor must make every effort to enroll TPG trainees by recruitment through the Program participant educational institutions to the extent eligible TPGs are available within a reasonable geographic area of the project. The Contractor is responsible for demonstrating, through documentation, the recruitment efforts it has undertaken prior to the determination by IDOT whether the Contractor is in compliance with this Special Provision, and therefore, entitled to the Training Program Graduate reimbursement of \$15.00 per hour.



Notwithstanding the on-the-job training requirement of this TPG Special Provision, some minimal off-site training is permissible as long as the offsite training is an integral part of the work of the contract, and does not compromise or conflict with the required on-site training that is central to the purpose of the Program. No individual may be employed as a TPG trainee in any work classification in which he/she has previously successfully completed a training program leading to journeyman status in any trade, or in which he/she has worked at a journeyman level or higher.

**WEEKLY DBE TRUCKING REPORTS (BDE)**

Effective: June 2, 2012

Revised: November 1, 2021

The Contractor shall submit a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used for DBE goal credit.

The report shall be submitted to the Engineer on Department form "SBE 723" within ten business days following the reporting period. The reporting period shall be Sunday through Saturday for each week reportable trucking activities occur.

Any costs associated with providing weekly DBE trucking reports shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

**WORK ZONE TRAFFIC CONTROL DEVICES (BDE)**

Effective: March 2, 2020

Add the following to Article 701.03 of the Standard Specifications:

"(q) Temporary Sign Supports ..... 1106.02"

Revise the third paragraph of Article 701.14 of the Standard Specifications to read:

"For temporary sign supports, the Contractor shall provide a FHWA eligibility letter for each device used on the contract. The letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device. The signs shall be supported within 20 degrees of vertical. Weights used to stabilize signs shall be attached to the sign support per the manufacturer's specifications."

Revise the first paragraph of Article 701.15 of the Standard Specifications to read:

**“701.15 Traffic Control Devices.** For devices that must meet crashworthiness standards, the Contractor shall provide a manufacturer’s self-certification or a FHWA eligibility letter for each Category 1 device and a FHWA eligibility letter for each Category 2 and Category 3 device used on the contract. The self-certification or letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device.”

Revise the first six paragraphs of Article 1106.02 of the Standard Specifications to read:

**“1106.02 Devices.** Work zone traffic control devices and combinations of devices shall meet crashworthiness standards for their respective categories. The categories are as follows.

Category 1 includes small, lightweight, channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These include cones, tubular markers, plastic drums, and delineators, with no attachments (e.g. lights). Category 1 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 1 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 2 includes devices that are not expected to produce significant vehicular velocity change but may otherwise be hazardous. These include vertical panels with lights, barricades, temporary sign supports, and Category 1 devices with attachments (e.g. drums with lights). Category 2 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 2 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 3 includes devices that are expected to cause significant velocity changes or other potentially harmful reactions to impacting vehicles. These include crash cushions (impact attenuators), truck mounted attenuators, and other devices not meeting the definitions of Category 1 or 2. Category 3 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 3 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2029. Category 3 devices shall be crash tested for Test Level 3 or the test level specified.

Category 4 includes portable or trailer-mounted devices such as arrow boards, changeable message signs, temporary traffic signals, and area lighting supports. It is preferable for Category 4 devices manufactured after December 31, 2019 to be MASH-16 compliant; however, there are currently no crash tested devices in this category, so it remains exempt from the NCHRP 350 or MASH compliance requirement.

For each type of device, when no more than one MASH-16 compliant is available, an NCHRP 350 or MASH-2009 compliant device may be used, even if manufactured after December 31, 2019.”

Revise Articles 1106.02(g), 1106.02(k), and 1106.02(l) to read:

“(g) Truck Mounted/Trailer Mounted Attenuators. The attenuator shall be approved for use at Test Level 3. Test Level 2 may be used for normal posted speeds less than or equal to 45 mph.

(k) Temporary Water Filled Barrier. The water filled barrier shall be a lightweight plastic shell designed to accept water ballast and be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings.

(l) Movable Traffic Barrier. The movable traffic barrier shall be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings. The barrier shall be capable of being moved on and off the roadway on a daily basis.”

## **MENTOR-PROTÉGÉ PROGRAM**

Effective: June 1, 2007      Revised: February 1, 2013

**Eligibility.** This contract is eligible for the Department's Mentor-Protégé Program for those bidders with an approved Mentor-Protégé Development Plan.

In order for a Mentor-Protégé relationship to be recognized as part of this contract, the Protégé shall be used as a subcontractor and a Mentor-Protégé Agreement for Contract Assistance and Training shall be fully executed and approved. The Mentor-Protégé Agreement for Contract Assistance and Training shall be completed on the form provided by the Department and submitted with the DBE Utilization Plan for approval by the Department. If approved, the Mentor-Protégé Agreement for Contract Assistance and Training shall become part of the contract. In the event the Mentor-Protégé Agreement for Contract Assistance and Training is not approved, the contract shall be performed in accordance with the DBE Utilization Plan exclusive of the Agreement.

**DBE Goal Reduction.** The DBE participation goal set for this contract may, at the discretion of the Department, be reduced according to the Mentor-Protégé Program Guidelines when the Protégé is used as a subcontractor. When submitting the DBE Utilization Plan, the bidder shall indicate whether the Protégé will be used as a subcontractor and to what extent.

**Quarterly Reports.** The Mentor shall submit quarterly progress reports as outlined in the Mentor-Protégé Program Implementation document. The reports shall indicate the progress toward each of the Plan's stated goals. The reports shall be signed by an authorized principal of each firm and submitted to the Engineer of Construction.

Failure to timely submit reports, or submission of incomplete reports may result in dissolution of relationship.

**Reimbursement of Mentor Expenses.** The direct and indirect expenses of the Mentor, as detailed in the approved Mentor-Protégé Agreement for Contract Assistance and Training will be reimbursed by the Department.

## **PROJECT LABOR AGREEMENT**

Effective: May 18, 2007

Revised: August 1, 2019

**Description.** The Illinois Project Labor Agreements Act, 30 ILCS 571, states that the State of Illinois has a compelling interest in awarding public works contracts so as to ensure the highest standards of quality and efficiency at the lowest responsible cost. A project labor agreement (PLA) is a form of pre-hire collective bargaining agreement covering all terms and conditions of employment on a specific project that is intended to support this compelling interest. It has been determined by the Department that a PLA is appropriate for the project that is the subject of this contract. The PLA document, provided below, only applies to the construction site for this contract. It is the policy of the Department on this contract, and all construction projects, to allow all contractors and subcontractors to compete for contracts and subcontracts without regard to whether they are otherwise parties to collective bargaining agreements.

**Execution of Letter of Assent.** A copy of the PLA applicable to this project is included as part of this special provision. As a condition of the award of the contract, the successful bidder and each of its subcontractors shall execute a "Contractor Letter of Assent", in the form attached to the PLA as Exhibit A. The successful bidder shall submit a Subcontractor's Contractor Letter of Assent to the Department prior to the subcontractor's performance of work on the project. Upon request, copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization at the pre-job conference.

**Quarterly Reporting.** Section 37 of the Illinois Project Labor Agreements Act requires the Department to submit quarterly reports regarding the number of minorities and females employed under PLAs. To assist in this reporting effort, the Contractor shall provide a quarterly workforce participation report for all minority and female employees working under the PLA of this contract. The data shall be reported on Construction Form BC 820, Project Labor Agreement (PLA) Workforce Participation Quarterly Reporting Form available on the Department's website <http://www.idot.illinois.gov/Assets/uploads/files/IDOT-Forms/BC/BC%20820.docx>.

The report shall be submitted no later than the 15th of the month following the end of each quarter (i.e., April 15 for the January – March reporting period). The form shall be emailed to [DOT.PLA.Reporting@illinois.gov](mailto:DOT.PLA.Reporting@illinois.gov) or faxed to (217) 524-4922.

Any costs associated with complying with this provision shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

Illinois Department of Transportation  
**PROJECT LABOR AGREEMENT**

This Project Labor Agreement (“PLA” or “Agreement”) is entered into this \_\_\_\_\_ day of \_\_\_\_\_, 2022, by and between the Illinois Department of Transportation (“IDOT” or “Department”) in its proprietary capacity, and each relevant Illinois AFL-CIO Building Trades signatory hereto as determined by the Illinois AFL-CIO Statewide Project Labor Agreement Committee on behalf of each of its affiliated members (individually and collectively, the “Unions”). This PLA shall apply to Construction Work (as defined herein) to be performed by IDOT’s Prime Contractor and each of its subcontractors of whatever tier (“Subcontractor” or “Subcontractors”) on Contract No. 60T46(hereinafter, the “Project”).

**ARTICLE 1 - INTENT AND PURPOSES**

- 1.1 This PLA is entered into in accordance with the Project Labor Agreement Act (“Act”, 30 ILCS 571). It is mutually understood and agreed that the terms and conditions of this PLA are intended to promote the public interest in obtaining timely and economical completion of the Project by encouraging productive and efficient construction operations; by establishing a spirit of harmony and cooperation among the parties; and by providing for peaceful and prompt settlement of any and all labor grievances or jurisdictional disputes of any kind without strikes, lockouts, slowdowns, delays, or other disruptions to the prosecution of the work. The parties acknowledge the obligations of the Contractors and Subcontractors to comply with the provisions of the Act. The parties will work with the Contractors and Subcontractors within the parameters of other statutory and regulatory requirements to implement the Act’s goals and objectives.
- 1.2 As a condition of the award of the contract for performance of work on the Project, IDOT’s Prime Contractor and each of its Subcontractors shall execute a “Contractor Letter of Assent”, in the form attached hereto as Exhibit A, prior to commencing Construction Work on the Project. The Contractor shall submit a Subcontractor’s Contractor Letter of Assent to the Department prior to the Subcontractor’s performance of Construction Work on the Project. Upon request copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization consistent with this Agreement and at the pre-job conference referenced in Article III, Section 3.1.

- 1.3 Each Union affiliate and separate local representing workers engaged in Construction Work on the Project in accordance with this PLA are bound to this agreement by the Illinois AFL-CIO Statewide Project Labor Agreement Committee which is the central committee established with full authority to negotiate and sign PLAs with the State on behalf of all respective crafts. Upon their signing the Contractor Letter of Assent, the Prime Contractor, each Subcontractor, and the individual Unions shall thereafter be deemed a party to this PLA. No party signatory to this PLA shall, contract or subcontract, nor permit any other person, firm, company, or entity to contract or subcontract for the performance of Construction Work for the Project to any person, firm, company, or entity that does not agree in writing to become bound for the term of this Project by the terms of this PLA prior to commencing such work and to the applicable area-wide collective bargaining agreement(s) with the Union(s) signatory hereto.
- 1.4 It is understood that the Prime Contractor(s) and each Subcontractor will be considered and accepted by the Unions as separate employers for the purposes of collective bargaining, and it is further agreed that the employees working under this PLA shall constitute a bargaining unit separate and distinct from all others. The parties hereto also agree that this PLA shall be applicable solely with respect to this Project, and shall have no bearing on the interpretation of any other collective bargaining agreement or as to the recognition of any bargaining unit other than for the specific purposes of this Project.
- 1.5 In the event of a variance or conflict, whether explicit or implicit, between the terms and conditions of this PLA and the provisions of any other applicable national, area, or local collective bargaining agreement, the terms and conditions of this PLA shall supersede and control. For any work performed under the NTL Articles of Agreement, the National Stack/Chimney Agreement, the National Cooling Tower Agreement, the National Agreement of the International Union of Elevator Constructors, and for any instrument calibration work and loop checking performed under the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, the preceding sentence shall apply only with respect to Articles I, II, V, VI, and VII.

- 1.6 Subject to the provisions of paragraph 1.5 of this Article, it is the parties' intent to respect the provisions of any other collective bargaining agreements that may now or hereafter pertain, whether between the Prime Contractor and one or more of the Unions or between a Subcontractor and one or more of the Unions. Accordingly, except and to the extent of any contrary provision set forth in this PLA, the Prime Contractor and each of its Subcontractors agrees to be bound and abide by the terms of the following in order of precedence: (a) the applicable collective bargaining agreement between the Prime Contractor and one or more of the Unions made signatory hereto; (b) the applicable collective bargaining agreement between a Subcontractor and one or more of the Unions made signatory hereto; or (c) the current applicable area collective bargaining agreement for the relevant Union that is the agreement certified by the Illinois Department of Labor for purposes of establishing the Prevailing Wage applicable to the Project. The Union will provide copies of the applicable collective bargaining agreements pursuant to part (c) of the preceding sentence to the Prime Contractor. Assignments by the Contractors or Subcontractors amongst the trades shall be consistent with area practices; in the event of unresolved disagreements as to the propriety of such assignments, the provisions of Article VI shall apply.
- 1.7 Subject to the limitations of paragraphs 1.4 to 1.6 of this Article, the terms of each applicable collective bargaining agreement as determined in accordance with paragraph 1.6 are incorporated herein by reference, and the terms of this PLA shall be deemed incorporated into such other applicable collective bargaining agreements only for purposes of their application to the Project.
- 1.8 To the extent necessary to comply with the requirements of any fringe benefit fund to which the Prime Contractor or Subcontractor is required to contribute under the terms of an applicable collective bargaining agreement pursuant to the preceding paragraph, the Prime Contractor or Subcontractor shall execute all "Participation Agreements" as may be reasonably required by the Union to accomplish such purpose; provided, however, that such Participation Agreements shall, when applicable to the Prime Contractor or Subcontractor solely as a result of this PLA, be amended as reasonably necessary to reflect such fact. Upon written notice in the form of a lien of a Contractor's or Subcontractor's delinquency from any applicable fringe benefit fund, IDOT will withhold from the Contractor's periodic pay request an amount sufficient to extinguish any delinquency obligation of the Contractor or Subcontractor arising out of the Project.
- 1.9 In the event that the applicable collective bargaining agreement between a Prime Contractor and the Union or between the Subcontractor and the Union expires prior to the completion of this Project, the expired applicable contract's terms will be maintained until a new applicable collective bargaining agreement is ratified. The wages and fringe benefits included in any new applicable collective bargaining agreement will apply on and after the effective date of the newly negotiated collective bargaining agreement, except to the extent wage and fringe benefit retroactivity is specifically agreed upon by the relevant bargaining parties.



**ARTICLE II – APPLICABILITY, RECOGNITION, AND COMMITMENTS**

- 2.1 The term Construction Work as used herein shall include all “construction, demolition, rehabilitation, renovation, or repair” work performed by a “laborer or mechanic” at the “site of the work” for the purpose of “building” the specific structures and improvements that constitute the Project. Terms appearing within quotation marks in the preceding sentence shall have the meaning ascribed to them pursuant to 29 CFR Part 5 and Illinois labor laws.
- 2.2 By executing the Letters of Assent, Prime Contractor and each of its Subcontractors recognizes the Unions signatory to this PLA as the sole and exclusive bargaining representatives for their craft employees employed on the jobsite for this Project. Unions who are signatory to this PLA will have recognition on the Project for their craft.
- 2.3 The Prime Contractor and each of its Subcontractors retains and shall be permitted to exercise full and exclusive authority and responsibility for the management of its operations, except as expressly limited by the terms of this PLA or by the terms and conditions of the applicable collective bargaining agreement.
- 2.4 Except to the extent contrary to an express provision of the relevant collective bargaining agreement, equipment or materials used in the Project may be pre-assembled or pre-fabricated, and there shall be no refusal by the Union to handle, transport, install, or connect such equipment or materials. Equipment or materials delivered to the job-site will be unloaded and handled promptly without regard to potential jurisdictional disputes; any such disputes shall be handled in accordance with the provisions of this PLA.
- 2.5 The parties are mutually committed to promoting a safe working environment for all personnel at the job-site. It shall be the responsibility of each employer to which this PLA applies to provide and maintain safe working conditions for its employees, and to comply with all applicable federal, state, and local health and safety laws and regulations.
- 2.6 The use or furnishing of alcohol or drugs and the conduct of any other illegal activity at the job-site is strictly prohibited. The parties shall take every practical measure consistent with the terms of applicable collective bargaining agreements to ensure that the job-site is free of alcohol and drugs.
- 2.7 All parties to this PLA agree that they will not discriminate against any employee based on race, creed, religion, color, national origin, union activity, age, gender or sexual orientation and shall comply with all applicable federal, state, and local laws.

- 2.8 In accordance with the Act and to promote diversity in employment, IDOT will establish, in cooperation with the other parties, the apprenticeship hours which are to be performed by minorities and females on the Project. IDOT shall consider the total hours to be performed by these underrepresented groups, as a percentage of the workforce, and create aspirational goals for each Project, based on the level of underutilization for the service area of the Project (together "Project Employment Objectives"). IDOT shall provide a quarterly report regarding the racial and gender composition of the workforce on the Project.

Persons currently lacking qualifications to enter apprenticeship programs will have the opportunity to obtain skills through basic training programs as have been established by the Department. The parties will endeavor to support such training programs to allow participants to obtain the requisite qualifications for the Project Employment Objectives.

The parties agree that all Contractors and Subcontractors working on the Project shall be encouraged to utilize the maximum number of apprentices as permitted under the terms of the applicable collective bargaining agreements to realize the Project Employment Objectives.

The Unions shall assist the Contractor and each Subcontractor in efforts to satisfy Project Employment Objectives. A Contractor or Subcontractor may request from a Union specific categories of workers necessary to satisfy Project Employment Objectives. The application of this section shall be consistent with all local Union collective bargaining agreements, and the hiring hall rules and regulations established for the hiring of personnel, as well as the apprenticeship standards set forth by each individual Union.

- 2.9 The parties hereto agree that engineering consultants and materials testing employees, to the extent subject to the terms of this PLA, shall be fully expected to objectively and responsibly perform their duties and obligations owed to the Department without regard to the potential union affiliation of such employees or of other employees on the Project.
- 2.10 This Agreement shall not apply to IDOT employees or employees of any other governmental entity.

### **ARTICLE III - ADMINISTRATION OF AGREEMENT**

- 3.1 In order to assure that all parties have a clear understanding of the PLA, and to promote harmony, at the request of the Unions a post-award pre-job conference will be held among the Prime Contractor, all Subcontractors and Union representatives prior to the start of any Construction Work on the Project. No later than the conclusion of such pre-job conference, the parties shall, among other matters, provide to one another contact information for their respective representatives (including name, address, phone number, facsimile number, e-mail). Nothing herein shall be construed to limit the right of the Department to discuss or explain the purpose and intent of this PLA with prospective bidders or other interested parties prior to or following its award of the job.
- 3.2 Representatives of the Prime Contractor and the Unions shall meet as often as reasonably necessary following award until completion of the Project to assure the effective implementation of this PLA.
- 3.3 Any notice contemplated under Article VI and VII of this Agreement to a signatory labor organization shall be made in writing to the Local Union with copies to the local union's International Representative.

### **ARTICLE IV - HOURS OF WORK AND GENERAL CONDITIONS**

- 4.1 The standard work day and work week for Construction Work on the Project shall be consistent with the respective collective bargaining agreements. In the event Project site or other job conditions dictate a change in the established starting time and/or a staggered lunch period for portions of the Project or for specific crafts, the Prime Contractor, relevant Subcontractors and business managers of the specific crafts involved shall confer and mutually agree to such changes as appropriate. If proposed work schedule changes cannot be mutually agreed upon between the parties, the hours fixed at the time of the pre-job meeting shall prevail.
- 4.2 Shift work may be established and directed by the Prime Contractor or relevant Subcontractor as reasonably necessary or appropriate to fulfill the terms of its contract with the Department. If used, shift hours, rates and conditions shall be as provided in the applicable collective bargaining agreement.
- 4.3 The parties agree that chronic and/or unexcused absenteeism is undesirable and must be controlled in accordance with procedures established by the applicable collective bargaining agreement. Any employee disciplined for absenteeism in accordance with such procedures shall be suspended from all work on the Project for not less than the maximum period permitted under the applicable collective bargaining agreement.

- 4.4 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, employment begins and ends at the Project site; employees shall be at their place of work at the starting time; and employees shall remain at their place of work until quitting time.
- 4.5 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, there shall be no limit on production by workmen, no restrictions on the full use of tools or equipment, and no restrictions on efficient use of manpower or techniques of construction other than as may be required by safety regulations.
- 4.6 The parties recognize that specialized or unusual equipment may be installed on the Project. In such cases, the Union recognizes the right of the Prime Contractor or Subcontractor to involve the equipment supplier or vendor's personnel in supervising the setting up of the equipment, making modifications and final alignment, and performing similar activities that may be reasonably necessary prior to and during the start-up procedure in order to protect factory warranties. The Prime Contractor or Subcontractor shall notify the Union representatives in advance of any work at the job-site by such vendor personnel in order to promote a harmonious relationship between the equipment vendor's personnel and other Project employees.
- 4.7 For the purpose of promoting full and effective implementation of this PLA, authorized Union representatives shall have access to the Project job-site during scheduled work hours. Such access shall be conditioned upon adherence to all reasonable visitor and security rules of general applicability that may be established for the Project site at the pre-job conference or from time to time thereafter.

**ARTICLE V – GRIEVANCE PROCEDURES FOR DISPUTES ARISING UNDER A PARTICULAR COLLECTIVE BARGAINING AGREEMENT**

- 5.1 In the event a dispute arises under a particular collective bargaining agreement specifically not including jurisdictional disputes referenced in Article VI below, said dispute shall be resolved by the Grievance/Arbitration procedure of the applicable collective bargaining agreement. The resulting determination from this process shall be final and binding on all parties bound to its process.
- 5.2 Employers covered under this Agreement shall have the right to discharge or discipline any employee who violates the provisions of this Agreement. Such discharge or discipline by a contractor or subcontractor shall be subject to Grievance/Arbitration procedure of the applicable collective bargaining agreement only as to the fact of such violation of this agreement. If such fact is established, the penalty imposed shall not be disturbed. Work at the Project site shall continue without disruption or hindrance of any kind as a result of a Grievance/Arbitration procedure under this Article.

- 5.3 In the event there is a deadlock in the foregoing procedure, the parties agree that the matter shall be submitted to arbitration for the selection and decision of an Arbitrator governed under paragraph 6.8.

#### **ARTICLE VI –DISPUTES: GENERAL PRINCIPLES**

- 6.1 This Agreement is entered into to prevent strikes, lost time, lockouts and to facilitate the peaceful adjustment of jurisdictional disputes in the building and construction industry and to prevent waste and unnecessary avoidable delays and expense, and for the further purpose of at all times securing for the employer sufficient skilled workers.
- 6.2 A panel of Permanent Arbitrators are attached as addendum (A) to this agreement. By mutual agreement between IDOT and the Unions, the parties can open this section of the agreement as needed to make changes to the list of permanent arbitrators.

The arbitrator is not authorized to award back pay or any other damages for a miss assignment of work. Nor may any party bring an independent action for back pay or any other damages, based upon a decision of an arbitrator.

- 6.3 The PLA Jurisdictional Dispute Resolution Process (“Process”) sets forth the procedures below to resolve jurisdictional disputes between and among Contractors, Subcontractors, and Unions engaged in the building and construction industry. Further, the Process will be followed for any grievance or dispute arising out of the interpretation or application of this PLA by the parties except for the prohibition on attorneys contained in 6.11. All decisions made through the Process are final and binding upon all parties.

#### **DISPUTE PROCESS**

- 6.4 Administrative functions under the Process shall be performed through the offices of the President and/or Secretary-Treasurer of the Illinois State Federation of Labor, or their designated representative, called the Administrator. In no event shall any officer, employee, agent, attorney, or other representative of the Illinois Federation of Labor, AFL- CIO be subject to any subpoena to appear or testify at any jurisdictional dispute hearing.
- 6.5 There shall be no abandonment of work during any case participating in this Process or in violation of the arbitration decision. All parties to this Process release the Illinois State Federation of Labor (“Federation”) from any liability arising from its action or inaction and covenant not to sue the Federation, nor its officers, employees, agents or attorneys.

- 6.6 In the event of a dispute relating to trade or work jurisdiction, all parties, including the employers, Contractors or Subcontractors, agree that a final and binding resolution of the dispute shall be resolved as follows:
- (a) Representatives of the affected trades and the Contractor or Subcontractor shall meet on the job site within two (2) business days after receiving written notice in an effort to resolve the dispute. (In the event there is a dispute between local unions affiliated with the same International Union, the decision of the General President, or his/her designee, as the internal jurisdictional authority of that International Union, shall constitute a final and binding decision and determination as to the jurisdiction of work.)
  - (b) If no settlement is achieved subsequent to the preceding Paragraph, the matter shall be referred to the local area Building & Construction Trades Council, which shall meet with the affected trades within two (2) business days subsequent to receiving written notice. In the event the parties do not wish to avail themselves of the local Building & Construction Trades Council, the parties may elect to invoke the services of their respective International Representatives with no extension of the time limitations. An agreement reached at this Step shall be final and binding upon all parties.
  - (c) If no settlement agreement is reached during the proceedings contemplated by Paragraphs "a" or "b" above, the matter shall be immediately referred to the Illinois Jurisdictional Dispute Process for final and binding resolution of said dispute. Said referral submission shall be in writing and served upon the Illinois State Federation of Labor, or the Administrator, pursuant to paragraph 6.4 of this agreement. The Administrator shall, within three (3) days, provide for the selection of an available Arbitrator to hear said dispute within this time period. Upon good cause shown and determined by the Administrator, an additional three (3) day extension for said hearing shall be granted at the sole discretion of the Administrator. Only upon mutual agreement of all parties may the Administrator extend the hearing for a period in excess of the time frames contemplated under this Paragraph. Business days are defined as Monday through Friday, excluding contract holidays.
- 6.7 The primary concern of the Process shall be the adjustment of jurisdictional disputes arising out of the Project. A sufficient number of Arbitrators shall be selected from list of approved Arbitrators as referenced Sec. 6.2 and shall be assigned per Sec. 6.8. Decisions shall be only for the Project and shall become effective immediately upon issuance and complied with by all parties. The authority of the Arbitrator shall be restricted and limited specifically to the terms and provisions of Article VI and generally to this Agreement as a whole.

- 6.8 Arbitrator chosen shall be randomly selected based on the list of Arbitrators in Sec. 6.2 and geographical location of the jurisdictional dispute and upon his/her availability, and ability to conduct a Hearing within two (2) business days of said notice. The Arbitrator may issue a “bench” decision immediately following the Hearing or he/she may elect to only issue a written decision, said decision must be issued within two (2) business days subsequent to the completion of the Hearing. Copies of all notices, pleadings, supporting memoranda, decisions, etc. shall be provided to all disputing parties and the Illinois State Federation of Labor.

Any written decision shall be in accordance with this Process and shall be final and binding upon all parties to the dispute and may be a “short form” decision. Fees and costs of the arbitrator shall be divided evenly between the contesting parties except that any party wishing a full opinion and decision beyond the short form decision shall bear the reasonable fees and costs of such full opinion. The decision of the Arbitrator shall be final and binding upon the parties hereto, their members, and affiliates.

In cases of jurisdictional disputes or other disputes between a signatory labor organization and another labor organization, both of which is an affiliate or member of the same International Union, the matter or dispute shall be settled in the manner set forth by their International Constitution and/or as determined by the International Union’s General President whose decision shall be final and binding upon all parties. In no event shall there be an abandonment of work.

- 6.9 In rendering a decision, the Arbitrator shall determine:
- (a) First, whether a previous agreement of record or applicable agreement, including a disclaimer agreement, between National or International Unions to the dispute or agreements between local unions involved in the dispute, governs;
  - (b) Only if the Arbitrator finds that the dispute is not covered by an appropriate or applicable agreement of record or agreement between the crafts to the dispute, he shall then consider the established trade practice in the industry and prevailing practice in the locality. Where there is a previous decision of record governing the case, the Arbitrator shall give equal weight to such decision of record, unless the prevailing practice in the locality in the past ten years favors one craft. In that case, the Arbitrator shall base his decision on the prevailing practice in the locality. Except, that if the Arbitrator finds that a craft has improperly obtained the prevailing practice in the locality through raiding, the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely on the decision of record and established trade practice in the industry rather than the prevailing practice in the locality; and,

- (c) Only if none of the above criteria is found to exist, the Arbitrator shall then consider that because efficiency, cost or continuity and good management are essential to the well being of the industry, the interests of the consumer or the past practices of the employer shall not be ignored.
- (d) The arbitrator is not authorized to award back pay or any other damages for a mis-assignment of work. Nor may any party bring an independent action for back pay or any other damages, based upon a decision of an arbitrator.

6.10 The Arbitrator shall set forth the basis for his/her decision and shall explain his/her findings regarding the applicability of the above criteria. If lower ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the Project. Agreements of Record, for other PLA projects, are applicable only to those parties signatory to such agreements. Decisions of Record are those that were either attested to by the former Impartial Jurisdictional Disputes Board or adopted by the National Arbitration Panel.

6.11 All interested parties, as determined by the Arbitrator, shall be entitled to make presentations to the Arbitrator. Any interested labor organization affiliated to the PLA Committee and party present at the Hearing, whether making a presentation or not, by such presence shall be deemed to accept the jurisdiction of the Arbitrator and to agree to be bound by its decision. In addition to the representative of the local labor organization, a representative of the labor organization's International Union may appear on behalf of the parties. Each party is responsible for arranging for its witnesses. In the event an Arbitrator's subpoena is required, the party requiring said subpoena shall prepare the subpoena for the Arbitrator to execute. Service of the subpoena upon any witness shall be the responsibility of the issuing party.

Attorneys shall not be permitted to attend or participate in any portion of a Hearing.

The parties are encouraged to determine, prior to Hearing, documentary evidence which may be presented to the Arbitrator on a joint basis.

6.12 The Order of Presentation in all Hearings before an Arbitrator shall be

- I. Identification and Stipulation of the Parties
- II. Unions(s) claiming the disputed work presents its case
- III. Union(s) assigned the disputed work presents its case
- IV. Employer assigning the disputed work presents its case
- V. Evidence from other interested parties (i.e., general contractor, project manager, owner)
- VI. Rebuttal by union(s) claiming the disputed work
- VII. Additional submissions permitted and requested by Arbitrator
- VIII. Closing arguments by the parties



- 6.13 All parties bound to the provisions of this Process hereby release the Illinois State Federation of Labor and IDOT, their respective officers, agents, employees or designated representatives, specifically including any Arbitrator participating in said Process, from any and all liability or claim, of whatsoever nature, and specifically incorporating the protections provided in the Illinois Arbitration Act, as amended from time to time.
- 6.14 The Process, as an arbitration panel, nor its Administrator, shall have any authority to undertake any action to enforce its decision(s). Rather, it shall be the responsibility of the prevailing party to seek appropriate enforcement of a decision, including findings, orders or awards of the Arbitrator or Administrator determining non-compliance with a prior award or decision.
- 6.15 If at any time there is a question as to the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process, the primary responsibility for any determination of the arbitrability of a dispute and the jurisdiction of the Arbitrator shall be borne by the party requesting the Arbitrator to hear the underlying jurisdictional dispute. The affected party or parties may proceed before the Arbitrator even in the absence or one or more stipulated parties with the issue of jurisdiction as an additional item to be decided by the Arbitrator. The Administrator may participate in proceedings seeking a declaration or determination that the underlying dispute is subject to the jurisdiction and process of the Illinois Jurisdictional Dispute Resolution Process. In any such proceedings, the non-prevailing party and/or the party challenging the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process shall bear all the costs, expenses and attorneys' fees incurred by the Illinois Jurisdictional Dispute Resolution Process and/or its Administrator in establishing its jurisdiction.

#### **ARTICLE VII - WORK STOPPAGES AND LOCKOUTS**

- 7.1 During the term of this PLA, no Union or any of its members, officers, stewards, employees, agents or representatives shall instigate, support, sanction, maintain, or participate in any strike, picketing, walkout, work stoppage, slow down or other activity that interferes with the routine and timely prosecution of work at the Project site or at any other contractor's or supplier's facility that is necessary to performance of work at the Project site. Hand billing at the Project site during the designated lunch period and before commencement or following conclusion of the established standard workday shall not, in itself, be deemed an activity that interferes with the routine and timely prosecution of work on the Project.

7.2 Should any activity prohibited by paragraph 7.1 of this Article occur, the Union shall undertake all steps reasonably necessary to promptly end such prohibited activities.

7.2.A No Union complying with its obligations under this Article shall be liable for acts of employees for which it has no responsibility or for the unauthorized acts of employees it represents. Any employee who participates or encourages any activity prohibited by paragraph 7.1 shall be immediately suspended from all work on the Project for a period equal to the greater of (a) 60 days; or (b) the maximum disciplinary period allowed under the applicable collective bargaining agreement for engaging in comparable unauthorized or prohibited activity.

7.2.B Neither the PLA Committee nor its affiliates shall be liable for acts of employees for which it has no responsibility. The principal officer or officers of the PLA Committee will immediately instruct, order and use the best efforts of his office to cause the affiliated union or unions to cease any violations of this Article. The PLA Committee in its compliance with this obligation shall not be liable for acts of its affiliates. The principal officer or officers of any involved affiliate will immediately instruct, order or use the best effort of his office to cause the employees the union represents to cease any violations of this Article. A union complying with this obligation shall not be liable for unauthorized acts of employees it represents. The failure of the Contractor to exercise its rights in any instance shall not be deemed a waiver of its rights in any other instance.

During the term of this PLA, the Prime Contractor and its Subcontractors shall not engage in any lockout at the Project site of employees covered by this Agreement.

7.3 Upon notification of violations of this Article, the principal officer or officers of the local area Building and Construction Trades Council, and the Illinois AFL-CIO Statewide Project Labor Agreement Committee as appropriate, will immediately instruct, order and use their best efforts to cause the affiliated union or unions to cease any violations of this Article. A Trades Council and the Committee otherwise in compliance with the obligations under this paragraph shall not be liable for unauthorized acts of its affiliates.

7.4 In the event that activities in violation of this Article are not immediately halted through the efforts of the parties, any aggrieved party may invoke the special arbitration provisions set forth in paragraph 7.5 of this Article.

- 7.5 Upon written notice to the other involved parties by the most expeditious means available, any aggrieved party may institute the following special arbitration procedure when a breach of this Article is alleged:
- 7.5.A The party invoking this procedure shall notify the individual designated as the Permanent Arbitrator pursuant to paragraph 6.8 of the nature of the alleged violation; such notice shall be by the most expeditious means possible. The initiating party may also furnish such additional factual information as may be reasonably necessary for the Permanent Arbitrator to understand the relevant circumstances. Copies of any written materials provided to the arbitrator shall also be contemporaneously provided by the most expeditious means possible to the party alleged to be in violation and to all other involved parties.
  - 7.5.B Upon receipt of said notice the Permanent Arbitrator shall set and hold a hearing within twenty-four (24) hours if it is contended the violation is ongoing, but not before twenty-four (24) hours after the written notice to all parties involved as required above.
  - 7.5.C The Permanent Arbitrator shall notify the parties by facsimile or any other effective written means, of the place and time chosen by the Permanent Arbitrator for this hearing. Said hearing shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of an Award by the Permanent Arbitrator.
  - 7.5.D The sole issue at the hearing shall be whether a violation of this Article has, in fact, occurred. An Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the Award. The Permanent Arbitrator may order cessation of the violation of this Article, and such Award shall be served on all parties by hand or registered mail upon issuance.
  - 7.5.E Such Award may be enforced by any court of competent jurisdiction upon the filing of the Award and such other relevant documents as may be required. Facsimile or other hardcopy written notice of the filing of such enforcement proceedings shall be given to the other relevant parties. In a proceeding to obtain a temporary order enforcing the Permanent Arbitrator's Award as issued under this Article, all parties waive the right to a hearing and agree that such proceedings may be ex parte. Such agreement does not waive any party's right to participate in a hearing for a final order of enforcement. The Court's order or orders enforcing the Permanent Arbitrator's Award shall be served on all parties by hand or by delivery to their last known address or by registered mail.

- 7.6 Individuals found to have violated the provisions of this Article are subject to immediate termination. In addition, IDOT reserves the right to terminate this PLA as to any party found to have violated the provisions of this Article.
- 7.7 Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance therewith are hereby waived by parties to whom they accrue.
- 7.8 The fees and expenses of the Permanent Arbitrator shall be borne by the party or parties found in violation, or in the event no violation is found, such fees and expenses shall be borne by the moving party.

### **ARTICLE VIII – TERMS OF AGREEMENT**

- 8.1 If any Article or provision of this Agreement shall be declared invalid, inoperative or unenforceable by operation of law or by any of the above mentioned tribunals of competent jurisdiction, the remainder of this Agreement or the application of such Article or provision to persons or circumstances other than those as to which it has been held invalid, inoperative or unenforceable shall not be affected thereby.
- 8.2 This Agreement shall be in full force as of and from the date of the Notice of Award until the Project contract is closed.
- 8.3 This PLA may not be changed or modified except by the subsequent written agreement of the parties. All parties represent that they have the full legal authority to enter into this PLA. This PLA may be executed by the parties in one or more counterparts.
- 8.4 Any liability arising out of this PLA shall be several and not joint. IDOT shall not be liable to any person or other party for any violation of this PLA by any other party, and no Contractor or Union shall be liable for any violation of this PLA by any other Contractor or Union.
- 8.5 The failure or refusal of a party to exercise its rights hereunder in one or more instances shall not be deemed a waiver of any such rights in respect of a separate instance of the same or similar nature.

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Addendum A

IDOT Slate of Permanent Arbitrators

1. Bruce Feldacker
2. Thomas F. Gibbons
3. Edward J. Harrick
4. Brent L. Motchan
5. Robert Perkovich
6. Byron Yaffee
7. Glenn A. Zipp

**Execution Page**

***Illinois Department of Transportation***

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Director of Highways Project Implementation

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Director of Finance & Administration

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Yangsung Kim, Chief Counsel

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Omer Osman, Secretary

(Date)

***Illinois AFL-CIO Statewide Project Labor Agreement Committee, representing the Unions listed below:***

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(Date)

List Unions:

Exhibit A - Contractor Letter of Assent

(Date)

To All Parties:

In accordance with the terms and conditions of the contract for Construction Work on [Contract No. 60T46], this Letter of Assent hereby confirms that the undersigned Prime Contractor or Subcontractor agrees to be bound by the terms and conditions of the Project Labor Agreement established and entered into by the Illinois Department of Transportation in connection with said Project.

It is the understanding and intent of the undersigned party that this Project Labor Agreement shall pertain only to the identified Project. In the event it is necessary for the undersigned party to become signatory to a collective bargaining agreement to which it is not otherwise a party in order that it may lawfully make certain required contributions to applicable fringe benefit funds, the undersigned party hereby expressly conditions its acceptance of and limits its participation in such collective bargaining agreement to its work on the Project.

(Authorized Company Officer)

(Company)

**REQUIRED CONTRACT PROVISIONS  
FEDERAL-AID CONSTRUCTION CONTRACTS**

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

**ATTACHMENTS**

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

**I. GENERAL**

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor

performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

**II. NONDISCRIMINATION**

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

**1. Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection



for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

**2. EEO Officer:** The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

**3. Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

**4. Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

**5. Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

## **6. Training and Promotion:**

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

**7. Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

**8. Reasonable Accommodation for Applicants / Employees with Disabilities:** The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

**9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

**10. Assurance Required by 49 CFR 26.13(b):**

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

**11. Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#).

The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

**III. NONSEGREGATED FACILITIES**

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

**IV. DAVIS-BACON AND RELATED ACT PROVISIONS**

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

**1. Minimum wages**

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each

classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a

separate account assets for the meeting of obligations under the plan or program.

## 2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

## 3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee ( e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

#### 4. Apprentices and trainees

##### a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice

performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

##### b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

##### d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

**5. Compliance with Copeland Act requirements.** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

**6. Subcontracts.** The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

**7. Contract termination: debarment.** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

**8. Compliance with Davis-Bacon and Related Act requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

**9. Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

#### **10. Certification of eligibility.**

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

### **V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT**

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

**1. Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one

and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

**2. Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

**3. Withholding for unpaid wages and liquidated damages.** The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

**4. Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

### **VI. SUBLETTING OR ASSIGNING THE CONTRACT**

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

## VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

## VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

## IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

## X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

### 1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contractor). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

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## **2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:**

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

## **2. Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contractor). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of



Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

\* \* \* \* \*

#### **Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

\* \* \* \* \*

#### **XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING**

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of

Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.



**ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS**

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

## Contract Provision - Cargo Preference Requirements

In accordance with Title 46 CFR § 381.7 (b), the contractor agrees—

“(1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

(2) To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b) (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract.”

Provisions (1) and (2) apply to materials or equipment that are acquired solely for the project. The two provisions do not apply to goods or materials that come into inventories independent of the project, such as shipments of Portland cement, asphalt cement, or aggregates, when industry suppliers and contractors use these materials to replenish existing inventories.