



Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

May 27th, 2026

SUBJECT FAI Route 290 (I-290/IL 53)
Project NHPP I9WF(826)
Section (0404-316-HB) BR 24
Cook County
Contract No.: 62W99

Item No. 012, June 12th, 2026, Letting
Addendum A

NOTICE TO PROSPECTIVE BIDDERS:

Attached is an addendum to the plans or proposal. This addendum involves revised and/or added material.

1. Revised Schedule of Prices.
2. Revised pages i-iv of the Table of Contents of the Special Provisions.
3. Revised pages 2-6, 14, 24, 29-30, 32, 36-94, 99-112, 132-134, 147-157, 159-165, and 168-173 of the Special Provisions.
4. Add pages 279-416 to the Special Provisions.
5. Revised sheets 1-11, 11A-B, 12-15, 19-25, 42, 47-51, 56-59, 59A-59F, 60-66, 77-79, 81, 83, 102-103, 105, 108-110, 112, 115, 168, 188-189, 192, 199-200 and 206-207 of the Plans.
6. Add sheets 59G-59R to the Plans.

Prime contractors must utilize the enclosed material when preparing their bid and must include any changes to the Schedule of Prices in their bid.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Jack A. Elston'.

Jack A. Elston, P.E.
Bureau Chief, Design and Environment

MTS

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MAINTENANCE OF ROADWAYS (D1)

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.

~~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 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 Contractor to then work in the stage under which the item has been listed.~~

~~Pre Stage~~

~~No conflicts to be resolved.~~

~~Stage 1~~

~~No conflicts to be resolved.~~

~~Stage 2~~

~~No conflicts to be resolved.~~

~~Pre Stage: _____ Days Total Installation~~

~~Stage 1: _____ Days Total Installation~~

~~Stage 2: _____ Days Total Installation~~

~~The following contact information is what was used during the preparation of the plans as provided by the agency/company responsible for resolution of the conflict.~~

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Agency/Company Responsible to Resolve Conflict	Name of contact	Phone	E-mail address

~~Utilities To Be Watched and Protected.~~ The areas of concern noted below have been identified by following the suggested staging plan included for the contract. 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.

Pre Stage

No conflicts to be resolved.

Stage 1

No conflicts to be resolved.

Stage 2

No conflicts to be resolved.

The following contact 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	Phone	E-mail address
AT&T	Tom Laskowski		g05256@att.com
Buckeye	Brad Yarzebinski		byarzebinski@buckeye.com
Comed	James Campbell III	630-940-6805	James.Campbelliii@ComEd.com
MWRD	Mr. Paul Sobanski	(708) 588-4080	
Nicor	Johanna Castro	(630) 353-4000 (Office) (630) 353-4020 (Cell)	jcastro@entrustsol.com
Verizon MCI	Eve Campbell	312.612.5216	ecampbell@telecom-eng.com
Uniti	Andres Bravo	224.201.0230	Andres.Bravo@uniti.com

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 Contractor's, and the utility companies when necessary. The Contractor is responsible for contacting J.U.L.I.E. prior to all excavation work.~~

~~All work within 25 feet of Buckeye's pipeline must be approved and requires a representative to be on site. Contact Bill O Malley at 847-878-3428.~~

PUBLIC CONVENIENCE AND SAFETY (D1)

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."

~~COMPLETION DATE PLUS WORKING DAYS (D1)~~

~~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, 2027 except as specified herein.~~

~~The Contractor will be allowed to complete all clean-up work and punch list items within ten 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.~~

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~~Article 108.09 or the Failure to Complete the Work on Time special provision, if included in this contract, shall apply to both the completion date and the number of working days.~~

FAILURE TO COMPLETE THE WORK ON TIME (D1)

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 Completion Date Plus Working Days special provision, 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 **\$15,000**, 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, 24 hours later.

CONTRACTOR COOPERATION

The Contractor's attention is directed to the fact that other separate contracts may be under construction during the duration of this contract. Adjacent contracts may consist of, but are not limited to projects near:

Contract 62N91 – Various Bridge and Culvert Replacements and Roadway Resurfacing
Between Algonquin Road to Lake Cook Road

Contract 62W38 – Various Bridge and Culvert Replacements and Roadway Resurfacing
Between Algonquin Road to Lake Cook Road

Contract 80B21 – CN 80B21 SMART Overlay and Improvement
Location 1: Higgins Road between N Meacham Road to I-290
Location 2: Golf Road at I-290

The Contractor will be governed by Article 105.08 of the Standard Specifications.

The Contractor will be required to attend a weekly coordination meeting at a time and location to be determined by the Department. Coordination with expressway traffic control supervisor and resident engineers for 62N91 and 62W38 is required.

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The Contractor will coordinate proposed project start dates and sequence of construction with the Engineer and other contractors to present an effective and timely schedule for successful completion of the project.

The cooperation between work under this contract and Contracts 62N91, 62W38, and 80B21 is essential due to the adjacent limits of construction and shared maintenance of traffic responsibilities along I-290/IL 53. All traffic staging configurations and changes to staging along I-290/IL 53 shall be coordinated with the contractor performing work under those contracts.

WORK RESTRICTIONS

~~At the start of this contract, work under Contracts 62N91, 62W38, and 80B21 will be ongoing. These contracts will have lane closure priority.~~

~~As a result of ongoing work under Contracts 62N91 and 62W38, the Contractor may proceed with SB I-290/IL 53 work in 2026 provided traffic control is compatible with stage work per these contracts. One week advanced approval from the resident engineers for Contracts 62N91 and 62W38 and the expressway traffic control supervisor will be required. Maintenance of traffic and sequence of operations must be presented at weekly coordination meeting.~~

~~Construction on East and West Frontage Roads between Golf Road and Higgins Road must be performed during nighttime only and should be completed by October 31, 2026.~~

TOLLWAY PERMIT AND BOND (D1)

Effective: January 13, 1989

The Contractor will be required to obtain a permit from the Illinois State Toll Highway Authority (ISTHA) according to Article 107.04 of the Standard Specifications prior to initiating any lane closures on the Tollway or doing any work on the ISTHA right of way. As part of the permit, the Contractor will be required to post a surety bond with the ISTHA.

The Contractor will furnish a copy of the authorized permit to the Engineer.

HOT-MIX ASPHALT BINDER AND SURFACE COURSE (D1)

Effective: November 1, 2019

Revised: April 1, 2026

Add the following to the end of Article 406.06(c) of the Standard Specifications:

“The amount of HMA binder course placed shall be limited to that which can be surfaced during the same construction season.”

Revise the fifteenth through eighteenth paragraphs of Article 406.14 of the Standard Specifications to read:

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TRAFFIC CONTROL PLAN (D1)

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:

~~701101 701400 701401 701402 701411 701428 701446 701901~~

Details:

~~TC-08
TC-09
TC-11
TC-12
TC-13
TC-16
TC-17
TC-18
TC-22
TC-25~~

Special Provisions:

~~Maintenance of Roadways (D1)
Public Convenience and Safety (D1)
Traffic Control and Protection (Arterials) (D1)
Keeping the Expressway Open to Traffic
Failure to Open Traffic Lanes to Traffic
Traffic Control and Protection (Expressways)
Temporary Information Signing
Traffic Control for Work Zone Areas
Speed Display Trailer (D1)
Vehicle and Equipment Warning Lights (BDE)
Short Term and Temporary Pavement Markings (BDE)
Work Zone Traffic Control Devices (BDE)~~

The speed indicator measurement and display functions shall be equipped with the power supply capable of providing 24 hours of uninterrupted service.”

~~SHOULDER RUMBLE STRIP REMOVAL~~

~~Description. This work shall consist of the scarification of existing shoulder rumble strips constructed in HMA shoulders and the furnishing and placement of HMA in the scarified area, prior to placing traffic onto the shoulder in a construction stage. This work shall take place per the limits shown on the plans and/or as directed by the Engineer.~~

~~General Requirements. The nominal depth of scarification of the HMA shoulders shall be 2 inches. Unless otherwise shown in the plans, the width of scarification shall be 3 feet.~~

~~After removing all millings from the scarified limits, the surface shall have a bituminous tack coat applied according to Article 406.05(b) of the Standard Specifications. The scarified area shall then be filled with HMA surface course and compacted flush with the adjoining pavement and shoulder surfaces. The mix to be used for this item shall be HMA surface course, IL 9.5, mix D, N70, unless otherwise specified in the contract.~~

~~Method of Measurement. This work will be measured for payment in square yards. Any portion of this work constructed outside the dimensions shown on the plans or as directed by the Engineer will not be measured for payment.~~

~~Basis of Payment. This work will be paid at the contract unit price per SQUARE YARD for SHOULDER RUMBLE STRIP REMOVAL.~~

~~Traffic control required for this work will not be paid for separately but shall be included in the cost for Traffic Control and Protection (Expressway).~~

FRICITION AGGREGATE (D1)

Effective: January 1, 2011

Revised: December 1, 2021

Revise Article 1004.03(a) of the Standard Specifications to read:

“1004.03 Coarse Aggregate for Hot-Mix Asphalt. The aggregate shall be according to Article 1004.01 and the following.

(a) Description. The coarse aggregate for HMA shall be according to the following table.

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Anchors shall be installed through pre-drilled holes in the pier door frames. Installation shall be in accordance with Article 509.06 of the Standard Specifications.

The Contractor shall be responsible for ensuring the door frames in the pier walls fit the openings cut in those walls for the doors. All accumulated foreign material shall be removed from the door opening and immediate surroundings. Any space between the steel frame and the concrete opening shall be filled with steel shims and nonshrink grout. This work shall be included in the cost of Access Door.

Method of Measurement. This work will be measured per each at the locations specified.

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

SLOPE WALL REPAIR

Description. This work shall consist of the removal and repair of damaged concrete slope wall at locations shown on the plans and as directed by the Engineer. Damaged slope wall areas will be marked in the field by the Engineer. The perimeter of the repair areas shall be saw cut, and the damaged slope wall removed in accordance with applicable portions of Section 501 of the Standard Specifications. Void areas below and adjacent to the damaged slope wall shall be filled to the bottom of the slope wall elevation with granular backfill in accordance with the applicable portions of Section 586 of the Standard Specifications. New concrete slope wall shall be constructed to complete the repair to the details shown in the plans and in accordance with Section 511 of the Standard Specifications.

Method of Measurement. This work will be measured for payment in square yards, complete and in place.

Basis of Payment. This work will be paid for at the contract unit price per SQUARE YARD for SLOPE WALL REPAIR, which shall include removal, disposal, and construction of the new concrete slope wall.

CLEANING BRIDGE SCUPPERS AND DOWNSPOUTS

~~Description: This work consists of cleaning the existing drainage scuppers and downspouts, floor drains, and sweeping entire deck. This item of work shall be performed in accordance to applicable portions of section 592 of the Standard Specifications.~~

~~Construction Requirements: The method for cleaning shall not damage the existing drainage system and shall be submitted to the Engineer for approval. Any damage to the drainage system shall be repaired by the Contractor at no additional cost. The drainage system shall be cleaned to the satisfaction of the Engineer, which includes the testing and inspecting of each scupper, floor drain, and deck surface to ensure that it has been completely cleaned.~~

~~Basis of Payment: This work will be paid for at the contract unit price per EACH for CLEANING BRIDGE SCUPPERS AND DOWNSPOUTS, which shall include sweeping the structure for debris jams along the parapet walls and entire deck surface and all labor and equipment necessary to satisfactorily complete the work.~~

~~**EXCAVATING AND GRADING EXISTING SHOULDER, (SPECIAL)**~~

~~Description: This work consists of excavating and grading existing shoulders as shown on the plans. Applicable portions of Sections 202 shall apply.~~

~~Basis of Payment: This work will be paid for at the contract unit price per UNIT (equivalent to 100 linear feet) for EXCAVATING AND GRADING EXISTING SHOULDER, (SPECIAL).~~

PROTECTIVE SHIELD (PERMANENT) REMOVAL

Description: This work shall consist of the removal of existing permanent protective shield that is installed between existing girders at the locations shown in the plans or as directed by the Engineer. This work shall be done according to Section 501 of the Standard Specifications.

Method of Measurement: This work shall be measured for payment in place, and the area computed in square feet. The length will be measured along the centerline of the structure. The width will be measured perpendicular to the centerline of the structure.

Basis of Payment: This work will be paid for at the contract unit price per SQUARE FOOT for PROTECTIVE SHIELD (PERMANENT) REMOVAL.

PERMANENT PROTECTIVE SHIELD SYSTEM

Effective: October 3, 1996

Revised: June 27, 2008

Description: This work shall consist of furnishing all labor, equipment, materials, and any modifications necessary to clear existing lighting fixtures, conduits, and utilities for the installation of a permanent protective shield system as required to protect pedestrian, vehicular, and/or railroad traffic from falling material from portions of the existing structure.

The permanent protective shield system shall protect the area shown on the plans and/or as directed by the Engineer. The system shall be fixed. The existing vertical clearances above roadways and railroad tracks shall be maintained. Lane closures and other traffic control required during installation shall be according to the contract traffic control plan.

When existing lighting fixtures, conduits, and/or other existing utilities are present that will interfere with installation of the protective shield, the Contractor shall submit, for approval by the Engineer, details of how they propose to adjust the protective shield to clear the existing lighting fixtures, conduits, and utilities. Proposed adjustments shall provide details with an equivalent strength to the plan details. The protective shield shall not diminish the existing level of lighting of the roadway beneath. The Contractor shall coordinate the installation with municipalities and/or utilities to

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fiberglass outlet. Straight runs may utilize a 45° reducing saddle bonded to the pipe. The female outlet shall be filled with a male threaded PVC plug.

Runs of pipe shall be supported at spacings not exceeding those recommended by the manufacturer of the pipe. Supports that have point contact or narrow supporting areas shall be avoided. Standard slings, clamps, clevis hangers, and shoe supports designed for use with steel pipe may be used. A minimum strap width for hangers shall be 1 1/2 in. for all pipe under 12 in. in diameter and 2 in. for diameters 12 in. or greater. Straps shall have 120° of contact with the pipe. Pipes supported on less than 120° of contact shall have a split fiberglass pipe protective sleeve bonded in place with adhesive.

All pipe, fittings, and expansion joints shall be handled and installed according to guidelines and procedures recommended by the manufacturer or supplier of the material.

Additional Requirements. Certain locations of repairs are at or below ground and may require the removal of bituminous or concrete materials and excavation to remove damaged sections of pipes and make proper new connections. This work shall be directed by the Engineer for each individual location that this applies. The work involved will also include backfilling and restoration of the surfaces with approved materials at the direction of the Engineer.

The Contractor, at the direction of the Engineer, may be required to install expansion joints at locations of pipe repairs where free movement is required to prevent future deterioration. Cost of furnishing and installing the expansion joint is included with this item.

Method of Measurement. Bridge drainage system repairs shall be measured for payment in place per foot along the centerline of pipe through and including any elbows, cleanouts, and connections from point to point of new pipe material. The Engineer shall verify the removal limits before the Contractor commences work.

Leaking joints repaired by wrapping will not be measured for payment. However, joints repaired with new pipe material will be measured along the centerline length of new pipe installed.

Basis of Payment. This work will be paid for at the contract unit price per FOOT for BRIDGE DRAINAGE SYSTEM REPAIR.

CLEANING DRAINAGE SYSTEM

Effective: September 30, 1985

Revised: May 1, 2022

~~All existing storm sewers, pipe culverts, manholes, catch basins, and inlets on bridge structures and their connection to roadway drainage system through catch basins/manholes shall be considered as part of drainage system insofar as the interpretation of this special provision is concerned. When specified for payment, the location of drainage systems to be cleaned shall be on and around bridge structures. All other existing drainage items such as storm sewer, pipe culvert, inlets, catch basins, and manholes are specified to be cleaned on and around bridge structures. They shall be cleaned according to Article 602.15 of the Standard Specifications.~~

~~Basis of Payment. This work will be paid for at the contract unit price per LUMP SUM for CLEANING DRAINAGE SYSTEM.~~

Revised 5-27-2026

TEMPORARY SHORING AND CRIBBING

Effective: July 16, 1992

Revised: March 18, 2024

Description: This item shall consist of furnishing all material, equipment, and labor to support the effected beam(s) during the steel and substructure repairs as shown on the plans, as herein specified and as directed by the Engineer.

Construction Requirements: The Contractor shall submit details and calculations, prepared and sealed by an Illinois licensed structural engineer, of the support system they propose to use for approval of the Engineer prior to ordering of material and implementation. Such approval shall in no way relieve the Contractor of responsibility for the safety of the structure. The supports used shall be such that vertical adjustments may be made to maintain the existing beam profile. Prior to starting substructure repairs, the temporary supports shall be used to place an upward reaction on the effected beams designated in the plans, equal to but not larger than the dead load reactions given in the plans, thus relieving the superstructure dead load reaction from the substructure unit to be repaired. It is not the intention to raise the effected beams. As the vertical load is incrementally increased to the specified load, if vertical movement is detected the load shall not be increased further.

Additionally, if the work is to be completed under stage construction without traffic directly over the beams being shored then the temporary shoring and cribbing shall be designed to carry the dead load plus 1/2 (live load + imp) as shown in the plans. If work is to be completed with traffic directly over the beams being shored, then the temporary shoring and cribbing shall be designed to carry the dead load plus full (live load + imp) as shown in the plans.

Basis of Payment: This work will be paid for at the contract unit price per EACH for TEMPORARY SHORING AND CRIBBING for each beam support location required.

GENERAL ELECTRICAL REQUIREMENTS

~~Effective: July 1, 2025~~

~~This special provision replaces Articles 801.01-801.07 and 801.09-801.16 of the Standard Specifications. Codes, standards, and industry specifications cited for electrical work shall be by definition the latest adopted version thereof, unless indicated otherwise.~~

~~Materials 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.~~

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~~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. 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 method as directed in the pre-construction meeting. 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.~~

~~Submittals shall be provided for all items used, temporary and permanent, for review and approval.~~

~~Equipment which will be owned and maintained by a local agency other than the State shall be reviewed and approved by that agency prior to submittal to the State. The submittal to the State shall include any comments made by the local agency.~~

~~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. Submittals must be the Manufacturers current published information. Out of date submittal material will be grounds for rejection.~~

~~The submittal shall be properly identified by contractor, pay item number, route, section, county, and contract number. Example:~~

Contractor: Contractor Name Pay Item: X0327607 Route: I-00 Section: 2013-xxx-yzx County: Cook Contract: 12Z34
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~~The Contractor shall have reviewed the submittal material and affixed the Contractor's stamp of approval, with date and signature, for each individual item prior to submittal. The Contractor's approval stamp shall be the first page of the submittal.~~

~~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. In general, the disciplines are as follows:~~

Discipline	Typical Items
ITS	CCTV CCTV structures Communication vaults Fiber optic Fiber optic duct Network equipment
Lighting	Breakaway devices Light poles Light tower Lighting cables Lighting controllers Luminaires Unit duct
Pump Station	All pump station equipment
Signing	Signing
Surveillance	Loop cables Detector equipment & associated structures Ramp metering & associated structures Wireless pavement sensors and assoc. structures Radar detection Data Probing Handholes Dynamic Message Signs (DMS)
Traffic Signal	Controllers/Cabinets Handholes Illuminated signs Pedestrian Push Buttons Signal Cable Signal Detectors Signal Heads Signal Loop Cable Signal Modules Signal Structures
Local Roads Lighting	Same as lighting
Local Roads Traffic Signal	Same as traffic signal
Discipline with the predominate amount of work in contract or ask Engineer.	Raceways Electric cables Junction boxes

~~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", "Incomplete", 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", "Incomplete" or "Approved as Noted" shall be resubmitted by the Contractor in their entirety, unless otherwise indicated within the submittal comments.~~

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~~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: 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 electrical systems (lighting, ITS, pump station, surveillance, and 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 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 the electrical systems which may be affected by the work.~~

~~Marking of Existing Cable Systems. The party responsible for maintenance of any existing electrical 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 their 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.~~

~~Electrical Infrastructure During Construction. The scope of work shall include locating and marking the proposed underground infrastructure installed in this contract.~~

~~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. ~~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~~
- ~~• Resistance of Grounding Electrodes~~
- ~~• 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 10% 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.~~

Surveillance. ~~The following tests 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 continuity test of the loop and loop lead-in shall not have a resistance greater than 2 ohms. The quality factor (Q) shall be 5 or greater. Loops which fail to test satisfactorily shall be repaired or replaced.~~

~~Telecommunication Cable. Once the telecommunication cable is installed complete with all cable terminations complete the Contractor shall request an end-to-end test. The Contractor shall request the end-to-end test at least seven days in advance to the TSC Engineer. Any lane closures and/or any other safety measures that need to be taken shall be provided for by the Contractor and shall be considered incidental to the cost of this item. The type of test performed shall be an end-to-end test with Halcyon type equipment transmitting and receiving at each end of the cable. Each pair shall be tested, and the results shall be recorded and submitted to the Engineer. If any results don't fall within the requirements set forth in (REA) PE-39, the Contractor shall correct and re-test that cable pair. Traffic systems will tolerate only one pair out of every 100 pair of cable that doesn't meet or exceed specifications set forth in (REA) PE-39.~~

~~Wireless in-pavement detection systems shall be tested in accordance with the approved testing procedures provided in the catalog cut submittal.~~

Fiber Optic Systems. ~~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 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 five working (seven 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 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 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 described herein with copies on CD ROM or USB Drive.~~

~~At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Engineer. The test documentation shall be submitted as two bound copies and three CD ROM, or USB drive 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							
Maximum Loss									
Minimum Loss									

~~The OTDR test results file format must be Bellcore/Telcordia compliant according to GR-196-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:~~

Sample OTDR Summary				
Cable Designation:	<i>TCF IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date: <i>1/1/00</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>29000 Ft.</i>	<i>.075</i>	<i>.063</i>
<i>2</i>	<i>Splice</i>	<i>29000 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:~~

~~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.~~

~~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.~~

~~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 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 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", "TS", "S", "A" number.~~
- ~~• Summary of Quantities, electrical items only~~
- ~~• Legends, schedules, and notes~~
- ~~• Plan sheets~~

- ~~Final fiber assignment tables~~
- ~~Pertinent details~~
- ~~Single line diagrams; electrical, communications, surveillance and fiber optic.~~
- ~~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 programming~~
- ~~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, marked "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 via a mutually agreed to electronic format 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 (bookmarks) the respective pay item number. Specific part or model numbers of items which have been selected shall be clearly visible.~~

~~If the electric service is new or modified, documentation as required in the Electric Utility Service Installation and Connection shall be submitted.~~

~~During the final inspection, 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 equipment designations and clearly identified.

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 or USB Drives of the final documentation shall be submitted. The identical material shall also be submitted in the same manner as the catalog cut submittals utilizing the following final documentation pay item numbers:

Pay Code	Description	Discipline
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
FDICG000	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
FDLES00	Electric Service—Lighting	Lighting
FDSES00	Electric Service—Surveillance	Surveillance
FDTES00	Electric Service—Traffic Signal	Traffic Signal
FDIES00	Electric Service—ITS	ITS

~~Record drawings shall include marked up plans, controller info, electric 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.~~
- ~~• Fiber optic utility markers~~
- ~~• 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.~~
- ~~• All wireless in-pavement vehicle detectors~~

~~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 six decimal places. Each coordinate shall have the following information:~~

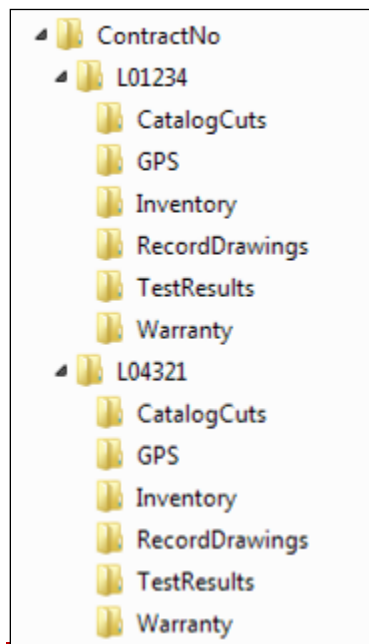
- ~~1. District~~
- ~~2. Description of item~~
- ~~3. Designation~~
- ~~4. Use~~
- ~~5. Approximate station~~
- ~~6. Contract number~~
- ~~7. Date~~
- ~~8. Owner~~
- ~~9. Latitude~~
- ~~10. Longitude~~
- ~~11. Comments~~

~~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 six years."~~

~~The documents on the CD-ROM, or USB Drive 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.~~

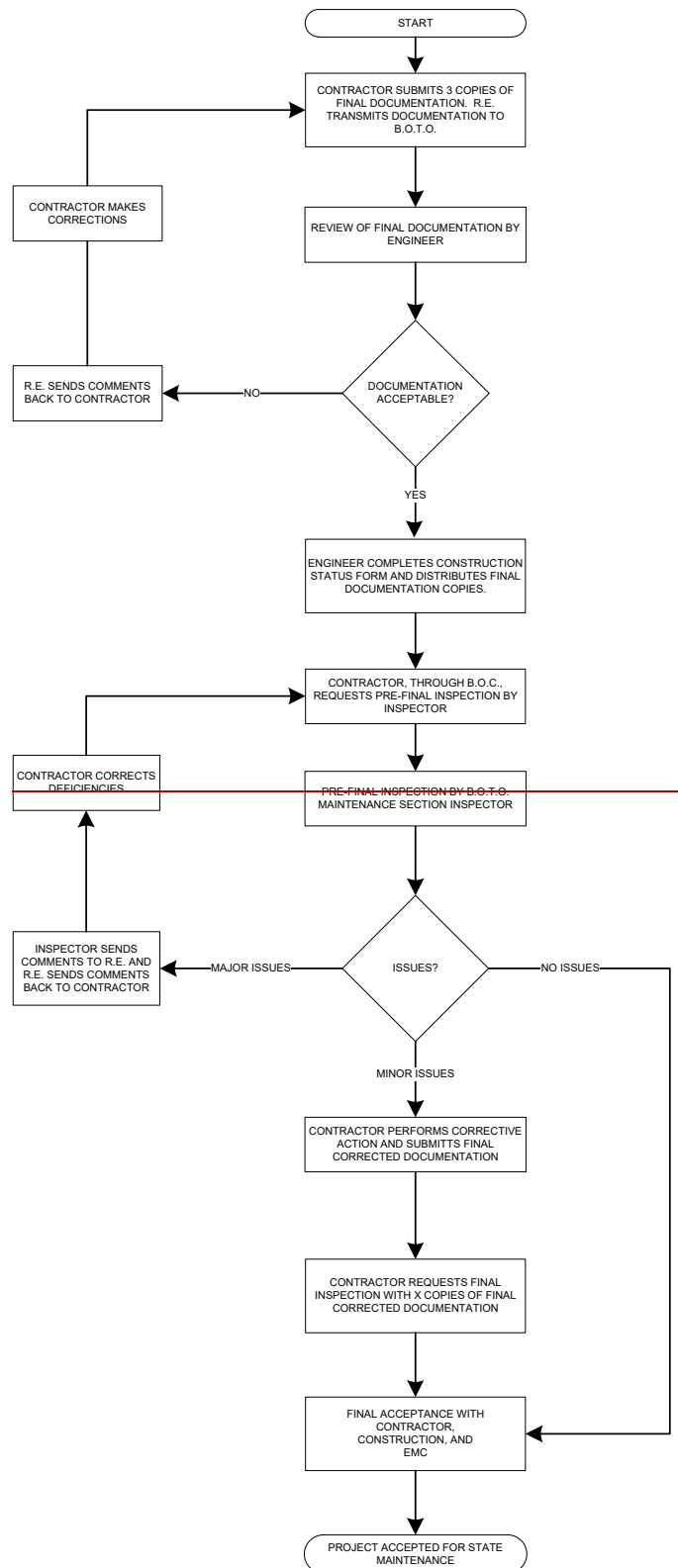
~~If CD's are used they shall be labeled as illustrated in the CD Label Template contained herein.~~

~~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)
Record Drawings		
—Three hardcopies (11" x 17")	☐	☐
—PDFs as required elsewhere	☐	☐
Field Inspection Tests		
—Voltage	☐	☐
—Amperage	☐	☐
—Cable Insulation Resistance	☐	☐
—Continuity	☐	☐
—Controller Ground Rod Resistance	☐	☐
(Three Hardcopies & PDFs as required)		
GPS Coordinates		
—Excel file	☐	☐
(Check Special Provisions, Excel file required.)		
Job Warranty Letter		
(Three Hardcopies & PDFs as required)	☐	☐
Catalog Cut Submittals		
—Approved & Approved as Noted	☐	☐
(PDFs as required)		
Lighting Inventory Form		
(Three Hardcopies & PDFs as required)	☐	☐
Lighting Controller Inventory Form		
(Three Hardcopies & PDFs as required)	☐	☐
Electric Service Documentation		
(Three Hardcopies & PDFs as required)	☐	☐
Light Tower Inspection Form		
(If applicable, Three Hardcopies & PDFs as required)	☐	☐

Three hardcopies & PDFs as required shall be submitted for all items above. If a CD-ROM is used it shall be labeled as shown in the example contained herein.

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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.~~

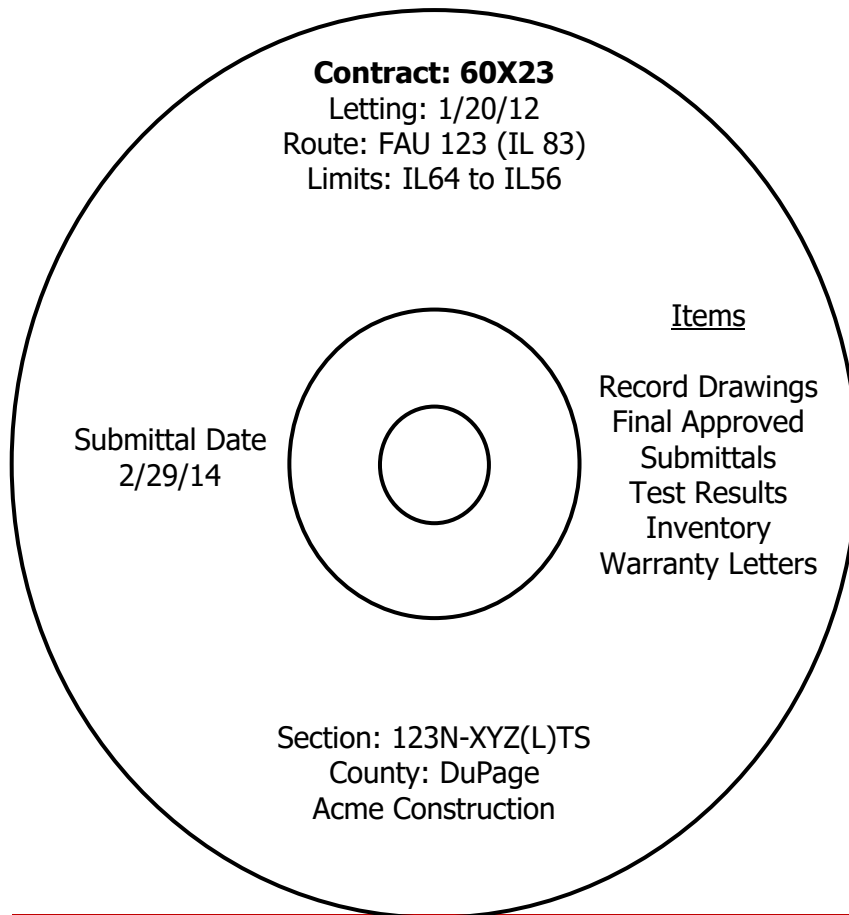
~~Lighting Inventory Form — Inventory form should include only proposed light poles, proposed light towers, proposed combination (traffic/light pole) lighting and proposed underpass luminaires.~~

~~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.~~



UNDERGROUND RACEWAYS

~~Effective: May 22, 2002~~

~~Revised: March 1, 2024~~

~~Revise Article 810.04 of the Standard Specifications to read:~~

~~"Installation. All underground conduits shall have a minimum depth of 30 in. below the finished grade and shall be installed to avoid existing and proposed utilities within the project limits."~~

~~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."~~

~~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 1 ft 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 1/8 in. thick. The cap shall be sealed to the conduit using a 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."~~

EXPOSED RACEWAYS

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° 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 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 protection. Hazardous location fittings, prior to plastic coating shall be UL listed.~~

~~b. The PVC coating shall have the following characteristics:~~

Hardness:	85+ Shore A Durometer
Dielectric Strength:	400V/mil @ 60 Hz
Aging:	1,000 Hours Atlas Weatherometer
Temperature	The PVC compound shall conform at 0° F. to Federal Specifications PL-406b, Method 2051, Amendment 1 of 25 September 1952 (ASTM D 746)
Elongation:	200%

- ~~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 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 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 1/2 inch apart and 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 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 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 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, of the diameter specified, RIGID GALVANIZED STEEL or CONDUIT ATTACHED TO STRUCTURE, of the diameter specified, PVC COATED GALVANIZED STEEL."~~

UNIT DUCT

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 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 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 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

WIRE AND CABLE

Effective: January 1, 2012

Add the following to the first paragraph of Article 1066.02(a):

“The cable shall be rated at a minimum of 90 °C dry and 75 °C wet and shall be suitable for installation in wet and dry locations and shall be resistant to oils and chemicals.”

Revise the Aerial Electric Cable Properties table of Article 1066.03(a)(3) to read:

Aerial Electric Cable Properties					
Phase Conductor			Messenger wire		
Size AWG	Stranding	Average Insulation Thickness		Minimum Size AWG	Stranding
		mm	mils		
6	7	1.1	(45)	6	6/1
4	7	1.1	(45)	4	6/1
2	7	1.1	(45)	2	6/1
1/0	19	1.5	(60)	1/0	6/1
2/0	19	1.5	(60)	2/0	6/1
3/0	19	1.5	(60)	3/0	6/1
4/0	19	1.5	(60)	4/0	6/1

Add the following to Article 1066.03(b) of the Standard Specifications:

“Cable sized No. 2 AWG and smaller shall be U.L. listed type RHH/RHW and may be type RHH/RHW/USE. Cable sized larger than No. 2 AWG shall be U.L. listed type RHH/RHW/USE.”

Revise Article 1066.04 to read:

“Aerial Cable Assembly. The aerial cable shall be an assembly of insulated aluminum conductors according to Section 1066.02 and 1066.03. Unless otherwise indicated, the cable assembly shall be composed of three insulated conductors and a steel reinforced bare aluminum conductor (ACSR) to be used as the ground conductor. Unless otherwise indicated, the code word designation of this cable assembly is “Palomino”. The steel reinforced aluminum conductor shall conform to ASTM B-232. The cable shall be assembled according to ANSI/ICEA S-76-474.”

Revise the second paragraph of Article 1066.05 to read:

“The tape shall have reinforced metallic detection capabilities consisting of a woven reinforced polyethylene tape with a metallic core or backing.”

ROADWAY LUMINAIRE, LED

Effective: November 1, 2025

Description. This work shall consist of furnishing and installing a roadway LED luminaire as shown on the plans, as specified herein.

The luminaire including the housing, driver, and optical assembly shall be assembled in the US. The luminaire shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. The size, weight, and shape of the luminaire shall be designed so as not to incite detrimental vibrations in its respective pole, and it shall be compatible with the pole and arm. All electrical and electronic components of the luminaire shall comply with the requirements of RoHS regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750

Submittal Requirements.

The Contractor shall also submit the following manufacturer's product data for each type of luminaire:

1. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided.
2. LED drive current, total luminaire input wattage, and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.
3. LED efficacy per luminaire expressed in lumens per watt (l/w).
4. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.
5. IES file associated with each submitted luminaire in the IES LM-63 format.
6. Computer photometric calculation reports as specified and in the luminaire performance table.
7. TM-15 BUG rating report.
8. Isofootcandle chart with max candela point and half candela trace indicated.
9. Documentation of manufacturers experience and verification that luminaires were assembled in the US as specified.
10. Written warranty.

Upon request by the Engineer, the submittals shall also include any or all the following:

- a. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F.
- b. LM-79 report with NVLAP current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.

- ~~c. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.~~
- ~~d. AGi32 calculation file matching the submittal package.~~
- ~~e. ISTMT report for the specified luminaire or luminaire family in PDF format.~~
- ~~f. Vibration test report in accordance with ANSI C136.31 in PDF format.~~
- ~~g. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.~~
- ~~h. ASTM G154 (ASTM D523) gloss test report in PDF format.~~
- ~~i. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F.~~
- ~~j. Power factor (pf) and THD at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.~~
- ~~k. IP test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.~~
- ~~l. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.~~
- ~~m. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.~~

~~A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the district headquarters. After review, the Contractor shall retrieve the luminaire.~~

~~Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 20-year lifetime. The luminaire manufacturer shall have a minimum of 15 years of experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the US.~~

~~Housing. All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.~~

~~Material. The luminaire shall be a single device not requiring on-site assembly for installation. The driver for the luminaire shall be integral to the unit.~~

~~Finish. The luminaire shall have a baked acrylic enamel finish. The color of the finish shall be gray, unless otherwise indicated.~~

~~The finish shall have a rating of six or greater according to ASTM D1654, Section 8.0 Procedure A—Evaluation of Rust Creepage for Scribed Samples after exposure to 1000 hours of testing according to ASTM B117 for painted or finished surfaces under environmental exposure. The luminaire finish shall have less than or equal to 30% reduction of gloss according to ASTM D523 after exposure of 500 hours to ASTM G154 Cycle 6 QUV® accelerated weathering testing.~~

~~The luminaire shall slip fit on a mounting arm with a 2" diameter tenon (2.375" outer diameter) and shall have a barrier to limit the amount of insertion. The slip fitter clamp shall utilize four bolts to clamp to the tenon arm. The luminaire shall be provided with a leveling surface and shall be~~

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~~capable of being tilted $\pm 5^\circ$ from the axis of attachment in 2.5° increments and rotated to any degree with respect to the supporting arm.~~

~~All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.~~

~~The effective projected area (EPA) of the luminaire shall not exceed 1.6 sq ft and the weight, including accessories, shall not exceed 40 lb. If the weight of the luminaire is less than 20 lb weight shall be added to the mounting arm or a supplemental vibration damper installed as approved by the Engineer.~~

~~A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.~~

~~The luminaire shall include a fully prewired, seven-pin twist lock ANSI C136.41 compliant receptacle. Unused pins shall be connected as directed by the Manufacturer and as approved by the Engineer. A shorting cap shall be provided with the luminaire that is compliant with ANSI C136.10.~~

~~Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual component shall pass this test with no noticeable damage and the luminaire must remain fully operational after testing.~~

~~Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.~~

~~An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. **TYPES** 1, 2, 3, 4, or 5).~~

~~Hardware. All hardware shall be stainless steel or of other corrosion resistant material approved by the Engineer.~~

~~Luminaires shall be designed to be easily serviced, having fasteners such as quarter-turn clips of the heavy spring-loaded type with large, deep straight slot heads, complete with a receptacle and shall be according to military specification MIL-f 5591.~~

~~All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.~~

~~Provisions for any future house-side external or internal shielding should be indicated along with means of attachment.~~

~~Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LED's.~~

~~Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.~~

~~Driver. The driver shall be integral to the luminaire shall be capable of receiving an indefinite open and short circuit output conditions without damage.~~

~~The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F or less.~~

~~The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an un-dimmed state, the power factor measurement shall be not less than 0.9 and the THD measurement shall be no greater than 20%.~~

~~The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for Class A devices with regard to electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.~~

~~The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.~~

~~Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a SPD that is UL1449 compliant with indicator light. An SPD failure shall open the circuit to protect the driver.~~

~~LED Optical Assembly. The optical assembly shall have an IP 65 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.~~

~~The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature ($\pm 300K$) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.~~

~~Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25° C.~~

~~The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.~~

~~The assembly shall have individual serial numbers or other means for manufacturer tracking.~~

~~Photometric Performance. Luminaires shall be tested according to IESNA LM 79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of Standards and Technology (NIST) NVLAP for the IESNA LM 79 test procedure.~~

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~~Data reports as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above mentioned tests.~~

~~The luminaire shall have a BUG rating of back light B3 or less, up light rating of U0, and a glare rating of G3 or less unless otherwise indicated in the luminaire performance table.~~

~~Photometric Calculations:~~

~~Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.~~

~~Complete point by point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).~~

~~When the quantity of luminaires requires independent testing, the AGi32 calculation file used for performance verification shall also be submitted with the initial submittal.~~

~~All photometry must be photopic. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.~~

**IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE
 ROADWAY LIGHTING**

GIVEN CONDITIONS

Roadway Data	Pavement Width	_____	Ft
	Number of Lanes Left of Median	_____	
	Number of Lanes Right of Median	_____	
	Lane Width	_____	Ft
	Median Width	_____	Ft
	IES Surface Classification	R3	
	Q-Value	0.07	
Mounting Data	Mounting Height	_____	Ft
	Mast Arm Length	_____	Ft
	Pole Set Back from Edge of Pavement	_____	Ft
Luminaire Data	Source	LED	
	Color Temperature	4000	°K
	Lumens	_____	Min
	Pay Item Lumen Designation	Choose an item.	
	BUG Rating	_____	
	IES Vertical Distribution	_____	
	IES Control of Distribution	_____	
	IES Lateral Distribution	_____	
Pole Layout Data	Total Light Loss Factor	0.75	
	Spacing	_____	Ft
	Configuration	Choose an item.	
	Luminaire Overhang over E.O.P.	_____	Ft

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested, and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

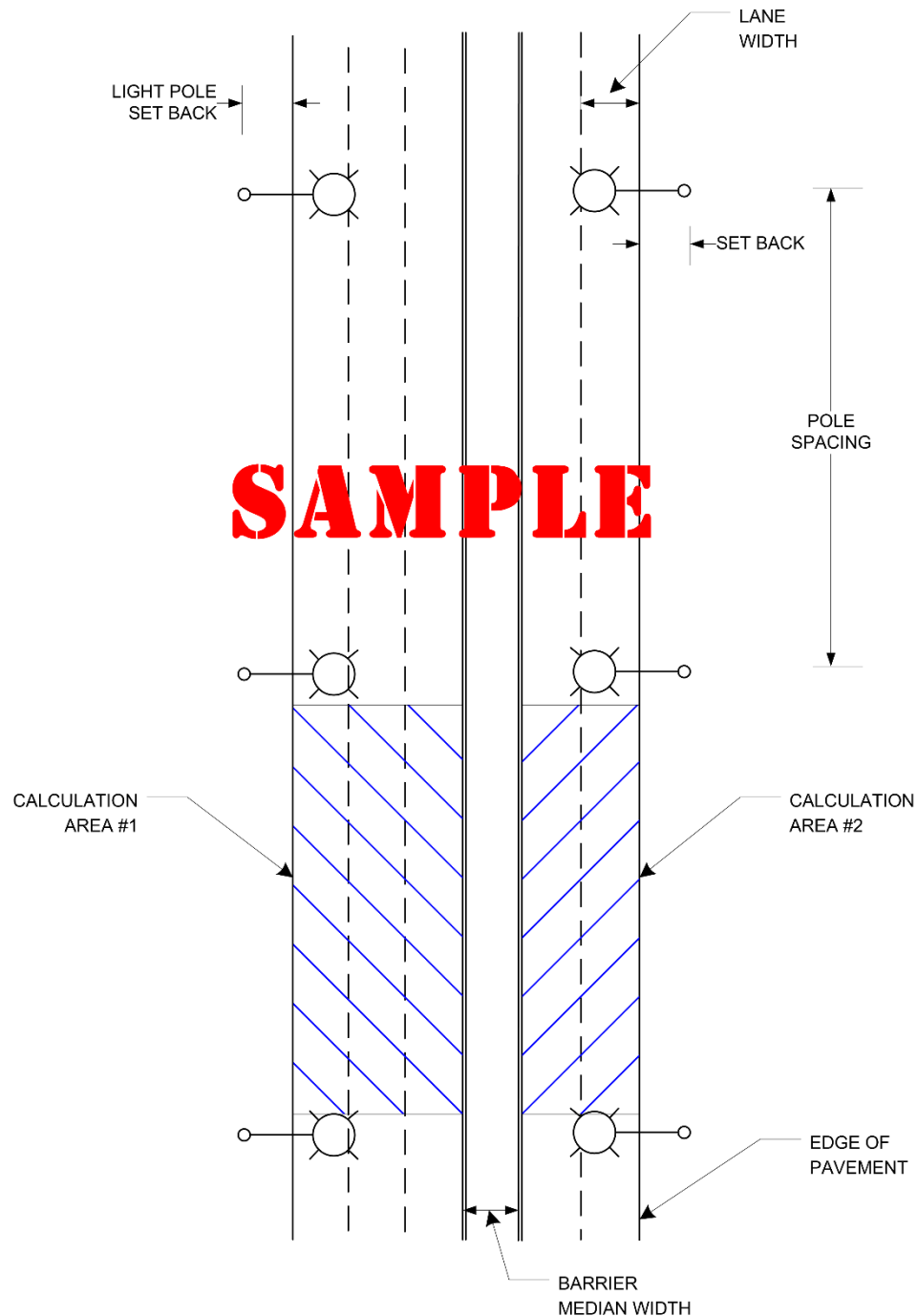
NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

Roadway Luminance	Average Luminance, L_{AVE} (Max)	_____	Cd/m ²
	Average Luminance, L_{AVE} (Min)	_____	Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	_____	Max
	Uniformity Ratio, L_{MAX}/L_{MIN}	_____	Max
	Veiling Luminance Ratio, L_v/L_{AVE}	_____	Max

INSERT DRAWING OF POLE LAYOUT. THIS IS A SAMPLE DIAGRAM.

**ALL DIAGRAMS MUST BE PROJECT SPECIFIC COORDINATED WITH THE
LUMINAIRE PERFORMANCE TABLES.**

INTERSECTIONS OR CURVES CANNOT BE USED.



~~Independent Testing. When a contract has 50 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.~~

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

~~The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead times and deadlines.~~

~~The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the district headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.~~

~~Alternative Selection Process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.~~

~~Luminaires shall be tested at a NVLAP accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire.~~

~~The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.~~

~~The testing performed shall include photometric and electrical testing.~~

~~All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.~~

~~Photometric testing shall be according to IES recommendations, performed with a goniophotometer and as a minimum, shall yield an isfootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone~~

~~plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.~~

~~Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion and LED drive current.~~

~~The summary report and the test results including IES photometric files shall be sent directly to the Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.~~

~~Photometric performance shall meet or exceed that of the specified values. The color temperature shall be within $\pm 300^{\circ}\text{K}$ of the submitted factory values. The measured lumen output of the luminaire shall be within $\pm 10\%$ of the submitted factory value. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.~~

~~Should any of the tested luminaires of a given type, and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance.~~

~~In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety.~~

~~The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table.~~

~~Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time.~~

~~Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.~~

~~Installation. Each luminaire shall be installed according to the luminaire manufacturer's recommendations.~~

~~Luminaires which are pole mounted shall be mounted on site such that poles and arms are not left unloaded. Pole mounted luminaires shall be leveled/adjusted after poles are set and vertically aligned before being energized. When mounted on a tenon, care shall be exercised to assure maximum insertion of the mounting tenon. Each luminaire shall be checked to assure compatibility with the project power system. When the night time check of the lighting system by the Engineer indicates that any luminaires are mis-aligned, the misaligned luminaires shall be corrected at no additional cost.~~

~~No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.~~

~~Pole wiring shall be provided with the luminaire. Pole wire shall run from handhole to luminaire. Pole wire shall be sized No. 10, rated 600 V, RHW/USE-2, and have copper conductors, stranded in conformance with ASTM B 8. Pole wire shall be insulated with cross-linked polyethylene (XLP) insulation. Pole wire shall include a phase, neutral, and green ground wire. Wire shall be trained within the pole or sign structure to avoid abrasion or damage to the insulation.~~

~~Pole wire shall be extended through the pole, pole grommet, luminaire ring, and any associated arm and tenon. The pole wire shall be terminated in a manner that avoids sharp kinks, pinching, pressure on the insulation, or any other arrangement prone to damaging insulation value and producing poor megger test results. Wires shall be trained away from heat sources within the luminaire. Wires shall be terminated so all strands are extended to the full depth of the terminal lug with the insulation removed far enough so it abuts against the shoulder of the lug but is not compressed as the lug is tightened.~~

~~Included with the pole wiring shall be fusing located in the handhole. Fusing shall be according to Article 1065.01 with the exception that fuses shall be 6 amperes.~~

~~Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.~~

~~Horizontal mount luminaires shall be installed in a level, horizontal plane, with adjustments as needed to ensure the optics are set perpendicular to the traveled roadway.~~

~~When the pole is bridge mounted, a minimum size stainless steel 1/4-20NC set screw shall be provided to secure the luminaire to the mast arm tenon. A hole shall be drilled and tapped through the tenon and luminaire mounting bracket and then fitted with the screw.~~

~~Warranty. The entire luminaire and all its component parts shall be covered by a ten year warranty. Failure is when one or more of the following occur:~~

- ~~1) Negligible light output from more than 10% of the discrete LEDs.~~
- ~~2) Significant moisture that deteriorates performance of the luminaire.~~
- ~~3) Driver that continues to operate at a reduced output due to overheating.~~

~~The warranty period shall begin on the date of luminaire delivery. The Contractor shall verify that the Engineer has noted the delivery date in the daily diary. Copy of the shipment and delivery documentation shall be submitted with the final documentation.~~

~~The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.~~

~~Method of Measurement. The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation.~~

Designation Type	Minimum Initial Luminous Flux	Designation Type	Minimum Initial Luminous Flux
A	2,200	F	12,500
B	3,150	G	15,500
C	4,400	H	25,200
D	6,300	I	33,000
E	9,450		

~~Where delivered lumens is defined as the minimum initial delivered lumens at the specified color temperature. Luminaires with an initial luminous flux less than the values listed in the above table will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.~~

~~Basis of Payment. This work will be paid for at the contract unit price per EACH for LUMINAIRE, LED, ROADWAY, of the output designation specified.~~

HIGHMAST LUMINAIRE, LED

~~Effective: April 1, 2024~~

~~Description. This work shall consist of furnishing and installing a highmast LED luminaire as shown on the plans, as specified herein.~~

~~The luminaire including the housing, driver, and optical assembly shall be assembled in the U.S., and shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. The size, weight, and shape of the luminaire shall be designed so to not incite detrimental vibrations in its respective structure, and shall be compatible with the mounting arm. All electrical and electronic components of the luminaire shall comply with the requirements of RoHS regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750.~~

~~The luminaire shall be designed and manufactured for highmast tower use. It shall be designed to withstand constant 80 mph wind speeds and 104 mph gusts and the physical stresses associated with such duty including shocks and vibrations.~~

~~Submittal Requirements. The Contractor shall also the following manufacturer's product data for each type of luminaire:~~

- ~~1. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided~~
- ~~2. LED drive current, total luminaire input wattage, and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.~~
- ~~3. LED efficacy per luminaire expressed in lumens per watt (l/w).~~
- ~~4. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.~~
- ~~5. IES file associated with each submitted luminaire in the IES LM-63 format.~~

- ~~6. Computer photometric calculation reports as specified and in the luminaire performance table.~~
- ~~7. TM-15 BUG rating report.~~
- ~~8. Isofootcandle chart with max candela point and half candela trace indicated.~~
- ~~9. Documentation of manufacturers experience and verification that luminaires were assembled in the U.S.A. as specified.~~
- ~~10. Written warranty.~~

~~Upon request by the Engineer, submittals shall also include any or all the following:~~

- ~~a. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F.~~
- ~~b. LM-79 report with NVLAP current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.~~
- ~~c. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.~~
- ~~d. AGi32 calculation file matching the submittal package.~~
- ~~e. In situ temperature measurement test (ISTMT) report for the specified luminaire or luminaire family in PDF format.~~
- ~~f. Vibration test report in accordance with ANSI C136.31 in PDF format.~~
- ~~g. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.~~
- ~~h. ASTM G154 (ASTM D523) gloss test report in PDF format.~~
- ~~i. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F.~~
- ~~j. Power factor (pf) and total harmonic distortion (THD) at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.~~
- ~~k. Ingress protection (IP) test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.~~
- ~~l. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.~~
- ~~m. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.~~

~~A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the district headquarters. After review, the Contractor shall retrieve the luminaire.~~

~~**Manufacturer Experience.** The luminaire shall be designed to be incorporated into a lighting system with an expected 20-year lifetime. The luminaire manufacturer shall have a minimum of 15 years of experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the U.S.A.~~

~~**Housing:**~~

~~Material. The luminaire shall be a single device not requiring onsite assembly for installation. The driver for the luminaire shall be integral to the unit.~~

~~Finish. The luminaire shall have a baked acrylic enamel finish. The color of the finish shall be gray, unless otherwise indicated.~~

~~The finish shall have a rating of six or greater according to ASTM D1654, Section 8.0 Procedure A—Evaluation of Rust Creepage for Scribed Samples after exposure to 1000 hours of testing according to ASTM B117 for painted or finished surfaces under environmental exposure. The luminaire finish shall have less than or equal to 30% reduction of gloss according to ASTM D523 after exposure of 500 hours to ASTM G154 Cycle 6 QUV@ accelerated weathering testing.~~

~~The luminaire shall slip-fit on a 2 to 2 3/8 in. O.D. pipe arm and shall have a barrier to limit the amount of insertion. The mounting shall be fully coordinated with the luminaire mounting method indicated in plans.~~

~~All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.~~

~~The effective projected area of the luminaire shall not exceed 2.1 sq. ft. The total weight including accessories, shall not exceed 80 lbs. If the weight of the luminaire is less than 20 lb., weight shall be added to the mounting arm or a supplemental vibration damper installed as approved by the Engineer.~~

~~A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.~~

~~The luminaire shall include a fully prewired, seven-pin twist lock ANSI C136.41-compliant receptacle. Unused pins shall be connected as directed by the manufacturer and as approved by the Engineer. A shorting cap shall be provided with the luminaire that is compliant with ANSI C136.10.~~

~~Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual component shall pass this test with no noticeable damage, and the luminaire must remain fully operational after testing.~~

~~Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.~~

~~An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. types 1, 2, 3, 4, or 5).~~

~~Hardware. All hardware shall be stainless steel or other corrosion resistant material approved by the Engineer.~~

~~Luminaires shall be designed to be easily serviced, having fasteners such as quarter turn clips of the heavy spring loaded type with large, deep straight slot heads, complete with a receptacle, and shall be according to military specification MIL-f-5591.~~

~~All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.~~

~~Provisions for any future house side external or internal shielding should be indicated along with means of attachment.~~

~~Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LEDs.~~

~~Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.~~

~~Driver. The driver shall be integral to the luminaire and shall be capable of receiving indefinite open and short circuit output conditions without damage. The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F or less.~~

~~The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an un-dimmed state, the power factor measurement shall be no less than 0.9 and the THD measurement shall be no greater than 20%.~~

~~The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for class A devices regarding electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.~~

~~The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.~~

~~Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a surge protective device (SPD) that is UL1449 compliant with indicator light. An SPD failure shall open the circuit to protect the driver.~~

~~LED Optical Assembly. The optical assembly shall have an IP65 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.~~

~~The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature (+/- 300K) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.~~

~~Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25° C.~~

~~The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.~~

~~The optical assembly shall be capable of being rotated 360° around its vertical axis. The luminaire shall be equipped with identifying markings to indicate the mounted orientation. Luminaire installation shall include engraved banding of the mounting arms to designate proper orientation.~~

~~The assembly shall have individual serial numbers or other means for manufacturer tracking.~~

~~Photometric Performance. Luminaires shall be tested according to IESNA LM-79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of Standards and Technology (NIST) NVLAP for the IESNA LM-79 test procedure.~~

~~Data reports as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above-mentioned tests.~~

~~The luminaire shall have a BUG rating of back light B3 or less, up light rating of U0, and a glare rating of G3 or less unless otherwise indicated in the luminaire performance table.~~

Photometric Calculations:

~~Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.~~

~~Complete point-by-point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).~~

~~All photometry must be **photopic**. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.~~

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE ROADWAY LIGHTING

GIVEN CONDITIONS

Roadway Data	Pavement Width	_____	Ft
	Number of Lanes Left of Median	_____	
	Number of Lanes Right of Median	_____	
	Lane Width	_____	Ft
	Median Width	_____	Ft
	IES Surface Classification	R3	
	Q-Value	0.07	
Mounting Data	Mounting Height	_____	Ft
	Mast Arm Length	_____	Ft
	Tower Set Back from Edge of Pavement	_____	Ft
Luminaire Data	Source	LED	
	Color Temperature	4000	°K
	Lumens	_____	Min
	Pay Item Lumen Designation	Choose an item.	
	BUG Rating	_____	
	IES Vertical Distribution	_____	
	IES Control of Distribution	_____	
	IES Lateral Distribution	_____	
	Total Light Loss Factor	0.70	
Tower Layout Data	Spacing	_____	Ft
	Configuration	See Diagram	
	Number of Luminaires per Tower	_____	

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested, and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

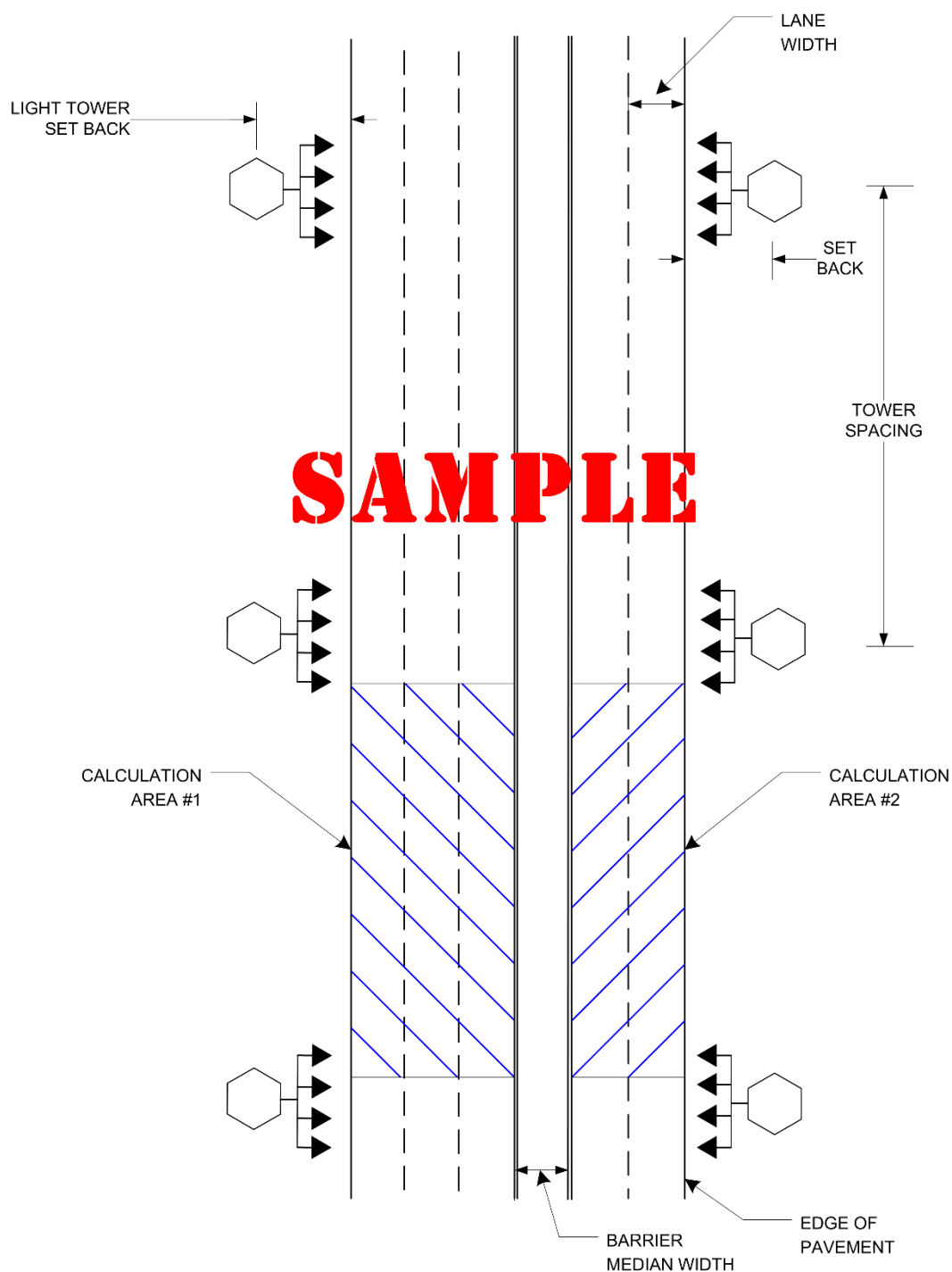
NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

Roadway Luminance	Average Luminance, L_{AVE} (Max)	_____	Cd/m ²
	Average Luminance, L_{AVE} (Min)	_____	Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	_____	Max
	Uniformity Ratio, L_{MAX}/L_{MIN}	_____	Max
	Veiling Luminance Ratio, L_V/L_{AVE}	_____	Max

**INSERT DRAWING OF LIGHT TOWER LAYOUT. THIS IS A SAMPLE
DIAGRAM.**

**ALL DIAGRAMS MUST BE PROJECT SPECIFIC COORDINATED WITH THE
LUMINAIRE PERFORMANCE TABLES.**

INTERSECTIONS OR CURVES CANNOT BE USED.



Revised 5-27-2026

~~Independent Testing. When a contract has 50 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.~~

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

~~Testing is not required for temporary lighting luminaires.~~

~~The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead times and deadlines.~~

~~The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the district headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.~~

~~Alternative Selection Process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.~~

~~Luminaires shall be tested at a NVLAP accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire. The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.~~

~~The testing performed shall include photometric and electrical testing. All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.~~

~~Photometric testing shall be according to IES recommendations, performed with a goniophotometer, and as a minimum shall yield an isofootcandle chart with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a~~

~~luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.~~

~~Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion and LED drive current.~~

~~The summary report and the test results including IES photometric files shall be sent directly to the Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.~~

~~Photometric performance shall meet or exceed that of the specified values. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.~~

~~Should any of the tested luminaires of a given type and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance. In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing, and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety. The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table. Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time~~

~~Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.~~

~~Installation. Each luminaire shall be installed according to the luminaire manufacturer's recommendations.~~

~~Luminaires shall be leveled/adjusted before being energized. When mounted on a tenon, care shall be exercised to assure maximum insertion of the mounting tenon. Each luminaire shall be checked to assure compatibility with the project power system. When the night time check of the lighting system by the Engineer indicates that any luminaires are misaligned, the misaligned luminaires shall be corrected at no additional cost.~~

~~No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.~~

~~Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.~~

~~Luminaires having asymmetrical photometric distributions shall be carefully oriented with respect to the roadway as indicated on the plans and as directed by the Engineer. The Contractor shall confirm all luminaire orientations with the Engineer prior to installation.~~

~~For horizontal mounts having rotating optical assemblies, after the orientation of each mast arm tenon is inspected and approved by the Engineer, the position shall be permanently marked in a manner acceptable to the Engineer. The luminaire shall then be leveled to the plane of the luminaire ring.~~

~~When the luminaire position and orientation has been confirmed and approved by the Engineer, the luminaire shall be anchored with a minimum size 1/4 20NC stainless steel bolt installed through tapped holes in the tenon and mounting bracket of the luminaire. The bolt shall not penetrate into the tenon more than 1/4 in. Counterweights on unused tenons shall be mounted in a similar manner. Pre-installed wire on the tower ring shall have the ends of each wire capped at the tenon with butt type crimp connectors for un-used tenons. The wires shall then be re-inserted into the tenon end, and the tenon end shall be capped.~~

~~**Warranty.** The entire luminaire and all component parts shall be covered by a ten-year warranty. Failure is when one or more of the following occur:~~

- ~~1) Negligible light output from more than 10% of the discrete LEDs.~~
- ~~2) Significant moisture that deteriorates performance of the luminaire.~~
- ~~3) Driver that continues to operate at a reduced output due to overheating.~~

~~The warranty period shall begin on the date of the luminaire delivery. The Contractor shall verify that the Engineer has noted the delivery date in the daily diary. Copy of the shipment documentation shall be submitted.~~

~~The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.~~

~~**Method of Measurement.** The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation.~~

Designation Type	Minimum Initial Luminous Flux
H	25,200
I	47,250
J	63,300
K	80,000+

~~Where delivered, lumens is defined as the minimum initial delivered lumens at the specified color temperature. Luminaires with an initial luminous flux less than the values listed in the above table will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.~~

~~**Basis of Payment.** This work will be paid for at the contract unit price per EACH for LUMINAIRE, LED, HIGHMAST or TEMPORARY LUMINAIRE, LED, HIGHMAST, of the output designation specified.~~

UNDERPASS LUMINAIRE, LED

Effective: April 1, 2024

~~Description. This work shall consist of furnishing and installing an underpass LED luminaire as shown on the plans, as specified herein.~~

~~The luminaire including the housing, driver, and optical assembly shall be assembled in the U.S.A., and shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. All electrical and electronic components of the luminaire shall comply with the requirements of RoHS regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750~~

~~Submittal Requirements.~~

~~The Contractor shall also submit the following manufacturer's product data for each type of luminaire:~~

- ~~1. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided.~~
- ~~2. LED drive current, total luminaire input wattage, and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.~~
- ~~3. LED efficacy per luminaire expressed in lumens per watt (l/w).~~
- ~~4. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.~~
- ~~5. IES file associated with each submitted luminaire in the IES LM-63 format.~~
- ~~6. Computer photometric calculation reports as specified and in the luminaire performance table.~~
- ~~7. TM-15 BUG rating report.~~
- ~~8. Isofootcandle chart with max candela point and half candela trace indicated.~~
- ~~9. Documentation of manufacturers experience and verification that luminaires were assembled in the US as specified.~~
- ~~10. Written warranty.~~

~~Upon request by the Engineer, the submittals shall also include any or all the following:~~

- ~~a. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F.~~
- ~~b. LM-79 report with NVLAP current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.~~
- ~~c. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.~~
- ~~d. AGI32 calculation file matching the submittal package.~~
- ~~e. ISTMT report for the specified luminaire or luminaire family in PDF format.~~
- ~~f. Vibration test report in accordance with ANSI C136.31 in PDF format.~~

Revised 5-27-2026

- ~~g. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.~~
- ~~h. ASTM G154 (ASTM D523) gloss test report in PDF format.~~
- ~~i. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F.~~
- ~~j. Power factor (pf) and THD at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.~~
- ~~k. IP test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.~~
- ~~l. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.~~
- ~~m. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.~~

~~A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the district headquarters. After review, the Contractor shall retrieve the luminaire.~~

~~Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 20-year lifetime. The luminaire manufacturer shall have a minimum of 15 years of experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the US.~~

~~Housing:~~

~~Material. The luminaire shall be a single device not requiring onsite assembly for installation. The power supply for the luminaire shall be integral to the unit. The housing shall be either stainless-steel or cast aluminum.~~

~~Aluminum Housing. The housing shall be extruded or cast aluminum; or a combination of both, and shall have a copper content of less than 1.0%. The housing shall be painted grey or silver unless specified otherwise. An epoxy base coat shall be applied to the aluminum after the aluminum is properly treated with a conversion coating. The finish coat shall be polyester powder coat with a minimum thickness of 2.0 mil.~~

~~The luminaire surfaces exposed to the environment shall exceed a rating of 6, according to ASTM D1654, after 1000 hours of ASTM B117 testing. The coating shall exhibit no greater than 30% reduction of gloss, according to ASTM D523, after 500 hours of ASTM G154 Cycle 6 QUV@ accelerated weathering testing.~~

~~Stainless Steel Housing. The housing shall be constructed from 16-gauge minimum, 304 stainless steel. The stainless steel housing does not need to be painted. The manufacturer may paint the luminaire at no additional cost.~~

~~The luminaire shall be optically sealed, mechanically strong, and easy to maintain. The luminaire shall be designed for wall mounting to a pier or abutment. It shall be provided with a suitable mounting bracket which allows for +90° adjustment from horizontal in 5° increments.~~

~~The luminaire shall be gasketed and sealed and shall be UL listed for wet locations. The luminaire optical assembly shall have a minimum IEC ingress penetration rating of IP66. When furnished with a lens and frame, the lens shall be made of crystal clear, impact and heat resistant, flat glass. The lens and frame shall be securely attached to the main housing and be readily removable for servicing the LED optical assembly.~~

~~All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.~~

~~The total weight including accessories shall not exceed 75 lbs.~~

~~A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.~~

~~Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual component shall pass this test with no noticeable damage and the luminaire must remain fully operational after testing.~~

~~Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.~~

~~An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. types 1, 2, 3, 4, or 5).~~

~~Hardware. All hardware shall be stainless steel or other corrosion resistant material approved by the Engineer.~~

~~Luminaires shall be designed to be easily serviced, having fasteners such as quarter turn clips of the heavy spring loaded type with large, deep straight slot heads, complete with a receptacle, and shall be according to military specification MIL-f 5591.~~

~~All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.~~

~~Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LED's.~~

~~Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.~~

~~The power connection to the luminaire shall be via liquid tight metallic conduit or an armored flexible cable assembly. The power connection, including any external shielding, must be secured to the luminaire and connected source. The location of the opening shall be coordinated with the~~

~~installation to minimize the length of flexible conduit required. The length of the cable or flexible conduit shall not exceed 6 feet.~~

~~Mounting Brackets. The brackets shall be properly sized to accommodate the weight of the luminaire with calculations or other suitable reference documentation submitted to support the material choice. The brackets shall be constructed of 304 stainless steel. The mounting brackets shall be fully coordinated with the luminaire mounting method indicated in plans.~~

~~Driver. The driver shall be integral to the luminaire and shall be capable of receiving an indefinite open and short circuit output conditions without damage.~~

~~The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F or less.~~

~~The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an undimmed state, the power factor measurement shall be no less than 0.9, and the THD measurement shall be no greater than 20%.~~

~~The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for class A devices regarding electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.~~

~~The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.~~

~~Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a SPD that is UL1449 compliant with indicator light. An SPD failure shall open the circuit to protect the driver.~~

~~LED Optical Assembly. The optical assembly shall have an IP66 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.~~

~~The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature ($\pm 300K$) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.~~

~~Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25 °C.~~

~~The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.~~

~~The assembly shall have individual serial numbers or other means for manufacturer tracking.~~

~~Photometric Performance. Luminaires shall be tested according to IESNA LM-79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of Standards and Technology NVLAP for the IESNA LM-79 test procedure.~~

~~Data reports as a minimum shall yield an isofootcandle chart with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above-mentioned tests.~~

~~The luminaire shall have a BUG rating of back light B3 or less, up light rating of U0, and a glare rating of G3 or less unless otherwise indicated in the luminaire performance table.~~

Photometric Calculations.

~~Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.~~

~~Complete point by point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).~~

~~All photometry must be **photopic**. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.~~

~~The luminaire may have an initial lumen value lower than the specified lumen range in the performance tables provided that the resulting calculations demonstrate that the performance requirements are being met.~~

~~IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 1~~
~~ROADWAY UNDERPASS LIGHTING~~
~~1 LANE~~

GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	16	(ft)
	Number of Lanes	4	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	15	(ft)
	Tilt	0-30	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge Of Pavement	12	(ft)
LUMINAIRE DATA	Lumens	10,000 — 13,500	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	40	(ft)
	Configuration	Single Sided	
	Luminaire Overhang over EOP	12	(ft)

~~NOTE:~~ Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS
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~~NOTE:~~ These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m ² (Max)
		1.2	Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1	(Max)
	Veiling Luminance Ratio, L_v/L_{AVE}	0.30:1	(Max)

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 2
ROADWAY UNDERPASS LIGHTING
2-LANE

GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	24	(ft)
	Number of Lanes	2	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	15	(ft)
	Tilt	0-30	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge-Of Pavement	12	(ft)
LUMINAIRE DATA	Lumens	10,000 — 13,500	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	35	(ft)
	Configuration	Single-Sided	
	Luminaire Overhang over EOP	-12	(ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m ² (Max)
		1.2	Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	—3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	—5:1	(Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1	(Max)

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 3
ROADWAY UNDERPASS LIGHTING
3 LANE

GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	36	(ft)
	Number of Lanes	3	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	15	(ft)
	Tilt	0-30	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge-Of Pavement	12	(ft)
LUMINAIRE DATA	Lumens	10,000 — 13,500	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	50	(ft)
	Configuration	Opposite	
	Luminaire Overhang over EOP	-12	(ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m ² (Max)
		1.2	Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	—3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	—5:1	(Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1	(Max)

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 4
ROADWAY UNDERPASS LIGHTING
4 LANE

GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	48	(ft)
	Number of Lanes	4	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	15	(ft)
	Tilt	0-15	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge-Of Pavement	12	(ft)
LUMINAIRE DATA	Lumens	10,000 — 13,500	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	45	(ft)
	Configuration	Opposite	
	Luminaire Overhang over EOP	-12	(ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS			
NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.			
ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m^2 (Max)
		1.2	Cd/m^2 (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	-3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	-5:1	(Max)
	Veiling Luminance Ratio, L_v/L_{AVE}	0.30:1	(Max)

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 5
ROADWAY UNDERPASS LIGHTING
5 LANE

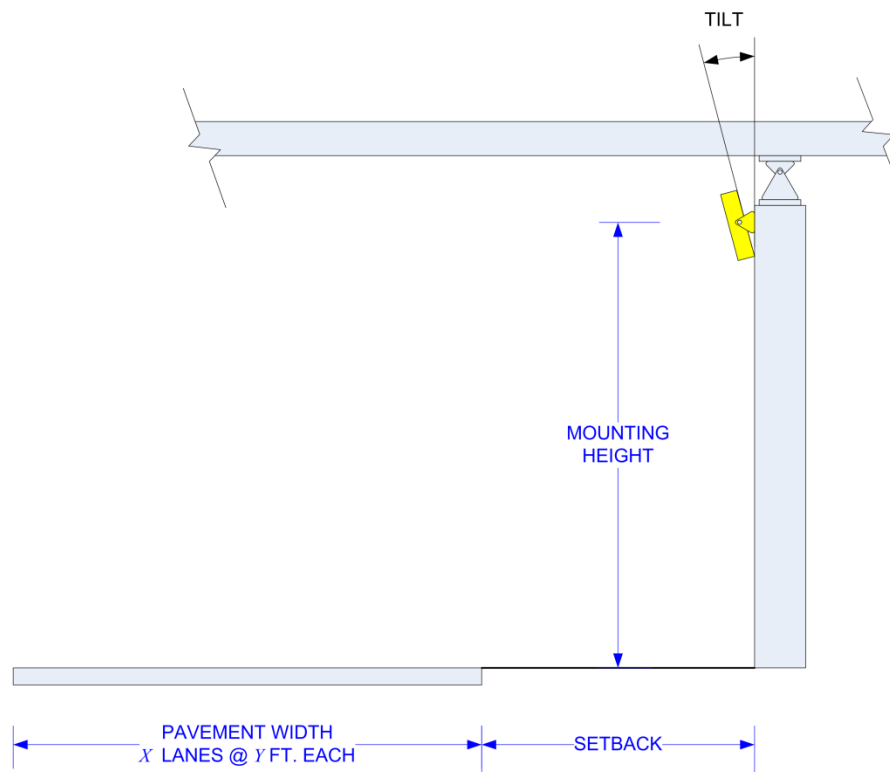
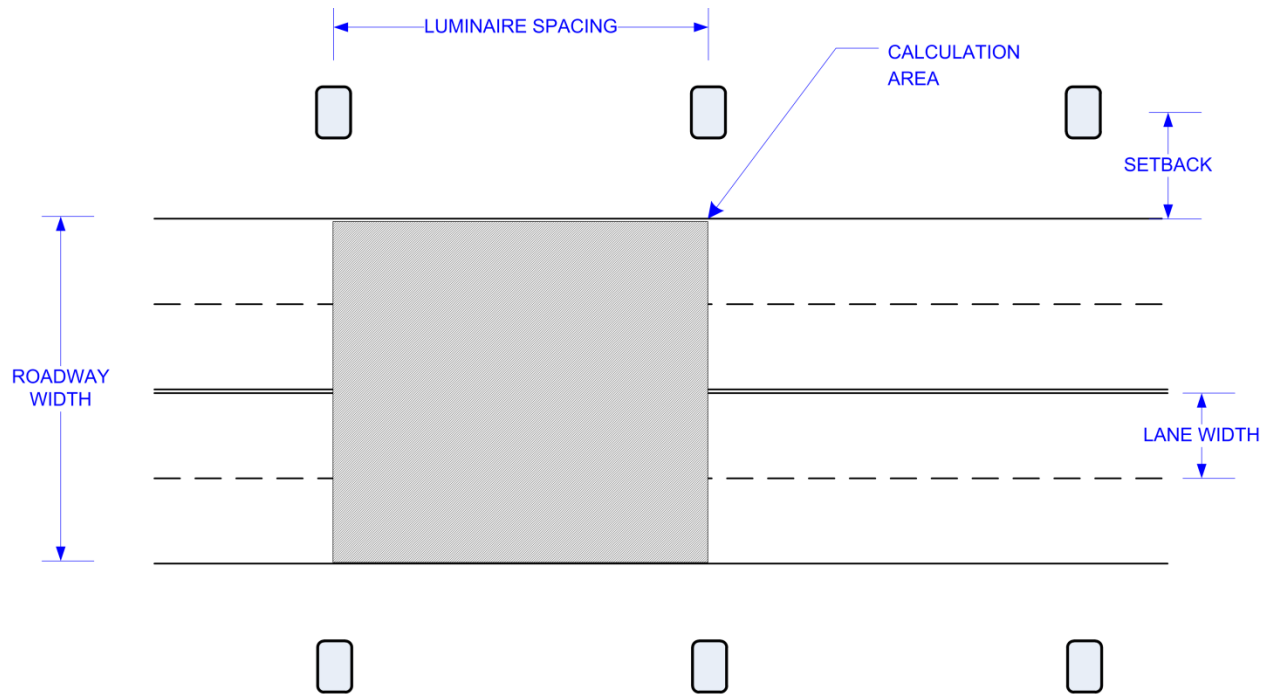
GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	60	(ft)
	Number of Lanes	5	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	15	(ft)
	Tilt	0-15	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge Of Pavement	12	(ft)
LUMINAIRE DATA	Lumens	10,000 — 13,500	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	40	(ft)
	Configuration	Opposite	
	Luminaire Overhang over EOP	-12	(ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m ² (Max)
		1.2	Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	—3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	—5:1	(Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1	(Max)



~~Independent Testing. When a contract has 30 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.~~

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

~~Testing is not required for temporary lighting luminaires.~~

~~The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead times and deadlines.~~

~~The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the district headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.~~

~~Alternative Selection Process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.~~

~~Luminaires shall be tested at a NVLAP accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire. The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.~~

~~The testing performed shall include photometric and electrical testing. All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.~~

~~Photometric testing shall be according to IES recommendations, performed with a goniophotometer and as a minimum shall yield an isofootcandle chart with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a~~

~~luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.~~

~~Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion, and LED drive current.~~

~~The summary report and the test results including IES photometric files shall be sent directly to the Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.~~

~~Photometric performance shall meet or exceed that of the specified values. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.~~

~~Should any of the tested luminaires of a given type and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance. In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety. The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table. Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time.~~

~~Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.~~

~~Installation. Each luminaire shall be installed according to the luminaire manufacturer's recommendations.~~

~~Underpass luminaires shall be either attached to structures (such as piers, etc.) or suspended from structures (such as bridge decks) as indicated or implied by the configuration on the plans. Mounting, including all hardware and appurtenant items, shall be included as part of this item. Luminaires shall be configured with the luminaire tilt as identified in the submitted documents.~~

~~Unless otherwise indicated, suspended underpass luminaires shall be installed 1 inch above the lowest underpass beam and shall be mounted using vibration dampening assemblies. All mounting hardware shall be corrosion resistant and shall be stainless steel unless otherwise indicated.~~

~~No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.~~

~~Luminaire wiring shall be provided with the luminaire. The wiring shall run from the junction box to the luminaire. Luminaire wire shall be sized No. 10, rated 600 V, RHW/USE 2, and have copper conductors, stranded in conformance with ASTM B 8. Luminaire wire shall be insulated with XLP~~

~~insulation. The wire shall include a phase, neutral, and green ground wire. Wires shall be trained within any raceways to avoid abrasion or damage to the insulation.~~

~~Included with the luminaire wiring shall be fusing located in the handhole or primary junction box. Fusing shall be according to Article 1065.01 with the exception that fuses shall be 6 amperes.~~

~~Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.~~

~~Warranty. The entire luminaire shall be covered by a ten-year warranty. Failure is when one or more of the following occur:~~

- ~~1) Negligible light output from more than 10% of the discrete LEDs.~~
- ~~2) Significant moisture that deteriorates performance of the luminaire.~~
- ~~3) Driver that continues to operate at a reduced output due to overheating.~~

~~The warranty period shall begin on the date of luminaire delivery. The Contractor shall verify that the Engineer has noted the delivery date in the daily diary. Copy of the shipment and delivery documentation shall be submitted.~~

~~The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.~~

~~Method of Measurement. The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation:~~

Designation Type	Minimum Initial Luminous Flux	Designation Type	Minimum Initial Luminous Flux
A	2,200	E	9,450
B	3,150	F	12,500
C	4,400	G	15,500
D	6,300	H	25,200

~~Where delivered, lumens is defined as the minimum initial delivered lumens at the specified color temperature. luminaires with an initial luminous flux less than the values listed in the above table will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.~~

~~Basis of Payment. This work will be paid for at the contract unit price per EACH for LUMINAIRE, LED, UNDERPASS, of the mount type and output designation specified.~~

it is to be installed for proper configuration. The camera's MAC address shall be clearly identified. After the switch is configured, the Contractor shall retrieve the switch from the TSC and install it.

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

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, and software/firmware version numbers in hardcopy and PDF formats on CDROM.

Measurement. CCTV dome cameras shall be counted as each upon successful completion of the testing described herein for payment.

Basis of Payment. This item will be paid for at the contract unit price per EACH for CLOSED CIRCUIT TELEVISION DOME CAMERA, HD, which shall be payment in full for all material and work as specified herein.

CABINET, MODEL 334

~~Description. This work shall consist of furnishing and installing a ground-mounted model 334 cabinet at locations as shown in the plans. The cabinet shall be used to house CCTV camera, any associated Ethernet switches, and other communications devices/infrastructure as shown on the plans. The furnishing and installation of CCTV camera equipment shall be paid for separately.~~

Materials

~~Cabinet Components. The housing shall be rainproof with the top of the enclosure crowned to prevent standing water. All exterior seams for the enclosure and doors shall be continuously welded and shall be smooth. The housing shall have no provisions for a police panel or door.~~

~~The cabinet shall have single front and rear doors, each equipped with a Corbin # 2 lock. The enclosure door frames shall be double flanged out on all four sides and shall have strikers to hold tension on and form a firm seal between the door gasketing and the frame. The front and rear doors shall be provided with catches to hold the door open at both 90 and 180 +/- 10°. Gasketing shall be provided on all door openings and shall be dust tight. For horizontal support and bolt attachment, cage bottom support mounting angles shall be provided on either side, level with the bottom edge of the door.~~

~~The latching handles on the doors shall have provisions for padlocking in the closed position. When the door is closed and latched, the door shall be locked. The locks and handles shall be on the right side of the front door and the left side of the rear door. The lock and lock support shall be rigidly mounted to the door. The locks shall be Corbin #2, and two keys shall be supplied to the Department with each lock. The keys shall be removable in the locked position only.~~

~~The front and rear doors shall be provided with louvered vents. A removable and reusable air filter shall be housed behind the door vents. The filter filtration area shall cover the vent opening area,~~

~~and the filter shell shall be provided so that it fits over the filter providing mechanical support for the filter. The shell shall be louvered to direct the incoming air downward.~~

~~The intake (including filter with shell) and exhaust areas shall pass a minimum of 60 cubic feet of air per minute for housing #1 and 26 cubic feet of air per minute for housing #2. The thermostatically controlled fan with ball or roller bearings shall be mounted within the housing and vented. The fan shall provide a capacity of at least 150 cubic feet of free air delivery per minute of ventilation. The fan shall be thermostatically controlled and activated when the temperature inside the cabinet exceeds 75° F and shut off when the temperature is less than 64°F. In addition, the fan shall be manually adjustable for automatic turn-on and off. The fan circuit shall be protected at 125% of the fan motor ampacity.~~

~~All subassemblies shall be mounted in removable 19 in. EIA self-standing rack assemblies. The EIA rack portion of the cage shall consist of two pairs of continuous, adjustable equipment mounting angles that comply with Standard EIA RS-310-B. The cage shall be centered within the cabinet and bolted to the cabinet at four points.~~

~~Each cabinet shall be equipped with two shelves. Shelves shall be the full width of the rack and 12 in. deep. The shelves shall be designed to support a minimum of 50 lbs.~~

~~The power distribution assembly shall be as shown in plans and shall consist of input files that are common to both model 332 and 336 type cabinets and provide 9 AC outputs and up to 28 isolated inputs. The power distribution assembly for cabinets not at DMS locations shall consist of the following: one 30A, 120V main circuit breaker; three 15A, 120V single pole secondary circuit breakers; eight standard 117 VAC controller and equipment receptacles; and one duplex, 3-prong, NEMA GF1 type 5-15R grounded utility type outlet. Cabinets at DMS locations shall be provided with one 60A, 240V, two pole main circuit breaker, one 40A, 240V, two pole secondary breaker, three 15A, 120V single pole secondary circuit breakers, eight standard controller and equipment receptacles, and one duplex GFI outlet.~~

~~Rating of breakers shall be shown on the face of breaker or handle. Breaker function shall also be labeled below breakers on front panel. The first equipment receptacle in the circuit shall have ground fault circuit interruption as defined in the NEC. Circuit interruption shall occur on 6 mA of ground fault current. All conductors from the power distribution assembly routed to the cabinet wiring shall be connected to the terminal block on the common side, except for the AC power conductor between the service terminal block and main circuit breaker. All internal conductors terminating at the blocks shall be connected to the other side of the blocks.~~

~~Two side panels shall be provided and mounted on the cabinet sidewalls. In viewing from the front door, the left side panel shall be designated as the "Input/Communications", and the right side panel shall be designated as the "Service Panel". The panel shall be drilled and tapped, as necessary, to mount the terminal blocks and other attachments described herein, as well as to mount the panel to the cabinet wall.~~

~~The terminal blocks shall be barrier type rated at 20 A 600 V RMS minimum. The terminal screws shall be nickel-plated brass binder head type with screw inserts of same material. The terminals of the power line service terminal block shall be labeled "AC+", "AC-", and "AC GND", and shall be covered with a clear insulating material to prevent inadvertent contact. Terminating lugs large enough to accommodate No. 2 conductors shall be furnished for the service terminal block. The terminal block shall be rated for 50 A at 600 V peak, minimum.~~

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~~Distribution power distribution assembly shall also protect the equipment powered by the assembly from power transients. Over voltage protection shall be provided for the power distribution assembly and shall contain, as a minimum, a surge arrester, which shall reduce the effect of power line voltage transients and be mounted to the service panel. The arrester shall have the following minimum features:~~

Recurrent Peak Voltage:	184 V
Energy Rating (Minimum):	50 J
Power Dissipation, Average:	0.85 W
Peak Current for pulses less than 7 microseconds:	1250 A
Stand-by Current for 60 Hz Sinusoidal:	1mA or less

~~Each cabinet shall be equipped with one LED lighting fixture mounted to the inside top front portion of the cabinet. The fixture shall have a cool white color. A door activated switch shall be installed to turn the cabinet light on when the front door is opened. The door switch shall be on a separate circuit by itself and used only to turn on the cabinet light.~~

~~Each cabinet shall be supplied with a heavy duty plastic envelope to store plans, wiring diagrams, schematics, etc. This envelope shall have metal grommets so that it hangs from the door hooks. The envelope shall have minimum dimensions of 10 in. x 15 in.~~

~~Foundations shall conform to those shown in the plans. The foundation is paid for separately.~~

~~Identification. The cabinet, model 334 shall be identified and labeled with external markings as specified in Article 1069.06 of the Standard Specifications and as shown in the plans.~~

~~Construction Requirements. The Contractor shall deliver the cabinet model 334 mounted on a plywood shipping pallet that is bolted to the cabinet base. The cabinet shall be enclosed in a slipcover cardboard packaging shell. The housing doors shall be blocked to prevent movement during transportation to the site.~~

~~The Contractor shall securely fasten the cabinet model 334 on the new concrete foundation at the locations shown in the plans. The Contractor shall confirm the orientation of the cabinet model 334 installation and its front door side with the Engineer prior to installation. Stainless steel bolted connections shall be provided with lock washers, locking nuts, or other approved means to prevent the connection nuts from backing off. Dissimilar materials shall be isolated from one another by stainless steel fittings.~~

~~The Contractor shall make all power connections to the cabinet in accordance with the plans and as required. The neutral bus shall be isolated from the cabinet and equipment ground. It shall terminate at the neutral lug ultimately attached to the meter pedestal. All conductors used in cabinet wiring shall terminate with properly sized non-insulated (if used, for DC logic only) or clear insulated spring spade type terminals except when soldered to a through panel solder lug on the rear side of the terminal block or as specified otherwise. All conductors, except those which can be readily traced, shall be labeled. Labels attached to each end of the conductor shall identify the destination of the other end of the conductor. Cabling shall be routed to prevent conductors from being in contact with metal edges. Cabling shall be arranged so that any removable assembly may be removed without disturbing conductors not associated with that assembly.~~

~~All equipment in the cabinet, when required, shall be clearly and permanently labeled using marker strips. The marker strips shall be made of material that can be easily and legibly written on using a pencil or ballpoint pen. Marker strips shall be located immediately below the item that they are to identify and must be clearly visible with the items installed.~~

Testing

~~Cabinet Acceptance Test— in addition to the environmental and design approval tests specified in the FHWA Type 170 Traffic Signal control System Hardware Specification, the following water spray test shall be performed for each type of cabinet:~~

~~Spray water from a point directly overhead at an angle of 60° from the vertical axis of the cabinet. Repeat for each of eight equally spaced positions around the cabinet for a period of five minutes in each position. The water shall be sprayed using a domestic type sprinkling nozzle at a rate of no less than 10 gal./min per square foot of surface area. The cabinet shall then be inspected for leakage. Evidence of water leakage shall be cause for rejection.~~

~~Operational Standalone Test: The operational standalone test for each cabinet, model 334 installed shall consist of the following:~~

- ~~• Visual inspection of the cabinet and its contents for workmanship~~
- ~~• Verification of the cabinet grounding in accordance with Article 1074.03 (a)(4) of the Standard Specifications~~
- ~~• Measurement of the voltage at the input panel~~

~~Documentation. Shop drawings and wiring lists showing the proposed layout of each type of cabinet shall be submitted to the Engineer for approval prior to the start of fabrication. Wiring lists for the internal manufacturer cut sheets for all electrical equipment included in each type of cabinet shall be included in the submission.~~

~~Four copies of drawings showing the wiring for each cabinet shall be provided. One copy shall be placed in the clear plastic envelope furnished as part of the cabinet. The other three copies shall be delivered to the Engineer.~~

~~For each cabinet, four copies of a configuration of the equipment reporting to that cabinet shall be provided. The sheet shall also list field-settable options for the equipment contained in the cabinet. This shall include device addresses and output voltage settings for power supplies. One of these copies shall be placed in the clear plastic envelope furnished as part of the cabinet. The other three copies shall be delivered to the Engineer.~~

~~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. The warranty shall warrant and guarantee repair of the component parts of the cabinet model 334 furnished by the Contractor that prove to be defective in workmanship and materials during the first two years of operation as defined and noted above at no additional cost to the Department.~~

~~The Engineer will notify the Contractor that a warranted item needs repair. The Contractor shall acknowledge the notification within 24 hours and replace or correct any part or parts of materials and equipment that are found defective within the two year in service warranty period. All items needing repair shall be returned to the Department in two weeks from the date of receipt at the Contractor's facility or replaced in kind by the Contractor, and the Contractor shall be responsible for any return shipping costs. No compensation will be made to the Contractor for such replacements or corrections.~~

~~The Contractor shall provide a warranty certificate for this item and its related components to the Department. The Department reserves the right to transfer this service to other parties who may be contracted with to provide overall maintenance of this item.~~

~~Method of Payment This work will be measured for payment per each cabinet, model 334.~~

~~Basis of Payment. This work will be paid for at the contract unit price per EACH for CABINET, MODEL 334.~~

ROD AND CLEAN EXISTING CONDUIT

Description. This work will consist of inserting a duct rod, electrical fish rod, or tape of sufficient length and rigidity into an electrical conduit opening in one electrical manhole, junction box, or handhole and pushing the said rod through the conduit to emerge at the next or subsequent manhole, junction box, or handhole 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, 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 included in the work of rodding and cleaning the conduit.

Any manhole which, in the opinion of the Engineer, contains excessive debris, dirt, or other materials to the extent that conduit rodding and cleaning is not feasible will be cleaned at the Engineer's order and will be paid for separately.

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.

Method of Measurement. This work will be measured per lineal foot for each conduit cleaned. Measurements will be made from point to point horizontally. No vertical rises will count in the measurement.

Basis of Payment. This work will be paid for at the contract unit price per FOOT for ROD AND CLEAN EXISTING CONDUIT. Such price will include the furnishing of all necessary tools, equipment, and polyethylene line as required to prepare a conduit for the installation of cable. When the number of cables to be installed requires the use of more than one conduit in the same run, each additional conduit required will be rodded and cleaned as a separate unit and paid for at the contract unit price.

~~CLOSED CIRCUIT TELEVISION (CCTV) EQUIPMENT – FIBER OPTIC DISTRIBUTION~~

~~Description. This item shall consist of furnishing and installing equipment for the control and distribution of CCTV video from the CCTV camera to and at a video collection point (VCP). Transmission for the video and control signals shall be by fiber optic cable as specified elsewhere herein and as indicated in the plans.~~

~~Construction Requirements. The Contractor shall prepare and submit a shop drawing detailing the complete closed-circuit television cabinet 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.~~

~~The Contractor shall demonstrate a pre-installation assembly using the proposed components. This demonstration shall take place at the D1 headquarters in Schaumburg. These conformance tests shall be completed prior to the delivery of any completed assemblies to the project site. Any deviations from these specifications that are identified during this testing shall be corrected prior to shipment of the assembly to the project site.~~

~~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 the appropriate power, communication, and video feed cables.~~

~~Testing. The Contractor shall test each installed CCTV cabinet equipment. The test shall be conducted from the field cabinet utilizing 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 repeat the test at the communications shelter associated with the CCTV camera. This test confirms the distribution portion of the video circuit, that is, the portion of the circuit from the CCTV camera to the network switch.~~

~~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 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.~~

~~Equipment Installation. The installation and mounting of the CCTV equipment shall be fully coordinated with the enclosure or co-location.~~

~~Co-location of CCTV Equipment. The CCTV equipment maybe co-located within a traffic signal controller, or other equipment as indicated. The equipment shall be securely mounted on a mounting back panel or on a corrosion resistant DIN rail system.~~

~~Closed Circuit Television Camera Power Supply. The power supply, as required, as specified elsewhere herein and as indicated in the plans, shall be placed in the cabinet. The power supply is included in the Closed Circuit Dome Television Camera, HD pay item.~~

~~Ethernet Managed Switch. The Ethernet managed switch, as specified elsewhere herein and as indicated in the plans, shall be placed in the cabinet.~~

~~Network (IP Video) SPD. The network (IP video) SPD shall be modular in design to support multiple installation options e.g. stand alone or DIN rail mounting configuration. SPD shall be a single port unit to support industrial 1000/100/10 base-T Ethernet and POE applications. SPD shall support shielded RJ45 connectors and comply with UL497B listed. SPD shall comply with the following standards: TIA/EIA-568-B.2-1, IEEE 802.3ab, IEEE 803.3af, and IEEE 803.3at.~~

~~Fiber Optic Cable Termination. The Contractor shall include all necessary wires and cables necessary to interconnect the components of the CCTV cabinet. The Contractor shall provide a factory terminated patch block with a 12 fiber pigtail of sufficient length to connect to the lateral splice handhole without the use of any intermediate splices. The patch block shall be a Fiber Connections, Gator Patch II or approved equal.~~

~~Method of Measurement. CCTV equipment shall be counted per each CCTV unit installed.~~

~~Basis of Payment. This item will be paid for at the contract unit price per EACH for CLOSED CIRCUIT TELEVISION EQUIPMENT, FIBER OPTIC DISTRIBUTION.~~

BUDGETARY ALLOWANCE FOR CCTV INTEGRATION

Description. This item is to establish a budget account to allocate funds for the payment of the video integration. A budgetary allowance has been established since 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 allowance under this special provision includes the coordination with camera equipment provided under this contract, adjacent contract(s), and coordination with existing CCTV equipment as indicated, including adjustments of or supplements to the equipment as may be required

Video Control Software. The existing control software is ICX's 360 Cameleon Enterprise camera control. Included in this item, the Contractor shall provide 10 Enterprise software license units. The Contractor shall configure the cameras within the video control software. This work shall be coordinated with the electrical maintenance contractor.

Provisioning of IP Routing and Switching Equipment. The Contractor shall fully integrate all the equipment to be installed with the existing video distribution system as a part of this item, and this coordination will require technical services of the existing system integrator, AT&T, a Cisco Systems Integrator (Contact: Jim Patterson, AT&T, 217.801.2329) and coordination with the District 1 electrical maintenance contractor. This work shall be included in the item and will not be paid for separately.

This item shall be bid at a price of \$30,000.00.

Basis of Payment. This work will be paid for at the contract unit price per LUMP SUM for BUDGETARY ALLOWANCE FOR CCTV INTEGRATION, which shall include all work as described herein.

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

~~Description.~~ This item shall consist of the construction of a reinforced concrete foundation, of the dimensions indicated, complete with raceways. The foundation depth shall be as indicated in the Foundation Depth Table on the plans (where applicable) or as otherwise shown on the contract drawings 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 when such work is not provided under other paid items.

~~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 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.~~ 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, using a pocket penetrometer and will establish foundation depth based upon the Foundation Depth Table shown on the plans, where applicable.

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 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 augered hole so that at the time of pouring the 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.

Method of Measurement. ~~The foundation shall be measured for payment in feet of the foundation in place, in accordance with the total length of concrete pier required, indicated as foundation depth, in the Foundation Depth Table on the plans and as directed by the Engineer, i.e., extra foundation depth, beyond the directive of the Engineer, will not be measured for payment. Where extension above grade is required, this distance shall be measured for payment.~~

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, which shall be payment in full for the work as shown on the drawings and described herein.~~

~~CCTV CAMERA STRUCTURE, GALVANIZED STEEL, 80 FT MOUNTING HEIGHT~~

Description. ~~This work shall consist of furnishing 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.~~

~~Shaft: 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 detail drawings~~

Materials. ~~Materials shall be as specified elsewhere herein.~~

Deflection. ~~The design of the structure shaft shall achieve a maximum, fully loaded deflection at the top of the structure, which is no greater than 1 inch~~

Submittals and Certifications. ~~The design shall be based upon AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" current at the time the project is advertised with the following exception; the Illinois Department of Transportation waives the requirements of Chapter 5, Section 5.14.6.2 — Reinforced Holes and Cutouts for high mast lighting towers. The pole shall be designed for use with a single or dual 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 camera structure 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~~

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~~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.~~

~~Shaft. The pole shall be a maximum of three 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 bottom section shall have a minimum .3125 wall thickness and a minimum diameter of 23". The three shafts sections shall taper at a rate of .14" per foot and have an overall height of 80'. The pole base plate shall meet the requirements of ASTM A572 or A1011 and be arranged to accommodate four 1 1/2" x 54" x 6" anchor bolts on a 27" bolt circle. Anchor rods shall conform to ASTM F1554 gr. 55.~~

~~The pole assembly shall be equipped with a 6" x 27" reinforced handhole opening with a three gauge cover and shall be attached with four 1/4" 20 hex head stainless steel screws. 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 handhole 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 1" I.D. eye rings for power and communication cables are required as shown on the drawing. Two shall be located 38" up from the bottom, two located 6" below the top of the bottom shaft and two 6" below the top of the center shaft.~~

~~There shall be a 3 1/2" schedule 40 (4" O.D.) 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 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.~~

~~Camera Lowering Device. The camera lowering system shall be designed to support and lower a HD closed circuit television camera, lens, housing, PTZ mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations. The~~

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~~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, suspension contact unit, divided support arm, and a pole adapter for attachment to a pole top tenon, pole top junction box, conduit mount adapter, and camera connection box. The divided support arm and receiver brackets shall be designed to self-align the contact unit with the pole center line during installation and ensure 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 100mph with a 30% 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 three years of experience in the successful manufacturing of camera lowering systems. The lowering device provider shall be able to identify a minimum of three previous projects where the purposed system has been installed successfully for over a one-year period of time each.~~

~~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 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.~~

~~Suspension Contact Unit. The suspension contact unit shall have a load capacity 200 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 two 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. The contact unit housing shall be weatherproof with a gasket provided to seal the interior from dust and moisture.~~

~~The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or video/Ethernet 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 PVC conduit and be located just below the cable stop block at the back of the lowering device. 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 female and male socket contact halves of the connector block 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 camera specified elsewhere herein.~~

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

~~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 connector 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 raintight seal when mated. The facility manufacturing the electrical contact connector must comply with Mil Spec Q-9858 and Mil Spec I-45208.~~

~~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 State 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.~~

~~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.~~

~~Materials. 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 seven strands of 19 wire each.~~

~~All electrical connections between the fixed and lowerable portion of the contact block shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The electrical connections between the fixed and movable lowering device components~~

~~shall be designed to conduct high frequency data bits as well as the power requirements for operation of dome environmental controls.~~

~~The interface and locking components shall be made of stainless steel 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 manufacturer shall provide weights and /or counterweights as necessary to ensure that the alignment of pins and connectors is 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.~~

~~Shipment and Installation. The structure, camera lowering device, etc., and hardware shall be packaged during shipment to protect all surfaces from being scratched, marred, chipped, or damaged in any way. Prior to installation, the structure and all its components will be inspected by the Engineer and any parts found to be damaged or defective shall be replaced. Any minor damage shall be touched up in a professional manner as approved by the structure manufacturer.~~

~~The structure shall be set plumb on the foundation and fastened to the anchor rods with double nuts and washers. Flat washers shall be installed below and above the base plate of the pole. Locknuts with nylon or steel inserts shall be installed on top of the top nut. The nuts shall be tightened in compliance with torque specifications recommended by the manufacturer of the structure.~~

~~The space between the finished top of the foundation and the bottom of the base plate of the structure shall be enclosed with an expanded metal screen made of stainless steel. The size of the mesh of the screen shall be 1/4 in. or less and #18 gauge thick, or heavier as approved by the Engineer. The screen shall be held in place with a stainless steel band installed around the tower base plate. The band shall be held tight by a ratchet-type device. Grouting shall not be used to enclose the above described space.~~

~~The structure shall be straight and centered on its longitudinal axis, under no-wind conditions, so, when examined with a transit from any direction, the deviation from the normal shall not exceed 1/8 in. in 3 ft within any 5 ft of height, with total deviation not to exceed 3 in. from the vertical axis through the center of the structure base.~~

~~The camera position and orientation shall be confirmed and approved by the Engineer. In general, the camera shall be oriented perpendicular to the main roadway. Installation of the lowering device and camera shall be included as a part of this item and shall not be paid for separately.~~

~~Method of Measurement. CCTV camera structures shall be counted per each with all appurtenances installed.~~

~~Basis of Payment. This item will be paid at the contract unit price per EACH for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, GALVANIZED STEEL, 80 FT. MOUNTING HEIGHT.~~

REMOVAL OF EXISTING LUMINAIRE

Effective: January 1, 2023

Description. This work shall consist of disconnecting, removing, disposing of, or packaging and transporting to a storage facility within District 1 an existing luminaire, either roadway, high mast, underpass or tunnel as specified herein and as directed by the Engineer.

Construction Requirements Prior to the removal of any equipment, the Contractor shall arrange an inventory inspection with the Engineer.

No removal work shall be permitted without approval from the Engineer.

Any damage resulting from the removal and/or transportation of the luminaires, shall be repaired to its original condition, or replace kind, at the Contractor's own expense, to the satisfaction of the Engineer. The Engineer shall be the sole judge to determine the extent of damage.

Luminaires shall be removed, boxed in new containers, approved by the Engineer, and delivered to a storage facility within District 1, as designated by the Engineer.

Lamps shall not be removed from the luminaires if they are being salvaged.

Packaging. The luminaires shall be individually boxed with internal bracing (corner board) to prevent the boxes being crushed when stacked. The boxes shall be sized to minimize the movement of the luminaires. The boxes shall then be palletized to facilitate transportation and storage. The pallet shall be shrink wrapped to prevent movement of the boxes.

The quantity of luminaires shall be coordinated with the Engineer to facilitate transportation and storage.

Method Of Measurement. Each luminaire which is removed and disposed of or delivered to storage shall be counted as a unit for payment.

Basis Of Payment. This work will be paid for at the contract unit price per EACH for REMOVAL OF LUMINAIRE, SALVAGE or REMOVAL OF LUMINAIRE, NO SALVAGE.

ETHERNET SWITCH

~~Description. This work shall consist of furnishing, installing, integrating, and testing an environmentally hardened layer III Ethernet switch. Switch shall be a Cisco IE 3400-8TS2 (with IE 3300-8S expansion module) or approved equivalent. Contractor shall provide Ethernet switches with all necessary hardware and software to make the switches operational and be compatible with IDOT's existing network. 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.~~

~~Materials.~~

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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~~

~~(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) Base Module
 - ~~(i) (8) 10/100/1000-Mbps copper Ethernet ports, RJ-45 connector~~
 - ~~(ii) (2) 100/1000-Mbps SFP ports with SM transceivers, LC connector~~~~
 - ~~(b) Expansion Module~~

- ~~(i) (8) 100/1000 Mbps SFP ports (with SM transceivers as required per Drawings, 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. Each switch shall be furnished with two GLC-LX-SM-RGD (or approved equivalent) SFP transceivers.~~
- ~~(3) All ports shall have diagnostic LED. These indicators shall include link, activity, and power LEDs.~~

Construction Requirements

~~Installation. Contractor shall locate shelf space or other suitable mounting location in the building or cabinet or as identified in the Drawings. Contractor shall secure the Ethernet switch as appropriate and approved by the Engineer.~~

~~Contractor shall install all necessary patch cords, optical transceivers, connectors, power supplies, communication transformers, or auxiliary equipment necessary to complete the communication circuits. Contractor shall connect the switch to the field devices as indicated in the Drawings.~~

~~Configuration. When requested by Contractor, the Engineer will provide the necessary IP address assignments and port assignments, including the necessary port provisioning. Contractor shall be responsible for all network programming of the switches and communicating elements within the building or cabinet.~~

~~Contractor shall configure switch ports for VLANs as shown in the drawings or directed by the Engineer. 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, 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. Contractor shall configure ACLs and work with the Department to determine IP Ranges, ports, and other settings to be used in configuring the ACLs.~~

~~The Department may elect to have its network administrator configure all network switches. If the Department makes this election, Contractor shall deliver all switches to the Department for configuration prior to installation. Contractor shall request a meeting with the Department's network administrator within two weeks from notice to proceed to determine the Department's preferred approach to switch configuration.~~

~~Method of Payment. This work will be measured for payment by each layer III (network) switch installed, configured, and tested.~~

~~Basis of Payment. This work will be paid for at the contract unit price per EACH for LAYER III (NETWORK) SWITCH.~~

In addition to the GPS documentation requirements in the General Electrical Provisions, the Contractor shall locate the microduct every 200' feet using a GIS locating device that is accurate to the nearest foot. All coordinates shall be in decimal degrees with the datum used identified.

The Contractor shall submit catalog cut sheets for the microduct system, splice kits, and all installation and testing documents to the Department for review prior to ordering.

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 microduct system between ends and changes in direction.

Vertical measurement of the duct shall be as follows. For runs terminating at junction boxes, the vertical measurement will be made from the bottom of the trench, or horizontal raceway, to a point 12 inches beyond the center of the junction box or control cabinet.

Basis of Payment. This work will be paid for at the contract unit price per FOOT for UNDERGROUND CONDUIT, MULTI-DUCT, of the number specified, 18MM MICRODUCTS.

FIBER OPTIC CABLE, SINGLE MODE

Effective: September 1, 2024

Description. The Contractor shall furnish and install loose-tube, single-mode, fiber optic cable of the number of fibers specified as shown in the plans and as directed by the Engineer. Other ancillary components, required to complete the fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

Materials 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.

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."

Physical Construction			
Requirement		Units	Value
Cladding Diameter		(μm)	125.0 ± 0.7
Core-to-Cladding Concentricity		(μm)	≤ 0.5
Cladding Non-Circularity			$\leq 0.7 \%$
Mode Field Diameter	1310 nm	(μm)	9.2 ± 0.4
	1550 nm		10.4 ± 0.5
Coating Diameter		(μm)	245 ± 5
Colored Fiber Nominal Diameter		(μm)	253 - 259
Fiber Curl radius of curvature		(m)	$> 4.0 \text{ m}$

Optical Characteristics				
Requirement			Units	Value
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
Cable Cutoff Wavelength (λ _{ccf})			(nm)	< 1260
Zero Dispersion Wavelength (λ _o)			(nm)	1302 ≤ λ _o ≤ 1322
Zero Dispersion Slope (S _o)			(ps/(nm²•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 ⁻²)	≤ 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 3.0 mm. 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." Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

For cables containing more than 12 buffer tubes, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed

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in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

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 2.5 mm or 3.0 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-swellaable yarn for water-blocking protection. The water-swellaable 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.

Water swellaable yarn(s) shall be applied longitudinally along the central member during stranding.

Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

For single layer cables, a water swellaable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water swellaable tape shall be applied longitudinally over both the inner and outer layer. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

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 dielectric yarns shall be helically stranded evenly around the cable core.

The cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members (as required) and water swellable tape. 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.

Fiber optic cables for 12 fibers used a lateral cable shall have a corrugated armored sheath.

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 2700 N during installation (short term) and 890 N 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 -30°C to +70°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 125 lbf/in applied uniformly over the length of the sample. The 125 lbf/in load shall be applied at a rate of 0.1 in per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 63 lbf/in. Alternatively, it is acceptable to remove the 125 lbf/in load entirely and apply the 63 lbf/in load within five minutes at a rate of 0.1 in per minute. The 63 lbf/in load shall be maintained for a

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period of 10 minutes. Attenuation measurements shall be performed before release of the 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 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 ten 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 ten 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 ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°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
 - a: Top (inside end of cable)
 - b: 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 specified requirements under the following conditions:

- Shipping/storage temperature: -58° F to +158° F
- Installation temperature: -22° F to +158° F
- Operating temperature: -40° F to +158° F
- Relative humidity from 0% to 95%, non-condensing

Optical Patch Cords and Pigtails. The optical patch cords and pigtails shall comply with the following:

- The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the optical patch cords and pigtails shall meet or exceed the requirements for approved connectors specified herein.

- The fiber portion of each patch cord and pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this contract.
- The twelve fiber single-mode fiber optic cable shall be installed as a pigtail with factory installed ST compatible connectors.
- The patch cords shall comply with Telcordia GR-326-CORE

Connectors. The optical connectors shall comply with the following:

- All connectors shall be factory installed ST compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- All fibers shall be connectorized at each end.
- All fibers shall terminate at a fiber patch panel
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. Pigtails shall be one meter in length.

Construction Requirements

Experience Requirements. 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 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 in Raceways.. 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 responsible for 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 reaches 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.

Armored fiber optic cables shall be grounded as shown on the plans.

Tracer Wire. Tracer wire shall be paid for separately and installed with all fiber optic cable runs as specified for Tracer Wire.

Aerial Fiber Optic Cable. Aerial fiber optic cable assemblies shall be of a self-supporting figure-8 design. The fiber optic cable shall be as described herein and shall be waterblocked utilizing water-swellaable materials. The cable assembly shall be designed and manufactured to facilitate midspan access.

The submittal information must include a copy of the standard installation instructions for the proposed cable. Installed cable sag shall not exceed 1% of the span distance. The submittal information must also include catalog cuts for all hardware to be utilized in the installation.

Construction Documentation Requirements

Installation Practices for Outdoor Fiber Optic Cable Systems. 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 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.

Operation and Maintenance Documentation. After the fiber optic cable plant has been installed, ten complete sets of operation and maintenance documentation shall be provided. The documentation shall, as a minimum, include the following:

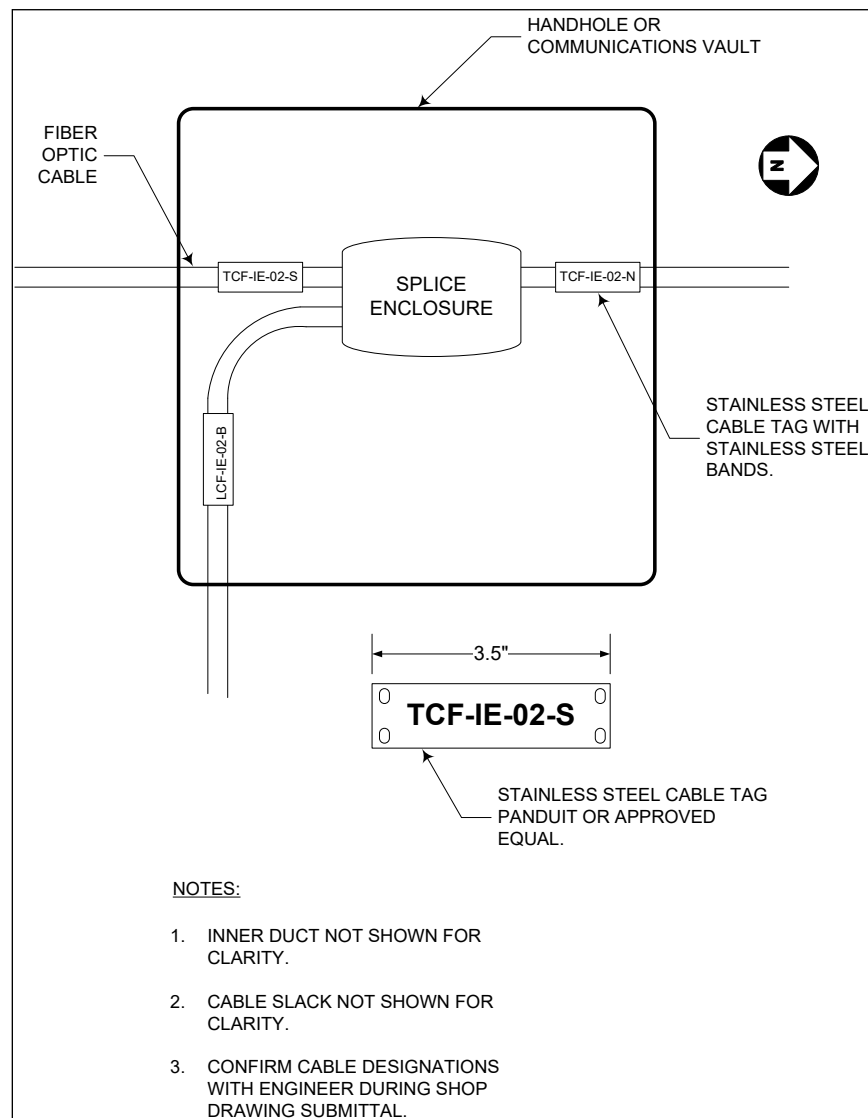
- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- Final copies of all approved test procedures
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
- Complete parts list including names of vendors.

Testing Requirements. The Contractor shall submit detailed test procedures for approval by the Engineer as specified in the General Electrical Provisions.

Splicing Requirements. Splices shall be made at locations shown on the plans. Any other splices shall be permitted only with the approval of the Engineer. Splices will be paid for separately. All splice locations must be identified in the record drawings. Cable runs which dead-end at a handhole, communications vault, interconnect cabinet, or any other type of enclosure, shall be dead ended in a splice enclosure.

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. See figure below:



Label the destination of each trunk cable onto the cable in each handhole, vault or cable termination panel.

Method of Measurement Fiber optic cable will be measured for payment in feet in place installed and tested. Fiber optic cable will be measured horizontally and vertically between the changes in direction, including slack cable. The entire lengths of cables installed in buildings will be measured for payment

Basis of Payment This work will be paid for at the contract unit price per FOOT for FIBER OPTIC CABLE of the number of fibers, SINGLE MODE; or FIBER OPTIC CABLE ARMORED of the number of fibers, SINGLE MODE specified. Payment shall not be made until the cable is installed, spliced, and tested in compliance with these special provisions.

FIBER OPTIC SPLICE

Effective: June 1, 2014

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.~~

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 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 0 and 100°F. 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 0 and 100°F. The test shall be performed after stabilizing the closure at the required temperature for a minimum of two hours. The test fixture shall consist of 20-lb cylindrical steel impacting head with a 2 in. spherical radius at the point where it contacts the closure. It shall be dropped from a height of 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~~

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~~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 10 ft water head from intruding into the splice compartment for a period of seven days. Testing of the splice closure is to be accomplished by placing 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 to 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 ensure that either the manufacturer, or an independent testing laboratory, has performed all 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. This loss shall not exceed 0.1 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 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 work will be paid at the contract unit price per 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.~~

FIBER OPTIC UTILITY MARKER

~~Description. This work shall consist of installing a fiber optic utility marker post.~~

~~Materials. Fiber optic utility marker posts shall be made of non-conductive high-density polymer. IDOT marker posts shall be white in color with an orange cap with black graphic and lettering on two sides. Third party markers shall be integrally orange in color with an orange cap with black graphic and lettering on two sides. Lettering on the IDOT markers shall read "IDOT DISTRICT 1 847-704-4611". Lettering on third party markers shall be as directed by the Engineer in coordination with District 1 and the IDOT Office of Planning and Programming. All colors shall be stabilized against ultraviolet light such that they will not fade under continuous exposure to direct sunlight. The marker shall retain dimensional stability in temperatures ranging between -40°F and 175°F. Each post shall be able to withstand a single vehicle impact at 45 MPH and return to within 10 degrees of vertical within 60 seconds.~~

~~Installation. Fiber optic utility marker posts shall be installed along the path of duct installation between communications vaults at a maximum spacing of 500 feet and changes in direction. For sections where IDOT and third party duct conduit are installed in a common trench, separate fiber optic utility marker posts shall be installed, one for IDOT and one for third party.~~

~~Method of Measurement. This work will be measured for payment in units of each.~~

~~Basis of Payment. This work will be paid for at the contract unit price per EACH for FIBER OPTIC UTILITY MARKER.~~

FIBER OPTIC CABLE INNERDUCT

Effective: October 1, 2014

Description. This item shall consist of furnishing, installing, splicing, connecting and demonstrating continuity of fiber optic cable innerduct of sizes specified herein and as shown on the contract drawings. The innerduct shall be high density polyethylene.

Materials. 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.)
4"	4.030"	4.315"	0.120"	14"	500	19
4.25"	4.313"	4.660"	0.151"	17"	750	31
4.5"	4.506"	4.900"	0.173"	19"	1000	40
2"	4.885"	2.375"	0.216"	24"	1600	60

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

Installation:

Pulling Tension. Pulling tension of the duct shall be monitored throughout the pull and pulling tension shall not exceed those listed in the table or the specific manufacturer maximum pulling tensions as indicated in the catalog cut submittals. Failure to monitor the pulling tension will result is 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 remain continuous unless a break is specifically indicated in the plans or as directed by the Engineer.~~

~~Handholes and Communications Vaults. Where duct passes through handholes or vaults, the duct shall be looped uncut within the handhole unless otherwise indicated on the plans or directed by the Engineer.~~

~~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. Where duct is installed in trench, it shall be placed in the bottom of the trench 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 no less than 30 inches unless otherwise indicated or specifically directed by the Engineer.~~

~~The inner duct may be plowed into place. Unless otherwise indicated or specifically approved by the Engineer, plowing of inner duct 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.~~

~~In Raceway. Where duct is installed in raceways, lubricating compounds shall be used where necessary to ensure smooth installation.~~

~~Encased in Concrete. Concrete shall be class SI complying with Section 720 of the Standard Specifications.~~

~~Steel Reinforcement Bars. Steel reinforcement bars shall comply with Section 706.10 of the Standard Specifications.~~

~~Underground concrete-encased conduit shall be supported on interlocking plastic spacers specifically designed for the purpose spaced along the length of the run as recommended by the manufacturer. Spacing between raceways within a common duct bank shall be no less than 2 inches. The interlocking spacers shall be used at a minimum interval of 8 ft.~~

~~Concrete cover overall shall not be less than 3 inches all around the encased run. Space below the conduit, and concrete fill shall be assured. Care shall be exercised during concrete placement to assure that there are no voids, so that spacers are undisturbed, and so that conduit joints stay secure and unbroken. Concrete shall be deflected during placement to minimize the possible damage to or movement of the conduits.~~

~~Conduit encased in concrete shall have steel reinforcing where installed below roadway or other paved vehicle areas (including shoulder) and the reinforcement shall extend no less than 5 feet additional from the edge of pavement unless otherwise indicated. Steel reinforcement shall not be~~

~~less than No. 4 bars at corners and otherwise spaced on 12-inch centers, tied with No. 4 bars on 12-inch centers.~~

~~The Engineer shall examine all conduit joints for compliance with this specification before concrete is poured.~~

~~Embedded. Conduit embedded in structure shall be supported on interlocking plastic spacers specifically designed for the purpose spaced along the length of the run as recommended by the manufacturer. Spacing between raceways within a common structure shall be no less than 2 inches. The interlocking spacers shall be used at a minimum interval of 8 ft.~~

~~Concrete cover overall shall not be less than 3 inches all around the embedded run. Space below the conduit, and concrete fill shall be assured. Care shall be exercised during concrete placement to ensure that there are no voids, so that spacers are undisturbed, and so that conduit joints stay secure and unbroken. Concrete shall be deflected during placement to minimize the possible damage to or movement of the conduits.~~

~~The Engineer shall examine all conduit joints for compliance with this specification before concrete is poured.~~

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

~~HDPE coailable non-metallic conduit to non-HDPE coailable 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 coailable 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	1,000
76.2	3.0	6225	1,400
101.6	4.0	8890	2,000

~~Measurement. The duct shall be measured for payment in linear feet in place as described herein. Measurements shall be made in straight lines between horizontal changes in direction between the centers of the terminating points (poles, cabinets, junction boxes). Vertical measurement of the duct shall be as follows:~~

~~For runs terminating at junction boxes and/or control cabinets, the vertical measurement shall be taken 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 measure shall be taken from the bottom of the trench, or horizontal raceway, to a point 18 inch beyond the center of the light pole handhole regardless of light pole mounting method~~

~~Innerduct installed in excess of the limits describes herein shall not be paid for.~~

~~Basis of Payment. This work will be paid for at the contract unit price per FOOT installed for FIBER OPTIC INNERDUCT, of the size of duct as indicated, which shall be payment in full for all material and work as specified herein.~~

CONCRETE FOUNDATION, SURVEILLANCE CABINET MODEL 334

Description. This work shall consist of constructing a concrete foundation to support ITS equipment cabinets at locations as indicated in the plans. This work shall include installing any necessary hardware (entering conduits, bolts, anchor rods, grounding, etc.) as shown in the plans. This work shall also include any topsoil, fertilizing, seeding, and mulching of the disturbed areas in accordance with Sections 211, 250, and 251 of the Standard Specifications.

Materials. Concrete foundations shall be according to materials defined in Article 836.02 of the Standard Specifications. All anchor bolts shall be in accordance with Section 1006.09 of the Standard Specifications except that all anchor bolts shall be hot dipped galvanized the full length of the anchor bolt including the hooks. Anchor bolts shall provide bolt spacing as shown in the plans and as required by the cabinet manufacturer.

The concrete foundations shall also be fabricated in accordance with Section 1070 of the Standard Specifications. These concrete foundations shall be fabricated from material new and unused in any previous application. The manufacturer shall provide a certificate of compliance that the materials are new and meet the specified requirements in accordance with the Standard Specifications and as shown in the plans.

Construction Requirements. The Engineer will determine the final placement of the concrete foundations. Concrete foundation dimensions shall be in accordance with those dimensions shown on the plans. The foundation shall be located as required to avoid existing and relocated utilities. The top of the foundation shall be finished level. Shimming of the appurtenance to be attached will not be permitted.

Prior to pouring the foundation, the Contractor shall check the plans for the specific number, size, and direction of conduit entrances required at the given location. All conduit in the foundation shall be installed rigidly in place before concrete is deposited in the form. Bushings shall be provided at the ends of the conduit. Anchor rods and ground rod shall be set in place before the concrete is deposited by means of a template constructed to space the anchor rods according to the pattern of the bolt holes in the base of the appurtenance to be attached. The appurtenance shall not be erected on the foundation until the bases have cured for at least seven days. The concrete shall cure according to Article 1020.13 of the Standard Specifications.

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 paid for at the contract unit price for each foundation installed.

Basis of Payment. This work will be paid for at the contract unit price per EACH for CONCRETE FOUNDATION, SURVEILLANCE CABINET MODEL 334.

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Basis of Payment. This work shall be paid for at the contract unit price per EACH for SPLICE FIBER IN CABINET. The unit price shall include all equipment; materials; fiber optic splice trays; testing and documentation; and labor required to fusion splice single mode fiber optic cable. Splices involving new fiber optic cable installed under this contract

Any splices shown on the plans as an included item, shall be included in the cost of the applicable fiber optic cable of the type, size, and number of fibers specified.

RELOCATING NAME PLATES

Description: This work shall include all labor, material, and equipment to remove and salvage the existing name plates and reinstall the name plate in accordance with Section 515 of the Standard Specifications.

Basis of Payment: This work will be paid for at the contract unit price per EACH for RELOCATING NAME PLATES.

MAINTENANCE OF LIGHTING SYSTEMS

~~Effective: December 1, 2024~~

~~Replace Article 801.11 and 801.12 of the Standard Specifications with the following:~~

~~Effective the date the Contractor's activities (electrical or otherwise) at the jobsite begin, the Contractor shall be responsible for the proper operation and maintenance of all existing and proposed lighting systems which are part of, or which may be affected by the work until final acceptance or as otherwise determined by the Engineer.~~

~~Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor shall initiate a request for a maintenance transfer and preconstruction inspection, as specified elsewhere herein, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any lighting systems which may be affected by the work. During the maintenance preconstruction inspection, the party responsible for existing maintenance shall perform testing of the existing system in accordance with Article 801.13a. The Contractor shall request a date for the preconstruction inspection no less than 14 days prior to the desired date of the inspection.~~

~~The Engineer will document all test results and note deficiencies. All substandard equipment will be repaired or replaced by the existing maintenance contractor, or the Engineer can direct the Contractor to make the necessary repairs under Section 109.04.~~

~~Existing lighting systems, when depicted on the plans, are intended only to indicate the general equipment installation of the systems involved and shall not be construed as an exact representation of the field conditions. It remains the Contractor's responsibility to visit the site to confirm and ascertain the exact condition of the electrical equipment and systems to be maintained. Contract documents shall indicate the circuit limits.~~

Maintenance of Existing Lighting Systems

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~~Existing Lighting Systems. Existing lighting systems shall be defined as any lighting system or part of a lighting system in service at the time of contract Letting regardless of the number of lighting controllers involved. The contract drawings indicate the general extent of any existing lighting, but whether indicated or not, it remains the Contractor's responsibility to ascertain the extent of effort required for compliance with these specifications and failure to do so will not be justification for extra payment or reduced responsibilities.~~

~~Extent of Maintenance.~~

~~Partial Maintenance. Unless otherwise indicated, if the number of circuits affected by the contract is equal to or less than 40% of the total number of circuits in each controller and the controller is not part of the contract work, the Contractor needs only to maintain the affected circuits within the project limits. The project limits are defined as those limits indicated in the contract plans. Equipment outside of the project limits, on the affected circuits shall be maintained and paid for under Article 109.04. The affected circuits shall be isolated by means of in-line waterproof fuse holders as specified elsewhere and as approved by the Engineer. The unaffected circuits and the controller will remain under the maintenance of the State or the City of McHenry.~~

~~Full Maintenance. If the number of circuits affected by the contract is greater than 40% of the total number of circuits in each controller, or if the controller is modified in any way under the contract work, the Contractor shall maintain the entire controller and all associated circuits within the project limits. Equipment outside of the project limits shall be maintained and paid for under Article 109.04.~~

~~If the existing equipment is damaged by normal vehicular traffic, not the Contractor's operations, and is beyond repair and cannot be re-set, the Contractor shall replace the equipment in kind with payment made for such equipment under Article 109.04. If the equipment damaged by any construction operations, not normal vehicular traffic, and is beyond repair and cannot be re-set, the Contractor shall replace the equipment in kind and the cost of the equipment shall be included in the cost of this pay item and shall not be paid for separately.~~

Maintenance of Proposed Lighting Systems

~~Proposed Lighting Systems. Proposed lighting systems shall be defined as any lighting system or part of a lighting system, temporary or permanent, which is to be constructed under this contract regardless of the project limits indicated in the plans.~~

~~The Contractor shall be fully responsible for maintenance of all items installed under this contract. Maintenance shall include, but not be limited to, any equipment failures or malfunctions as well as equipment damage either by the motoring public, Contractor's operations, vandalism, or other means. The potential cost of replacing or repairing any malfunctioning, damaged, or vandalized equipment shall be included in the bid price of this item and will not be paid for separately.~~

~~Lighting System Maintenance Operations. The Contractor's responsibility shall include all applicable responsibilities of the electrical maintenance contract for City of McHenry. These responsibilities shall include the maintenance of lighting units (including sign lighting), cable runs and lighting controls. In the case of a pole knockdown or sign light damage, the Contractor shall~~

~~promptly clear the lighting unit and circuit discontinuity and restore the system to service. The equipment shall then be re-set by the Contractor within the time limits specified herein.~~

~~If the existing equipment is damaged by normal vehicular traffic, not contractor operations, is beyond repair and cannot be re-set, the Contractor shall replace the equipment in kind with payment made for such equipment under Article 109.04. If the equipment damaged by any construction operations, not normal vehicular traffic, and is beyond repair and cannot be re-set, the Contractor shall replace the equipment in kind and the cost of the equipment shall be included in the cost of this pay item and shall not be paid for separately.~~

~~Responsibilities shall also include weekly night time patrol of the lighting system, with patrol reports filed immediately with the Engineer and with deficiencies corrected within 24 hours of the patrol. Patrol reports shall be presented on standard forms as designated by the Engineer. Uncorrected deficiencies may be designated by the Engineer as necessitating emergency repairs as described elsewhere herein.~~

~~The following chart lists the maximum response, service restoration, and permanent repair time the Contractor will be allowed to perform corrective action on specific lighting system equipment.~~

INCIDENT OR PROBLEM	SERVICE RESPONSE TIME	SERVICE RESTORATION TIME	PERMANENT REPAIR TIME
Control cabinet out	1 hour	4 hours	7 Calendar days
Hanging mast arm	1 hour to clear	N/A	7 Calendar days
Radio problem	1 hour	4 hours	7 Calendar days
Motorist caused damage or leaning light pole 10 degrees or more	1 hour to clear	4 hours	7 Calendar days
Circuit out—Needs to reset breaker	1 hour	4 hours	N/A
Circuit out—Cable trouble	1 hour	24 hours	21 Calendar days
Outage of 3 or more successive lights	1 hour	4 hours	N/A
Outage of 75% of lights on one tower	1 hour	4 hours	N/A
Outage of light nearest RR crossing approach, Islands and gores	1 hour	4 hours	N/A
Outage (single or multiple) found on night outage survey or reported to EMC	N/A	N/A	7 Calendar days
Navigation light outage	N/A	N/A	24 hours

- ~~• Service Response Time—amount of time from the initial notification to the Contractor until a patrolman physically arrives at the location.~~
- ~~• Service Restoration Time—amount of time from the initial notification to the Contractor until the time the system is fully operational again (In cases of motorist caused damage the undamaged portions of the system are operational.)~~

- ~~• Permanent Repair Time—amount of time from initial notification to the Contractor until the time permanent repairs are made if the Contractor was required to make temporary repairs to meet the service restoration requirement.~~

~~Failure to provide this service will result in liquidated damages of \$500 per day per occurrence. In addition, the Department and the City of McHenry reserve the right to assign any work not completed within this timeframe to the electrical maintenance contractor. All costs associated to repair this uncompleted work shall be the responsibility of the Contractor. Failure to pay these costs to the electrical maintenance contractor within one month after the incident will result in additional liquidated damages of \$500 per month per occurrence. Unpaid bills will be deducted from any monies owed to the Contractor. Repeated failures and/or a gross failure of maintenance shall result in the State's or City of McHenry's electrical maintenance contractor being directed to correct all deficiencies and the resulting costs deducted from any monies owed to the Contractor.~~

~~Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract.~~

~~Operation of Lighting. The lighting shall be operational every night, dusk to dawn. Duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously. Lighting systems shall not be kept in operation during long daytime periods.~~

~~Method of Measurement. The Contractor shall demonstrate to the satisfaction of the Engineer that the lighting system is fully operational prior to submitting a pay request. Failure to do so will be grounds for denying the pay request. Months in which the lighting systems are not maintained and not operational will not be paid. Payment shall not be made retroactively for months in which lighting systems were not operational.~~

~~Basis of Payment. This work will be paid for at the contract unit price per CALENDAR MONTH for MAINTENANCE OF LIGHTING SYSTEM.~~

COMMUNICATIONS VAULT

Effective: March 1, 2010

~~Description. Work under this item shall consist of constructing a composite concrete handhole a cover, in accordance with the details shown on the plans and as specified herein.~~

~~Materials. The composite concrete handhole and two piece vault lid shall be constructed of polymer concrete material, and shall be gray in color. The composite concrete handhole shall be 48 inches x 48 inches and shall have an effective depth of 36 inches. The composite concrete handhole and cover shall have a design/test loading of 22,500/33,750 lbs respectively. The cover shall have a permanently recessed logo that reads "IDOT COMMUNICATIONS", or as otherwise designated by the Engineer. The composite concrete handhole lid shall have two ½-in x 4-in pull slots. The lid surface shall have a coefficient of friction of 0.50 in accordance with ASTM C-1028.~~

~~The Contractor shall install manufacturer approved gasketing between the lid and the handhole to prevent water from entering the composite concrete handhole.~~

~~The composite concrete handhole lid shall be secured to the vault with two 3/8-inch NC stainless steel penta-head bolts and washers to lock the lid. In addition, a "lock tool" shall be provided for composite concrete handhole entry.~~

~~A fiber optic cable support assembly shall be recommended by the manufacturer and approved by the Engineer for fiber optic cable and splice enclosures used in the vault. Each support assembly shall consist of multiple brackets, racks, and/or rails required to suspend the required surplus cabling and any splice enclosures required.~~

~~The support assembly shall be made from or coated with weather resistant material such that there is no corrosion of the supports. The support assemblies shall be anchored to the vault using stainless steel hardware.~~

~~The fiber optic cable support assemblies shall be included in the contract unit price for the composite concrete handhole. Void areas between openings and conduit shall be filled with self-curing caulking consisting of a permanent, flexible rubber which is unaffected by sunlight, water, oils, mild acids or alkalis. The caulking shall be mildew resistant and non-flammable. The material shall provide a permanent bond between the conduit entering the vault and the polymer concrete. The caulking shall be gray in color.~~

~~Construction Requirements. Composite concrete handholes shall be installed in accordance with applicable requirements of Section 800 of the Standard Specifications and as provided herein.~~

~~A manufacturer approved knockout punch driver shall be used to provide openings in the vaults for conduit, or the required openings may be machined at the time of stackable vault fabrication. Voids between entering conduits and punch driven or machined openings shall not exceed 1/2-inch.~~

~~Any void areas shall be caulked from the interior and exterior of the composite concrete handhole. The caulk shall be allowed to fully cure per the manufacturer's specifications, prior to backfilling. The composite concrete handhole shall be placed on 12 inches of coarse aggregate, CA-5 or CA-7 Class A, as specified in Section 1004 of the Standard Specifications. Seal and flash test the vault per the manufacturer's recommendations.~~

~~A minimum of 150 feet of excess cable per cable run shall be coiled in each composite concrete handhole containing splices to allow moving the splice enclosure to the splicing vehicle unless otherwise indicated in the plans.~~

~~Basis of Payment. This item will be paid for at the contract unit price per EACH for COMMUNICATIONS VAULT, of the size indicated, which shall be payment in full for all material and work as specified herein.~~

CLEANING EXISTING DRAINAGE STRUCTURES (D1)

Effective: September 30, 1985

Revised: May 1, 2022

All existing storm sewers, pipe culverts, manholes, catch basins, and inlets shall be considered as drainage structures insofar as the interpretation of this special provision is concerned. When specified for payment, the location of drainage structures to be cleaned will be determined in the field by the Engineer.

All existing drainage structures which are to be adjusted or reconstructed shall be cleaned according to Article 602.15 of the Standard Specifications. This work will be paid for according to accordance with Article 602.16 of the Standard Specifications.

All other existing drainage structures which are specified to be cleaned by the Engineer will be cleaned according to Article 602.15 of the Standard Specifications.

Basis of Payment. This work will be paid for at the contract unit price per EACH for DRAINAGE STRUCTURES TO BE CLEANED, and at the contract unit price per FOOT for STORM SEWERS TO BE CLEANED, of the diameter specified.

CABLE REMOVAL FROM CONDUIT

Effective: April 1, 2026

This work shall consist of removing or removing and reinstalling existing fiber optic cable in accordance with Section 895 of the Standard Specifications with the following modifications. Add the following to Article 895.05:

(f) Fiber Optic Cable from Conduit. An existing fiber optic cable shall be removed, as directed by the Engineer, from a conduit.

Revise Article 895.06 to read:

895.06 Removal and Reinstallation. This work shall consist of removing an existing electric cable or fiber optic cable from a conduit and then reinstalling it in an existing or a new conduit. When a new conduit is constructed as part of the work the existing electric and/or fiber cable shall be reinstalled in the new conduit unless directed otherwise by the Engineer.

Electric cable shall be reinstalled in accordance with Article 873.03 of the Standard Specifications.

Fiber optic cable shall be removed and reinstalled by a qualified contractor in accordance with Article 871.03 of the Standard Specifications and reinstalled in accordance with Article 871.04 of Standard Specifications.

The reinstalled cable shall be tested in compliance with the fiber optic cable special provisions.

Any damage sustained to the existing electrical and/or fiber optic cable during removal, storage and/or reinstallation operations shall require the existing electric cable and/or fiber optic cable be replaced in kind to the satisfaction of the Engineer at the Contractor's expense. Any replacement cable must meet the material and construction requirements of the current Standard Specifications and the special provisions for Electric Cable, Fiber Optic Cable, Splice Fiber in Cabinet and Terminate Fiber in Cabinet.

Revise the first paragraph of Article 895.07 to read:

895.07 Method of Measurement. Removal of electric cable and fiber optic cable will be measured for payment in place in feet. Removal and reinstallation of existing fiber optic cable will be measured for payment in feet from point to point horizontally of the conduit the fiber is being removed from. No vertical rises or slack shall count in the measurement. If two or more cables in a conduit are to be removed, or removed and reinstalled, each cable will be measured for payment separately.

Revise the sixth paragraph of Article 895.08 to read:

Removal of an existing electric cable or fiber optic cable will be paid for at the contract unit price per foot for REMOVE ELECTRIC CABLE FROM CONDUIT.

Add the following paragraph after the seventh paragraph of Article 895.08:

Removing and reinstalling the fiber optic cable will be paid for at the contract unit price per foot for REMOVE AND REINSTALL FIBER OPTIC CABLE FROM CONDUIT.

COMPLETION DATE PLUS WORKING DAYS (D1)

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 November 19, 2027 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.

Article 108.09 or the Special Provision for "Failure to Complete the Work on Time", if included in this contract, shall apply to both the completion date and the number of working days.

CHAIN LINK FENCE REMOVAL

Description. This work consists of the removal and satisfactory disposal of existing chain link fence at the locations shown on the plans or as directed by the Engineer.

General. The chain link fences to be removed are approximately 4 ft and 6 ft in height with the posts set in concrete. Removal shall include posts, fence fabric, fittings, appurtenances, attachments and concrete foundation. Any holes created by removal of the foundation shall be filled with clean earth to eliminate any hazard to the public.

Method of Measurement. This work will be measured for payment per foot and measured along the top of the fence from center to center of end posts, including length occupied by gates.

Basis of Payment. This work will be paid for at the contract unit price per foot for CHAIN LINK FENCE REMOVAL.

CCTV STRUCTURE FOUNDATION

Effective: February 1, 2016

Description. This work shall consist of constructing a drilled shaft foundation for a CCTV structure.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) Anchor Rod Assembly	1070.03
(c) Fine Aggregate	1003.04
(d) Reinforcement Bars	1006.10(a)

Note 1. Class SI concrete shall be used for the concrete work pad and shall be cured according to Article 1020.13 under other incidental concrete.

CONSTRUCTION REQUIREMENTS

Installation. Drilled shaft foundations shall be constructed according to Section 516 and the following.

When obstructions are encountered, the Contractor shall request to relocate the foundation. Any abandoned holes shall be backfilled to the satisfaction of the Engineer.

Grounding electrodes shall be according to Section 806.

The anchor rod assembly may be factory fabricated with the reinforcing cage or it may be field assembled. The cage shall be hand tied, no tack welding will be allowed. Anchor rods shall sufficiently overlap with the rebar cage to develop their full holding strength. Full length anchor rods shall not be used unless approved by the Engineer.

The top of the foundation to 18 in. (450 mm) below grade shall be formed. The reinforcing cage, anchor rods, and wireway shall be accurately held in place by the form. The anchor rods shall be held plumb above the top of the foundation during concrete placement.

A permanent, concrete work pad shall be constructed as shown on the plans. This 36 x 36 x 8 in. (900 x 900 x 200 mm) pad shall be centered in front of the handhole and finished level.

Concrete shall be cured before CCTV camera structures are installed.

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

Excavation in rock will be measured for payment according to Article 502.12.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for **CCTV CAMERA STRUCTURE FOUNDATION** of the diameter specified.

Revised 5-27-2026

Excavation in rock will be paid for according to Article 502.13.

Obstruction mitigation or abandoned foundation excavations and backfill will be paid for according to Article 109.04.

CCTV CAMERA STRUCTURE, 80 FT. M.H.

Effective: January 1, 2026

Description. This work shall consist of furnishing 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.

Shaft: 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 detail drawings

Materials. Materials shall be as specified elsewhere herein.

Deflection. The design of the structure shaft shall achieve a maximum, fully loaded deflection at the top of the structure, which is not greater than 1-inch

Submittals and Certifications. The design shall be based upon AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" current at the time the project is advertised with the following exception: the Illinois Department of Transportation waives the requirements of Chapter 5, Section 5.14.6.2 – Reinforced Holes and Cutouts for high mast lighting towers. The pole shall be designed for use with a single or dual 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 camera structure 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

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.

Shaft. The pole shall be a maximum of three sections for field assembly. The pole shafts shall be a round cross section and meet the requirements of ASTM A595 grade A with a minimum yield strength of 55,000 psi. The bottom section shall have a minimum .3125 wall thickness and a minimum diameter of 23". The three shaft sections shall taper at a rate of .14" per foot and have an overall height of 80'. The pole base plate shall meet the requirements of ASTM A36 and be arranged to accommodate four (4) 1 1/2" x 54" x 6" anchor bolts on a 27" bolt circle. Anchor bolts shall conform to ASTM F1554 gr. 55

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. 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.

Camera Lowering Device

General. The camera lowering system shall be designed to support and lower a high-definition closed circuit television 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, suspension contact unit, support arm, and a pole adapter for attachment to a pole top tenon, pole top junction box, conduit mount adapter and camera connection box. The 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.

The camera-lowering device shall withstand wind forces of 100mph with a 30 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 10 years of experience in the successful manufacturing of camera lowering systems. The lowering device provider shall be able to identify a minimum of 5 previous projects where the purposed system has been installed successfully for over a one-year period each.

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 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.

Suspension Contact Unit. The suspension contact unit shall have a load capacity 200 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 tracking guide and means to allow latching in the same position each time. The contact unit housing shall be weatherproof with a gasket provided to seal the interior from dust and moisture.

The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or Ethernet 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 PVC conduit and be located just below the cable stop block at the back of the lowering device. The Contractor shall supply internal conduit in the pole as directed by the Lowering Device manufacturer. 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 current carrying male contacts shall be a minimum 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 high-definition camera specified elsewhere herein.

The contacts shall be recessed from the face of the connector. Cored holes in the socket molded into the connector body are centered on each contact on the face of the connector to create rain-tight seals when mated with the male connector.

The wire leads from both the male and female contacts shall be permanently and integrally molded into the connector body. The current carrying and signal wires molded to the connector body shall be constructed of #18 AWG-jacketed wire.

The contacts shall be self-wiping.

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 hand hole 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 State 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.

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 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.

Materials. 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.

All electrical connections between the fixed and lowerable portion of the contact block shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The electrical connections between the fixed and movable lowering device components shall be designed to conduct high frequency data bits 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 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

Shipment and Installation.. The structure, camera lowering device, etc., and hardware shall be packaged during shipment to protect all surfaces from being scratched, marred, chipped, or damaged in any way. Prior to installation, the structure and all its components will be inspected by the Engineer and any parts found to be damaged or defective shall be replaced. Any minor damage shall be touched up in a professional manner as approved by the structure manufacturer.

The structure shall be set plumb on the foundation and fastened to the anchor rods with double nuts and washers. Flat washers shall be installed below and above the base plate of the pole. Locknuts with nylon or steel inserts shall be installed on top of the top nut. The nuts shall be tightened in compliance with torque specifications recommended by the manufacturer of the structure.

The space between the finished top of the foundation and the bottom of the base plate of the structure shall be enclosed with an expanded metal screen made of stainless steel. The size of the mesh of the screen shall be 1/4 in. (6 mm) or less and #18 gauge (1.22 mm) thick, or heavier as approved by the Engineer. The screen shall be held in place with a stainless-steel band installed around the tower base plate. The band shall be held tight by a ratchet-type device. Grouting shall not be used to enclose the above-described space.

The structure shall be straight and centered on its longitudinal axis, under no-wind conditions, so, when examined with a transit from any direction, the deviation from the normal shall not exceed 1/8 in. in 3 ft (3 mm in 1 m) within any 5 ft (1.5 m) of height, with total deviation not to exceed 3 in. (75 mm) from the vertical axis through the center of the structure base.

The camera position and orientation shall be confirmed and approved by the Engineer. In general, the camera shall be oriented perpendicular to the main roadway.

Installation of the lowering device and camera shall be included as a part of this item and shall not be paid for separately.

Method Of Measurement. CCTV camera structures shall be counted, each with all appurtenances installed.

Basis Of Payment. This item shall be paid at the contract unit each for **CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, GALVANIZED STEEL, 80 FT. M.H.**

UNDERPASS LUMINAIRE, LED

Effective: November 1, 2025

Description. This work shall consist of furnishing and installing an underpass LED luminaire as shown on the plans, as specified herein.

The luminaire including the housing, driver and optical assembly shall be assembled in the U.S.A. The luminaire shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. All electrical and electronic components of the luminaire shall comply with the requirements of Restriction of Hazardous Materials (RoHS) regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750

Submittal Requirements. The Contractor shall also the following manufacturer's product data for each type of luminaire:

11. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided
12. LED drive current, total luminaire input wattage and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.
13. LED efficacy per luminaire expressed in lumens per watt (l/w).
14. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.
15. IES file associated with each submitted luminaire in the IES LM-63 format.
16. Computer photometric calculation reports as specified and in the luminaire performance table.
17. TM-15 BUG rating report.
18. Isofootcandle chart with max candela point and half candela trace indicated.
19. Documentation of manufacturers experience and verification that luminaires were assembled in the U.S.A. as specified.
20. Written warranty.

Upon request by the Engineer, submittals shall also include any or all the following:

- n. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F (25 °C).

- o. LM-79 report with National Voluntary Laboratory Accreditation Program (NVLAP) current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.
- p. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.
- q. AGi32 calculation file matching the submittal package.
- r. In Situ Temperature Measurement Test (ISTMT) report for the specified luminaire or luminaire family in PDF format.
- s. Vibration test report in accordance with ANSI C136.31 in PDF format.
- t. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.
- u. ASTM G154 (ASTM D523) gloss test report in PDF format.
- v. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F (25 °C).
- w. Power factor (pf) and total harmonic distortion (THD) at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.
- x. Ingress protection (IP) test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.
- y. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.
- z. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.

A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the District Headquarters. After review, the Contractor shall retrieve the luminaire.

Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 20 year lifetime. The luminaire manufacturer shall have a minimum of 15 years' experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the U.S.A.

Housing.

Revised 5-27-2026

Material. The luminaire shall be a single device not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit. The housing shall be either stainless-steel or cast aluminum.

Aluminum Housing. The housing shall be extruded or cast aluminum; or a combination of both and shall have a copper content of less than 1.0%.

The housing shall be painted grey or silver unless specified otherwise. A epoxy base coat shall applied to the aluminum after the aluminum is properly treated with a conversion coating. The finish coat shall be polyester powder coat with a minimum thickness of 2.0 mil.

The luminaire surfaces exposed to the environment shall exceed a rating of six, according to ASTM D1654, after 1000 hours of ASTM B117 testing. The coating shall exhibit no greater than 30% reduction of gloss, according to ASTM D523, after 500 hours of ASTM G154 Cycle 6 QUV® accelerated weathering testing.

Stainless-Steel Housing. The housing shall be constructed from 16-gauge minimum, 304 stainless steel.

The stainless-steel housing does not need to be painted. The manufacturer may paint the luminaire at no additional cost.

The luminaire shall be optically sealed, mechanically strong and easy to maintain. The luminaire shall be designed for wall mounting to a pier or abutment. It shall be provided with a suitable mounting bracket which allows for +90° adjustment from horizontal in 5° increments.

The luminaire shall be gasketed and sealed and shall be UL listed for wet locations. The luminaire optical assembly shall have a minimum IEC ingress penetration rating of IP66. When furnished with a lens and frame, the lens shall be made of crystal clear, impact and heat resistant flat glass. The lens and frame shall be securely attached to the main housing and be readily removable for servicing the LED optical assembly.

All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.

The total weight including accessories, shall not exceed 75 lbs.

A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.

Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual component shall pass this test with no noticeable damage and the luminaire must remain fully operational after testing.

Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.

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An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. Types 1, 2, 3, 4, or 5).

Hardware. All hardware shall be stainless steel or of other corrosion resistant material approved by the Engineer.

Luminaires shall be designed to be easily serviced, having fasteners such as quarter-turn clips of the heavy spring-loaded type with large, deep straight slot heads, complete with a receptacle and shall be according to military specification MIL-f-5591.

All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.

Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LED's.

Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.

The power connection to the luminaire shall be via liquid tight metallic conduit or an armored flexible cable assembly. The power connection, including any external shielding, must be secured to the luminaire and connected source. The location of the opening shall be coordinated with the installation to minimize the length of flexible conduit required. The length of the cable or flexible conduit shall not exceed six (6) feet.

Mounting Brackets. The brackets shall be properly sized to accommodate the weight of the luminaire with calculations or other suitable reference documentation submitted to support the material choice. The brackets shall be constructed of 304 stainless steel

The mounting brackets shall be fully coordinated with the luminaire mounting method indicated in plans.

Driver. The driver shall be integral to the luminaire shall be capable of receiving an indefinite open and short circuit output conditions without damage.

The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F (25 °C) to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F (40 °C) or less.

The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an un-dimmed state, the power factor measurement shall be not less than 0.9 and the THD measurement shall be no greater than 20%.

The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for Class A devices with regard to electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.

The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.

Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a surge protective device (SPD) that is UL1449 compliant. An SPD failure shall open the circuit to protect the driver.

LED Optical Assembly. The optical assembly shall have an IP66 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.

The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature (+/-300K) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.

The actual measured luminous flux output shall be within +/- 10% of the published lumen value.

Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25° C.

The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.

The assembly shall have individual serial numbers or other means for manufacturer tracking.

Photometric Performance. Luminaires shall be tested according to IESNA LM-79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) for the IESNA LM-79 test procedure.

Data reports as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above-mentioned tests.

The luminaire shall have a BUG rating of Back Light B3 or less, Up Light rating of U0, and a Glare rating of G3 or less unless otherwise indicated in the luminaire performance table.

Photometric Calculations. Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.

Complete point-by-point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).

When the quantity of luminaires requires independent testing, the AGi32 calculation file used for performance verification shall also be submitted with the initial submittal.

All photometry must be **photopic**. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.

The luminaire may have an initial lumen value lower than the specified lumen range in the performance tables provided that the resulting calculations demonstrate that the performance requirements are being met.

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 5
ROADWAY UNDERPASS LIGHTING
5 LANES – DESIGNATION D

GIVEN CONDITIONS			
ROADWAY DATA	Pavement Width	60	(ft)
	Number of Lanes	5	
	I.E.S. Surface Classification	R3	
	Q-Zero Value	.07	
MOUNTING DATA	Mounting Height	13	(ft)
	Tilt	0-30	(degrees)
	Orientation	Perpendicular to roadway	
	Set-Back from Edge Of Pavement	10	(ft)
LUMINAIRE DATA	Lumens (min)	6,350	
	Total Light Loss Factor	0.65	
LAYOUT DATA	Spacing	30	(ft)
	Configuration	Opposite	
	Luminaire Overhang over EOP	-10	(ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6	Cd/m ² (Max)
		1.2	Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1	(Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1	(Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1	(Max)

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE 5
ROADWAY UNDERPASS LIGHTING
8 LANES – DESIGNATION E

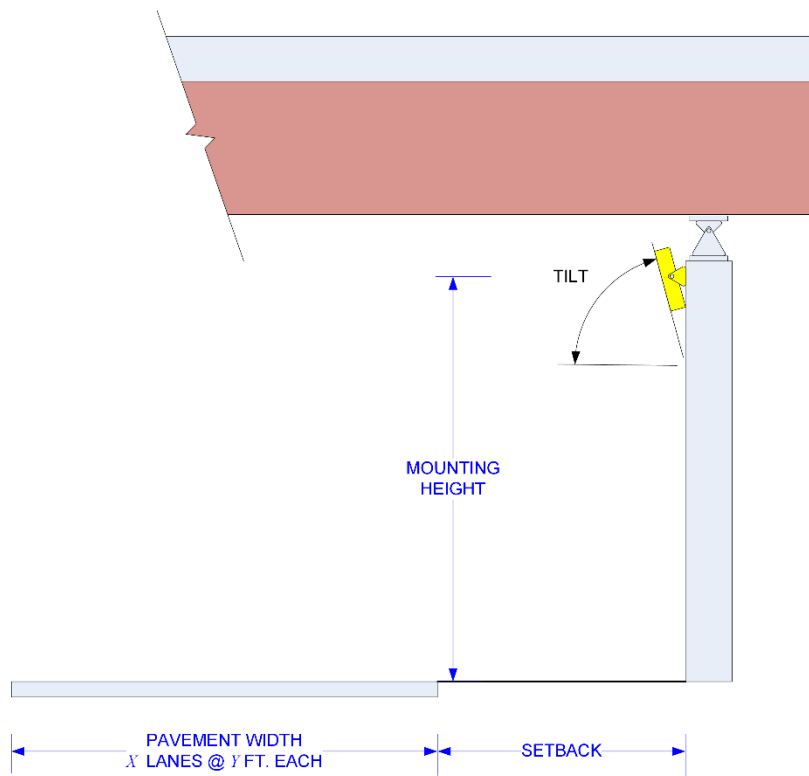
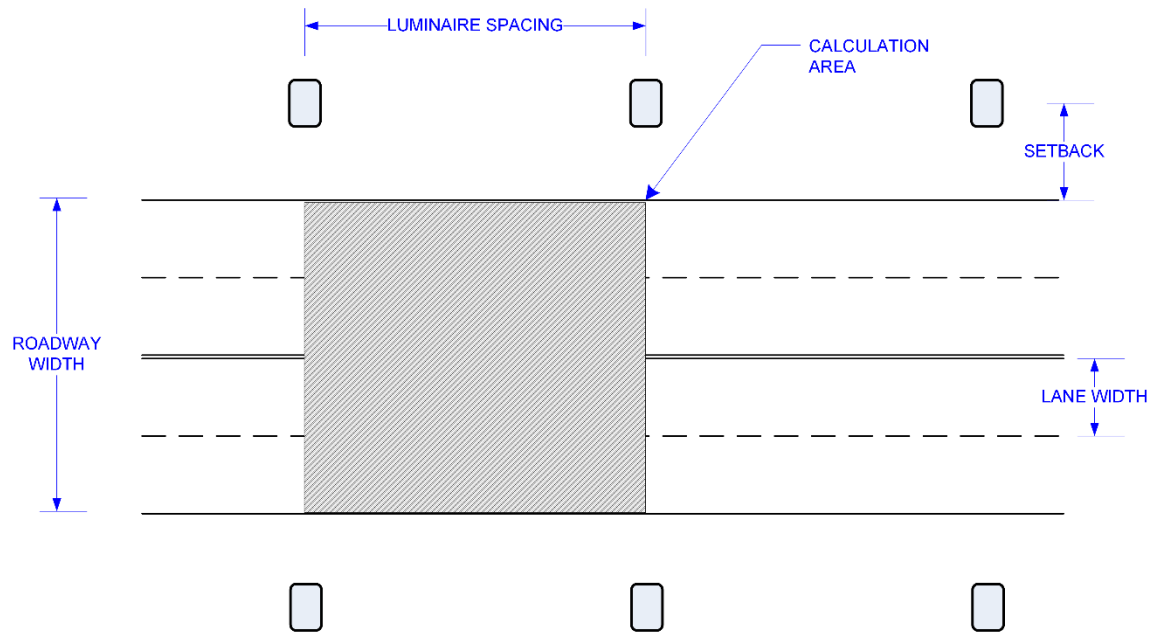
GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	100 (ft)
	Number of Lanes	8
	I.E.S. Surface Classification	R3
	Q-Zero Value	.07
MOUNTING DATA	Mounting Height	14.7 (ft)
	Tilt	0-30 (degrees)
	Orientation	Perpendicular to roadway
	Set-Back from Edge Of Pavement	2 (ft)
LUMINAIRE DATA	Lumens (min)	9,450
	Total Light Loss Factor	0.65
LAYOUT DATA	Spacing	30 (ft)
	Configuration	Opposite
	Luminaire Overhang over EOP	-12 (ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

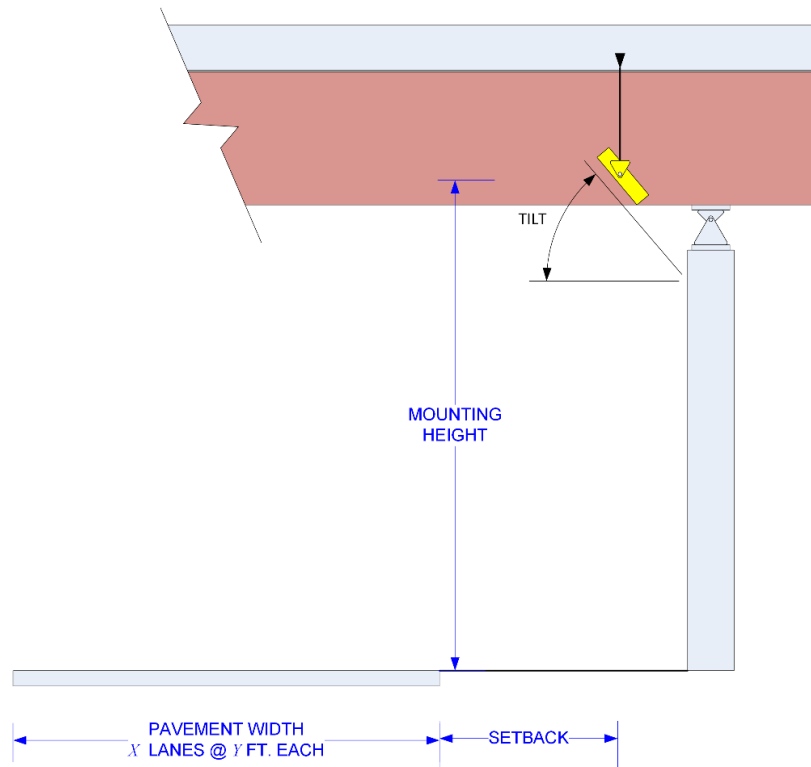
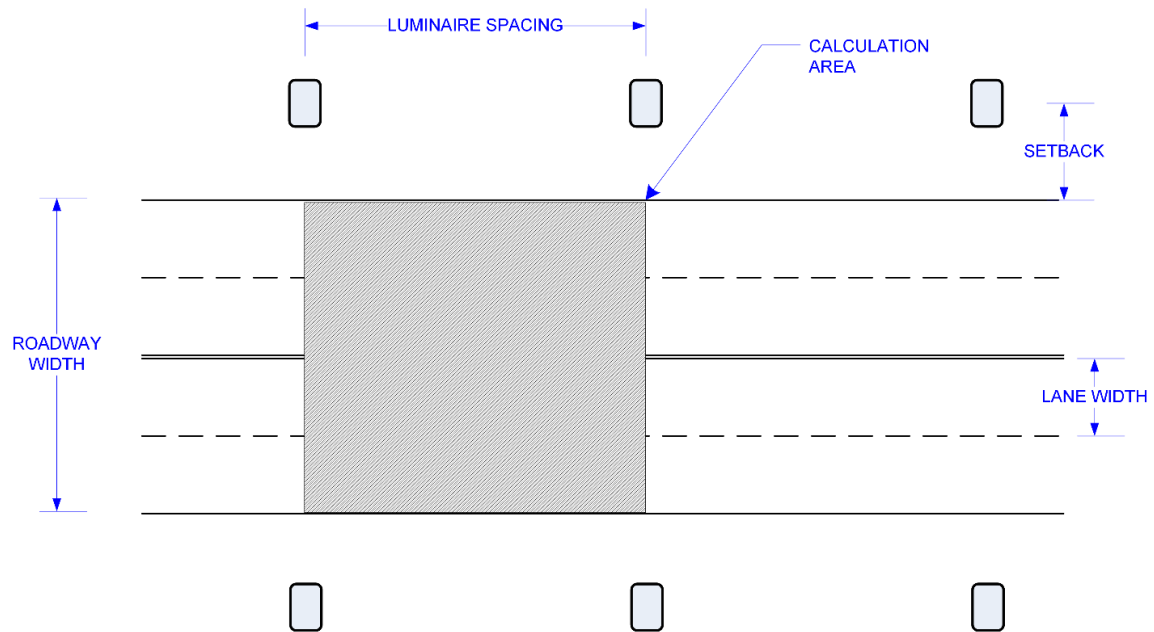
PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ROADWAY	Average Luminance, L_{AVE}	1.6 Cd/m ² (Max)
		1.2 Cd/m ² (Min)
LUMINANCE	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1 (Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1 (Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1 (Max)



Wall Mounted Underpass Luminaire



Suspended Underpass Luminaire

Independent Testing When a contract has 30 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

Testing is not required for temporary lighting luminaires.

The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead-times and deadlines.

The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the District Headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.

Alternative selection process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.

Luminaires shall be tested at a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire.

The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.

The testing performed shall include photometric and electrical testing.

All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.

Photometric testing shall be according to IES recommendations, performed with a goniophotometer and as a minimum, shall yield an isofootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone plots of candela, a candlepower table (House and street side), a coefficient of utilization chart, a luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.

Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion and LED drive current.

The summary report and the test results including IES photometric files shall be sent directly to the Resident Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.

Photometric performance shall meet or exceed that of the specified values. The color temperature shall be within $\pm 300^{\circ}\text{K}$ of the submitted factory values. The measured lumen output of the luminaire shall be within $\pm 10\%$ of the submitted factory value. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.

Should any of the tested luminaires of a given type, and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance.

In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety.

The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table.

Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time.

Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.

Installation. Each luminaire shall be installed according to the luminaire manufacturer's recommendations.

Underpass luminaires shall be either attached to structures (such as piers, etc.) or suspended from structures (such as bridge decks) as indicated or implied by the configuration on the Plans. Mounting, including all hardware and appurtenant items, shall be included as part of this item. Luminaires shall be configured with the luminaire tilt as identified in the submitted documents.

Unless otherwise indicated, suspended underpass luminaires shall be installed one-inch above the lowest underpass beam and shall be mounted using vibration dampening assemblies. All

mounting hardware shall be corrosion resistant and shall be stainless steel unless otherwise indicated.

No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.

Luminaire wiring shall be provided with the luminaire. The wiring shall run from the junction box to the luminaire.

Luminaire wire shall be sized No. 10, rated 600 V, RHW/USE-2, and have copper conductors, stranded in conformance with ASTM B 8. Luminaire wire shall be insulated with cross-linked polyethylene (XLP) insulation. The wire shall include a phase, neutral, and green ground wire. Wires shall be trained within any raceways so as to avoid abrasion or damage to the insulation.

Included with the luminaire wiring shall be fusing located in the handhole or primary junction box. Fusing shall be according to Article 1065.01 with the exception that fuses shall be 6 amperes.

Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.

Warranty. The entire luminaire shall be covered by a 10-year warranty. Failure is when one or more of the following occur:

- 1) Negligible light output from more than 10 percent of the discrete LEDs.
- 2) Significant moisture that deteriorates performance of the luminaire.
- 3) Driver that continues to operate at a reduced output due to overheating.

The warranty period shall begin on the date of luminaire delivery. The Contractor shall verify that the Resident Engineer has noted the delivery date in the daily diary. Copy of the shipment and delivery documentation shall be submitted.

The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.

Method of Measurement. The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation.

Designation Type	Minimum Initial Luminous Flux	Designation Type	Minimum Initial Luminous Flux
A	2,200	E	9,450
B	3,150	F	12,500
C	4,400	G	15,500
D	6,300	H	25,200

Where delivered lumens is defined as the minimum initial delivered lumens at the specified color temperature. Luminaires with an initial luminous flux less than the values listed in the above table

will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.

Basis of Payment. This work will be paid for at the contract unit price per each for **LUMINAIRE, LED, UNDERPASS**, of the mount type and output designation specified.

HIGHMAST LUMINAIRE, LED

Effective: November 1, 2025

Description. This work shall consist of furnishing and installing a highmast LED luminaire as shown on the plans, as specified herein.

The luminaire including the housing, driver and optical assembly shall be assembled in the U.S.A. The luminaire shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. The size, weight, and shape of the luminaire shall be designed so as not to incite detrimental vibrations in its respective structure and it shall be compatible with the mounting arm. All electrical and electronic components of the luminaire shall comply with the requirements of Restriction of Hazardous Materials (RoHS) regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750.

The luminaire shall be designed and manufactured for high mast tower use. It shall be designed to withstand constant 80 mph (130 km/hr) wind speeds and 104 mph (167 km/hr) gusts and the physical stresses associated with such duty including shocks and vibrations.

Submittal Requirements.

The Contractor shall also the following manufacturer's product data for each type of luminaire:

21. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided
22. LED drive current, total luminaire input wattage and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.
23. LED efficacy per luminaire expressed in lumens per watt (l/w).
24. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.
25. IES file associated with each submitted luminaire in the IES LM-63 format.
26. Computer photometric calculation reports as specified and in the luminaire performance table.
27. TM-15 BUG rating report.

28. Isofootcandle chart with max candela point and half candela trace indicated.
29. Documentation of manufacturers experience and verification that luminaires were assembled in the U.S.A. as specified.
30. Written warranty.

Upon request by the Engineer, submittals shall also include any or all the following:

- aa. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F (25 °C).
- bb. LM-79 report with National Voluntary Laboratory Accreditation Program (NVLAP) current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.
- cc. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.
- dd. AGi32 calculation file matching the submittal package.
- ee. In Situ Temperature Measurement Test (ISTMT) report for the specified luminaire or luminaire family in PDF format.
- ff. Vibration test report in accordance with ANSI C136.31 in PDF format.
- gg. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.
- hh. ASTM G154 (ASTM D523) gloss test report in PDF format.
- ii. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F (25 °C).
- jj. Power factor (pf) and total harmonic distortion (THD) at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.
- kk. Ingress protection (IP) test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.
- ll. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.
- mm. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.

A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the District Headquarters. After review, the Contractor shall retrieve the luminaire.

Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 20 year lifetime. The luminaire manufacturer shall have a minimum of 15 years' experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the U.S.A.

Housing.

Material. The luminaire shall be a single device not requiring on-site assembly for installation. The driver for the luminaire shall be integral to the unit.

Finish. The luminaire shall have a baked acrylic enamel finish. The color of the finish shall be gray, unless otherwise indicated.

The finish shall have a rating of six or greater according to ASTM D1654, Section 8.0 Procedure A – Evaluation of Rust Creepage for Scribed Samples after exposure to 1000 hours of testing according to ASTM B117 for painted or finished surfaces under environmental exposure.

The luminaire finish shall have less than or equal to 30% reduction of gloss according to ASTM D523 after exposure of 500 hours to ASTM G154 Cycle 6 QUV® accelerated weathering testing.

The luminaire shall slip-fit on a 2 to 2 3/8 in. (50 to 60 mm) O.D. pipe arm and shall have a barrier to limit the amount of insertion. The mounting shall be fully coordinated with the luminaire mounting method indicated in plans.

All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.

The effective projected area of the luminaire shall not exceed 2.1 sq. ft.

The total weight including accessories, shall not exceed 80 lbs (36.3 kg). If the weight of the luminaire is less than 20 lb (9.07 kg), weight shall be added to the mounting arm or a supplemental vibration damper installed as approved by the Engineer.

A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.

The luminaire shall include a fully prewired, 7-pin twist lock ANSI C136.41-compliant receptacle. Unused pins shall be connected as directed by the Manufacturer and as approved by the Engineer. A shorting cap shall be provided with the luminaire that is compliant with ANSI C136.10.

Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual

component shall pass this test with no noticeable damage and the luminaire must remain fully operational after testing.

Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.

An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. Types 1, 2, 3, 4, or 5).

Hardware. All hardware shall be stainless steel or of other corrosion resistant material approved by the Engineer.

Luminaires shall be designed to be easily serviced, having fasteners such as quarter-turn clips of the heavy spring-loaded type with large, deep straight slot heads, complete with a receptacle and shall be according to military specification MIL-f-5591.

All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.

Provisions for any future house-side external or internal shielding should be indicated along with means of attachment.

Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LED's.

Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.

Driver. The driver shall be integral to the luminaire shall be capable of receiving an indefinite open and short circuit output conditions without damage.

The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F (25 °C) to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F (40 °C) or less.

The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an un-dimmed state, the power factor measurement shall be not less than 0.9 and the THD measurement shall be no greater than 20%.

The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for Class A devices with regard to electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.

The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.

Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a surge protective device (SPD) that is UL1449 compliant. An SPD failure shall open the circuit to protect the driver.

LED Optical Assembly The optical assembly shall have an IP65 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.

The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature (+/-300K) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.

The actual measured luminous flux output shall be within +/- 10% of the published lumen value.

Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25° C.

The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.

The optical assembly shall be capable of being rotated 360 degrees around its vertical axis. The luminaire shall be equipped with identifying markings to indicate the mounted orientation. Luminaire installation shall include engraved banding of the mounting arms to designate proper orientation.

The assembly shall have individual serial numbers or other means for manufacturer tracking.

Photometric Performance. Luminaires shall be tested according to IESNA LM-79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) for the IESNA LM-79 test procedure.

Data reports as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above-mentioned tests.

The luminaire shall have a BUG rating of Back Light B3 or less, Up Light rating of U0, and a Glare rating of G3 or less unless otherwise indicated in the luminaire performance table.

Photometric Calculations. Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.

Revised 5-27-2026

Complete point-by-point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).

When the quantity of luminaires requires independent testing, the AGi32 calculation file used for performance verification shall also be submitted with the initial submittal.

All photometry must be **photopic**. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.

**IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE
 ROADWAY LIGHTING**

GIVEN CONDITIONS

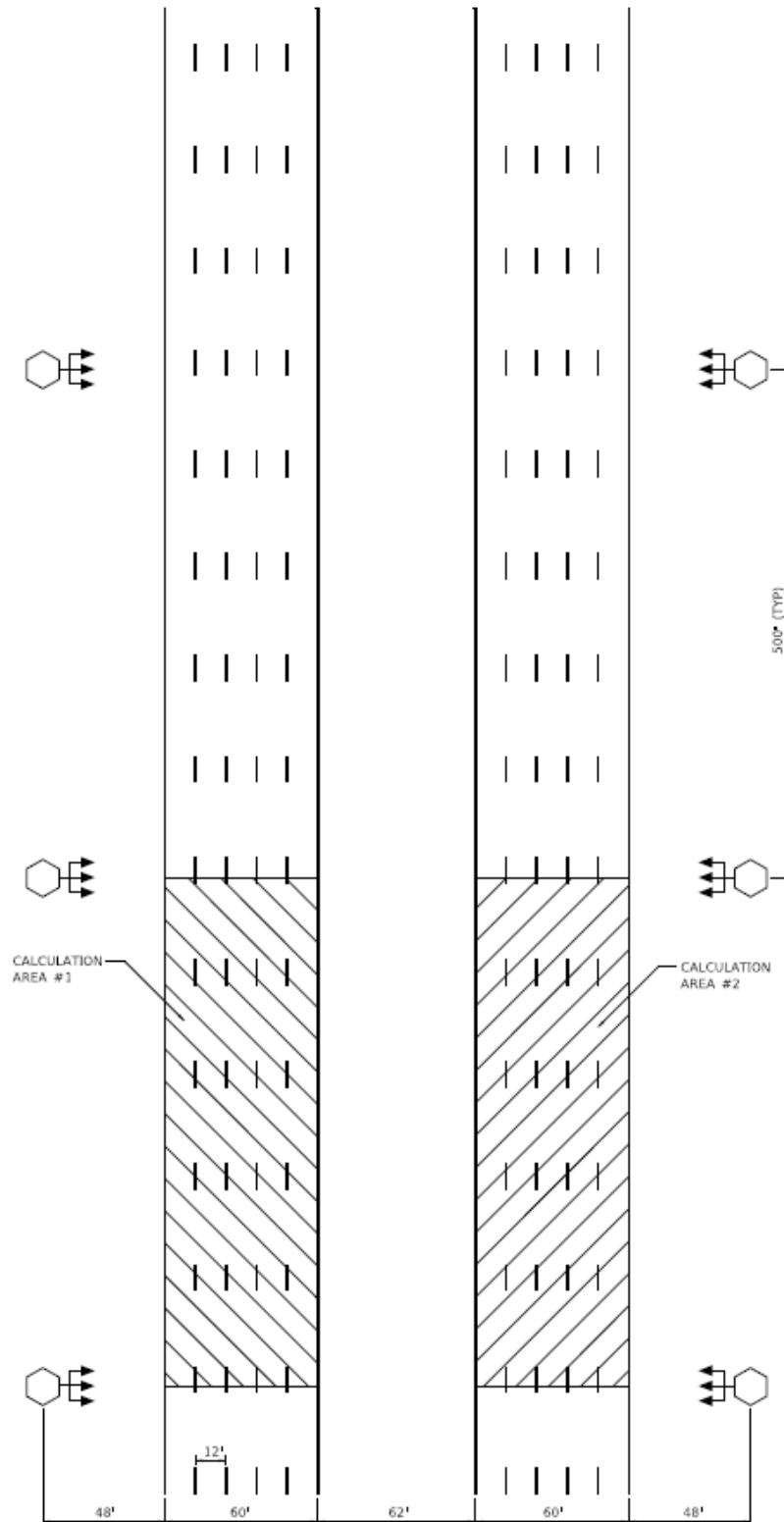
Roadway Data	Pavement Width	60	Ft
	Number of Lanes Left of Median	5	
	Number of Lanes Right of Median	5	
	Lane Width	12	Ft
	Median Width	62	Ft
	IES Surface Classification	R3	
	Q-Zero Value	0.07	
Mounting Data	Mounting Height	120	Ft
	Mast Arm Length	3	Ft
	Tower Set-Back from Edge of Pavement	48	Ft
Luminaire Data	Source	LED	
	Color Temperature	4000	°K
	Lumens	47,250	Min
	Pay Item Lumen Designation	I	
	BUG Rating	B4-U0-G5	
	IES Vertical Distribution	Medium	
	IES Control of Distribution	Short	
	IES Lateral Distribution	Type III	
Tower Layout Data	Total Light Loss Factor	0.75	
	Spacing	500	Ft
	Configuration	See Diagram	
	Number of Luminaires per Tower	3	

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested, and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

Roadway Luminance	Average Luminance, L_{AVE} (Max)	1.2	Cd/m ²
	Average Luminance, L_{AVE} (Min)	0.8	Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5	Max
	Uniformity Ratio, L_{MAX}/L_{MIN}	6	Max
	Veiling Luminance Ratio, L_v/L_{AVE}	0.30	Max



**LUMINAIRE, LED, HIGHMAST, OUTPUT DESIGNATION I
 TOWER LAYOUT DIAGRAM**

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Independent Testing. When a contract has 50 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

Testing is not required for temporary lighting luminaires.

The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead-times and deadlines.

The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the District Headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.

Alternative selection process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.

Luminaires shall be tested at a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire.

The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.

The testing performed shall include photometric and electrical testing.

All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.

Photometric testing shall be according to IES recommendations, performed with a goniophotometer and as a minimum, shall yield an isofootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone plots of candela, a candlepower table (House and street side), a coefficient of utilization chart, a luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.

Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion and LED drive current.

The summary report and the test results including IES photometric files shall be sent directly to the Resident Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.

Photometric performance shall meet or exceed that of the specified values. The color temperature shall be within $\pm 300^{\circ}\text{K}$ of the submitted factory values. The measured lumen output of the luminaire shall be within $\pm 10\%$ of the submitted factory value. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.

Should any of the tested luminaires of a given type, and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance.

In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety.

The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table.

Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time

Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.

Installation. Each luminaire shall be installed according to the luminaire manufacturer's recommendations.

Luminaires shall be leveled/adjusted before being energized. When mounted on a tenon, care shall be exercised to assure maximum insertion of the mounting tenon. Each luminaire shall be checked to assure compatibility with the project power system. When the night-time check of the lighting system by the Engineer indicates that any luminaires are mis-aligned, the mis-aligned luminaires shall be corrected at no additional cost.

No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.

Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.

Luminaires having asymmetrical photometric distributions shall be carefully oriented with respect to the roadway as indicated on the plans and as directed by the Engineer. The Contractor shall confirm all luminaire orientations with the Engineer prior to installation.

For horizontal mounts having rotating optical assemblies, after the orientation of each mast arm tenon is inspected and approved by the Engineer, the position shall be permanently marked in a manner acceptable to the Engineer. The luminaire shall then be leveled to the plane of the luminaire ring.

When the luminaire position and orientation has been confirmed and approved by the Engineer, the luminaire shall be anchored with a minimum size 1/4-20NC stainless steel bolt installed through tapped holes in the tenon and mounting bracket of the luminaire. The bolt shall not penetrate into the tenon more than 1/4 in. (6 mm). Counterweights on un-used tenons shall be mounted in a similar manner. Pre-installed wire on the tower ring shall have the ends of each wire capped at the tenon with butt type crimp-connectors for un-used tenons. The wires shall then be re-inserted into the tenon end and the tenon end shall be capped.

Warranty. The entire luminaire and all component parts shall be covered by a 10-year warranty. Failure is when one or more of the following occur:

- 1) Negligible light output from more than 10 percent of the discrete LEDs.
- 2) Significant moisture that deteriorates performance of the luminaire.
- 3) Driver that continues to operate at a reduced output due to overheating.

The warranty period shall begin on the date of luminaire delivery. The Contractor shall verify that the Resident Engineer has noted the delivery date in the daily diary. Copy of the shipment documentation shall be submitted.

The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.

Method of Measurement. The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation.

Designation Type	Minimum Initial Luminous Flux
H	25,200
I	47,250
J	63,300
K	80,000+

Where delivered lumens is defined as the minimum initial delivered lumens at the specified color temperature. Luminaires with an initial luminous flux less than the values listed in the above table will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.

Basis of Payment. This work will be paid for at the contract unit price per each for **LUMINAIRE, LED, HIGHMAST**, or **TEMPORARY LUMINAIRE, LED, HIGHMAST**, of the output designation specified.

GENERAL ELECTRICAL REQUIREMENTS

Effective: January 1, 2026

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 the latest adopted version thereof, unless indicated otherwise.

Materials 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.

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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 method as directed in the pre-construction meeting. 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.

Submittals shall be provided for all items used, temporary and permanent, for review and approval.

Equipment which will be owned and maintained by a local agency other than the State shall be reviewed and approved by that agency prior to submittal to the State. The submittal to the State shall include any comments made by the local agency.

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

The following submittal file naming convention shall be used:

Contract#_PayItemNumbe#1_PayItem#2_PayItem#3_Description.pdf

The Description can be the Pay Item Abbreviation.

Examples:

62Z54_81702140_81702150_EC-C-XLP-USE.pdf

62Z54_X0327683_ CCTV-CAM-STR-GS-100MH.pdf

62Z34_81028200_81028240_UNDRGRD-C-GALVS-Resub-1.pdf

The submittal must clearly identify the specific model number or catalog number of the item being proposed. Submittals must be the Manufacturers current published information. Out of date submittal material will be grounds for rejection.

Any comments or notations made on the submittal by the Manufacturer, Representative, and or Contractor shall be in **BLUE**. The reviewing agency shall make comments in **RED**.

The submittal shall be properly identified by Contractor, Pay Item Number, route, section, county, and contract number in **BLUE** lettering as previously described. Example:

Contractor: Contractor Name
Pay Item: X0327607
Route: I-00
Section: 2013-xxx-yzx
County: Cook
Contract: 12Z34

The Contractor shall have reviewed the submittal material and affixed the Contractor's stamp of approval, with date and signature, for each individual item prior to submittal. The Contractor's approval stamp shall be the first page of the submittal.

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. In general, the disciplines are as follows:

Discipline	Typical Items
ITS	CCTV CCTV structures CCTV Cabinets Communication vaults Heavy Duty Handhole
Lighting	Breakaway devices Light poles Light tower Lighting cables Lighting controllers Luminaires Unit duct
Surveillance	Loop cables Detector equipment & associated structures Ramp metering & associated structures Wireless pavement sensors and associated structures Radar detection and associated structures Cabinets for surveillance equipment Data Probing Handholes Dynamic Message Signs (DMS) Fiber optic cable, duct, splices, terminations, patch panels Fiber Optic Utility Markers Network equipment (Ethernet switches, power supplies, media converters)
Traffic Signal	Controllers/Cabinets Handholes Illuminated signs Pedestrian Push Buttons Signal Cable Signal Detectors Signal Heads Signal Loop Cable Signal Modules Signal Structures
Pump Station	All pump station equipment
Signing	Signing
Local Roads Lighting	Same as lighting
Local Roads Traffic Signal	Same as traffic signal
Discipline with the predominate amount of work in contract or ask Engineer.	Raceways Electric cables Junction boxes

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", "Incomplete", or "Information Only". The Engineer's review is for conformance with the design concept only, it shall be the

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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", "Incomplete" 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 electrical systems (lighting, ITS, Pump Station, Surveillance, and 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 the electrical systems which may be affected by the work.

Marking of Existing Cable Systems. The party responsible for maintenance of any existing electrical 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.

Electrical Infrastructure During Construction. The scope of work shall include locating and marking the proposed underground infrastructure installed in this contract.

Energy and Demand Charges. The payment of basic energy and demand charges by the electric utility for existing lighting, and temporary 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. 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.

General. 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
- Resistance of Grounding Electrodes
- 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.

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

- (1) 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.
- (2) The loop and lead-in circuit shall have an inductance between 20 and 2500 microhenries.
- (3) The resistance to ground shall be a minimum of 50 megohms under any conditions of weather or moisture.
- (4) The continuity test of the loop and loop lead-in shall not have a resistance greater than two (2) ohms
- (5) The quality factor (Q) shall be 5 or greater.

Loops which fail to test satisfactorily shall be repaired or replaced.

Telecommunication Cable. Once the telecommunication cable is installed complete with all cable terminations complete the Contractor shall request an end-to-end test. The Contractor shall request the end-to-end test at least 7 days in advance to the TSC Engineer. Any lane closures and/or any other safety measures that need to be taken shall be provided for by the Contractor and shall be considered incidental to the cost of this item. The type of test performed shall be an end-to-end test with Halcyon type equipment transmitting and receiving at each end of the cable. Each pair shall be tested, and the results shall be recorded and submitted to the Engineer. If any results don't fall within the

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requirements set forth in (REA) PE-39, the Contractor shall correct and re-test that cable pair. Traffic Systems will tolerate only one pair out of every 100 pair of cable that doesn't meet or exceed specifications set forth in (REA) PE-39.

Wireless In-Pavement Detection Systems shall be tested in accordance with the approved testing procedures provided in the catalog cut submittal.

Fiber Optic Systems.

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 IDOT 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 described herein with copies on CD ROM or USB Drive.

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, or USB drive copies, and shall include the following:

Cable & Fiber Identification:

- Cable ID
- Cable Location - beginning and end point
- Fiber ID, including tube and fiber color
- Wavelength
- Pulse width (OTDR)
- Refractory index (OTDR)
- Operator Name
- Date & Time
- Setup Parameters
- Range (OTDR)
- Scale (OTDR)
- Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR Test results
- Total Fiber Trace
- Splice Loss/Gain
- Events > 0.10 dB
- Measured Length (Cable Marking)
- Total Length (OTDR)
- Optical Source/Power Meter Total Attenuation (dB/km)

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							
Maximum Loss									
Minimum Loss									

The OTDR test results file format must be Bellcore/Telcordia compliant according to GR-196-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 manufacture'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:

Sample OTDR Summary				
Cable Designation:	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date: <i>1/1/00</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>29000 Ft.</i>	<i>.075</i>	<i>.063</i>
<i>2</i>	<i>Splice</i>	<i>29000 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:

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.

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.

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", "TS", "S", "A" number.
- Summary of Quantities, electrical items only
- Legends, Schedules, and Notes
- Plan Sheets
- Final fiber assignment tables
- Pertinent Details
- Single Line Diagrams; electrical, communications, surveillance and fiber optic.
- 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 programming
- 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, marked “**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 via a mutually agreed to electronic format 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 (bookmarks) the respective pay item number.** Specific part or model numbers of items which have been selected shall be clearly visible.

If the Electric Service is new or modified, documentation as required in the Electric Utility Service Installation and Connection shall be submitted.

During the Final Inspection, 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 equipment designations and clearly identified.

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.

The identical material shall also be submitted in the same manner as the catalog cut submittals utilizing the following final documentation pay item numbers:

Pay Code	Description	Discipline
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

Pay Code	Description	Discipline
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
FDLES00	Electric Service - Lighting	Lighting
FDSES00	Electric Service - Surveillance	Surveillance
FDTES00	Electric Service - Traffic Signal	Traffic Signal
FDIES00	Electric Service - ITS	ITS

Record Drawings shall include Marked up plans, controller info, Electric 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.
- Fiber Optic Utility Markers
- 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.

- All wireless in-pavement vehicle detectors

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:

12. District
13. Description of item
14. Designation
15. Use
16. Approximate station
17. Contract Number
18. Date
19. Owner
20. Latitude
21. Longitude
22. Comments

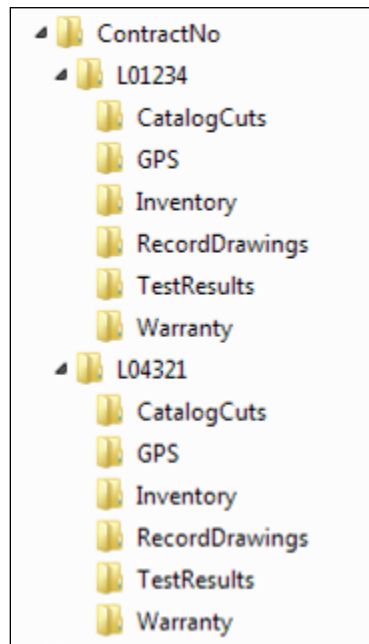
A spreadsheet template will be available from the Engineer for use by the Contractor.

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 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.

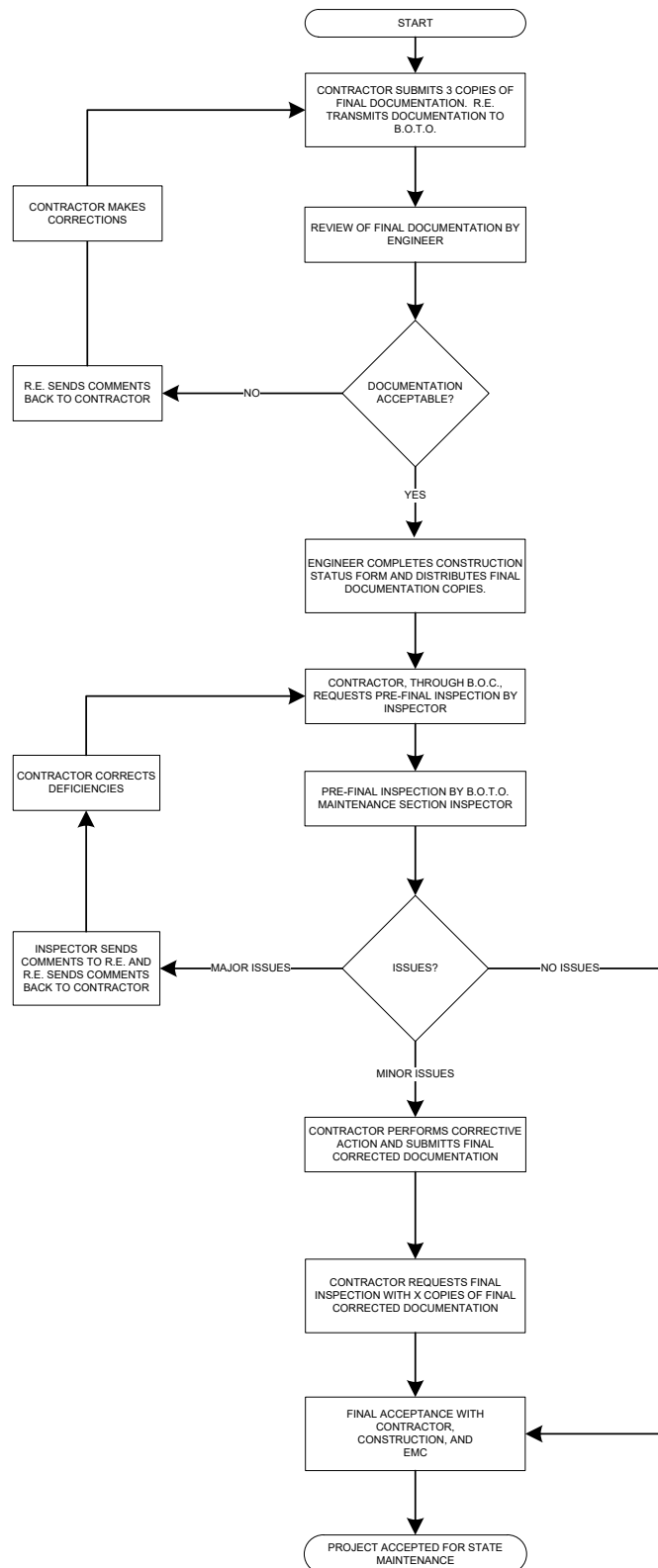
The inspection will not be made until after the delivery of acceptable record drawings, specified certifications, and the required guarantees.

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

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)
Record Drawings		
-Three hardcopies (for cabinets)	☐	☐
-PDFs as required elsewhere	☐	☐
Field Inspection Tests		
-Voltage	☐	☐
-Amperage	☐	☐
-Cable Insulation Resistance	☐	☐
-Continuity	☐	☐
-Controller Ground Rod Resistance	☐	☐
(PDFs as required)		
GPS Coordinates		
-Excel file	☐	☐
(Check Special Provisions, Excel file required.)		
Job Warranty Letter		
(PDFs as required)	☐	☐
Catalog Cut Submittals		
-Approved & Approved as Noted	☐	☐
(PDFs as required)		
Lighting Inventory Form		
(PDFs as required)	☐	☐
Lighting Controller Inventory Form		
(PDFs as required)	☐	☐
Electric Service Documentation		
(PDFs as required)	☐	☐
Light Tower Inspection Form		
(If applicable, PDFs as required)	☐	☐

PDFs as required shall be submitted for all items above.

General Notes:

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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. Coordinates in Latitude and Longitude, decimal degrees.

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.

MINERALIZED CARBON DIOXIDE CONCRETE (D-1)

Effective: January 1, 2026

Description. This work shall consist of the proportioning, mixing, placement, curing, and evaluation testing of portland cement concrete that utilizes an admixture which promotes carbon dioxide (CO₂) mineralization or an equivalent effect at the Contractor's option.

Materials. Materials shall be according to the following.

<u>Item</u>	<u>Article/Section</u>
(a) Portland Cement Concrete (Note 1)	1020
(b) Concrete Admixtures (Note 2)	1021

Note 1: Concrete shall meet the requirements of Class SI concrete used for the construction of curb and gutter, driveways, sidewalks and other applications as allowed by the Engineer. However, the mix design cement content shall be reduced by 3 to 6 % and an admixture which promotes CO₂ mineralization, or an equivalent effect shall utilized.

Note 2: The admixture which promotes CO₂ mineralization, or an equivalent effect shall be food grade quality from a nearby supplier. In addition, it shall, at a minimum, be according to AASHTO M 194 , Type S (specific performance). The Department also reserves the right to require other testing, as determined by the Engineer, to show evidence of specific performance

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characteristics. Testing according to AASHTO M 194 and other testing if required by the Engineer shall be by an independent laboratory accredited by AASHTO re:source for Portland Cement Concrete. Test data required to be submitted to AASHTO Product Eval and Audit according to Article 1021.01 and other testing data, if required by the Engineer, shall be submitted to the Department. The independent accredited lab report shall show the results of physical tests conducted no more than five years prior to the time of submittal.

Mix Design Verification and Evaluation. The mineralized CO₂ concrete mix design will be verified by the Engineer. Verification of a mix design shall in no manner be construed as acceptance of any mixture produced.

Equipment. Equipment shall be according to applicable portions of Sections 420, 424, 483, and 606; except special equipment needed for production of mineralized CO₂ concrete shall be approved by the Engineer.

Construction Requirements. Construction requirements shall be according to applicable portions of Sections 420, 424, 483, and 606.

The placement locations for the mineralized CO₂ concrete shall be according to the plans or as directed by the Engineer.

The same mixture proportions shall be used for the entire project, unless otherwise stated in the project documents. If during the project there is a change in the type or source of the cement, finely divided minerals, aggregates, or CO₂ mineralization admixture; the mixing shall be suspended, and a new mix design shall be developed, and re-verified.

The cost of this work shall be included in the contract unit price of the PCC pay item involved.

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC (LANE CLOSURES ONLY) (FOUR-OR-MORE LANE, TWO-WAY)

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 Details.

Arterial lane closures shall be in accordance with the Standard Specifications, Highway Standards, District Details, and the direction of the Engineer. The Contractor shall request and gain approval from the Engineer seventy-two (72) hours in advance of all long-term (24 hrs. or longer) lane closures.

Arterial **one lane** closures not shown in the staging plans will not be permitted during **peak traffic volume hours**.

Peak traffic volume hours for one lane closures are defined as weekdays (Monday through Friday) from **6:00 AM to 8:30 AM and 4:30 PM to 6:00 PM**.

Arterial **two-lane** closures in the same direction of travel not shown in the staging plans will not be permitted during **peak traffic volume hours**.

Peak traffic volume hours for two lane closures are defined as weekdays (Monday through Friday) from **5:00 AM to 9:00 PM**.

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 locations approved by the Engineer in accordance with Articles 701.08 and 701.11 of the Standard Specifications.

Should the Contractor fail to completely open and keep open all the traffic lanes to traffic in accordance with the limitations specified above, the Contractor shall be liable to the Department for the amount of:

One lane or ramp blocked = \$ 1,000
Two lanes blocked = \$ 2,500

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.

CURB OR COMBINATION CURB AND GUTTER REMOVAL AND REPLACEMENT (D1)

Effective: November 1, 2020

Revised: September 1, 2022

Description. This work shall consist of the complete removal and replacement of curb or combination curb and gutter. Work shall be according to Sections 440 and 606 of the Standard Specifications, State Standard 606001, District Detail BD-24 and as directed by the Engineer except as modified herein.

Curb or combination curb and gutter removal and replacement shall match the type of the existing curb or combination curb and gutter. Types may be variable and are to meet existing dimensions and field conditions. Locations of removal and replacement shall be determined by the Resident Engineer at the time of construction.

Unsuitable material to be removed, as directed by the Engineer, shall be replaced with subbase granular material, type B or additional thickness of concrete. Suitable backfill material, when required, shall be replaced as directed by the Engineer.

Epoxy coated tie bars, #6 (20) - 24" (610) long at 24" (610) centers, shall be used except when adjacent to flexible pavement. Longitudinal bars, if encountered, are not to be replaced.

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Hot-mix asphalt surface removal on the existing gutter flag, if encountered, shall be included in the removal of the curb and gutter.

Saw cuts shall be according to Article 440.03 of the Standard Specifications.

½" (13) preformed expansion joints shall be used at concrete sidewalks, driveways and medians.

Method of Measurement. Concrete curb removal and replacement, or combination concrete curb and gutter removal and replacement will be measured for payment in feet (meters) along the face of concrete curb. A minimum replacement length of 4 feet is required.

Basis of Payment. This item will be paid for at the contract unit price per foot (meter) for CURB REMOVAL AND REPLACEMENT GREATER THAN 10 FEET or COMBINATION CURB AND GUTTER REMOVAL AND REPLACEMENT GREATER THAN 10 FEET for lengths greater than 10 feet.

This item will be paid at the contract unit price per foot (meter) for CURB REMOVAL AND REPLACEMENT LESS THAN OR EQUAL TO 10 FEET or COMBINATION CURB AND GUTTER REMOVAL AND REPLACEMENT LESS THAN OR EQUAL TO 10 FEET for lengths less than or equal to 10 feet.

Where unsuitable material is encountered in the subgrade or subbase and its removal and replacement is required by the Engineer, such removal and replacement will be paid for according to Article 109.04.

Sidewalk removal, driveway pavement removal and median surface removal will be paid for according to Article 440.08 of the Standard Specifications.

Portland cement concrete sidewalk will be paid for according to Article 424.13 of the Standard Specifications.

Portland cement concrete driveway pavement will be paid for according to Article 423.11 of the Standard Specifications.

Hot-mix asphalt driveway will be paid for according to Article 355.11 and 406.14 of the Standard Specifications.

Concrete median surface will be paid for according to Article 606.15 of the Standard Specifications.

Topsoil will be paid for according to Article 211.08 of the Standard Specifications.

Sodding will be paid for according to Article 252.13 of the Standard Specifications. Fertilizer for the placement of sod is not required.

GRADING AND SHAPING SHOULDERS (D1)

Effective: December 28, 2001

Revised: January 1, 2007

Description. This work consists of regrading the existing aggregate shoulder high areas before a new layer of stone is laid for the proposed Aggregate Shoulder.

Construction Requirements. Applicable portions of Sections 202 and 481 shall apply. The existing aggregate shoulder shall be redistributed and regraded to fill any low spots and compacted in a manner approved by the Engineer.

Basis of Payment. This work will be paid for at the contract unit price per unit (equivalent to 100 linear feet) for GRADING AND SHAPING SHOULDERS

MAINTENANCE OF LIGHTING SYSTEMS

Effective: November 1, 2025

Replace Article 801.11 and 801.12 of the Standard Specifications with the following:

Effective the date the Contractor's activities (electrical or otherwise) at the job site begin, the Contractor shall be responsible for the proper operation and maintenance of all existing and proposed lighting systems which are part of, or which may be affected by the work until final acceptance or as otherwise determined by the Engineer.

Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor shall initiate a request for a maintenance transfer and preconstruction inspection, as specified elsewhere herein, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any lighting systems which may be affected by the work. During the maintenance preconstruction inspection, the party responsible for existing maintenance shall perform testing of the existing system in accordance with Article 801.13a. The Contractor shall request a date for the preconstruction inspection no less than fourteen (14) days prior to the desired date of the inspection.

The Engineer will document all test results and note deficiencies. All substandard equipment will be repaired or replaced by the existing maintenance contractor, or the Engineer can direct the Contractor to make the necessary repairs under Section 109.04.

Existing lighting systems, when depicted on the plans, are intended only to indicate the general equipment installation of the systems involved and shall not be construed as an exact representation of the field conditions. It remains the Contractor's responsibility to visit the site to confirm and ascertain the exact condition of the electrical equipment and systems to be maintained. Contract documents shall indicate the circuit limits.

Maintenance of Existing Lighting Systems

Existing lighting systems. Existing lighting systems shall be defined as any lighting system or part of a lighting system, including combination traffic signal lighting, in service

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at the time of contract Letting regardless of the number of lighting controllers involved. The contract drawings indicate the general extent of any existing lighting, but whether indicated or not, it remains the Contractor's responsibility to ascertain the extent of effort required for compliance with these specifications and failure to do so will not be justification for extra payment or reduced responsibilities.

Extent of Maintenance.

Partial Maintenance. Unless otherwise indicated, if the number of circuits affected by the contract is equal to or less than 40% of the total number of circuits in a given controller and the controller is not part of the contract work, the Contractor needs only to maintain the affected circuits within the project limits. The project limits are defined as those limits indicated in the contract plans. Equipment outside of the project limits, on the affected circuits shall be maintained and paid for under Article 109.04. The affected circuits shall be isolated by means of in-line waterproof fuse holders as specified elsewhere and as approved by the Engineer. The unaffected circuits and the controller will remain under the maintenance of the State.

Full Maintenance. If the number of circuits affected by the contract is greater than 40% of the total number of circuits in a given controller, or if the controller is modified in any way under the contract work, the Contractor shall maintain the entire controller and all associated circuits within the project limits. Equipment outside of the project limits shall be maintained and paid for under Article 109.04.

If the existing equipment is damaged by normal vehicular traffic, not contractor operations, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind with payment made for such equipment under Article 109.04. If the equipment damaged by any construction operations, not normal vehicular traffic, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind and the cost of the equipment shall be included in the cost of this pay item and shall not be paid for separately.

Maintenance of Proposed Lighting Systems

Proposed Lighting Systems. Proposed lighting systems shall be defined as any lighting system, part of a lighting system, combination traffic signal lighting, temporary or permanent, which is to be constructed under this contract regardless of the project limits indicated in the plans.

The Contractor shall be fully responsible for maintenance of all items installed under this contract. Maintenance shall include, but not be limited to, any equipment failures or malfunctions as well as equipment damage either by the motoring public, Contractor operations, vandalism, or other means. The potential cost of replacing or repairing any malfunctioning, damaged, or vandalized equipment shall be included in the bid price of this item and will not be paid for separately.

Lighting System Maintenance Operations

The Contractor's responsibility shall include all applicable responsibilities of the Electrical Maintenance Contract, State of Illinois, Department of Transportation, Division of Highways, District

One. These responsibilities shall include the maintenance of lighting units (including sign lighting), cable runs and lighting controls. In the case of a pole knockdown or sign light damage, the Contractor shall promptly clear the lighting unit and circuit discontinuity and restore the system to service. The equipment shall then be re-set by the contractor within the time limits specified herein.

If the existing equipment is damaged by normal vehicular traffic, not contractor operations, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind with payment made for such equipment under Article 109.04. If the equipment damaged by any construction operations, not normal vehicular traffic, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind and the cost of the equipment shall be included in the cost of this pay item and shall not be paid for separately.

Responsibilities shall also include weekly night-time patrol of the lighting system, with patrol reports filed immediately with the Engineer and with deficiencies corrected within 24 hours of the patrol. Patrol reports shall be presented on standard forms as designated by the Engineer. Uncorrected deficiencies may be designated by the Engineer as necessitating emergency repairs as described elsewhere herein.

The following chart lists the maximum response, service restoration, and permanent repair time the Contractor will be allowed to perform corrective action on specific lighting system equipment.

INCIDENT OR PROBLEM	SERVICE RESPONSE TIME	SERVICE RESTORATION TIME	PERMANENT REPAIR TIME
Control cabinet out	1 hour	4 hours	7 Calendar days
Hanging mast arm	1 hour to clear	N/A	7 Calendar days
Radio problem	1 hour	4 hours	7 Calendar days
Motorist caused damage or leaning light pole 10 degrees or more	1 hour to clear	4 hours	7 Calendar days
Circuit out – Needs to reset breaker	1 hour	4 hours	N/A
Circuit out – Cable trouble	1 hour	24 hours	21 Calendar days
Outage of 3 or more successive lights	1 hour	4 hours	N/A
Outage of 75% of lights on one tower	1 hour	4 hours	N/A
Outage of light nearest RR crossing approach, Islands and gores	1 hour	4 hours	N/A
Outage (single or multiple) found on night outage survey or reported to EMC	N/A	N/A	7 Calendar days
Navigation light outage	N/A	N/A	24 hours

- **Service Response Time** -- amount of time from the initial notification to the Contractor until a patrolman physically arrives at the location.

- **Service Restoration Time** – amount of time from the initial notification to the Contractor until the time the system is fully operational again (In cases of motorist caused damage the undamaged portions of the system are operational.)
- **Permanent Repair Time** – amount of time from initial notification to the Contractor until the time permanent repairs are made if the Contractor was required to make temporary repairs to meet the service restoration requirement.

Failure to provide this service will result in liquidated damages of \$500 per day per occurrence. In addition, the Department reserves the right to assign any work not completed within this timeframe to the Electrical Maintenance Contractor. All costs associated to repair this uncompleted work shall be the responsibility of the Contractor. Failure to pay these costs to the Electrical Maintenance Contractor within one month after the incident will result in additional liquidated damages of \$500 per month per occurrence. Unpaid bills will be deducted from any monies owed to the Contractor. Repeated failures and/or a gross failure of maintenance shall result in the State's Electrical Maintenance Contractor being directed to correct all deficiencies and the resulting costs deducted from any monies owed the contractor.

Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract.

Operation of Lighting

The lighting shall be operational every night, dusk to dawn. Duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously. Lighting systems shall not be kept in operation during long daytime periods.

Method of Measurement

The contractor shall demonstrate to the satisfaction of the Engineer that the lighting system is fully operational prior to submitting a pay request. Failure to do so will be grounds for denying the pay request. Months in which the lighting systems are not maintained and not operational will not be paid. Payment shall not be made retroactively for months in which lighting systems were not operational.

Basis of Payment. Maintenance of lighting systems shall be paid for at the contract unit price per calendar month for **MAINTENANCE OF LIGHTING SYSTEM.**

UNDERGROUND CONDUIT, MULTI-DUCT, 18MM MICRODUCTS

Effective: January 1, 2026

Description. This work shall consist of furnishing, installing, splicing, connecting, and demonstrating continuity a of fiber optic microduct system of the size specified herein and as shown on the Plans.

Materials The microduct and fittings shall meet the requirements of Article 1088.01(c) of the Standard Specifications, except as modified herein. The microduct system shall consist of four or seven 18mm O.D. (14mm I.D.) microducts contained inside a HDPE protective outer sheath with

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a minimum thickness of 0.07" inch as specified. The microduct system shall be designed for direct burial.

For four microducts, the overall conduit shall have a nominal 1.9" inches outside diameter with a supported bend radius of 19" inches, an unsupported bend radius of 37" inches, and a safe working load of 2,200 lbs.

For seven microducts, the overall conduit shall have a nominal 2.25" inches outside diameter with a supported bend radius of 31" inches, an unsupported bend radius of 52" inches, and a safe working load of 3,500 lbs.

The anticipated product life shall be a minimum of fifteen years after installation, allowing for jetting (blowing) operations for cable installations and replacements.

Microducts shall be free from holes, blisters, inclusions, cracks, or other imperfections that would affect the performance or serviceability of the product.

Microducts shall be constructed of polymeric materials, which are lightweight, flexible, corrosion resistant and nonconductive. The base material shall be clean virgin grade high-density polyethylene (HDPE), which conforms to ASTM D3350-98a, Type III, Category 5, Class B or C and Grade P- 34 per ASTM D1248-84 or equivalent.

The base HDPE material shall conform to the following minimum mechanical properties:

Description Property ASTM Standard Density D1505 0.940-0.950 g/cm³ Melt Index (E) D1238 0.10 – 0.35 g/10 Minute Environmental Stress Crack Resistance (ESCR) D1693 192.0 hrs (per ASTM D3350) Tensile @ Yield (min) D638 2500 – 3200 psi (1,700 – 2,200 N/cm²) % Elongation D638 300% Flexural Modulus (min) D790 115,000 psi (790,000 kPa) Hardness D2240 60 Shore D VICAT Softening Point D1525 248°F (120°C) Brittleness Temperature D746 -94°F (-70°C)

Microducts shall be smooth on the outside and have a co-extruded permanent layer of a low friction boundary layer between the microduct and the fiber optic cable for the anticipated service life of the microduct.

Factory pre-lubrication shall be performed with materials or agents that provide a stable treatment and result in a dynamic coefficient of friction less than or equal to ($\leq$) 0.20, when tested in accordance with Telcordia (Bellcore) GR-356-CORE, section 4.2.5. Lubricants, whether factory applied, or field applied, shall be chemically compatible with both conduit and cable jacket materials.

Standard available microduct colors shall be blue, yellow, green, brown, grey, black, and red, or other colors as approved. Microducts shall be individually colored and be sequentially numbered every two feet. Colors shall be protected from ultra-violet (UV) degradation by the incorporation of Hindered Amine Light Stabilizers (HALS) to allow for two years of outside storage UV protection. The duct material shall be compounded with antioxidant additives to prevent thermal degradation.

Unless otherwise indicated or as directed by the Engineer, the microduct outer jacket for trunk ducts shall be orange and blue for distribution ducts.

The microduct system shall be equipped with an integrated 20 AWG copper tracer wire, insulated and installed inside the microduct system that is designed to be used for underground utility locating purposes. Continuity of the tracer wire must be maintained at all points. Connection devices used shall be as approved by the microduct manufacturer, except wire nuts of any type are not acceptable. The Contractor must perform a locate or conductivity test as a part of the final documentation.

Microducts shall be supplied on minimum 3,500 ft. reels (or larger as equipment and installation techniques permit) to minimize the number of microduct splices. Fittings shall be mechanical or glued splices that preserve the smooth, seamless surface on the inside of the conduit. Fittings shall be capable of developing a minimum of 75% of the rated tensile (pull) strength of the conduit.

Installation. The microduct shall be installed according to Section 810 of the Standard Specifications, in accordance with manufacturer's specifications, and as specified herein.

Fiber optic cable shall be air blown (jetted) into the microducts.

Microduct shall be buried a minimum of 42" inches ($\pm 3"$) below final grade throughout its entire length. Microduct shall be installed in straight runs as much as possible with a minimum number of bends according to Section 816 of the Standard Specifications. Any bend in the microduct shall be limited to the bend radius specified herein.

Microduct termination. Microduct inside access points, i.e. pull boxes, junction boxes handholes and communication vaults shall have 8 inches to 12 inches exposed microduct inside of the access point. It is brought to the Contractors attention that long microduct installation may stretch the microduct. If the microduct is slightly stretched during installation and placed among several adjacent success points during the same micro-duct pull, then the microduct is cut to place the 8 to 12 inches of exposed microduct inside the access point, the microduct may pull back into the soil and not leave any microduct exposed in the access point. Microduct installation may be rejected if microduct pullback occurs resulting in less than 8 to 12 inches of exposed microduct.

The microduct system shall be always sealed during construction to eliminate the ingress of dirt and moisture. The Contractor shall utilize caps that are approved for use by the microduct manufacturer. Microduct end stop caps shall be used for empty micro ducts and divisible duct seals shall be used for microducts with installed microfiber cables. Catalog cuts shall be provided for review and approval of the seals. Expandable foam seal and taping is not permitted.

Splicing. Use mechanical splices made in accordance with microduct and splice manufacturer's recommendations. Fusion microduct splices are not allowed. Submit materials to be used for microduct splices to the Engineer for review and approval along with the manufacturer's recommendations and installation procedures.

The Contractor shall submit testing information to the Department for review and approval prior to ordering material.

The Contractor shall perform post installation testing on all microducts prior to installing fiber optic cable. As a minimum, tests shall include: an air test, a foam sponge test, a plastic sphere test and a pressure test. The tracer wire shall be tested per specifications prior to any fiber optic cable being installed.

Each microduct shall be tested for continuity by blowing a sponge and then a sphere (approximately 85% of the inside duct diameter) from one end to the other and each duct shall be pressure tested in accordance with the manufacturer's procedures to ensure that the duct will pressurize and hold air pressure for a specific amount of time.

The Contractor shall perform acceptance testing of the microducts in accordance with the manufacturer's recommended practices. Testing, at a minimum shall demonstrate that the microducts are installed and assembled correctly, are air-tight, and have had no reduction of the interior diameter. Each microduct shall be pressurized to check for leaks and other problems that would prevent the installation of fiber optic cable in the future. All testing shall be performed in the presence of the Resident Engineer or designated representative.

A cable marking tape shall be installed above the conduit system according to Article 819.05 of the Standard Specifications. The color of the tape shall be red with large black lettering which reads "WARNING – FIBER OPTIC CABLE BELOW" or similar.

In addition to the GPS documentation requirements in the General Electrical Provisions, the Contractor shall locate the microduct every 200' feet using a GIS locating device that is accurate to the nearest foot. All coordinates shall be in decimal degrees with the Datum used identified.

The Contractor shall submit catalog cut sheets for the microduct system, splice kits, and all installation and testing documents to the Department for review prior to ordering.

The fiber optic micro duct outer sheath shall be tagged.

Tag material. Thickness: 20.0 mils, +/- 2.0 mils. The self-laminating portion shall be clear polyester with a vinyl printable portion.

Labels shall be mechanically imprinted or handwritten and shall be smear resistant, fade resistant, wrap around, self-laminating type.

The fiber optic micro duct outer sheath shall be tagged inside all access points, no closer than 12-inches from point of entry

Labels shall be two (2) lines of text. The first line shall have the near-end terminal information. The second line shall have far-end terminal information.

Labels shall clearly visible/viewable from point of final resting orientation

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 microduct system between ends and changes in direction.

Vertical measurement of the duct shall be as follows:

For runs terminating at junction boxes, the vertical measurement will be made from the bottom of the trench, or horizontal raceway, to a point 12 inches beyond the center of the junction box or control cabinet.

Basis of Payment. This work will be paid for at the contract unit price per foot for **UNDERGROUND CONDUIT, MULTI-DUCT**, of the number specified, **18MM MICRODUCTS**.

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FIBER OPTIC CABLE INNERDUCT

Effective: January 1, 2026

1. Description.

This item shall consist of furnishing, installing, splicing, connecting and demonstrating continuity of fiber optic cable innerduct of sizes specified herein and as shown on the contract drawings.

3. Materials.

3.1 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.

3.2 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"	1.030"	1.315"	0.120"	14"	500	19
1.25"	1.313"	1.660"	0.151"	17"	750	31
1.5"	1.506"	1.900"	0.173"	19"	1000	40
2"	1.885"	2.375"	0.216"	24"	1600	60

3.3 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.

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3.4 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 or greater fibers and ducts designated as trunk fibers)	Orange
Fiber Optic Distribution Cable (Ducts containing cables of 12, 6 or 4 fibers and ducts designated as distribution fibers)	Blue

3.5 Tracer Wire

A tracer wire shall be installed with all fiber raceways. Tracer wire shall be installed and paid for as specified for Tracer Wire.

4. Installation.

4.1 Pulling Tension.

Pulling tension of the duct shall be monitored throughout the pull and pulling tension shall not exceed those listed in the 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.

4.2 Junction boxes.

Where duct passes through junction and/or pull boxes, the duct shall remain continuous unless a break is specifically indicated in the plans or as directed by the Engineer.

4.3 Handholes and Communications Vaults.

Where duct passes through handholes or vaults, the duct shall be looped uncut within the handhole unless otherwise indicated on the Plans or directed by the Engineer.

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.

4.4 In Trench

Where duct is installed in trench, it shall be placed in the bottom of the trench 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 42 inches unless otherwise indicated or specifically directed by the Engineer.

The inner duct may be plowed into place. Unless otherwise indicated or specifically approved by the Engineer, plowing of inner duct 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.

4.5 In Raceway

Where duct is installed in raceways, lubricating compounds compatible with the duct shall be used where necessary to assure smooth installation.

4.6 Encased in Concrete

Concrete shall be class SI complying with Section 720 of the Standard Specifications.

Steel Reinforcement Bars. Steel reinforcement bars shall comply with Section 706.10 of the Standard Specifications.

Underground concrete-encased conduit shall be supported on interlocking plastic spacers specifically designed for the purpose spaced along the length of the run as recommended by the manufacturer. Spacing between raceways within a common duct bank shall be not less than 2 inches. The interlocking spacers shall be used at a minimum interval of 8 ft.

Concrete cover overall shall not be less than 3 inches all around the encased run. Space below the conduit, and concrete fill shall be assured. Care shall be exercised during concrete placement to assure that there are no voids, so that spacers are undisturbed, and so that conduit joints stay secure and unbroken. Concrete shall be deflected during placement to minimize the possible damage to or movement of the conduits.

Conduit encased in concrete shall have steel reinforcing where installed below roadway or other paved vehicle areas (including shoulder) and the reinforcement shall extend not less than 5 feet additional from the edge of pavement unless otherwise indicated. Steel reinforcement shall not be less than No. 4 bars at corners and otherwise spaced on 12-inch centers, tied with No. 4 bars on 12-inch centers.

The Engineer shall examine all conduit joints for compliance with section 5 of this specification before concrete is poured.

4.7 Embedded

Duct embedded in structure shall be supported on interlocking plastic spacers specifically designed for the purpose spaced along the length of the run as recommended by the manufacturer. Spacing between raceways within a common structure shall be not less than 2 inches. The interlocking spacers shall be used at a minimum interval of 8 ft.

Concrete cover overall shall not be less than 3 inches all around the embedded run. Space below the conduit, and concrete fill shall be assured. Care shall be exercised during concrete placement to assure that there are no voids, so that spacers are undisturbed, and so that conduit joints stay secure and unbroken. Concrete shall be deflected during placement to minimize the possible damage to or movement of the conduits.

The Engineer shall examine all conduit joints for compliance with section 5 of this specification before concrete is poured.

4.8 Innerduct caps

Following installation, the ends of the innerduct shall be capped to keep out dirt and other debris. The caps shall be manufacturer for the intended purpose and not improvised devices such as plastic cups and/or tape.

5. Joints

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

5.2 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	1,000
76.2	3.0	6225	1,400
101.6	4.0	8890	2,000

6. Fiber optic inner duct shall be tagged.

Tag material:

Thickness: 20.0 mils, +/- 2.0 mils. The self-laminating portion shall be clear polyester with a vinyl printable portion.

Labels shall be mechanically imprinted or handwritten and shall be smear resistant, fade resistant, wrap around, self-laminating type.

Fiber optic ducts shall be tagged inside all access points, no closer than 12-inches from point of entry

Labels shall be two (2) lines of text. The first line shall have the near-end terminal information. The second line shall have far-end terminal information.

Labels shall clearly visible/viewable from point of final resting orientation.

7. Measurement.

The duct shall be measured for payment in linear feet in place as described herein. Measurements shall be made in straight lines between horizontal changes in direction between the centers of the terminating points (poles, cabinets, junction boxes). Vertical measurement of the duct shall be as follows:

For runs terminating at junction boxes and/or control cabinets, the vertical measurement shall be taken 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 measure shall be taken from the bottom of the trench, or horizontal raceway, to a point 18-inch beyond the center of the light pole handhole regardless of light pole mounting method

Innerduct installed in excess of the limits describes herein shall not be paid for.

8. Basis of Payment.

This item will be paid for at the contract unit price per foot installed for **INNERDUCT**, of the size of duct as indicated, which shall be payment in full for all material and work as specified herein.

COMMUNICATIONS VAULT

Effective: January 1, 2026

Description. Work under this item shall consist of constructing a composite concrete communications vault with cover and a cable marker locate post in accordance with the details shown on the plans and as specified herein.

Materials. The composite concrete handhole and two-piece vault lid shall be constructed of polymer concrete material and shall be gray in color.

The composite concrete handhole shall be 36 inches x 60 inches and shall have an effective depth of 36 inches.

The composite concrete handhole and cover shall have a design/test loading of 22,500/33,750 lbs respectively. The cover shall have a permanently recessed logo that reads "IDOT", or as otherwise designated by the Engineer. The composite concrete handhole lid shall have two ½-in x 4-in pull slots. The lid surface shall have a coefficient of friction of 0.50 in accordance with ASTM C-1028.

The cover of IDOT communications vaults, as shown on the plans, shall have a permanently recessed logo that reads "**IDOT**". The cover of Third-Party communications vaults shall have a permanently recessed logo that reads "**IDOT-DoIT**".

The Contractor shall install manufacturer-approved gasketing between the lid and the handhole to prevent water from entering the composite concrete handhole.

The composite concrete handhole lid shall be secured to the vault with two 3/8-inch NC stainless steel penta-head bolts and washers to lock the lid. In addition, a "lock tool" shall be provided for composite concrete handhole entry.

A fiber optic cable support assembly shall be recommended by the manufacturer and approved by the Engineer for fiber optic cable and splice enclosures used in the vault. Each support assembly shall consist of multiple brackets, racks, and/or rails required to suspend the required surplus cabling and any splice enclosures required.

The support assembly shall be made from or coated with weather resistant material such that there is no corrosion of the supports. The support assemblies shall be anchored to the vault using stainless steel hardware.

The fiber optic cable support assemblies shall be included in the Contract unit price for the composite concrete handhole. Void areas between openings and conduit shall be filled with self-curing caulking consisting of a permanent, flexible rubber which is unaffected by sunlight, water, oils, mild acids or alkalis. The caulking shall be mildew resistant and non-flammable. The material shall provide a permanent bond between the conduit entering the vault and the polymer concrete. The caulking shall be gray in color.

Fiber optic utility marker locate posts shall be made of non-conductive high-density polyethylene with a minimum outside diameter of 3.5 inches. The length above grade shall be a minimum of 54 inches or as shown on the plans, whichever is greater. The minimum anchor length below grade shall be 18 inches.

IDOT marker locate posts shall be white in color with an orange cap with black graphic and lettering on two sides. Lettering on the IDOT locate posts shall read "**IDOT 847-705-4611**".

Third-Party locate posts shall be integrally orange in color with an orange cap with black graphic and lettering on two sides. Lettering on the Third-Party locate posts shall read "**IDOT 847-705-4611**".

All colors shall be stabilized against ultraviolet light such that they will not fade under continuous exposure to direct sunlight. The marker shall retain dimensional stability in temperatures ranging between -40°F and 175°F. Each locate post shall be able to withstand a single vehicle impact at 45 MPH and return to within 10 degrees of vertical within 60 seconds.

The Locate post will have a removeable top with 6 terminals, bolt lugs with locking washer and nut. A #6 (green) ground wire shall be connected to the top lug in the locate post through the connecting conduit to the communication vault and connected to the ground rod. The tracer wires from each micro-duct or other raceway entering the communications vault shall be connected to the terminals on the locate post. The post shall include 6 terminals, 5 for tracer wires and one for the ground connection.

CONSTRUCTION REQUIREMENTS

Composite concrete handholes shall be installed in accordance with applicable requirements of Section 800 of the Standard Specifications and as provided herein.

A manufacturer-approved knockout punch driver shall be used to provide openings in the vaults for conduit, or the required openings may be machined at the time of stackable vault fabrication. Voids between entering conduits and punch driven or machined openings shall not exceed ½-inch.

Any void areas shall be caulked from the interior and exterior of the composite concrete handhole. The caulk shall be allowed to fully cure per the manufacturer's specifications, prior to backfilling.

The composite concrete handhole shall be placed on 12 inches of coarse aggregate, CA-5 or CA 7 Class A, as specified in Section 1004 of the Standard Specifications. Seal and flash test the vault per the manufacturer's recommendations.

A minimum of 150 feet of excess cable per cable run shall be coiled in each composite concrete handhole containing splices to allow moving the splice enclosure to the splicing vehicle unless otherwise indicated in the plans.

Basis of Payment. This item will be paid for at the contract unit price each for **COMMUNICATIONS VAULT**, of the size indicated, which shall be payment in full for all material and work as specified herein.

FIBER OPTIC UTILITY MARKER

Effective: January 1, 2026

Description. This work shall consist of furnishing and installing a fiber optic utility marker post.

Materials. Fiber optic utility marker posts shall be made of non-conductive high-density polyethylene with a minimum outside diameter of 3.5 inches. The length above grade shall be a minimum of 54 inches or as shown on the plans, whichever is greater. The minimum anchor length below grade shall be 18 inches.

IDOT marker posts shall be white in color with an orange cap with black graphic and lettering on two sides. Lettering on the IDOT markers shall read **"IDOT 847-705-4611"**

Third-Party markers shall be integrally orange in color with an orange cap with black graphic and lettering on two sides. Lettering on the Third-Party markers shall read **"IDOT 847-705-4611"**.

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All colors shall be stabilized against ultraviolet light such that they will not fade under continuous exposure to direct sunlight. The marker shall retain dimensional stability in temperatures ranging between -40°F and 175°F. Each post shall be able to withstand a single vehicle impact at 45 MPH and return to within 10 degrees of vertical within 60 seconds.

Installation. Fiber optic utility marker posts shall be installed along the path of the fiber optic raceway installation between access points at a maximum spacing of 500 feet and changes in direction. For sections where IDOT and Third Party microduct conduit are installed in a common trench, separate fiber-optic utility marker posts shall be installed, one for IDOT and one for the third party.

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

Basis of Payment. This work will be paid for at the contract unit price per each for **FIBER OPTIC UTILITY MARKER**.

DEBRIS REMOVAL

Effective: June 27, 2002

Description. This work shall consist of the satisfactory removal and disposal of debris and sediment below the existing steel plate beam guardrail, type D as shown on the plans.

Construction Requirements. This work shall be performed according to Article 202.03 of the Standard Specifications for removal of unsuitable material and organic waste.

Basis of Payment. This work will be paid for at the contract unit price per cubic yard for DEBRIS REMOVAL.

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.

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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.

DETECTOR LOOP REPLACEMENT AND/OR INSTALLATION (ROADWAY GRINDING, RESURFACING, & PATCHING OPERATIONS)

Effective: January 1, 1985

Revised: March 1, 2024

The following Traffic Signal Special Provisions and the "District 1 Standard Traffic Signal Design Details" supplement the requirements of the State of Illinois "Standard Specifications for Road and Bridge Construction" Sections 810, 886, 1079 and 1088.

The intent of this Special Provision is to prescribe the materials and construction methods commonly used to replace traffic signal detector loops and replace magnetic signal detectors with detector loops during roadway resurfacing, grinding and patching operations. Loop detector replacement will not require the transfer of traffic signal maintenance from the District Electrical Maintenance Contractor to this Contract's electrical contractor. Replacement of magnetic detector will require wiring revisions inside the control cabinet and therefore the transfer of maintenance will be required. All material furnished shall be new. The locations and the details of all installations shall be as indicated on the Plans or as directed by the Engineer.

The work to be provided under the Contract consists of furnishing and installing all traffic signal work as specified on the Plans and as specified herein in a manner acceptable and approved by the Engineer.

Notification of Intent to Work.

Contracts such as pavement grinding or patching which result in the destruction of traffic signal detection require a notification of intent to work and an inspection. A minimum of seven (7) working days prior to the detection removal, the Contractor shall notify the Area Traffic Signal Maintenance and Operations Engineer.

Failure to provide proper notification may require the District's Electrical Maintenance Contractor to be called to investigate complaints of inadequate traffic signal timing. All costs associated with these expenses will be paid for by the Contractor at no additional expense to the Department according to Section 109 of the Standard Specifications.

Removal, Disposal and Salvage of Existing Traffic Signal Equipment.

The removal, disposal, and salvage of existing traffic signal equipment shall be included in the cost of this item. All material and equipment removed shall become the property of the Contractor

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and disposed of by the Contractor outside the State's right-of-way. No additional compensation shall be provided to the Contractor for removal, disposal or salvage expense for the work in this contract.

DETECTOR LOOP REPLACEMENT.

This work shall consist of replacing existing detector loops which are destroyed during grinding, resurfacing, or patching operations.

If damage to the detector loop is unavoidable, replacement of the existing detection system will be necessary. This work shall be completed by an approved Electrical Contractor as directed by the Engineer.

Replacement of the loops shall be accomplished in the following manner: The Area Traffic Signal Maintenance and Operations Engineer shall be called to approve loop locations prior to the cutting of the pavement. The Contractor may reuse the existing coilable non-metallic conduit (CNC) located between the existing handhole and the pavement if it hasn't been damaged. CNC meeting the requirements of NEC Article 353 shall be used for detector loop raceways to the handholes. All burrs shall be removed from the edges of the existing conduit which could cause damage to the new detector loop during installation. If the existing conduit is damaged beyond repair, if it cannot be located, or if additional conduits are required for each proposed loop, the Contractor shall be required to drill through the existing pavement into the appropriate handhole and install 1 in. (25 mm) CNC. This work and the required materials shall not be paid for separately but shall be included in the pay item Detector Loop Replacement. Once suitable CNC raceways is established, the loop may be cut, installed, sealed and spliced to the twisted-shielded lead-in cable in the handhole.

All loops installed in new asphalt pavement shall be installed in the binder course and not in the surface course. The edge of pavement or the curb shall be cut with a 1/4 in. (6.3 mm) deep x 4 in. (100 mm) saw-cut to mark location of each loop lead-in.

A minimum of seven (7) working days prior to the Contractor cutting loops, the Contractor shall have the proposed loop locations marked and contact the Area Traffic Signal Maintenance and Operations Engineer to inspect and approve the layout.

Loop detectors shall be installed according to the requirements of the "District 1 Standard Traffic Signal Design Details." Saw-cuts from the loop to the edge of pavement shall be made perpendicular to the edge of pavement when possible in order to minimize the length of the saw-cut unless directed otherwise by the Engineer or as shown on the plan.

The detector loop cable insulation shall be labeled with the cable specifications.

Each loop detector lead-in wire shall be labeled in the handhole using a waterproof tag secured to each wire with nylon ties. The lead-in wire, including all necessary connections for proper operation, from the edge of pavement to the handhole, shall be included in the detector loop pay item.

Loop sealant shall be a two-component thixotropic chemically cured polyurethane. The sealant shall be installed 1/8 in. (3 mm) below the pavement surface. If installed above the surface the excess shall be removed immediately.

Round loop(s) 6 ft (1.8 m) in diameter may be substituted for 6 ft (1.8 m) x 6 ft (1.8 m) square loop(s) and shall be paid for as 24 ft (7.2 m) of detector loop.

Resistance to ground shall be a minimum of 500 mega-ohms under any conditions of weather or moisture. Inductance shall be more than 50 and less than 700 microhenries.

Heat shrink splices shall be used according to the "District 1 Standard Traffic Signal Design Details."

Detector loop replacement shall be measured along the sawed slot in the pavement containing the loop cable up to the edge of pavement, rather than the actual length of the wire in the slot. Drilling handholes, sawing the pavement, furnishing and installing CNC to the appropriate handhole, cable splicing to provide a fully operable detector loop, testing and all trench and backfill shall be included in this item.

Basis of Payment.

Detector Loop Replacement shall be paid for at the Contract unit price per foot (meter) of DETECTOR LOOP REPLACEMENT.

MAGNETIC DETECTOR REMOVAL AND DETECTOR LOOP INSTALLATION.

This work shall consist of the removal of existing magnetic detectors, magnetic detector lead-in cable and magnetic detection amplifiers and related control equipment wiring, installation of detector lead-in cable, detector loops, detector amplifiers and related equipment wiring. The detector loop, cable, and amplifier shall be installed according to the applicable portions of the Standard Specifications and the applicable portions of the Special Provision for "Detector Loop Replacement." All drilling of handholes, furnishing and installing CNC, cable splicing, trench and backfill, removal of equipment, and removing cable from conduit shall be included in this item.

Basis of Payment.

Magnetic Detector Removal and Detector Loop Installation shall be paid for at the contract unit price per foot (meter) for DETECTOR LOOP, TYPE I, per each for INDUCTIVE LOOP DETECTOR, and foot (meter) for ELECTRIC CABLE IN CONDUIT, LEAD-IN, NO. 14 1 PAIR.

FIBER OPTIC CABLE, SINGLE MODE

Effective: January 1, 2026

Description. The Contractor shall furnish and install loose-tube, single-mode, fiber optic cable of the number of fibers specified as shown in the plans and as directed by the Engineer.

Other ancillary components, required to complete the fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

Materials 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.

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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."

Physical Construction			
Requirement		Units	Value
Cladding Diameter		(μm)	125.0 ± 0.7
Core-to-Cladding Concentricity		(μm)	≤ 0.5
Cladding Non-Circularity			$\leq 0.7 \%$
Mode Field Diameter	1310 nm	(μm)	9.2 ± 0.4
	1550 nm		10.4 ± 0.5
Coating Diameter		(μm)	245 ± 5
Colored Fiber Nominal Diameter		(μm)	253 - 259
Fiber Curl radius of curvature		(m)	$> 4.0 \text{ m}$

Optical Characteristics				
Requirement			Units	Value
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
Cable Cutoff Wavelength (λ _{ccf})			(nm)	< 1260
Zero Dispersion Wavelength (λ _o)			(nm)	1302 ≤ λ _o ≤ 1322
Zero Dispersion Slope (S _o)			(ps/(nm²•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 ⁻²)	≤ 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 3.0 mm. 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." Buffer tube colored stripes

shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

For cables containing more than 12 buffer tubes, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

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 2.5 mm or 3.0 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-swellaable yarn for water-blocking protection. The water-swellaable 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.

Water swellaable yarn(s) shall be applied longitudinally along the central member during stranding.

Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

For single layer cables, a water swellaable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water swellaable tape shall be applied longitudinally over both the inner and outer layer. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

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 dielectric yarns shall be helically stranded evenly around the cable core.

The cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members (as required) and water swellable tape. 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 2700 N (608 lbf) during installation (short term) and 890 N (200 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 -30°C to +70°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 ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°C and +60°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
 - a: Top (inside end of cable)
 - b: 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 Patch Cords and Pigtails. The optical patch cords and pigtails shall comply with the following:

- The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the optical patch cords and pigtails shall meet or exceed the requirements for approved connectors specified herein.
- The fiber portion of each patch cord and pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this contract.
- The twelve fiber single-mode fiber optic cable shall be installed as a pigtail with factory installed ST compatible connectors.
- The patch cords shall comply with Telcordia GR-326-CORE

Connectors. The optical connectors shall comply with the following:

- All connectors shall be factory installed ST compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- All fibers shall be connectorized at each end.
- All fibers shall terminate at a fiber patch panel
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. Pigtails shall be one meter in length.

CONSTRUCTION REQUIREMENTS

Experience Requirements. Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

- A minimum of three (3) 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 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 in Raceways. 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 responsible for 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 reaches 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.

Armored fiber optic cables shall be grounded as shown on the plans.

Tracer Wire. Tracer wire shall be paid for separately and installed with all fiber optic cable runs as specified for Tracer Wire.

Aerial Fiber Optic Cable. Aerial fiber optic cable assemblies shall be a self-supporting figure-8 design. The fiber optic cable shall be as described herein and shall be waterblocked utilizing

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water-swellable materials. The cable assembly shall be designed and manufactured to facilitate midspan access.

The submittal information must include a copy of the standard installation instructions for the proposed cable. Installed cable sag shall not exceed 1% of the span distance. The submittal information must also include catalog cuts for all hardware to be utilized in the installation.

Construction Documentation Requirements

Installation Practices for Outdoor Fiber Optic Cable Systems. 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.

Operation 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 as specified in the General Electrical Provisions.

Splicing Requirements. Splices shall be made at locations shown on the Plans. Any other splices shall be permitted only with the approval of the Engineer. Splices will be paid for separately. All splice locations must be identified in the Record Drawings. **Cable runs which dead-end at a handhole, communications vault, interconnect cabinet, or any other type of enclosure, shall be dead ended in a splice enclosure.**

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 vaults or in above ground fiber optic junction boxes in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be **a minimum of 100 feet** for each cable at each access point location, above or below ground unless otherwise directed by the Engineer. The following table is included as an approximate guide only; actual measurements shall be made for documentation.

Access Point	Approximate Dimensions (inches)			Slack in Feet and resulting loop count		
	L	W	Coil Dia	50	100	150
CommVault	60	36	34	6	12	17
CommVault	48	48	46	5	9	13
HD Handhole	21	22	20	10	20	29
Double Handhole	48	24	22	9	18	27
Junction Box	42	36	34	6	12	17

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 cables shall be tagged.

Tag material:

Thickness: 20.0 mils, +/- 2.0 mils. The self-laminating portion shall be clear polyester with a vinyl printable portion.

Labels shall be mechanically imprinted or handwritten and shall be smear resistant, fade resistant, wrap around, self-laminating type.

Fiber optic cables shall be tagged inside all access points, no closer than 12-inches from point of entry

Labels shall be three (3) lines of text. The first line shall be the cable name.

Labels shall clearly visible/viewable from point of final resting orientation.

Method of Measurement Fiber optic cable will be measured for payment in feet in place installed and tested. Fiber optic cable will be measured horizontally and vertically between the changes in direction, including slack cable. The entire lengths of cables installed in buildings will be measured for payment

Basis of Payment This work will be paid for at the contract unit price per foot for **FIBER OPTIC CABLE** of the number of fibers, **SINGLE MODE**; or **FIBER OPTIC CABLE ARMORED** of the number of fibers, **SINGLE MODE** specified. Payment shall not be made until the cable is installed, spliced and tested in compliance with these special provisions.

DRAINAGE STRUCTURE ADJUSTMENT (SPECIAL)

Description: This work shall be performed as directed by the ENGINEER in conformance with applicable provisions of Sections 353, 406, 602, 603, and 1006 of the "Standard Specifications for Road and Bridge Construction".

The existing drainage structures located along the frontage roads are required to be adjusted as part of the resurfacing.

Method of Measurement: This work will be measured for payment per Each.

Basis of Payment: Payment for this work shall be at the contract unit price per EACH for DRAINAGE STRUCTURE ADJUSTMENT (SPECIAL), which will include all labor, material, and equipment necessary to complete this item of work. Furnishing and installing of the new frame and lids shall be paid for separately.

CABINET, MODEL 334

Description. This work shall consist of furnishing and installing a ground-mounted Model 334 cabinet at locations as shown in the Plans. The cabinet shall be used to house CCTV camera and any associated Ethernet switches, and other communications devices/infrastructure as shown on the plans. The furnishing and installation of CCTV camera equipment shall be paid for separately.

Materials

Cabinet Components. The housing and the mounting cage assembly shall conform to those of the Model 334 cabinet provisions of the "Traffic Signal Control Equipment Specifications" (TSCES) issued by the State of California, Department of Transportation, and to all addenda thereto current at the time of project advertising. The housing shall be rainproof with the top of the enclosure crowned to prevent standing water. All exterior seams for the enclosure and doors shall be continuously welded and shall be smooth. The housing shall have no provisions for a police panel or door.

The cabinet shall have single front and rear doors, each equipped with a Corbin # 2 lock. The enclosure door frames shall be double flanged out on all 4 sides and shall have strikers to hold tension on and form a firm seal between the door gasketing and the frame. The front and rear doors shall be provided with catches to hold the door open at both 90 and 180 +/- 10 degrees. Gasketing shall be provided on all door openings and shall be dust-tight. For horizontal support and bolt attachment, cage bottom support mounting angles shall be provided on either side, level with the bottom edge of the door.

The latching handles on the doors shall have provisions for padlocking in the closed position. When the door is closed and latched, the door shall be locked. The locks and handles shall be on the right side of the front door and the left side of the rear door. The lock and lock support shall be rigidly mounted to the door. The locks shall be Corbin#2 and two keys shall be supplied to the Department with each lock. The keys shall be removable in the locked position only.

The front and rear doors shall be provided with louvered vents. A removable and reusable air filter shall be housed behind the door vents. The filter filtration area shall cover the vent opening area, and the filter shell shall be provided that fits over the filter providing mechanical support for the filter. The shell shall be louvered to direct the incoming air downward.

The intake (including filter with shell) and exhaust areas shall pass a minimum of 60 cubic feet (1.7 cubic meters) of air per minute for housing #1 and 26 cubic feet (0.74 cubic meters) of air per minute for housing #2. The thermostatically controlled fan with ball or roller bearings shall be mounted within the housing and vented. The fan shall provide a capacity of at least 150 cubic feet (4.25 cubic meters) of free air delivery per minute of ventilation. The fan shall be thermostatically controlled and activated when the temperature inside the cabinet exceeds 75° F (24° Celsius) and shut off when the temperature is less than 64°F (18° Celsius). In addition, the fan shall be manually adjustable for automatic turn on and off. The fan circuit shall be protected at 125% of the fan motor ampacity.

All subassemblies shall be mounted in removable 19 in. (482 mm) EIA self-standing rack assemblies. The EIA rack portion of the cage shall consist of 2 pairs of continuous, adjustable equipment mounting angles that comply with Standard EIA RS-310-B. The cage shall be centered within the cabinet and bolted to the cabinet at 4 points.

Each cabinet shall be equipped with 2 shelves. Shelves shall be the full width of the rack and 12 in. (300mm) deep. The shelves shall be designed to support a minimum of 50 lbs. (23 kg).

The power distribution assembly shall be as shown in Plans and shall consist of input files that are common to both Model 332 and 336 type cabinets and provides 9 AC outputs and up to 28 isolated inputs. The power distribution assembly for cabinets not at DMS locations shall consist of the following: one 30A, 120V main circuit breaker; three 15A, 120V single pole secondary circuit breakers; eight standard 117 VAC controller and equipment receptacles; and one duplex, 3-prong, NEMA GF1 Type 5-15R grounded utility type outlet. Cabinets at DMS locations shall be provided with one 60A, 240V, two-pole main circuit breaker, one 40A, 240V, two-pole secondary breaker, three 15A, 120V single pole secondary circuit breakers, eight standard controller and equipment receptacles, and one duplex GFI outlet.

Rating of breakers shall be shown on face of breaker or handle. Breaker function shall also be labeled below breakers on front panel. The first equipment receptacle in the circuit shall have ground-fault circuit interruption as defined in the NEC. Circuit interruption shall occur on 6 mA of ground-fault current. All conductors from the power distribution assembly routed to the cabinet wiring shall be connected to the terminal block on the common side, except for the AC power conductor between the service terminal block and main circuit breaker. All internal conductors terminating at the blocks shall be connected to the other side of the blocks.

Two side panels shall be provided and mounted on the cabinet sidewalls. In viewing from the front door, the left side panel shall be designated as the "Input/Communications" and the right side panel shall be designated as the "Service Panel". The panel shall be drilled and tapped, as necessary, to mount the terminal blocks and other attachments described herein, as well as to mount the panel to the cabinet wall.

The terminal blocks shall be barrier type rated at 20 A 600 V RMS minimum. The terminal screws shall be nickel-plated brass binder head type with screw inserts of same material. The terminals of the power line service terminal block shall be labeled "AC+", "AC-", and "AC GND", and shall be

covered with a clear insulating material to prevent inadvertent contact. Terminating lugs large enough to accommodate No. 2 conductors shall be furnished for the service terminal block. The terminal block shall be rated for 50 A at 600 V peak, minimum.

Distribution power distribution assembly shall also protect the equipment powered by the assembly from power transients. Over voltage protection shall be provided for the power distribution assembly and shall contain, as a minimum, a surge arrestor, which shall reduce the effect of power line voltage transients and be mounted to the service panel. The arrestor shall have the following minimum features:

Recurrent Peak Voltage:	184 V
Energy Rating (Minimum):	50 J
Power Dissipation, Average:	0.85 W
Peak Current for pulses less than 7 microseconds:	1250 A
Stand-by Current for 60 Hz Sinusoidal:	1mA or less

Each cabinet shall be equipped with one LED lighting fixture mounted to the inside top front portion of the cabinet. The fixture shall have an cool white color. A door-activated switch shall be installed to turn the cabinet light on when the front door is opened. The door switch shall be on a separate circuit by itself and used only to turn on the cabinet light.

Each cabinet shall be supplied with a heavy-duty plastic envelope to store plans, wiring diagrams, schematics, etc. This envelope shall have metal grommets so that it hangs from the door hooks. The envelope shall have minimum dimensions of 10 in. (250mm) x 15 in. (381mm).

Foundations shall conform to those shown in the Plans. The foundation is paid for separately.

Identification. The Cabinet, Model 334 shall be identified and labeled with external markings as specified in Article 1069.06 of the Standard Specifications and as shown in the Plans.

Construction Requirements. The Contractor shall deliver the Cabinet Model 334 mounted on a plywood-shipping pallet that is bolted to the cabinet base. The cabinet shall be enclosed in a slipcover cardboard packaging shell. The housing doors shall be blocked to prevent movement during transportation to the site.

The Contractor shall securely fasten the Cabinet Model 334 on the new concrete foundation at the locations shown in the Plans. The Contractor shall confirm the orientation of the Cabinet Model 334 installation and its front door side with the Engineer prior to installation. Stainless steel bolted connections shall be provided with lock-washers, locking nuts, or other approved means to prevent the connection nuts from backing off. Dissimilar materials shall be isolated from one another by stainless steel fittings.

The Contractor shall make all power connections to the cabinet in accordance with the Plans and as required. The neutral bus shall be isolated from the cabinet and equipment ground. It shall terminate at the neutral lug ultimately attached to the meter pedestal. All conductors used in cabinet wiring shall terminate with properly sized non-insulated (if used, for DC logic only) or clear insulated spring-spade type terminals except when soldered to a through-panel solder lug on the rear side of the terminal block or as specified otherwise. All conductors, except those which can be readily traced, shall be labeled. Labels attached to each end of the conductor shall identify the destination of the other end of the conductor. Cabling shall be routed to prevent conductors from

being in contact with metal edges. Cabling shall be arranged so that any removable assembly may be removed without disturbing conductors not associated with that assembly.

All equipment in the cabinet, when required, shall be clearly and permanently labeled using marker strips. The marker strips shall be made of material that can be easily and legibly written on using a pencil or ballpoint pen. Marker strips shall be located immediately below the item that they are to identify and must be clearly visible with the items installed.

Testing. Cabinet Acceptance Test – in addition to the environmental and design approval tests specified in the FHWA Type 170 Traffic Signal control System Hardware Specification, the following water spray test shall be performed for each type of cabinet:

Spray water from a point directly overhead at an angle of 60° from the vertical axis of the cabinet. Repeat for each of eight equally spaced positions around the cabinet for a period of five minutes in each position. The water shall be sprayed using a domestic type sprinkling nozzle at a rate of not less than 10 gal./min (40 liters/min) per square foot (0.1 meters) of surface area. The cabinet shall then be inspected for leakage. Evidence of water leakage shall be cause for rejection.

Operational Standalone Test: The operational standalone test for each Cabinet, Model 334 installed shall consist of the following:

Visual inspection of the cabinet and its contents for workmanship

Verification of the cabinet grounding in accordance with Article 1074.03 (a)(4) of the Standard Specifications

Measurement of the voltage at the input panel

Documentation. Shop drawings and wiring lists showing the proposed layout of each type of cabinet shall be submitted to the Engineer for approval prior to the start of fabrication. Wiring lists for the internal manufacturer cut sheets for all electrical equipment included in each type of cabinet shall be included in the submission.

Four copies of drawings showing the wiring for each cabinet shall be provided. One copy shall be placed in the clear plastic envelope furnished as part of the cabinet. The other three copies shall be delivered to the Engineer.

For each cabinet, four copies of a configuration of the equipment reporting to that cabinet shall be provided. The sheet shall also list field settable options for the equipment contained in the cabinet. This shall include device addresses and output voltage settings for power supplies. One of these copies shall be placed in the clear plastic envelope furnished as part of the cabinet. The other three copies shall be delivered to the Engineer.

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. The warranty shall warrant and guarantee repair of the component parts of the Cabinet Model 334 furnished by the Contractor that prove to be defective in workmanship and materials

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during the first two years of operation as defined and noted above at no additional cost to the Department.

The Engineer will notify the Contractor that a warranted item needs repair. The Contractor shall acknowledge the notification within 24 hours and replace or correct any part or parts of materials and equipment that are found defective within the two-year in-service warranty period. All items needing repair shall be returned to the Department in two weeks from the date of receipt at the Contractor's facility or replaced in-kind by the Contractor, and the Contractor shall be responsible for any return shipping costs. No compensation will be made to the Contractor for such replacements or corrections.

The Contractor shall provide a warranty certificate for this item and its related components to the Department. The Department reserves the right to transfer this service to other parties who may be contracted with in order to provide overall maintenance of this item.

Method of Measurement. This work will be measured for payment per each CABINET, MODEL 334.

Basis of Payment. This work will be paid for at the contract unit price per each for CABINET, MODEL 334.

DRAINAGE STRUCTURE TO BE ADJUSTED AND DRAINAGE STRUCTURE TO BE RECONSTRUCTED

Description. This work shall consist of the adjustment or reconstruction of manholes, inlets, and catch basins in accordance with Section 602 of the Standard Specifications.

Construction Requirements. In addition to Section 602 of the Standard Specifications, the following shall apply:

Work completed under these items shall include the removal and disposal of unsuitable adjusting rings, brick, or block down to the top of the original structure and rebuilding the structure using adjusting rings, masonry brick or inlet block and setting the frame with grate or lid to finish grade. Reconstruction shall also include the removal and disposal and/or addition of full-diameter structure sections, flat-slab tops, or "cone" sections. Only Portland cement mortar shall be used.

The existing frames and grates not used in construction shall become the property of the Contractor and shall be disposed of outside the limits of the right-of-way.

The cost of pavement removal and replacement adjacent to drainage structures adjusted or reconstructed shall be included in the contract unit price for DRAINAGE STRUCTURE TO BE ADJUSTED or DRAINAGE STRUCTURE TO BE RECONSTRUCTED. The material used to replace the pavement shall be Class SI Concrete unless otherwise directed by the Engineer.

Basis of Payment. This work will be paid for at the contract unit price EACH for DRAINAGE STRUCTURE TO BE ADJUSTED or DRAINAGE STRUCTURE TO BE RECONSTRUCTED.

CLOSED CIRCUIT DOME VIDEO CAMERA, HIGH DEFINITION

Effective: February 1, 2026

1. Description.

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

2. Materials.

- 2.1 General. The HD (High Definition) CCTV Dome Color Camera shall be a rugged, non-pressurized, outdoor surveillance camera system with or without a dome bubble. The HD CCTV 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 Starlight 7000I, a Siquira PD950NW, or an Axis Q6355-LE in compliance with the requirements herein.

The 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.

The camera shall be ONVIF compliant, Profiles S, and G.

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 shipment. 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.

- 2.2 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:

Environmental	Requirement
IP Rating	IP 66
Weight (max.)	10 lbs
Overall Dimensions	10" dia. x 14"
Humidity	0 to 100%
Operating temperature	-40°C to 55°C
Mount	1 ½" 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, if equipped, throughout the operating temperature range of the camera.

- 2.3 Power. The CCTV Dome Camera shall be designed to operate from a 120v power source or Hi-PoE provided the proper Hi-PoE injector is utilized, (802.3bt Type 3: max 60 W). The appropriate power supply 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; 22 to 27 VDC	
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)

- 2.4 Camera.

The camera shall provide a minimum of four simultaneous video streams, auto iris with 30X (minimum) optical, and 10X digital zoom. The CCTV Dome Camera shall incorporate:

Item	Requirement
Sensor Type	1/2.8-inch CMOS sensor
Optical Zoom	30X (minimum)
Digital Zoom	12X
Maximum Resolution	2065 X 1553
Horizontal Angle of View	63° (wide) – 2.3° (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)	0.65 lux
Color (250 ms)	0.07 lux
Mono (33 ms)	0.20 lux
Mono (250 ms)	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

3.5 Video

Item	Requirement
Video Encoding	H.264. H.265, in High, Main, or Base profiles and MJPEG
Video Streams	Up to 4 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	1920 x 1080 1280 x 720 720 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

3.6 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.

4. 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 1920 x 1080 pixels. 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.

5. Local Storage.

The camera shall have a SD/SDHC/SDXC memory card slot. The camera shall be provided with a 64GB SDXC memory card with a UHS Speed Class 1, minimum serial data transfer rate of 10MB/s. The camera shall be capable of continuous recording of video and audio, alarm/events/schedule recording. The stored video shall be remotely downloadable over the network the camera is connected to without any field intervention.

6. 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.

7. 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.

8. Installation.

Thirty (30) days prior to the scheduled field installation of each CCTV camera, the Contractor shall deliver the camera to the Traffic Systems Center (TSC) for network configuration prior to installation by the Contractor. The camera shall be clearly identified as to which location it is to be installed for proper configuration. The camera's MAC address shall be clearly identified. After the switch is configured, the Contractor shall retrieve the camera from the TSC and install it.

The Contractor shall install the CCTV camera in accordance with manufacturer's instructions. The camera firmware shall be the latest stable release available at the time of installation and shall be identified in the final documentation. Installation shall be paid for under a separate pay item.

9. Licensing.

New camera installations, cameras which are not a replacement for an existing camera, may require licensing to be integrated into the Cameleon ITS management software. This additional cost shall be paid in accordance with Article 109.05 of the Standard Specifications, Expenses Incurred by the Department.

9. 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 in a mutually agreeable format.

10. Measurement.

Closed-Circuit Television (CCTV) Dome Cameras shall be counted as each upon successful completion of the testing describer herein for payment.

11. Basis of Payment.

This item will be paid for at the contract unit price each for **CLOSED CIRCUIT DOME TELEVISION CAMERA, HD**, which shall be payment in full for all material and work as specified herein.

DRAINAGE STRUCTURES TO BE CLEANED AND CLEANING DRAINAGE SYSTEM

Description. This work shall consist of cleaning drainage facilities, including manholes, catch basins, inlets, end sections, type 4 and type 5 drainage structures, bridge scuppers and deck drainage piping, underground storm sewer pipes of all types and sizes as designated on the plans or as directed by the Engineer. This work does not include the cleaning of existing pipe underdrains, box culverts or combined sewers.

Materials. Equipment for cleaning pipe lines includes hoses, rodding machines, balls, hydraulic cleaners, root cutters, small clam shell buckets, steel porcupines, pumps, or other suitable and approved means. Water used for cleaning and flushing pipes shall be fresh and free of oils, acid, salt, alkali, organic matter, or any other deleterious substances. The Contractor shall provide all water for the cleaning operation.

Methods. The Contractor shall be responsible for the proper operation of the drainage system during the cleaning operations. The safe control of flows shall be accomplished by the Contractor such as to preclude an injury to persons or property due to flooding. The Contractor shall clean and flush those drain lines designated on the plans or as designated by the Engineer by use of pressure hoses, suction pumps, and/or any other methods required to perform this work. A suitable weir or dam shall be constructed in the nearest downstream manhole or catch basin in such a manner that debris material will be trapped. Under no circumstances shall such material be passed on from one section to the next.

No additional payment shall be provided for additional rodding or jetting for heavy cleaning.

Each manhole, catch basin, inlet, end section, or type 4 or type 5 drainage structure shall be cleaned independently of other portions of the drainage system and shall be cleaned to the satisfaction of the Engineer. The Contractor shall maintain flows through sewer systems at all times. The existing structures and pipes shall be inspected by the contractor, and this information shall be provided to the Engineer before construction begins. As directed by the Engineer, any accumulation of material in the structures or pipes caused by construction operations shall be removed by the Contractor at his expense.

Method of Measurement. DRAINAGE STRUCTURES TO BE CLEANED will be measured per each for such drainages structures actually cleaned, including manholes, catch basins, inlets, end sections, and Type 4 and Type 5 drainage structures, in accordance with the plans and/or as directed by the Engineer. CLEANING DRAINAGE SYSTEM will be measured in linear feet from center-to-center of drainage facilities for all underground storm sewer actually cleaned, regardless of the sizes of pipe and the amount of jetting required. CLEANING DRAINAGE SYSTEM will not be measured in payment for drainage systems to be cleaned on and around bridge structures.

Basis of Payment. DRAINAGE STRUCTURES TO BE CLEANED will be paid for at the contract unit price per EACH for all drainage structures cleaned, regardless of type or size, in accordance with the plans and/or as directed by the Engineer. CLEANING DRAINAGE SYSTEM for underground storm sewers will be paid for at the contract unit price per FOOT for all pipe lines cleaned, regardless of the sizes of pipe, in accordance with the plans and/or as directed by the Engineer. CLEANING DRAINAGE SYSTEM for drainage systems on and around bridge structures will be paid for at the contract unit price per LUMP SUM in accordance with the plans and/or as directed by the Engineer.

WORK RESTRICTIONS

At the start of this contract, work under Contracts 62N91, 62W38, and 80B21 will be ongoing. These contracts will have lane closure priority.

As a result of ongoing work under Contracts 62N91 and 62W38, the Contractor may proceed with SB I-290/IL 53 work in 2026 provided traffic control is compatible with stage work per these contracts. No work on NB I-290/IL 53 will be allowed on contract 62W99 in 2026. One-week advanced approval from the Resident Engineers for Contracts 62N91 and 62W38 and the Expressway Traffic Control Supervisor will be required for all mainline work. Maintenance of traffic and sequence of operations must be presented at weekly coordination meeting.

Construction on East and West Frontage Roads between Golf Road and Higgins Road must be performed during nighttime only and should be completed by October 31, 2026. Frontage road full closures are allowed between 7 pm and 5 am. Additional hours may be granted if approved by Resident Engineer and the Expressway Traffic Control Supervisor.

SB I-290/IL 53 Extended Weekend Closures Extended weekend closures shall extend from Friday night 8 PM to 5 AM Monday to complete all SB I-290/IL 53 concrete and bridge deck patching. The extended weekend closures will be limited to 3 weekend closures in Stage 1 and 3 weekend closures in Stage 2.

- RE and IDOT Expressways must approve all sequencing, staging and duration of the weekend shutdown operation. RE will provide guidance at weekly/bi-weekly contractor lane closure coordination meetings. One week advanced notice and concurrence from the RE and IDOT Expressways is required prior to start.
- One lane in the local lanes shall remain open at all times during the Extended Weekend shutdown periods.
- During the SB Extended Weekend shutdown periods, the contractor must keep all lanes in the Express open during daytime Saturday, Sunday day 9AM-7PM. Night time lane closures in the Express may be granted - allowable hours will be designated with request from contractor. IDOT RE and Expressways Operations will review and approve –
- Advanced warning PCMS boards required along SB IL. 53. **A total of 6 Portable Changeable Message Boards (PCMS) will be required at part of this operation. Locations to be designated by the Engineer.**

FIBER OPTIC CABLE, MICRO, SINGLE MODE

Effective: January 1, 2026

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 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."

Physical Construction		
Requirement	Units	Value
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

Optical Characteristics			
Requirement		Units	Value
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	
	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
Cable Cutoff Wavelength (X_{ccf})		nm	< 1260
Zero Dispersion Wavelength (X_0)		nm	1302 < X_0 < 1322
Zero Dispersion Slope (S_0)		ps/(nm ² •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 ⁻²	< 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.

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 1.5 mm. 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

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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-swellaable yarn for water-blocking protection. The water-swellaable 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 ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°C and +60°C.

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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
 - a: Top (inside end of cable)
 - b: 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 Patch Cords and Pigtails. The optical patch cords and pigtails shall comply with the following:

- The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the optical patch cords and pigtails shall meet or exceed the requirements for approved connectors specified herein.
- The fiber portion of each patch cord and pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this contract.
- The twelve fiber single-mode fiber optic cable shall be installed as a pigtail with factory installed **SC** compatible connectors.
- The patch cords shall comply with Telcordia GR-326-CORE

Connectors. The optical connectors shall comply with the following:

- All connectors shall be factory installed **SC** compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- All fibers shall be connectorized at each end.
- All fibers shall terminate at a fiber patch panel
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. Pigtails shall be one meter in length.

CONSTRUCTION REQUIREMENTS

Experience Requirements. Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

- A minimum of three (3) 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

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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 (furation) kits and splice closures. 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 installation 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 installation 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 responsible for the technical adequacy of the proposed procedures.

During cable installation operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and installation 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 may 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 cable shall be blown or jetted into the microduct. The Contractor shall use a micro cable blowing machine designed for use with the particular cable being installed. A Compressed air cooler shall be used when ambient air temperatures reaches 68°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.

A tracer wire shall be installed with all fiber raceways. Tracer wire shall be installed and paid for as specified for Tracer Wire.

Construction Documentation Requirements

Installation Practices for Outdoor Fiber Optic Cable Systems. 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.

Operation 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 as specified in the General Electrical Provisions.

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Splicing Requirements. Splices shall be made at locations shown on the Plans. Any other splices shall be permitted only with the approval of the Engineer. Splices will be paid for separately. All splice locations must be identified in the Record Drawings. Cable runs which dead-end at a handhole, communications vault, interconnect cabinet, or any other type of enclosure, shall be dead ended in a splice enclosure.

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 vaults or in above ground fiber optic junction boxes in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be **a minimum of 100 feet** for each cable at each access point location, above or below ground unless otherwise directed by the Engineer. The following table is included as an approximate guide only; actual measurements shall be made for documentation.

Access Point	Approximate Dimensions (inches)			Slack in Feet and resulting loop count		
	L	W	Coil Dia	50	100	150
CommVault	60	36	34	6	12	17
CommVault	48	48	46	5	9	13
HD Handhole	21	22	20	10	20	29
Double Handhole	48	24	22	9	18	27
Junction Box	42	36	34	6	12	17

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 cables shall be tagged.

Tag material:

Thickness: 20.0 mils, +/- 2.0 mils. The self-laminating portion shall be clear polyester with a vinyl printable portion.

Labels shall be mechanically imprinted or handwritten and shall be smear resistant, fade resistant, wrap around, self-laminating type.

Fiber optic cables shall be tagged inside all access points, no closer than 12-inches from point of entry

Labels shall be three (3) lines of text. The first line shall be the cable name.

Labels shall clearly visible/viewable from point of final resting orientation.

Method of Measurement Fiber optic cable will be measured for payment in feet in place installed and tested. Fiber optic cable will be measured horizontally and vertically between the changes in

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direction, including slack cable. The entire lengths of cables installed in buildings will be measured for payment.

Basis of Payment This work will be paid for at the contract unit price per foot for **FIBER OPTIC CABLE** of the type, size, and number of fibers specified. Payment shall not be made until the cable is installed, spliced and tested in compliance with these special provisions.

GENERAL REQUIREMENTS FOR WEED CONTROL SPRAYING

Experience. The Contractor shall have previous experience with the use of weed control chemicals. He/she shall have had at least one (1) season's experience in the use of their chemicals in spraying highway right-of-way or at least three (3) season's experience in their use in farm or custom spraying. The Contractor shall observe and comply with all sections of the Illinois Custom Spray Law, including licensing.

Equipment: The equipment used shall consist of a vehicle-mounted tank, pump, spray bar and handgun, plus any other accessories needed to complete the specified work. Spraying shall be done through multiple low-pressure flooding or broad jet nozzles mounted on spray bars operated not more than 36" above the ground. If different sizes or types of nozzles are used to make up the spray pattern, the pressure, sizes and capacities shall be adjusted to provide a uniform rate of application for each segment of the spray pattern. Hand spray guns may be used for spraying areas around traffic control devices, lighting standard and similar inaccessible areas. Maximum speed of the spray vehicle during application of chemical shall be five (5) miles per hour.

Pumps used shall have a volume and pressure capacity range sufficient to deliver the mixture at a pressure to provide the required coverage and to keep the spray pattern full and steady without pulsation or excessive pressure as to cause fogging. Maximum pressure for application shall be 15 PSI. Quick acting shut-off valves and spring-loaded ball check valves shall be provided to stop the spray pattern with a minimum of nozzle drip. In areas where the spray vehicle must traverse the right-of-way, a four-wheel drive vehicle with flotation tires will be required to minimize damage to the ground surface.

Prior to beginning work, the Contractor shall obtain approval from the Engineer of the spraying equipment proposed for completing this work. The proposed equipment shall be in an operational condition and available for inspection by the Engineer at least two (2) weeks prior to the proposed starting time. If requested by the Engineer, the Contractor shall demonstrate the calibration of the equipment.

The equipment must provide consistently uniform coverage and keep the spray mixture sufficiently agitated or the work will be suspended until the equipment is repaired or replaced.

Spraying Areas: This work includes roadsides and other types of right-of-way of various widths and gradients. Spray areas often extend more than thirty (30) feet from the edge of the roadway, requiring both spray bar and hand gun applications.

When the description of work requires weed control of a stated species, such as teasel, the chemical shall be applied only to locations where the stated species is present. When the

description of work requires general weed control within a bed or area, such as broadleaf weed control in turf, then the chemical shall be applied to the entire bed or area.

Exclusion of Spraying Areas: Areas where weed control spraying is inappropriate or detrimental to the environment, desirable planting, or private property shall be excluded from the spray area.

Spraying will not be permitted over any drainage swales or waterways, or other areas where the chemical label prohibits application. Spraying within 150 feet of a natural area or site where endangered or threatened species occur.

Responsibility for Prevention of Damage to Private Property: The Contractor shall, at all times, exercise extreme caution to prevent damage to residential plantings, flower or vegetable gardens, vegetable crops, farm crops, orchard or desirable plants adjacent to the roadside.

The Contractor or Department receives a complaint, the Contractor shall contact a complaint within ten (10) days after receiving a claim for damages, either in person or by letter. The Contractor, or his authorized representative, shall make a personal contact with the complainant within twenty (20) days. The Engineer shall also be notified by the Contractor of all claims for damage he received and shall keep the Engineer informed as to the progress in arriving at a settlement for such claims.

Communication with the Engineer: The Contractor is required to communicate with the Engineer to receive all required approvals in a timely way and to assure that the Engineer can accurately document the work performed.

It shall be the Contractor's responsibility to assure that all chemical containers are opened and added to the spray mixture in the presence of the Engineer.

The Contractor shall obtain approval from the Engineer to proceed with spraying at each location 24 hours prior to the proposed spray operations.

Notification of Pesticide Application The Contractor will be required to properly provide notification of pesticide application as required by the IL Public Act 103-0976 (Pesticide Application on Rights-of Way Notification Act).

Two weeks prior to the application of pesticides, including but not limited to herbicides, insecticides, algaecides, and fungicides, the Contractor shall complete Operations form "OPER 758" which may be found at the following link: <https://idot.illinois.gov/resources/forms.html>

The Contractor shall return the completed form to the Engineer. The completed form will be uploaded on the IDOT website as required by the Department of Agriculture and IL Public Act 103-0976 at:

<https://idot.illinois.gov/transportation-system/environment/natural-resources/roadside-maintenance/pesticide-application.html>

The Contractor shall confirm submission of the form has been uploaded before starting spraying operations. Submissions will be sorted by District (One) and county (Cook, DuPage, Kane, Lake, McHenry, or Will). Allow at least a week for notifications to be uploaded.

Pesticide Application Daily Spray Record. The Contractor will be required to properly track pesticide applications as required by the ILG87 Permit. Reported data from this form will be collected and complied annually and reported to the IEPA as required.

Within 48 hours of the application of pesticides, including but not limited to herbicides, insecticides, algaecides, and fungicides, the Contractor shall complete and return to the Engineer, Operations form "OPER 2720". OPER 2720 may be found at the following link:

<https://idot.illinois.gov/resources/forms.html>

WIREWAY AND CONDUIT SYSTEMS

Effective: April 1, 2026

All steel conduit utilized shall be Galvanized Rigid Metal Conduit, Intermediate Metal Conduit is unacceptable. Where PVC coated conduit is specified, the conduit shall be PVC-coated galvanized rigid steel conduit

Revise the first paragraph of 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 Galvanized Rigid Steel Conduit unless otherwise indicated on the plans.

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."

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

“Rigid Metal Conduit. 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° C. When PVC coated conduit is utilized, the hubs shall also be PVC coated.”

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

“Supports. Surface-mounted conduits shall be held in place by one-hole clamps and clamp backs. Conduit mounted to steel beams or columns shall be held in place by suitable beam clamps. Clamps, clamp backs, and beam clamps shall be hot-dip galvanized steel or stainless steel. When PVC coated conduit is utilized, the supports shall be either stainless steel or 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)(2) of the Standard Specifications to read:

“(2) Intermediate Metal Conduit. Intermediate Metal Conduit is unacceptable and shall not be used.”

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

“(3). PVC Coated Steel Conduit. The PVC coated rigid metal conduit shall be UL Listed (UL 6) or verified by ETL (PVC-001). 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 protection. Hazardous location fittings, prior to plastic coating shall be UL listed.

The PVC coating shall have the following characteristics:

Hardness:	85+ Shore A Durometer
Dielectric Strength:	400V/mil @ 60 Hz
Aging	1,000 Hours Atlas Weatherometer
Temperature	The PVC compound shall conform at 0° F. to Federal Specifications PL-406b, Method 2051, Amendment 1 of 25 September 1952 (ASTM D 746)
Brittleness Temperature	0 °F (-18 °C) when tested according to ASTM D 746
Elongation	200%

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.

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).

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.

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.

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 they do not unbond 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 unbonds, 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 unbonds, 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."

WEED CONTROL, NON-SELECTIVE AND NON-RESIDUAL

Description: This work shall consist of the application of a non-selective and non-residual herbicide to kill all existing vegetation at designated areas along highway roadsides.

Materials: The non-selective and non-residual herbicide shall have the following formulation:

A. Active Ingredient	
*Glyphosate, N- (phosphonomethyl) glycine, in the form of its isopropylamine salt	41.00%
B. Inert Ingredients (including surfactant)	<u>59.00%</u>
	TOTAL 100.00%

*Contains 480 grams per liter or 4 pounds per U.S. gallon of the active ingredient Glyphosate, in the form of its isopropylamine salt. Equivalent to 356 grams per liter or 3 pounds per U.S. gallon of the acid, glyphosate.

The Contractor shall submit a certificate, including the following, prior to starting work:

1. The chemical names of the compound and the percentage by volume of the ingredients which must match the above specified formulation.
2. A statement that the material is in a solution which will form a satisfactory emulsion for use when diluted with water for normal spraying conditions.
3. A statement that the herbicide, when mixed with water, will be completely soluble and dispersible and remain in suspension with continuous agitation.
4. A statement describing the products proposed for use when the manufacturer requires that surfactants, drift control agents, or other additives be used with the product. These tank mix additives shall be used as specified by the manufacture. Required additives will not be paid for separately.

All material shall be brought to the spray area in the original, unopened containers supplied by the manufacturer.

Schedule: Spraying will not be allowed when temperatures exceed 85° F or under 60° F, when wind velocities exceed fifteen (15) miles per hour, when foliage is wet or rain is eminent, when visibility is poor or during legal holiday periods.

More than one application of the herbicide may be required during the duration of the contract.

Application Rate: The non-selective and non-residual herbicide shall be applied at the rate of one (1) gallon per acre.

One (1) gallon of herbicide formulation shall be diluted with a minimum of fifty-five (55) gallons of water and applied as a mixture. Water for dilution of the mixture will not be paid for separately.

Method of Measurement: Weed Control, Non-Selective and Non-Residual will be measured for payment in gallons of undiluted herbicide applied as specified. The gallons for payment will be determined based on the gallons specified on the label attached to the original container supplied by the manufacturer.

Basis of Payment: Weed Control, Non-Selective and Non-residual will be paid for at the contract unit price per gallon for WEED CONTROL, NON-SELECTIVE AND NON-RESIDUAL. Water for dilution of the mixture and additives required for application will not be paid for as separate items, but the costs shall be considered as included in the contract unit price for We

HIGH MAST LUMINAIRE COUNTERWEIGHT

Description. This item shall consist of furnishing and installing a high mast luminaire counterweight as specified herein and as indicated in the plans.

Removal of Existing Counterweights. Existing counterweights shall be removed to allow installation of new counterweights matched to the proposed luminaires. The removed counterweights and associated hardware shall be disposed of by the Contractor.

Materials. Materials shall be according to the following:

Counterweights shall be fabricated from A36 steel and hot dipped galvanized in accordance with ASTM A123. All attachment hardware shall be stainless steel. Counterweights shall be installed at all empty luminaire positions to ensure proper balance of luminaire ring. Counterweights shall match the weight of the proposed luminaires. Counterweights shall be coordinated with the luminaires to be installed.

Basis of Payment. This work shall be paid for at the contract price each for HIGH MAST LUMINAIRE COUNTERWEIGHT.

TRAFFIC CONTROL PLAN (D1)

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.

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

STANDARDS: 643001 701400 701401 701411 701426 701427
 701428 701446 701601 701701 701801 701901
 704001 780001 782006

DETAILS: TC-08 TC-09 TC-10 TC-12 TC-13 TC-16 TC-17
 TC-18 TC-21 TC-22 TC-25

SPECIAL PROVISIONS:

MAINTENANCE OF ROADWAYS (D1)
 PUBLIC CONVENIENCE AND SAFETY (D1)
 CONTRACTOR COOPERATION
 WORK RESTRICTIONS
 TOLLWAY PERMIT AND BOND (D1)
 TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D1)
 KEEPING THE EXPRESSWAY OPEN TO TRAFFIC
 FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC
 TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)
 TEMPORARY INFORMATION SIGNING
 TRAFFIC CONTROL FOR WORK ZONE AREAS
 SPEED DISPLAY TRAILER (D1)
 RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL
 RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REPLACEMENT
 SHORT TERM AND TEMPORARY PAVEMENT MARKINGS (BDE)
 TEMPORARY CONCRETE BARRIER (BDE)
 VEHICLE AND EQUIPMENT WARNING LIGHTS (BDE)
 WORK ZONE TRAFFIC CONTROL DEVICES (BDE)

HOT-MIX ASPHALT SURFACE REMOVAL, VARIABLE DEPTH

This work shall be done in accordance with Section 440 of the STANDARD SPECIFICATIONS except as modified herein.

440.01 Description. Revise this Article to read:

"440.01 Description. This work shall consist of the removal and satisfactory disposal of the HMA pavement surface to the variable depths indicated in the plans.

440.03 General. Add the following paragraph to the end of this Article:

"No additional compensation will be allowed because of variations from the assumed HMA surface thickness or from the HMA surface thickness shown on the Plans." "No additional compensation will be allowed due to the presence of geotextile fabric in the milled asphalt layer(s)."

Basis of Payment. This work shall be paid for at the contract unit price per square yard for HOTMIX ASPHALT SURFACE REMOVAL, VARIABLE DEPTH.

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.

Pre-Stage

No conflicts to be resolved.

Stage 1

No conflicts to be resolved.

Stage 2

No conflicts to be resolved.

Pre-Stage: _____ Days Total Installation

Stage 1: _____ Days Total Installation

Stage 2: _____ Days Total Installation

The following contact information is what was used during the preparation of the plans as provided by the Agency/Company responsible for resolution of the conflict.

Agency/Company Responsible to Resolve Conflict	Name of contact	Phone	E-mail address

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UTILITIES TO BE WATCHED AND PROTECTED

The areas of concern noted below have been identified by following the suggested staging plan included for the contract. 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 Department's 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.

Pre-Stage

No conflicts to be resolved.

Stage 1

No conflicts to be resolved.

Stage 2

No conflicts to be resolved.

The following contact 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	Phone	E-mail address
AT&T	Tom Laskowski		g05256@att.com
Buckeye	Brad Yarzebinski		byarzebinski@buckeye.com
Comed	James Campbell III	630-940-6805	James.Campbelliii@ComEd.com
Illinois Tollway – Fiber Optic Cable			utilitypermits@getipass.com
MWRD	Mr. Paul Sobanski	(708) 588-4080	
Nicor	Johanna Castro	(630) 353 4000 (Office) (630) 353 4020 (Cell)	jcastro@entrustsol.com
Verizon MCI	Eve Campbell	312.612.5216	ecampbell@telecom-eng.com
Uniti	Andres Bravo	224.201.0230	Andres.Bravo@uniti.com

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

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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 Department's contractor is responsible for contacting J.U.L.I.E. prior to all excavation work.

All work within 25 feet of Buckeye's pipeline must be approved and requires a representative to be on site. Contact Bill O'Malley at 847-878-3428.

LIGHT POLE BREAKAWAY DEVICE

Effective: November 1, 2025

Description.

This work shall consist of furnishing and installing a breakaway device. The device may be either a transformer base or a set of four breakaway couplings at the Contractor's discretion. However, all breakaway devices for the contract must be of the same type; mixing transformer bases and couplings in the same contract is not allowed.

Materials.

Breakaway Couplings

General.

Certification shall be submitted from the supplier that the device used under the conditions of the particular design meets the AASHTO breakaway specification. Certification shall include test results performed by the manufacturer, supplier or others. If test results have been previously approved by a letter from the FHWA, a copy of the approval letter from FHWA should accompany the certification. The coupling shall not alter the bolt circle of the pole. The breakaway device shall be vandal resistant and shall not adversely affect the light pole installation and maintenance or decrease the resistance of the light pole to non-collision type of design loading. The breakaway device shall be field attachable and detachable.

Breakaway Coupling Cover.

The breakaway device shall have a cover enclosing the space between the bottom of the pole base plate and the foundation consisting of a Type 304 stainless steel wire cloth mesh with a maximum opening of 1/4 in. (6 mm) and a minimum wire diameter of AWG No. 16 (1.6 mm) with a minimum lap of 6 in. (150 mm) to enclose the void between the pole base and the foundation. The lap shall be tied together with Type 304 stainless steel wire ties. When specified, an aluminum skirt cover shall be provided over the wire cloth. The aluminum skirt shall be made of ASTM B209 Alloy 3003-H14 or 5052-H32, 0.0625 in. (1.6 mm) thick minimum. The enclosure shall fit snugly around the wire cloth and

breakaway devices between the bottom face of the pole base plate and the top of the foundation. Vertical or horizontal movement of the cover will not be acceptable.

Transformer Base.

General.

The breakaway device shall be a cast and welded aluminum transformer base type pole base. The breakaway device shall have a listing of approval by FHWA to AASHTO breakaway requirements. This shall require compliance to AASHTO "Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Sixth Edition, 2013". Submittal information shall document the approval listing.

The device shall be approximately 17 in. (430 mm) high or approximately 9 in. (230 mm) high and shall have a large fiberglass or polyethylene access door of a color to match the base finish which shall be held in place with a button-type tamper resistant stainless-steel screw or other means approved by the Engineer.

The 17-inch high transformer base cannot be installed on metal helix foundations.

Bolt Circle Size.

The transformer base shall come in two standard bolt circles.

11.5 in. (290 mm) Pole Bolt Circle Devices. Breakaway devices for poles having nominal 11.5 in. (290 mm) bolt circles shall accommodate bottom (foundation) bolt circles ranging roughly 10 to 12 in. (255 to 300 mm) and shall accommodate top (pole) bolt circles ranging roughly 10.5 to 12 in. (265 to 300 mm).

15 in. (380 mm) Pole Bolt Circle Devices. The bottom foundation bolt circle shall have a range of 15 to 17 in. (380 to 430 mm) and shall accommodate top (pole) bolt circles having a range of 13 to 15 in. (330 to 380 mm).

Access door.

The polyethylene access door shall be fabricated from a high-density polyethylene. The door shall withstand temperature extremes of -76 to 150°F (-60 to 65°C). Ultraviolet light inhibitors shall also be incorporated into the door material. The door shall be reinforced and have tabs to lock into the transformer base door frame.

The appearance of the breakaway device shall be of such general configuration as not to detract from the aesthetic value of the light pole. The device shall have finish that matches the finish of the pole.

Installation.

All entryway points created using breakaway devices shall be permanently and completely sealed against rodent entry. This includes the pole base plate and foundation plate openings, elongated holes for anchor rods, the opening below the pole base plate, and the wiring windows in both steel and concrete foundations. Where breakaway couplings are used in conjunction with steel

foundations, the Contractor shall match the plate sizes to seal out rodents between the foundation and pole base. Breakaway devices are not allowed on bridge parapets, barrier walls, or pedestrian conflict areas, and are not required behind guardrail. The Contractor shall verify that the loading of the pole, arm(s), luminaire(s), banner(s), and appurtenances does not exceed the capacity of the breakaway device.

Transformer Base.

The transformer base shall be installed level and flush with the foundation without the use of leveling washers or shims according to the manufacturer's installation procedures. The anchor rods shall be inserted full depth into the slotted holes of the transformer base. The transformer base shall be installed with access door aligned with light pole handhole. All nuts, bolts, washers, and lock washers required to complete the installation of the transformer base shall be included. A minimum of two thread pitches shall extend beyond the top surface of the nut.

Breakaway Couplings.

The breakaway couplings shall be coordinated to match anchor rod size. The breakaway coupling shall be installed on the anchor rod according to the manufacturer's recommendations and fully coordinated with the foundation. When used with a metal foundation, a nut shall be installed under the foundation plate on the stud bolt to prevent it from backing out of the breakaway coupling. The coupling installation shall not be used to level the pole base in lieu of a level foundation. The screen shall be tied back on itself and secured with stainless steel wire ties. The screen shall fit tightly and shall completely fill all openings including the voids in the bottom of the pole base

Method of Measurement.

Transformer bases used for breakaway devices will be measured for payment as each, breakaway couplings will be measured as each, for a set of four couplings.

Basis of Payment.

This work will be paid for at the contract unit price per each for **LIGHT POLE BREAKAWAY DEVICE**.

LUMINAIRE SHIELD

Effective: May 1, 2024

Description: This item shall consist of providing a luminaire shield as specified herein and as indicated in the plans.

Materials. Materials shall be according to the following:

The shield shall be made of aluminum and compatible with luminaire it is to be installed on.

The shield shall limit the light directed to the sides and above/below the luminaire, and the house side shield is intended to limit the light directed directly behind the luminaire.

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The shield shall be installable in 4 different positions: 0°, 90°, 180°, and 270°.

CONSTRUCTION REQUIREMENTS

General. The shield shall be installed as instructed by the manufacturer and indicated in the plan details.

Basis of Payment: This work shall be paid for at the contract price each for **LUMINAIRE SHIELD**, which shall be payment for the work as described herein and as indicated in the plans.

SHOULDER RUMBLE STRIP REMOVAL

Description. This work shall consist of the scarification of existing shoulder rumble strips constructed in hot-mix asphalt shoulders and the furnishing and placement of hot-mix asphalt in the scarified area, prior to placing traffic onto the shoulder in a construction stage. This work shall take place per the limits shown on the plans and/or as directed by the Engineer and according to Section 406 of the Standard Specifications.

General Requirements. The nominal depth of scarification of the hot-mix asphalt shoulders shall be 2 inches. Unless otherwise shown in the plans, the width of scarification shall be 2 feet. After removing all millings from the scarified limits, the surface shall have a bituminous tack coat applied according to Article 406.05(b) of the Standard Specifications. The scarified area shall then be filled with hot-mix asphalt surface course and compacted flush with the adjoining pavement and shoulder surfaces. The mix to be used for this item shall be hot mix asphalt surface course, IL-9.5, mix D, N70, unless otherwise specified in the Contract.

Method of Measurement. This work will be measured for payment in square yards. Any portion of this work constructed outside the dimensions shown on the plans or as directed by the Engineer will not be measured for payment.

Basis of Payment. This work will be paid at the contract unit price per SQUARE YARD for SHOULDER RUMBLE STRIP REMOVAL.

Traffic control required for this work will not be paid for separately but shall be included in the cost for Traffic Control and Protection (Expressway).

NETWORK SWITCH

Effective: November 1, 2023

Revised: April 1, 2026

Description.

This item must consist of furnishing and installation of various network switches as shown in the plan. The network switches consist of Access, Distribution and Core Switch.

Materials. Materials must be according to the following:

A. General Requirements:

1. Management and Support Capabilities. Must include the following:
 - a. support full-duplex Ethernet
 - b. be capable Layer 2 LAN Base services
 - c. have American Standard Code for Information Interchange (ASCII) based configuration files for offline editing and bulk configuration
 - d. be managed using Simple Network Management Protocol (SNMP) Version 3.
 - e. be able to use Secure File Transfer Protocol (SFTP) to transfer configuration file to and from a central server.
 - f. 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).
 - g. perform multicast filtering using Internet Group Management Protocol (IGMP) snooping.
 - h. support Address Resolution Protocol (ARP)
 - i. Need to have TACACS/RADIUS access via SSH
 - j. Need to support CDP protocol for neighbor reporting/discovery
 - k. Support for MAB security (ISE)
2. Power Requirements:
 - a. Input Voltage to Power Supply Modules: 100 to 240 VAC
 - b. Capable of using Redundant Power Supplies
 - c. Must use Manufacturer approved power supply.
3. Must utilize Single Mode Fiber Small Form-Factor Plug (SFP) Modules that have the following:
 - a. Minimum performance of 1Gbps
 - b. From the manufacturer of the switch.
 - c. See plans for distance, type and quantity requirements
4. All ports must have Diagnostic light-emitting diodes (LED). These indicators must include link, activity, and power LEDs.

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5. Must include a 1-year hardware support agreement and license (contract type SNT)

B. Additional Requirements for Distribution and Core Switches:

1. Switches must support the following Layer 3 capabilities:
 - a. Support of Enhanced Interior Gateway Routing Protocol (EIGRP).
 - b. Support of Border Gateway Protocol (BGP).
 - c. Internet Protocol Version 4 (IPv4);
 - d. Internet Protocol Version 6 (IPv6);
 - e. Open Shortest Path First (OSPF);
 - f. Generic Routing Encapsulation (GRE);
 - g. Inter-VLAN Internet Protocol (IP) routing for full Layer 3 routing between two or more VLANs;
 - h. Virtual Router Redundancy Protocol (VRRP);
 - i. IP multicast routing utilizing Protocol Independent Multicast (PIM) and Internet Group Management Protocol, Version 2 (IGMPv2).
 - j. Support for PIM sparse mode (PIM-SM) and PIM dense mode (PIM-DM);
 - k. Security utilizing Access Control Lists (ACLs).

C. Switch Types:

1. Access Switch:
 - a. Must include:
 1. **General Requirements.**
 2. the following port types or better:
 - 10/100/1000 Mbps copper Ethernet ports, RJ-45 connector
 - FE/GE SFP ports
 - b. Environmental Requirements:
 1. Operating Temperature: -34° to +70°C
 2. Humidity: 0 to 95% (non-condensing)
 3. IEC/EN/EN61000-4-2 (Electro Static Discharge), 8kV air/6kV contact
 4. IEC/EN 61000-4-3 (Radiated Immunity, 10 V/m 80-2000MHz, 3V/m 2000-2700MHz)
 5. IEC/EN 61000-4-4 (Fast Transients - 2kV DC power, 2kV data line, 4kv earth)
 6. IEC/EN 61000-4-5 (Surge 2 kV/1 kV DC power, 2 kV shielded and unshielded data line)
 7. IEC/EN 61000-4-6 (Conducted Immunity, 10 V/emf 0.15-80MHz)
 8. IEC/EN 61000-4-8 (Power Frequency Magnetic Field Immunity 30A/m 60 sec, 300A/m 3 sec)
 9. IEC/EN 61000-4-9 (Pulse Magnetic Field Immunity 300A/m)
 10. IEC/EN 61000-4-29 (Voltage Dips Immunity)
 11. IEC 60068-2-27 (Operational Shock: 30G 11ms, half sine)
 12. IEC 60068-2-27 (Non-Operational Shock 65-80G, trapezoidal)
 13. IEC 60068-2-6, IEC 60068-2-64 (Operational Vibration)

14. EC 60068-2-6, IEC 60068-2-64, IEC 60068-2-47 (Non-operational Vibration)

2. Distribution Switch:

a. Must include:

1. **General Requirements.**
2. **Additional Requirements for Distribution and Core Switches**
3. The following port types or better:
 - 10/100/1000 Mbps copper Ethernet ports, RJ-45 connector
 - FE/GE SFP ports

b. Environmental Requirements:

1. Operating Temperature: -40° to +75°C
2. Operate in a cabinet enclosure
3. Humidity: 5 to 95% (non-condensing)
4. CISPR 24 / CISPR 35
5. EN55024 / EN55035
6. KN 35
7. EN 61000-4-2 Electro Static Discharge (air – 15kV, contact – 8kV)
8. EN 61000-4-3 Radiated RF (10V/m UTP, 20V/m STP)
9. EN 61000-4-4 Electromagnetic Fast Transients (4kV)
10. EN 61000-4-5 Surge (2KV/1KV Power, 4KV STP)
11. EN 61000-4-6 Conducted RF (10Vrms UTP)
12. EN 61000-4-8 Power Frequency Magnetic Field (1000A/m)
13. EN 61000-4-10 Damped Oscillatory Magnetic Field (100 A/m)
14. EN 61000-4-16 Conducted CM Disturbances (30V, Cont/ 300V, 1 sec)
15. EN 61000-4-17 Ripple Immunity DC Power (10%)
16. EN 61000-4-18 Damped Oscillatory Wave (2.5kV, 1MHz)
17. EN-61000-4-29 DC Voltage Dips and Interruptions
18. ANSI/ISA 12.12.01 (Class1, Div2 A-D)
19. EN 60079-0, -15 ATEX certificate (Class 1, Zone2 A-D)
20. EC 60079-0, 15 (report only)
21. UL 60079-0, 15
22. IEC 60068-2-27 (operational shock, 50G, 3ms, half sine)
23. IEC 60068-2-27 (non-operational shock, 65-80G, 9ms, trapezoidal)
24. IEC 60068-2-6 (vibration-sinusoidal, 5Hz-150Hz)

3. Core Switch:

a. Must include:

1. **General Requirements.**
2. **Additional Requirements for Distribution and Core Switches**
3. Network Port Requirements:
 - 48x 1/10/25G Gigabit Ethernet SFP ports
 - 4x 40/100G Uplink
 - Or better

b. Environmental requirements:

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1. Operating Temperature: -5°C to +35°C (23° to 95° F)
2. Relative humidity operating: 10 to 85% (noncondensing)
3. Must be installed in a temperature-controlled environment.

Configuration.. Thirty (30) days prior to the installation of the network switches, The Contractor must deliver the switches, for configuration, to the Traffic Systems Center (TSC) located at 445 Harrison St Oak Park, IL.

The switches must be delivered with markings on the box indicating the cabinet the item will be installed in per the plans. TSC will provide final network label on the switch.

After the switch is configured, the Contractor must coordinate an appointment to pick up the switches from the TSC and install it.

Installation. Access and Distribution Switches are to be installed in cabinets identified in the plans. Core Switches are only to be installed in temperature-controlled environments identified in the plans.

Documentation. In addition to the initial submittal(s) prior to procurement, the Contractor must provide installation and operation manuals, documentation of exact equipment model and serial numbers, software/firmware version numbers, location installed in PDF formats on flash drive or via electronic delivery.

Basis of Payment. This work will be paid for at the contract price per each for NETWORK SWITCH, (of the type specified), the price of which shall include all equipment, materials, and labor required to furnish, and install the switch, including all necessary connectors, cables, fiber optic jumpers, hardware, software and other peripheral equipment required to place the switch in operation to the satisfaction of the Engineer.

ROADWAY LUMINAIRE, LED, REPLACEMENT

Effective: November 1, 2025

Description.

This work shall consist of furnishing and installing a replacement roadway LED luminaire as shown on the plans, as specified herein.

General. The luminaire including the housing, driver and optical assembly shall be assembled in the U.S.A. The luminaire shall be assembled by and manufactured by the same manufacturer. The luminaire shall be mechanically strong and easy to maintain. The size, weight, and shape of the luminaire shall be designed so as not to incite detrimental vibrations in its respective pole and it shall be compatible with the pole and arm. All electrical and electronic components of the luminaire shall comply with the requirements of Restriction of Hazardous Materials (RoHS) regulations. The luminaire shall be listed for wet locations by an NRTL and shall meet the requirements of UL 1598 and UL 8750

Submittal Requirements. The Contractor shall also submit the following manufacturer's product data for each type of luminaire:

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31. Descriptive literature and catalogue cuts for luminaire, LED driver, and surge protection device. Completed manufacturer's luminaire ordering form with the full catalog number provided
32. LED drive current, total luminaire input wattage and total luminaire current at the system operating voltage or voltage range and ambient temperature of 25 C.
33. LED efficacy per luminaire expressed in lumens per watt (l/w).
34. Initial delivered lumens at the specified color temperature, drive current, and ambient temperature.
35. IES file associated with each submitted luminaire in the IES LM-63 format.
36. Computer photometric calculation reports as specified and in the luminaire performance table.
37. TM-15 BUG rating report.
38. Isofootcandle chart with max candela point and half candela trace indicated.
39. Documentation of manufacturers experience and verification that luminaires were assembled in the U.S.A. as specified.
40. Written warranty.

Upon request by the Engineer, the submittals shall also include any or all the following:

- nn. TM-21 calculator spreadsheet (XLSX or PDF format) and if available, TM-28 report for the specified luminaire or luminaire family. Both reports shall be for 50,000 hours at an ambient temperature of 77 °F (25 °C).
- oo. LM-79 report with National Voluntary Laboratory Accreditation Program (NVLAP) current at the time of testing in PDF format inclusive of the following: isofootcandle diagram with half candela contour and maximum candela point; polar plots through maximum plane and maximum cone; coefficient of utilization graph; candela table; and spectral distribution graph and chromaticity diagram.
- pp. LM-80 report for the specified LED package in PDF format and if available, LM-84 report for the specified luminaire or luminaire family in PDF format. Both reports shall be conducted by a laboratory with NVLAP certification current at the time of testing.
- qq. AGi32 calculation file matching the submittal package.
- rr. In Situ Temperature Measurement Test (ISTMT) report for the specified luminaire or luminaire family in PDF format.
- ss. Vibration test report in accordance with ANSI C136.31 in PDF format.

- tt. ASTM B117/ASTM D1654 (neutral salt spray) test and sample evaluation report in PDF format.
- uu. ASTM G154 (ASTM D523) gloss test report in PDF format.
- vv. LED drive current, total luminaire input wattage, and current over the operating voltage range at an ambient temperature of 77 °F (25 °C).
- ww. Power factor (pf) and total harmonic distortion (THD) at maximum and minimum supply and at nominal voltage for the dimmed states of 70%, 50%, and 30% full power.
- xx. Ingress protection (IP) test reports, conducted according to ANSI C136.25 requirements, for the driver and optical assembly in PDF format.
- yy. Installation, maintenance, and cleaning instructions in PDF format, including recommendations on periodic cleaning methods.
- zz. Documentation in PDF format that the reporting laboratory is certified to perform the required tests.

A sample luminaire shall also be provided upon request of the Engineer. The sample shall be as proposed for the contract and shall be delivered by the Contractor to the District Headquarters. After review, the Contractor shall retrieve the luminaire.

Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 20 year lifetime. The luminaire manufacturer shall have a minimum of 15 years' experience manufacturing LED roadway luminaires; parking lot, architectural, or residential luminaires are not applicable to this requirement. The manufacturer shall have a minimum of 100,000 total LED roadway luminaires installed on a minimum of 100 separate installations, all within the U.S.A.

Housing.

Material. The luminaire shall be a single device not requiring on-site assembly for installation. The driver for the luminaire shall be integral to the unit.

Finish. The luminaire shall have a baked acrylic enamel finish. The color of the finish shall be gray, unless otherwise indicated.

The finish shall have a rating of six or greater according to ASTM D1654, Section 8.0 Procedure A – Evaluation of Rust Creepage for Scribed Samples after exposure to 1000 hours of testing according to ASTM B117 for painted or finished surfaces under environmental exposure.

The luminaire finish shall have less than or equal to 30% reduction of gloss according to ASTM D523 after exposure of 500 hours to ASTM G154 Cycle 6 QUV® accelerated weathering testing.

The luminaire shall slip-fit on a mounting arm with a 2" diameter tenon (2.375" outer diameter), and shall have a barrier to limit the amount of insertion. The slip fitter clamp shall utilize four (4) bolts to clamp to the tenon arm. The luminaire shall be provided with a leveling surface and shall

be capable of being tilted ± 5 degrees from the axis of attachment in 2.5 degree increments and rotated to any degree with respect to the supporting arm.

All external surfaces shall be cleaned in accordance with the manufacturer's recommendations and be constructed in such a way as to discourage the accumulation of water, ice, and debris.

The effective projected area (EPA) of the luminaire shall not exceed 1.6 sq ft (0.149 sq m) and the weight, including accessories, shall not exceed 40 lb (18.14 kg). **If the weight of the luminaire is less than 20 lb (9.07 kg), weight shall be added to the mounting arm or a supplemental vibration damper installed as approved by the Engineer.**

A passive cooling method with no moving, rotating parts, or liquids shall be employed for heat management.

The luminaire shall include a fully prewired, 7-pin twist lock ANSI C136.41-compliant receptacle. Unused pins shall be connected as directed by the Manufacturer and as approved by the Engineer. A shorting cap shall be provided with the luminaire that is compliant with ANSI C136.10.

Vibration Testing. All luminaires shall be subjected to and pass vibration testing requirements at "3G" minimum zero to peak acceleration in accordance with ANSI C136.31 requirements using the same luminaire. To be accepted, the luminaire housing, hardware, and each individual component shall pass this test with no noticeable damage and the luminaire must remain fully operational after testing.

Labels. An internal label shall be provided indicating the luminaire is suitable for wet locations and indicating the luminaire is an NRTL listed product to UL1598 and UL8750. The internal label shall also comply with the requirements of ANSI C136.22.

An external label consisting of two black characters on a white background with the dimensions of the label and the characters as specified in ANSI C136.15 for HPS luminaires. The first character shall be the alphabetical character representing the initial lumen output as specified in Table 1 of Article 1067.06(c). The second character shall be the numerical character representing the transverse light distribution type as specified in IES RP-8 (i.e. Types 1, 2, 3, 4, or 5).

Hardware. All hardware shall be stainless steel or of other corrosion resistant material approved by the Engineer.

Luminaires shall be designed to be easily serviced, having fasteners such as quarter-turn clips of the heavy spring-loaded type with large, deep straight slot heads, complete with a receptacle and shall be according to military specification MIL-f-5591.

All hardware shall be captive and not susceptible to falling from the luminaire during maintenance operations. This shall include lens/lens frame fasteners as well hardware holding the removable driver and electronic components in place.

Provisions for any future house-side external or internal shielding should be indicated along with means of attachment.

Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LED's.

Wiring. Wiring within the electrical enclosure shall be rated at 600v, 105°C or higher.

Driver. The driver shall be integral to the luminaire shall be capable of receiving an indefinite open and short circuit output conditions without damage.

The driver shall incorporate the use of thermal foldback circuitry to reduce output current under abnormal driver case temperature conditions and shall be rated for a lifetime of 100,000 hours at an ambient temperature exposure of 77 °F (25 °C) to the luminaire. If the driver has a thermal shut down feature, it shall not turn off the LEDs when operated at 104 °F (40 °C) or less.

The driver shall have an input voltage range of 120 to 277 volts ($\pm 10\%$) or 347 to 480 volts ($\pm 10\%$) according to the contract documents. When the driver is operating within the rated input voltage range and in an un-dimmed state, the power factor measurement shall be not less than 0.9 and the THD measurement shall be no greater than 20%.

The driver shall meet the requirements of the FCC Rules and Regulations, Title 47, Part 15 for Class A devices with regard to electromagnetic compatibility. This shall be confirmed through the testing methods in accordance with ANSI C63.4 for electromagnetic interference.

The driver shall be dimmable using the protocol listed in the Luminaire Performance Table shown in the contract.

Surge Protection. The luminaire shall comply the requirements of ANSI C136.2 for electrical transient immunity at the "Extreme" level (20KV/10KA) and shall be equipped with a surge protective device (SPD) that is UL1449 compliant. An SPD failure shall open the circuit to protect the driver.

LED Optical Assembly. The optical assembly shall have an IP 65 or higher rating in accordance with ANSI C136.25. The circuiting of the LED array shall be designed to minimize the effect of individual LED failures on the operation of other LEDs. All optical components shall be made of glass or a UV stabilized, non-yellowing material.

The optical assembly shall utilize high brightness, long life, minimum 70 CRI, 4,000K color temperature ($\pm 300K$) LEDs binned in accordance with ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass.

The actual measured luminous flux output shall be within $\pm 10\%$ of the published lumen value.

Lumen depreciation at 50,000 hours of operation shall not exceed 15% of initial lumen output at the specified LED drive current and an ambient temperature of 25° C.

The luminaire may or may not have a glass lens over the LED modules. If a glass lens is used, it must be a flat lens. Material other than glass will not be acceptable. If a glass lens is not used, the LED modules may not protrude lower than the luminaire housing.

The assembly shall have individual serial numbers or other means for manufacturer tracking.

Photometric Performance. Luminaires shall be tested according to IESNA LM-79. This testing shall be performed by a test laboratory holding accreditation from the National Institute of

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Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) for the IESNA LM-79 test procedure.

Data reports as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, spectral distribution plots, chromaticity plots, and other standard report outputs of the above mentioned tests.

The luminaire shall have a BUG rating of Back Light B3 or less, Up Light rating of U0, and a Glare rating of G3 or less unless otherwise indicated in the luminaire performance table.

Photometric Calculations. Calculations. Submitted report shall include a luminaire classification system graph with both the recorded lumen value and percent lumens by zone along with the BUG rating according to IESNA TM-15.

Complete point-by-point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided in accordance with IESNA RP-8 recommendations. Lighting calculations shall be performed using AGi32 software with all luminance calculations performed to one decimal place (i.e. x.x cd/m²). Uniformity ratios shall also be calculated to one decimal place (i.e. x.x:1). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Table(s). Values shall be rounded to the number of significant digits indicated in the luminaire performance table(s).

When the quantity of luminaires requires independent testing, the AGi32 calculation file used for performance verification shall also be submitted with the initial submittal.

All photometry must be **photopic**. Scotopic or mesopic factors will not be allowed. The AGi32 file shall be submitted at the request of the Engineer.

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE
ROADWAY LIGHTING
DESIGNATION 'G'

GIVEN CONDITIONS

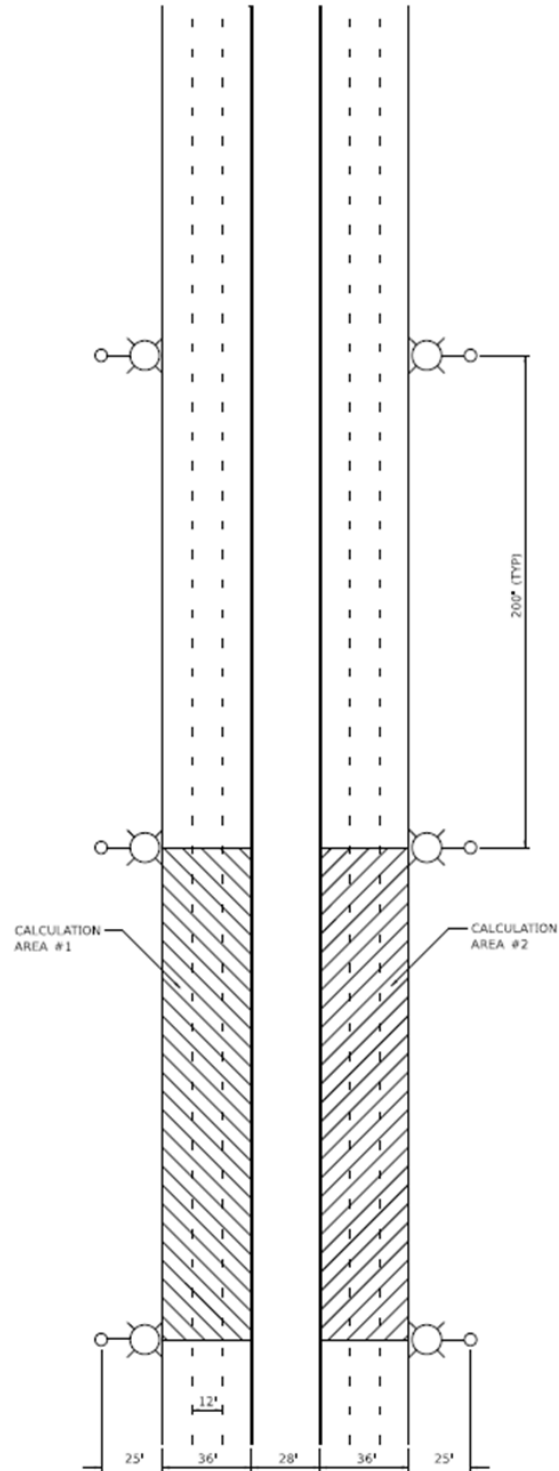
Roadway Data	Pavement Width	36	Ft
	Number of Lanes Left of Median	3	
	Number of Lanes Right of Median	3	
	Lane Width	12	Ft
	Median Width	28	Ft
	IES Surface Classification	R3	
	Q-Zero Value	0.07	
Mounting Data	Mounting Height	47.5	Ft
	Mast Arm Length	15	Ft
	Pole Set-Back from Edge of Pavement	25	Ft
Luminaire Data	Source	LED	
	Color Temperature	4000	°K
	Lumens	15,500	Min
	Pay Item Lumen Designation	G	
	BUG Rating	B3-U0-G3	
	IES Vertical Distribution	Medium	
	IES Control of Distribution	Cutoff	
	IES Lateral Distribution	Type III	
Pole Layout Data	Total Light Loss Factor	0.75	
	Spacing	200	Ft
	Configuration	Opposite	
	Luminaire Overhang over E.O.P.	-10	Ft

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested, and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

Roadway Luminance	Average Luminance, L_{AVE} (Max)	1.2	Cd/m ²
	Average Luminance, L_{AVE} (Min)	0.8	Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5	Max
	Uniformity Ratio, L_{MAX}/L_{MIN}	6.0	Max
	Veiling Luminance Ratio, L_v/L_{AVE}	0.3	Max



LUMINAIRE, LED, ROADWAY, OUTPUT DESIGNATION G
POLE LAYOUT DIAGRAM

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE
ROADWAY LIGHTING
DESIGNATION 'H'

GIVEN CONDITIONS

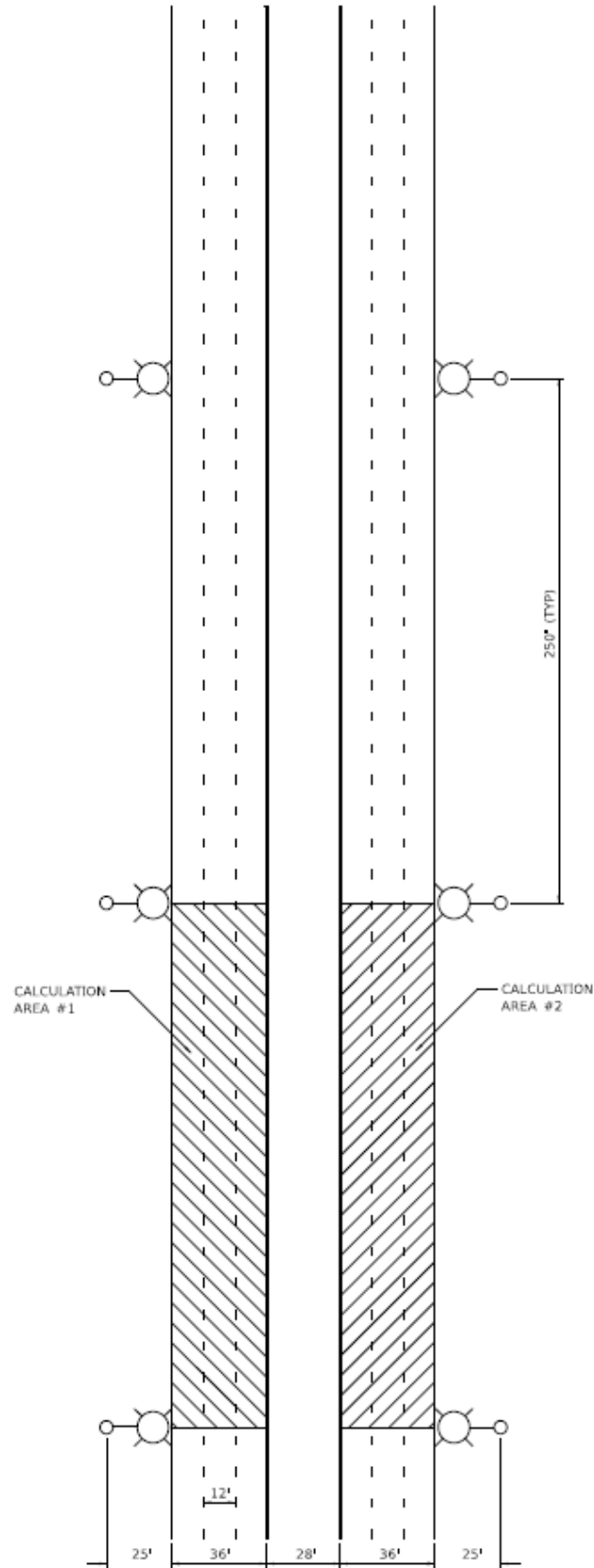
Roadway Data	Pavement Width	36	Ft
	Number of Lanes Left of Median	3	
	Number of Lanes Right of Median	3	
	Lane Width	12	Ft
	Median Width	28	Ft
	IES Surface Classification	R3	
	Q-Zero Value	0.07	
Mounting Data	Mounting Height	47.5	Ft
	Mast Arm Length	15	Ft
	Pole Set-Back from Edge of Pavement	25	Ft
Luminaire Data	Source	LED	
	Color Temperature	4000	°K
	Lumens	15,500	Min
	Pay Item Lumen Designation	H	
	BUG Rating	B3-U0-G4	
	IES Vertical Distribution	Medium	
	IES Control of Distribution	Cutoff	
	IES Lateral Distribution	Type III	
Pole Layout Data	Total Light Loss Factor	0.75	
	Spacing	250	Ft
	Configuration	Opposite	
	Luminaire Overhang over E.O.P.	-10	Ft

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested, and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

Roadway Luminance	Average Luminance, L_{AVE} (Max)	1.2	Cd/m ²
	Average Luminance, L_{AVE} (Min)	0.8	Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5	Max
	Uniformity Ratio, L_{MAX}/L_{MIN}	6.0	Max
	Veiling Luminance Ratio, L_v/L_{AVE}	0.3	Max



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Independent Testing

When a contract has 50 or more luminaires of the same type (distribution type and lumen output/wattage), that luminaire type shall be independently tested, unless otherwise noted. The quantity of luminaires to be tested shall be as specified in the following table.

Contract Quantity	Luminaires to be Tested
1-49	0 (unless otherwise noted)
50-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7

The Contractor shall coordinate the testing with the contract schedule considering submittal, manufacturing, testing, and installation lead-times and deadlines.

The Electrical Engineer shall select from all the project luminaires at the Contractor's or distributor's storage facility, within District 1, the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. An additional luminaire shall also be selected for physical inspection by the Engineer at the District Headquarters. This luminaire will be available for the Contractor to pick up at a later date to be installed under this contract. This luminaire is in addition to the luminaire required as a part of the submittal process specified elsewhere.

Alternative selection process. With the Engineer's prior approval, the Contractor shall provide a list of luminaire serial numbers for all the luminaires. The Engineer shall make a random selection of the required number of luminaires for testing from the serial numbers. That luminaire must then be photographed clearly showing the serial number prior to shipment to the selected and approved testing laboratory. The testing laboratory shall include a photograph of the luminaire along with the test results directly to the Engineer.

Luminaires shall be tested at a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory approved for each of the required tests. The testing facility shall not be associated in any way, subsidiary or otherwise, with the luminaire manufacturer. All costs associated with luminaire testing shall be included in the bid price of the luminaire.

The selection of the proposed independent laboratory shall be presented with the information submitted for review and approval.

The testing performed shall include photometric and electrical testing.

All tests shall be conducted at the luminaire system operating voltage of 240 volts unless specified differently in the contract plans.

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Photometric testing shall be according to IES recommendations, performed with a goniophotometer and as a minimum, shall yield an isofootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum planned and maximum cone plots of candela, a candlepower table (House and street side), a coefficient of utilization chart, a luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results.

Electrical testing shall conform to NEMA and ANSI standards and, as a minimum shall include a complete check of wiring connections and a table of characteristics showing input amperes, watts, power factor, total harmonic distortion and LED drive current.

The summary report and the test results including IES photometric files shall be sent directly to the Resident Engineer, the Electrical Engineer, and the Contractor via email or other mutually agreeable means.

Photometric performance shall meet or exceed that of the specified values. The color temperature shall be within $\pm 300^{\circ}\text{K}$ of the submitted factory values. The measured lumen output of the luminaire shall be within $\pm 10\%$ of the submitted factory value. If the luminaire does not meet the specified photometric values, the luminaire has failed regardless of whether the test results meet the submitted factory data.

Should any of the tested luminaires of a given type, and distribution fail to satisfy the specifications and perform according to approved submittal information, the luminaire type of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance.

In the case of corrections, the Contractor shall advise the Engineer of the proposed corrections and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated in its entirety.

The number of luminaires to be tested shall be the same quantity as originally tested as required in the above table.

Retesting, should it become necessary, shall not be grounds for additional compensation or extension of time.

Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.

Installation.

Each luminaire shall be installed according to the luminaire manufacturer's recommendations.

Luminaires which are pole mounted shall be mounted on site such that poles and arms are not left unloaded. Pole mounted luminaires shall be leveled/adjusted after poles are set and vertically aligned before being energized. When mounted on a tenon, care shall be exercised to assure maximum insertion of the mounting tenon. Each luminaire shall be checked to assure compatibility with the project power system. When the night-time check of the lighting system by the Engineer

indicates that any luminaires are mis-aligned, the mis-aligned luminaires shall be corrected at no additional cost.

No luminaire shall be installed prior to approval. Where independent testing is required, full approval will not be given until complete test results, demonstrating compliance with the specifications, have been reviewed and accepted by the Engineer.

Existing pole wiring and fusing shall be replaced as a part of this item.

Pole wiring shall be provided with the luminaire. Pole wire shall run from handhole to luminaire. Pole wire shall be sized No. 10, rated 600 V, RHW/USE-2, and have copper conductors, stranded in conformance with ASTM B 8. Pole wire shall be insulated with cross-linked polyethylene (XLP) insulation. Pole wire shall include a phase, neutral, and green ground wire. Wire shall be trained within the pole or sign structure to avoid abrasion or damage to the insulation.

Pole wire shall be extended through the pole, pole grommet, and any associated arm and tenon. The pole wire shall be terminated in a manner that avoids sharp kinks, pinching, pressure on the insulation, or any other arrangement prone to damaging insulation value and producing poor megger test results. Wires shall be trained away from heat sources within the luminaire. Wires shall be terminated so all strands are extended to the full depth of the terminal lug with the insulation removed far enough so it abuts against the shoulder of the lug, but is not compressed as the lug is tightened.

Included with the pole wiring shall be fusing located in the handhole. Fusing shall be according to Article 1065.01 with the exception that fuses shall be 6 amperes.

Each luminaire and optical assembly shall be free of all dirt, smudges, etc. Should the optical assembly require cleaning, a luminaire manufacturer approved cleaning procedure shall be used.

Horizontal mount luminaires shall be installed in a level, horizontal plane, with adjustments as needed to insure the optics are set perpendicular to the traveled roadway.

When the pole is bridge mounted, a minimum size stainless steel 1/4-20NC set screw shall be provided to secure the luminaire to the mast arm tenon. A hole shall be drilled and tapped through the tenon and luminaire mounting bracket and then fitted with the screw.

Warranty.

The entire luminaire and all of its component parts shall be covered by a 10-year warranty. Failure is when one or more of the following occur:

- 1) Negligible light output from more than 10 percent of the discrete LEDs.
- 2) Significant moisture that deteriorates performance of the luminaire.
- 3) Driver that continues to operate at a reduced output due to overheating.

The warranty period shall begin on the date of luminaire delivery. The Contractor shall verify that the Resident Engineer has noted the delivery date in the daily diary. Copy of the shipment and delivery documentation shall be submitted with the final documentation.

The replacement luminaire shall be of the same manufacturer, model, and photometric distribution as the original.

Method of Measurement.

The rated initial minimum luminous flux (lumen output) of the light source, as installed in the luminaire, shall be according to the following table for each specified output designation.

Designation Type	Minimum Initial Luminous Flux	Designation Type	Minimum Initial Luminous Flux
A	2,200	F	12,500
B	3,150	G	15,500
C	4,400	H	25,200
D	6,300	I	33,000
E	9,450		

Where delivered lumens is defined as the minimum initial delivered lumens at the specified color temperature. Luminaires with an initial luminous flux less than the values listed in the above table will not be acceptable even if they meet the requirements given in the Luminaire Performance table shown in the contract.

Basis of Payment.

This work will be paid for at the contract unit price per each for **LUMINAIRE, LED, ROADWAY, REPLACEMENT**, of the output designation specified.

RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REPLACEMENT

Effective: August 1, 2023

Description: This work shall be completed in accordance with Section 781 of the Standard Specifications for Road and Bridge Construction. This work shall consist of reinstallation of reflectors into the raised pavement marker castings upon completion of staging in which the markers were in conflict with temporary lane usage.

Basis of Payment: This work will be measured for payment at the contract unit price per each for **RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REPLACEMENT**. Payment shall be full compensation for materials, labor and equipment required to complete this work.

RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL

Effective: August 1, 2023

Description: This work shall be completed in accordance with Section 783 of the Standard Specifications for Road and Bridge Construction. This work shall consist of removing the reflector unit from existing raised reflector pavement markers that will remain in place at the end of construction activities. Existing reflectors that conflict with revised traffic patterns shall be removed immediately to facilitate a change in lane assignment. If darkness or inclement weather prohibits the removal operations, such operation shall be resumed the next morning or when weather permits.

The base casting shall remain in place in areas where no pavement rehabilitation is required, therefore only the reflector shall be removed. Debris from the removal operations shall be removed from the pavement prior to opening the roadway to traffic.

Basis of Payment: This work will be measured for payment at the contract unit price per each for RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL. Payment shall be full compensation for materials, labor and equipment required to complete this work.