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Letting February 27, 2026

Notice to Bidders, Specifications and Proposal



**Contract No. 62R19
GRUNDY-KENDALL-WILL Counties
Section FAI 80 21 VLS
Route FAI 80
Project NHPP-846T(970)
District 1 Construction Funds**

Prepared by

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Checked by

(Printed by authority of the State of Illinois)



NOTICE TO BIDDERS

- 1. TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 12:00 p.m. February 27, 2026 at which time the bids will be publicly opened from the iCX SecureVault.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 62R19
GRUNDY-KENDALL-WILL Counties
Section FAI 80 21 VLS
Project NHPP-846T(970)
Route FAI 80
District 1 Construction Funds**

Replacement and upgrading of the existing Intelligent Transportation Systems (ITS) from east of Ridge Rd to just west of Wheeler Rd and from Gardner St to I-355 for a net length of approximately 87,518 feet (16.58 miles). The improvement is located in the Villages of Shorewood, Minooka, Rockdale, and New Lenox and in the City of Joliet within Grundy, Kendall, and Will Counties.

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to re-advertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Gia Biagi,
Secretary

INDEX
FOR
SUPPLEMENTAL SPECIFICATIONS
AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2026

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS, frequently used RECURRING SPECIAL PROVISIONS, and LOCAL ROADS AND STREETS RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction
(Adopted 1-1-22) (Revised 1-1-26)

SUPPLEMENTAL SPECIFICATIONS

<u>Std. Spec. Sec.</u>	<u>Page No.</u>
109 Measurement and Payment	1
202 Earth and Rock Excavation	2
204 Borrow and Furnished Excavation	3
207 Porous Granular Embankment	4
211 Topsoil and Compost	5
214 Grading and Shaping Ditches	6
406 Hot-Mix Asphalt Binder and Surface Course	7
407 Hot-Mix Asphalt Pavement (Full-Depth)	9
420 Portland Cement Concrete Pavement	10
502 Excavation for Structures	11
504 Precast Concrete Structures	12
509 Metal Railings	13
522 Retaining Walls	14
540 Box Culverts	15
542 Pipe Culverts	35
550 Storm Sewers	44
586 Granular Backfill for Structures	51
601 Pipe Drains, Pipe Underdrains, and French Drains	52
630 Steel Plate Beam Guardrail	53
632 Guardrail and Cable Road Guard Removal	54
644 High Tension Cable Median Barrier	55
665 Woven Wire Fence	56
701 Work Zone Traffic Control and Protection	57
781 Raised Reflective Pavement Markers	59
782 Reflectors	60
801 Electrical Requirements	62
821 Roadway Luminaires	65
1003 Fine Aggregates	66
1004 Coarse Aggregates	67
1010 Finely Divided Minerals	69
1020 Portland Cement Concrete	70
1030 Hot-Mix Asphalt	73
1040 Drain Pipe, Tile, and Wall Drain	74
1042 Precast Concrete Products	75
1061 Waterproofing Membrane System	76
1067 Luminaire	77
1097 Reflectors	84
1102 Hot-Mix Asphalt Equipment	85

RECURRING SPECIAL PROVISIONS

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

<u>CHECK SHEET #</u>			<u>PAGE NO.</u>
1	X	Additional State Requirements for Federal-Aid Construction Contracts	87
2	X	Subletting of Contracts (Federal-Aid Contracts)	90
3	X	EEO	91
4		Specific EEO Responsibilities Nonfederal-Aid Contracts	101
5		Required Provisions - State Contracts	106
6		Asbestos Bearing Pad Removal	112
7		Asbestos Waterproofing Membrane and Asbestos Hot-Mix Asphalt Surface Removal	113
8		Temporary Stream Crossings and In-Stream Work Pads	114
9	X	Construction Layout Stakes	115
10		Use of Geotextile Fabric for Railroad Crossing	118
11		Subsealing of Concrete Pavements	120
12		Hot-Mix Asphalt Surface Correction	124
13		Pavement and Shoulder Resurfacing	126
14		Patching with Hot-Mix Asphalt Overlay Removal	127
15		Polymer Concrete	129
16		Reserved	131
17		Bicycle Racks	132
18		Temporary Portable Bridge Traffic Signals	134
19		Nighttime Inspection of Roadway Lighting	136
20		English Substitution of Metric Bolts	137
21		Calcium Chloride Accelerator for Portland Cement Concrete	138
22		Quality Control of Concrete Mixtures at the Plant	139
23	X	Quality Control/Quality Assurance of Concrete Mixtures	147
24		Reserved	163
25		Reserved	164
26		Temporary Raised Pavement Markers	165
27		Restoring Bridge Approach Pavements Using High-Density Foam	166
28		Portland Cement Concrete Inlay or Overlay	169
29		Portland Cement Concrete Partial Depth Hot-Mix Asphalt Patching	173
30		Longitudinal Joint and Crack Patching	176
31		Concrete Mix Design – Department Provided	178
32		Station Numbers in Pavements or Overlays	179

TABLE OF CONTENTS

LOCATION OF IMPROVEMENT	1
DESCRIPTION OF IMPROVEMENT	1
COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS	2
COOPERATION BETWEEN CONTRACTORS	4
SURVEY OF EXISTING ITS INFRASTRUCTURE.....	5
WORK RESTRICTIONS	5
MAINTENANCE OF ROADWAYS (D1).....	7
STATUS OF UTILITIES (D-1).....	7
PUBLIC CONVENIENCE AND SAFETY (D1).....	12
COMPLETION DATE FOR COMMUNICATIONS SHELTER PROCUREMENT	12
FAILURE TO COMPLETE COMMUNICATIONS SHELTER PROCUREMENT	12
COMPLETION DATE FOR ITS WORK	13
FAILURE TO COMPLETE ITS WORK	13
COMPLETION DATE PLUS WORKING DAYS (D1).....	13
COOPERATION WITH UTILITIES	14
PROGRESS SCHEDULE.....	14
REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (PROJECT SPECIFIC)	21
TRAFFIC CONTROL PLAN	25
KEEPING THE EXPRESSWAY OPEN TO TRAFFIC	26
FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC (D-1)	28
TRAFFIC CONTROL FOR WORK ZONE AREAS	29
KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC (LANE CLOSURES ONLY)	29
SPEED DISPLAY TRAILER (D1)	30
CLEANING OF TRAFFIC CONTROL DEVICES	31
GENERAL ELECTRICAL REQUIREMENTS.....	32
ELECTRIC SERVICE INSTALLATION.....	52
ELECTRIC UTILITY SERVICE CONNECTION.....	52
UNDERGROUND RACEWAYS.....	54
EXPOSED RACEWAYS	55
CONDUIT, RIGID NONMETALLIC	58
WIRE AND CABLE	61
BREAKAWAY DEVICE	63
GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8)	63
CONCRETE FOUNDATION, TYPE A	64
CONCRETE FOUNDATION, TYPE E 30-INCH DIAMETER	64

CLOSED CIRCUIT TELEVISION DOME CAMERA, HD	65
ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE	67
CABINET, MODEL 334	111
CLOSED CIRCUIT TELEVISION CABINET	116
ATMS INTEGRATION	119
CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT	120
CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER	124
STEP-DOWN TRANSFORMER	125
WEED CONTROL, NATIVE LANDSCAPE ENHANCEMENT	126
BUDGETARY ALLOWANCE FOR CCTV INTEGRATION	128
BUDGETARY ALLOWANCE FOR NETWORK DESIGN AND INTEGRATION	128
OUTDOOR RATED NETWORK CABLE	130
WIRELESS VEHICLE DETECTION SYSTEM	131
LIGHT POLE, SPECIAL	142
LAYER II (DATALINK) SWITCH	143
TERMINATE FIBER IN CABINET	149
DIRECTIONAL BORING THROUGH ROCK	150
CABINET, MODEL 336S	151
MODIFY EXISTING FIBER OPTIC CABINET	156
MODIFY EXISTING CABINET EQUIPMENT AND APPURTENANCES	157
DMS SIGN CONTROL EQUIPMENT	159
LAYER III (NETWORK) SWITCH	161
TREE REMOVAL, ACRES (SPECIAL)	164
DYNAMIC MESSAGE SIGN, WALK-IN ACCESS, FULL MATRIX, COLOR, NTCIP 1203	166
TEMPORARY CONSTRUCTION FENCE	215
ENGINEER'S FIELD OFFICE TYPE A (SPECIAL) (D1)	215
TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D-1)	217
TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)	218
UNDERGROUND CONDUIT, MULTI-DUCT, 7-18MM MICRODUCTS	222
LIGHT POLE, STEEL 50 FT. WITH CAMERA LOWERING SYSTEM	225
DISCONNECT SWITCH	230
FIBER OPTIC CABLE 12 FIBERS, SINGLE MODE	232
FIBER OPTIC TERMINATION PANEL	242
FIBER OPTIC CABLE, MICRO, SINGLE MODE	244
FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT	255
ETHERNET MANAGE SWITCH	256
FIBER OPTIC SPLICE	258

FIBER OPTIC UTILITY MARKER.....	262
FIBER OPTIC INNERDUCT 1 ¼" DIA.	263
CONCRETE FOUNDATION (SPECIAL)	265
MODIFY EXISTING LIGHTING CONTROLLER.....	266
REMOVE EXISTING TRAFFIC SURVEILLANCE EQUIPMENT	267
REMOVE FIBER OPTIC CABLE FROM CONDUIT	268
COMMUNICATIONS VAULT	269
GATEWAY INTEGRATION.....	271
STORM WATER POLLUTION PREVENTIONPLAN.....	272
PROTECTION OF THE PIPELINES AND EASEMENTS OF ONEOK	285
VEHICLE CROSSING DATA SHEET	288
DRILLED SHAFTS	289
CEMENT, FINELY DIVIDED MINERALS, ADMIXTURES, CONCRETE, AND MORTAR (BDE).....	300
COMPENSABLE DELAY COSTS (BDE).....	317
CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE).....	322
EROSION CONTROL BLANKET (BDE).....	324
REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (BDE)	326
SEEDING (BDE)	328
SHORT TERM AND TEMPORARY PAVEMENT MARKINGS (BDE).....	333
SOURCE OF SUPPLY AND QUALITY REQUIREMENTS (BDE)	337
SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)	338
SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)	339
SUBMISSION OF BIDDERS LIST INFORMATION (BDE).....	339
SUBMISSION OF PAYROLL RECORDS (BDE)	340
SURVEYING SERVICES (BDE)	341
TRAINING SPECIAL PROVISIONS (BDE)	342
IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION.....	345
VEHICLE AND EQUIPMENT WARNING LIGHTS (BDE)	347
WORK ZONE TRAFFIC CONTROL DEVICES (BDE)	347

STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2022, the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," and the "Manual of Test Procedures for Materials" in effect on the date of invitation for bids, and the Supplemental Specifications and Recurring Special Provisions indicated on the Check Sheets included herein which apply to and govern the construction of FAI Route 80 (I-80), Section FAI 80 21 VLS, Project NHPP-846T(970), Various Counties, Contract No. 62R19 and in case of conflict with any part or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

FAI Route 80 (I-80)
Section FAI 80 21 VLS
Project NHPP-846T(970)
Various Counties
Contract No. 62R19

LOCATION OF IMPROVEMENT

This improvement begins at a point on the centerline of FAI 80 just east of Ridge Road and extends easterly direction to a point just west of Wheeler Avenue and then starts again just east of Gardner Road to I-355 for a gross length of approximately 96,107 feet (18.20 miles) and a net length of approximately 87,518 feet (16.58 miles). The improvement is located in the Villages of Shorewood, Minooka, Rockdale and New Lenox and in the City of Joliet within Grundy, Kendall and Will Counties.

DESCRIPTION OF IMPROVEMENT

- Replacement and upgrading of the existing Intelligent Transportation Systems
- Traffic will be maintained on I-80 using lane and shoulder closures during the allowable off-peak hours
- The work shall include all incidental and ancillary work necessary to complete the project as shown in the plans and as described herein

COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS

This contract abuts and/or overlaps with other concurrent contracts listed below. Each contract includes work items requiring close coordination between the various Contractors regarding the sequence and timing of execution of work items. This contract also includes critical work items that affect the future staging of traffic and completion dates of other contracts. These critical items along with completion dates are listed after each contract.

Contract 62P71 – FAI Route 80 (Ridge Rd to River Rd) Roadway Reconstruction

Contract 62P71 will furnish and install the ITS Infrastructure within the contract limits.

Critical items affecting the above contract: None

Completion date: September 30, 2025

Contract 62R28 – FAI Route 80 (River Rd to Houbolt Rd) Roadway Reconstruction

Contract 62R28 will furnish and install the ITS Infrastructure within the contract limits except for the ITS Communications Hut which shall be installed in this contract (62R19).

Critical items affecting the above contract: None

Completion date: October 30, 2026

Contract 62R27 – FAI Route 80 (Houbolt Rd to Joliet Junction Trail) Roadway Reconstruction

Contract 62R27 will furnish and install the ITS Infrastructure within the contract limits.

Critical items affecting the above contract: None

Completion date: October 30, 2026

Contract 62R89 – FAI Route 80 (Joliet Junction Trail to Wheeler Ave) Roadway Reconstruction

Contract 62R89 will furnish and install the ITS Infrastructure within the contract limits.

Critical items affecting the above contract: None

Completion date: October 30, 2026

Contract 62R22 – I-80 at Center Street Interchange

Critical items affecting the above contract: MOT

Completion date: October 31, 2028

Contract 62R23 – FAI Route 80 (Interstate 80) at Des Plaines River

Critical items affecting the above contract: MOT

Completion date: October 31, 2028

Contract 62F94 – I-80 at Chicago Street Interchange

Critical items affecting the above contract: MOT

Completion date: October 31, 2028

Contract 60W35 - Westbound FAI Route 80 (Gardner Street to Rowell Avenue) Roadway Reconstruction

Critical items affecting the above contract: None

Completion date: August 30, 2024

Contract 62R29 – FAI Route 80 (Rowell Ave to Gougar Rd) Roadway Reconstruction

Contract 62R29 will furnish and install the ITS Infrastructure within the contract limits.

Critical items affecting the above contract: None

Completion Date: June 30, 2026

Contract 62R26 – FAI Route 80 Interchange at FAI Route 55

Critical items affecting the above contract: MOT

Completion Date: October 30, 2026

Contract 62R25 – Larkin Ave Interchange

Critical items affecting the above contract: None

Completion Date: November 7, 2025

Contract 62380 – Richards St Reconstruction

Critical items affecting the above contract: None

Completion Date: September 30, 2025

COOPERATION BETWEEN CONTRACTORS

The following should be added to Article 105.08:

The Department reserves the right to have work performed by other contractors and by Department forces and to permit public utility companies and others to perform work during the progress and within the limits of or adjacent to the work. The Contractor shall conduct its work in a manner and shall cooperate with such other parties to cause as little interference as possible with such other work and as the Department may also direct. If there is a difference of opinion as to the respective rights of the Contractor and others doing work within the limits of or adjacent to the work, the Engineer will decide the order and coordination of the work. The Engineer's decision shall be final and binding on the Contractor. The Contractor shall make no claims against the Department for additional compensation due to delays or other conditions created by the operations of such other parties.

Coordination with Other Contractors. The Contractor is advised that certain operations will involve coordination with Department personnel and Contractors currently performing work on or adjacent to this project for the Department and other agencies. The Contractor shall cooperate to the fullest extent with the Department and the Contractors working on adjacent projects in compliance with Articles 105.07 and 105.08 of these Specifications.

The Contractor shall submit to the Resident Engineer a daily work schedule for the purpose of coordinating the Contractor's activities for the next working day. The daily work schedule must be submitted by 3:00 p.m. the day prior. This schedule is necessary and shall be used by the Engineer to schedule inspections, material testing and checking of layout as part of the following day's work. Failure to submit a schedule may result in uninspected work and therefore considered unacceptable.

The daily schedule shall include the Contractor's or Sub-Contractor's planned work for that day including the location, description, scheduled work hours and pay items of work to be performed. The schedule shall also include any material testing requests, layout check requests and all traffic control measures to be implemented for that day's work.

The Department and the Engineer shall be notified in writing by the Contractor at least 48 hours prior to the start of any operation requiring cooperating with others. All other agencies, unless otherwise noted, will be notified in writing by the Contractor ten (10) days prior to the start of any such operation. The Contractor shall make no claims against the Department for additional compensation due to delays or other conditions created by the operations of such other parties.

SURVEY OF EXISTING ITS INFRASTRUCTURE

Locations, dimensions and details of the existing ITS infrastructure shown in the plans have been taken from existing plans and are subject to nominal construction variations. The Contractor shall survey the existing ITS infrastructure (including all handholes, vaults, junction boxes, and foundations) using a licensed accredited professional surveyor in the State of Illinois to verify that the infrastructure is within allowable tolerances for locations, dimensions, lines and elevations. In addition, the Contractor shall confirm all existing foundations are properly finished with anchor rods of the correct size, set in the correct pattern and orientation, and plumb with the specified extension including thread length above the top of concrete.

Prior to construction and ordering materials, the survey and field notes shall be prepared in standard survey format using field notebooks and submitted to the Engineer for review, random checking, and acceptance. The survey shall also be prepared and submitted electronically as MicroStation ORD file(s) along with the appropriate raw survey file format. It is not the responsibility of the Engineer to check the correctness of the Contractor's field survey and the Contractor shall assume full responsibility for all dimensions and measurements taken or derived by the Contractor. The field survey information shall become the property of the Engineer at the completion of the project. Electronic survey information shall be provided in Open Roads Designer (ORD) format and the original raw survey file format.

If physical conditions are encountered at the site differing from either those indicated in the contract or materially from those ordinarily encountered and generally recognized as inherent in this required work for the contract, the Contractor shall promptly notify the Engineer in writing before the affected work is performed or ordering of materials. The Contractor shall field verify existing locations, dimensions and details affecting new construction and make necessary approved adjustments prior to construction or ordering of materials. Such variations shall not be cause for additional compensation for a change in scope of the work, however, the Contractor will be paid for the quantity actually furnished at the unit price bid for the work. The cost incurred by the Contractor for completing this work and in complying with this requirement shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be made.

WORK RESTRICTIONS

Prior to the actual beginning and completion of the various stages of construction and traffic control and protection, the Contractor will be required to provide lane closures and barricade systems, for preparation work such as pavement marking removal, temporary lane marking, placing temporary concrete barrier, relocating existing guardrail, etc. These lane closures and barricade systems, including barricades, drums, cones, lights, signs, flaggers etc. shall be provided in accordance with details in the Plans and these Special Provisions and as approved by the Engineer.

The Contractor shall submit to the Department two (2) weeks ahead of time, in writing, the starting date for each of the extended ramp and/or lane closures. Approval from the Department is required prior to closing the ramp and/or lanes. Should the Contractor fail to complete the work and reopen the ramp to traffic within the allowable time limit, the Contractor shall be liable to the Department for liquidated damages as noted below.

Prior to and after stage construction, temporary lane closures on I-80 and associated ramps will only be permitted at night during the allowable hours as listed in the Special Provision Keeping the Expressway Open to Traffic. These hours also apply to temporary closures of the ramps, which are shown as open on the Maintenance of Traffic plan sheets.

For all lane and ramp closures, the Contractor shall furnish and install signage per District Detail TC-08, as directed by the Engineer.

The Contractor shall request and gain approval from the Illinois Department of Transportation's Expressway Traffic Operations Engineer at www.idotlcs.com seven (7) days in advance of all permanent and weekend closures on all Freeways and/or Expressways in District One. This advance notification is calculated based on workweek of Monday through Friday and shall not include weekends or Holidays.

WORK RESTRICTIONS

Commencement Date 1: The Contractor shall not start field work on the Communications Hut prior to **May 1, 2026**, unless otherwise directed by the Engineer.

Commencement Date 2: The Contractor shall not start field work within the Contracts 62R29 limits prior to **July 1, 2026**, to coincide with Contracts 62R29 Contract Completion Date unless otherwise directed by the Engineer.

Commencement Date 3: The Contractor shall not start field work within the Contracts 62R28, 62R27, & 62R89 limits prior to **October 30, 2026**, to coincide with Contracts 62R28, 62R27, & 62R29 Contract Completion Dates unless otherwise directed by the Engineer.

The Special Provision for COOPERATION BETWEEN CONTRACTORS shall apply to this special provision.

The cost of this work will not be paid for separately but shall be considered included in the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (SPECIAL).

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 (D-1)

Effective: June 1, 2016

Revised: April 1, 2025

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

No conflicts to be resolved.

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.

STAGE / LOCATION	TYPE	DESCRIPTION	OWNER
Crossing I-80 near 239+30	Gas	36" Metallic Pipeline	ONEOK*
Crossing I-80 near 284+05	Petroleum	24" Petroleum Pipeline	Enbridge
Crossing I-80 near 284+50	Petroleum	14" Petroleum Pipeline	BP
Crossing I-80 near 299+40	Gas	36" Steel in 42" Steel Casing Gas Main	Kinder Morgan
Crossing I-80 near 301+15	Gas	30" Steel in 34" Steel Casing Gas Main	Kinder Morgan
Crossing I-80 near 308+35	Gas	30" Steel in 42" Steel Casing Gas Main	TC Energy
Crossing I-80 near 308+45	Gas	22" Steel Gas Main	TC Energy
Crossing I-80 near 338+50	Fiber Optic	3-1.5" HDPE Conduit	Century Link (Lumen)
IDOT Communications Shelter Site 47+00 to 48+00 Frontage Rd	Fiber Optic	2x1" Conduit Fiber Optic	Metro
Crossing I-80 near 338+25	Telephone	2-4" Pipes	AT&T
Crossing I-80 near 338+15	Electric	2-6" HDPE Conduit	ComEd
IDOT Communications Shelter Site 47+00 to 48+00 Frontage Rd	Electric	7-6" HDPE Conduit	ComEd
Crossing I-80 near 526+00	Gas	30" Steel in 34" Casing Gas Main	Kinder Morgan
Crossing I-80 near 527+00	Gas	24" Conduit in 42" Casing Gas Main	Kinder Morgan
Crossing I-80 near 528+00	Gas	24 Conduit in 28" Casing Gas Main	Kinder Morgan
Crossing I-80 near 573+45	Gas	24" Conduit in 30" Casing Gas Main	Kinder Morgan

Crossing I-80 near 573+65	Gas	30" Steel in 36" Casing Gas Main	Kinder Morgan
Crossing I-80 near 574+10	Gas	42" Steel Gas Main	Kinder Morgan
Crossing I-80 near 598+80	Gas	8" Steel in 12" Casing Gas Main	Nicor
Crossing I-80 near 615+00	Gas	12" Gas Main	Nicor
Crossing I-80 near 615+90	Water	18" Water Main	Unknown
Crossing I-80 near 723+75	Sanitary	48" RCP Sanitary Sewer	City of Joliet
Crossing I-80 near 727+10	Telephone	Duct Telephone	AT&T
Crossing I-80 near 727+10	Gas	QLD Gas Main	Nicor
Crossing Richards Ramp A near 111+00	Gas	4" Gas Main	Nicor
Crossing I-80 near 727+28	Water	12" Metallic Water Main	City of Joliet
Crossing I-80 near 750+50	Electric	6" Conduit Electric	ComEd
Crossing I-80 near 919+10	Gas	12" Steel Gas Main	Nicor
Crossing I-80 near 919+15	Water	36" Casing Water Main	New Lenox
Crossing I-80 near Sta. 934+20	Petroleum	Petroleum Pipeline	Wolverine
Crossing I-80 near Sta. 935+60	Petroleum	18" Petroleum Pipeline	Mustang

* The Contractor shall comply with the Special Provision for Protection of the Pipeline and Easements of ONEOK and shall complete and submit ONEOK's Vehicle Crossing Data Sheet.

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	Steven Pesola	630-573-5703	Sp9653@att.com
G4S / ISTHA	Bill Mitchell	708-528-0128	bill.mitchell@adestagroup.com
Kinder Morgan	Mark Cavazos, PE	713-420-4363	Mark_Cavazos@kindermorgan.com
ComEd	Joseph Milani	708-208-9758	Joseph.Milani@ComEd.com
Century Link (Lumen)	Ben Pacocha	847-954-8250	ben.pacocha@lumen.com
METRO Fiber	Taylor Rich	217-728-9056	trich@metrocomm.com
TC Energy	Karen Macejewski	832-320-5414	karen_macejewski@tcenergy.com
Enbridge	Shane Young	346-732-7291	Shane.young@enbridge.com
BP	Blake Patrick	872-245-3915	Blake.Patrick@bp.com
ONEOK	Kalli Ritterbush	405-433-1044	Kalli.Ritterbush@oneok.com
Nicor	Joe Gaca	708-243-5317	JGaca@southernco.com
MCI/Verizon	Joe Chaney	312-617-2131	joe.chaney@verizon.com
City of Joliet	Allison Swisher	815-724-4230	aswisher@joliet.gov
New Lenox	Brian Williams	815-215-4800	bwilliams@newlenox.net
Wolverine	Gary Goblen	773-879-7210	Gary_Goblen@wplco.com
ExxonMobil (Mustang)	Craig Dixon	815-919-5174	Craig.dixon@exxonmobil.com
Comcast	Bob Schulter or Robert Stoll	224-229-5861 or 224-229-5849	Bob_Schulter@comcast.com
Village of Rockdale	Dan Malinowski	779-242-1094 or 779-242-1097	dmalinowski@willetthofmann.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 Department's contractor, and the utility companies when necessary.

The contractor is responsible for contacting JULIE (or DIGGER within the City of Chicago) prior to any excavation work. Please note that IDOT electrical facilities are not part of the one-call locating services, such as JULIE or DIGGER.

If the contract requires the services of an electrical contractor, it is the contractor's responsibility, at their own expense, to locate existing IDOT electrical facilities before commencing work. For contracts that do not require an electrical contractor, the contractor may request one free locate of IDOT electrical facilities by contacting the Department's Electrical Maintenance Contractor. Additional locate requests will be at the contractor's expense.

The Department's Electrical Maintenance Contractor must be notified at least 72 hours in advance of the work by calling 773-287-7600 or emailing dispatch@meade100.com to arrange for the locating of underground electrical facilities.

Please note, the marking of underground facilities does not absolve the contractor of their responsibility to repair or replace any facilities damaged during construction at their expense.

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 FOR COMMUNICATIONS SHELTER PROCUREMENT

The Contractor shall complete and receive approval of all required material submittals and all shop drawings and provide evidence to the Engineer of a released purchase order for fabrication of the Prefabricated Equipment Shelter by 11:59 p.m. on **July 13, 2026**.

FAILURE TO COMPLETE COMMUNICATIONS SHELTER PROCUREMENT

Should the Contractor fail to complete the work on or before the completion date as specified in the Special Provision for “Completion Date for Communications Shelter Procurement”, 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 **\$6,775**, 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 ITS if the project is delayed in completion. The Department shall not be required to provide any actual loss in order to recover these liquidated damages provided herein, as said damages are very difficult to ascertain. Furthermore, no provision of this clause shall be construed as a penalty, as such is not the intention of the parties.

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

COMPLETION DATE FOR ITS WORK

The Contractor shall complete all ITS work including installation of ITS infrastructure, wiring, cabling, fiber optic cables, termination/splicing, devices, cabinets and equipment installation, testing, and construction of the Communications Shelter by 11:59 p.m. on **October 29, 2027**. Commissioning, device burn-in, and other system integration work, including acceptance, may occur after this date until the Contract Completion Date.

FAILURE TO COMPLETE ITS WORK

Should the Contractor fail to complete the work on or before the completion date as specified in the Special Provision for "Completion Date for ITS Work", 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 **\$6,775**, 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 ITS if the project is delayed in completion. The Department shall not be required to provide any actual loss in order to recover these liquidated damages provided herein, as said damages are very difficult to ascertain. Furthermore, no provision of this clause shall be construed as a penalty, as such is not the intention of the parties.

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

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, **March 31, 2028** 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.

COOPERATION WITH UTILITIES

The Contractor is responsible for verifying the nature and status of all utility relocation work before preparing the Baseline Schedule. The Contractor shall take appropriate measures to ensure that construction operations do not interfere with utility facilities and relocation work. The Baseline Schedule shall reflect construction sequencing, which coordinates with all utility relocation work. The Contractor shall be required to adjust the order of its work from time to time, to coordinate with utility relocation work, and shall prepare revised Baseline Schedule(s) as directed by the Engineer.

PROGRESS SCHEDULE

Description. Time is of the essence in this Contract. It may be necessary for the Contractor to work longer hours, use additional crews, and work during weekends to complete the work within the required time limit. The Contractor shall submit a Critical Path Method (CPM) Progress Schedule as described below for the Engineer's approval before the work can be started.

The Contractor will not be allowed any compensation for working longer hours or using extra shifts; and working on weekends or during Holidays; working during winter months, etc. to meet the specified Completion Date.

This work shall consist of preparing, revising, and updating a detailed progress schedule based upon the Critical Path Method (CPM). This work shall also consist of performing time impact analysis of the progress schedule based upon the various revisions and updates as they occur.

Requirements. The software shall produce an electronic progress schedule for submission to the department that is 100% compatible with Primavera SureTrak 3.0 Project Manager, published by Primavera Systems, Inc. and Primavera P6.

Format. The electronic schedule format shall contain the following:

- a. Project Name: (Optional).
- b. Template: Construction.

Type: Provide Primavera P6.xer native file format and a pdf file during each submittal.
- c. Planning Unit: Days (calendar working).
- d. Number/Version: Original or updated number.
- e. Start Date: Not later than ten days after execution of the contract.

- f. Must Finish Date: Completion date for completion date contracts.
- g. Project Title: Contract number.
- h. Company Name: Contractor's name.

Calendars.

- a. Completion Date Contracts. The base calendar shall show the proposed working days of the week and the proposed number of work hours per day.

Schedule Development. The detailed schedule shall incorporate the entire contract time. The minimum number of activities shown on the schedule shall represent the work incorporating the pay items whose aggregate contract value constitutes 80 percent of the total contract value. These pay items shall be determined by starting with the pay item with the largest individual contract value and adding subsequent pay item contract values in descending order until 80 percent of the contract value has been attained. Any additional activities required to maintain the continuity of the schedule logic shall also be shown.

No schedule or updates containing negative total float will be accepted.

The following shall be depicted in the schedule for each activity:

- a. Activity Identification (ID) Numbers. The Contract shall utilize numerical designations to identify each activity. Numbering of activities shall be in increments of not less than ten digits.
- b. A description of the work represented by the activity (maximum forty-five characters). The use of descriptions referring to a percentage of a multi-element item (i.e., construct deck 50%) shall not be used. Separate activities shall be included to represent different elements of multi-element items (i.e., forms, reinforcing, concrete, etc.). Multiple activities with the same work description shall include a location as part of the description.
- c. Proposed activity duration shall be shown in whole days. The Contractor shall provide production rates to justify the activity duration. Schedule duration shall be contiguous and not interruptible.
- d. Duration of all major activities included in the Contractor's Work.
- e. Identification of all precedent relationships between the Contractor's activities, as well as those of subcontractors, utilities, and the Department, based on a thorough review of the Contract Documents, showing the interface between separate contractor's work.

- f. Estimated crew sizes, equipment, production rates, and similar data used to arrive at adequate durations and sequences.
- g. Activity descriptions and durations for preparation and processing of shop drawings; preparation and review of required coordination drawings; conducting any required testing or inspections; obtaining product data and samples; and fabrication, delivery and installation/erection of products, materials and equipment.

The schedule shall indicate the sequence and interdependence of activities required for the prosecution of the work. The schedule logic shall not be violated.

Activities should be broken down such that each activity encompasses a single operation or tightly integrated operations in a single, contiguous, and continuous area of the project, with no activity exceeding \$200,000 without the consent of the Engineer.

Total Float shall be calculated as finish float. The schedule shall be calculated using retained logic. The Contractor shall not sequester float by calendar manipulations or extended duration. Float is not for the exclusive use or benefit of either the Department or the Contractor.

A Schedule Narrative that describes the critical path(s) of the project, outlines the Contractor's approach to complete the work, defines the project calendars and identifies critical resources. Updated Schedule Narratives will also be required for each monthly update and Revised Baseline Schedules.

Activity description shall be descriptive to identify its intent, including location of work. Activity Durations for construction activities in excess of 30 calendar days will not be allowed.

The contractor shall provide additional schedule tasks as requested to assist the Engineer with communicating how its work will impact local communities and traffic.

The Contractor is responsible for verifying the nature and status of all utility relocation work before preparing the Baseline Schedule. The Contractor shall take appropriate measures to ensure that construction operations do not interfere with utility facilities and relocation work. The Baseline Schedule shall reflect construction sequencing, which coordinates with all utility relocation work. The Contractor shall be required to adjust the order of its work from time to time, to coordinate same with utility relocation work, and shall prepare revised Baseline Schedule(s) in compliance and in addition to that directed by the Engineer.

Tabular Reports.

- a. The following tabular reports will be required with each schedule submission:
 1. Classic Gantt
 2. Pert with Time Scale
- b. The heading of each tabular report shall include, but not be limited to, the project name, contract number, Contractor name, report date, data date, report title and page number.
- c. Each of the tabular reports shall also contain the following minimum information for each activity.
 1. Activity ID
 2. Activity Description
 3. Original Duration (calendar day/working day)
 4. Remaining Duration (calendar day/working day)
 5. Activity Description
 6. Early Start Date
 7. Late Start Date
 8. Early Finish Date
 9. Late Finish Date
 10. Percent Complete
 11. Total Float
 12. Calendar ID
 13. Work performed by DBE Subcontractors and Trainees shall be shown in the Gantt Report.

- d. Reports shall be printed in color on 11 in. x 17 in. (minimum) size sheets. The Classic Gantt shall show all columns, bars, column headings at the top, time scale at the top and shall show relationships.

Submission Requirements. The initial schedule shall be submitted prior to starting work but no later than five calendar days after execution of the contract. Updated schedules shall be submitted according to Article 108.02 except that monthly updates will be required according to the following Monthly Schedule Update section.

Updating.

- a. The Contractor shall not make any changes to the original duration, activity relationships, constraints, costs, add or delete activities, or alter the schedule's logic when updating the schedule.
- b. The originally approved baseline CPM schedule shall only be changed based on a Change Order that extends the Contract duration. All updates will be plotted against the "Baseline Schedule or approved Revised Schedule." If the Contractor believes any such changes result in an overall increase in the contract time, the Contractor will immediately submit a request for extension of time along with the changed progress schedule and a detailed justification for the time extension request in accordance with Article 108.08.
- c. The updated information will include the original schedule detail and the following additional information:
 - 1. Actual start dates
 - 2. Actual finish dates
 - 3. Activity percent completion
 - 4. Remaining duration of activities in progress
 - 5. Identified or highlighted critical activities
- d. The Contractor shall submit scheduling documents in the same formats and number as indicated in this section.
- e. The Engineer shall withhold progress payments if the Contractor does not submit scheduled updates as required.

- f. Upon receipt of the CPM schedule update, the Engineer will review the schedule for conformance with the Contract Documents and degree of detail. The Engineer, within fourteen (14) Days after receipt of the Updated CPM Schedule and supporting documents, will approve or reject it with written comments. If the Updated CPM schedule is rejected, the Contractor must submit a Revised Updated CPM Schedule within seven (7) Days after the date of rejection.
- g. The updated progress schedule must accurately represent the Project's status.

Contractor Changes to the Schedule. The Contractor shall comply with the following requirements regarding proposed changes to the approved baseline CPM schedule:

- a. If the Contractor proposes to make any changes in the approved baseline CPM schedule, the Contractor shall notify the Engineer in writing, stating the reasons for the change, identifying each changed activity (including duration and interrelationships between activities), and providing a diskette of the proposed changed schedule. Every effort must be made by the Contractor to retain the original Activity ID numbers.
- b. The Engineer has the authority to approve or disapprove the proposed change in the baseline CPM schedule and shall do so in writing within ten (10) Days after receipt to the Contractor's submission.
- c. If the Engineer approves the change in the baseline. All monthly updates will be plotted against the new "Revised Schedule."
- d. If the Engineer approves a portion of the change to the baseline CPM schedule, the Contractor shall submit a revised CPM schedule incorporating such change(s) within ten (10) Days after approval along with a written description of the change(s) to the schedule.

Recovery Schedule.

- a. The Contractor shall maintain an adequate work force and the necessary materials, supplies and equipment to meet the current approved baseline CPM schedule. If the Contractor, in the judgment of the Engineer, is failing to meet the approved CPM schedule including any Contract milestones, the Contractor shall submit a recovery schedule.
- b. The recovery schedule shall set forth a plan to eliminate the schedule slippage (negative float). The plan must be specific to show the methods to achieve the recovery of time, i.e., increasing manpower, working overtime, weekend work, employing multiple shifts. All costs associated with implementing the recovery schedule shall be borne by the Contractor.

- c. Upon receipt of the CPM recovery schedule, the Engineer will review the schedule for conformance with the Contract Documents and degree of detail. The Engineer will approve the schedule or reject it with written comments within fourteen (14) Days of receipt of the recovery schedule and supporting documents. If the detailed CPM recovery schedule is rejected, the Contractor must submit a revised CPM recovery schedule within seven (7) Days of the date of rejection.

Revised Schedule. The Engineer may direct the Contractor to revise the approved CPM schedule. Reasons for such direction may include, but are limited to, the following: (1) changes in the Work, (2) rephrasing of the Project or any phase, (3) a change in the duration of the Project or phase, and (4) acceleration of the Project or phase.

- a. The Engineer will direct the Contractor to provide a revised CPM schedule in writing.
- b. The Contractor will provide the revised CPM schedule within ten (10) Days of receipt of the Engineer's written direction.
- c. The Engineer has the authority, in its sole discretion, to approve or reject the revised CPM schedule and will do so in writing within ten (10) Days after receipt of the Contractor's submission. If the Engineer approves the revised schedule, such schedule will be designated the new "Target Schedule."

The schedule shall be submitted in the Sorted by Activity Layout (SORT4). The activities on the schedule shall be plotted using early start, late start, early finish, late finish, and total finish.

For every schedule submission, the Contractor shall submit to the Engineer, four USB thumb drives of all schedule data. Included on the thumb drives shall be all the tabular and graphic reports, network diagrams and bar chart data. In addition, four plots of the USB thumb drives will be approved initial or revised progress schedule for the contract. The approval will be documented by the Engineer on a corresponding plot of the schedule and returned to the Contractor.

Four copies of each schedule submission shall be printed in color on 11 in. x 17 in. (minimum) size sheets showing all columns, bars, column headings at the top, time scale at the top and showing relationships.

The schedule shall indicate the critical path to contract completion. Only one controlling item shall be designated at any point in time on the schedule.

Acceptance or approval of any progress schedule by the Engineer shall not be construed to imply approval of any method of construction, sequence of construction, any implied or stated rate of production. Acceptance will not function as a waiver of the obligation of the Contractor to complete the work in accordance with the contract proposal, Plans and Specifications, modify any rights or obligations of the Department as set forth in the contract, nor imply any obligation of a third party. Acceptance shall not be construed to modify or amend the contract or the time limit(s) therein. Acceptance shall not relieve the Contractor of the responsibility for the accuracy of any of the information included on the schedule. Failure of the Contractor to include in the schedule any element of work required for the performance of the contract, any sequence of work required by the contract, or any known or anticipated condition affecting the work shall not excuse the Contractor from completing all work required within the time limit(s) specified in the contract notwithstanding acceptance of the schedule by the Engineer.

Monthly Schedule Update (MSU). After acceptance of the Contractor's Baseline Schedule, the contractor shall monitor progress of the work and update the schedule 30 Calendar Days from the date of acceptance and every 30 Calendar Days thereafter no later than the 10th calendar day of each month thereafter to reflect actual progress. Completed work must not be removed from the MSU. The MSU will be used as the basis for reviewing the Contractor's monthly progress. The purpose of the MSU is to report progress in accordance with the latest accepted schedule and is not to be used to revise the schedule logic, resources, durations or constraints. If the Engineer is going to reject a MSU, the Engineer will call a meeting with the Contractor and CM in order to discuss the deficiencies in an attempt to more quickly reach resolution and obtain an acceptable MSU.

Basis of Payment. This work will not be paid for separately but shall be considered as included in the costs of the various items of work in the contract.

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (PROJECT SPECIFIC)

Description. This work shall consist of the removal and disposal of regulated substances according to Section 669 of the Standard Specifications as revised below.

Contract Specific Sites. The excavated soil and groundwater within the areas listed below shall be managed as either "uncontaminated soil", hazardous waste, special waste or non-special waste. For stationing, the lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit, whichever is less.

Soil Disposal Analysis. When the waste material requires sampling for landfill disposal acceptance, the Contractor shall secure a written list of the specific analytical parameters and analytical methods required by the landfill. The Contractor shall collect and analyze the required number of samples for the parameters required by the landfill using the appropriate analytical procedures. A copy of the required parameters and analytical methods (from landfill email or on landfill letterhead) shall be provided as Attachment 4A of the BDE 2733 (Regulated Substances Final Construction Report). The price shall include all sampling materials and effort necessary for collection and management of the samples, including transportation of samples from the job site to the laboratory. The Contractor shall be responsible for determining the specific disposal facilities to be utilized; and collect and analyze any samples required for disposal facility acceptance using a NELAP certified analytical laboratory registered with the State of Illinois.

Site 2233V3-1: ROW, I-80 from Ridge Road to US 30, Various Cities and Townships, Will County

Westbound

- Station 718+90 to Station 720+65 (CL I-80), 60 feet to 100 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameters: Manganese.
- Station 723+00 to Station 727+60 (CL I-80), 65 feet to 170 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Lead and Manganese.
- Station 727+60 to Station 729+90 (CL I-80), 60 feet to 90 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameters: Lead and Manganese.
- Station 731+50 to Station 735+80 (CL I-80), 60 feet to 90 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Lead and Manganese.
- Station 735+80 to Station 740+40 (CL I-80), 60 feet to 110 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(b)(1).
- Station 740+40 to Station 745+00 (CL I-80), 60 feet to 110 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Benzo(a)pyrene and Pentachlorophenol.
- Station 745+00 to Station 750+10 (CL I-80), 60 feet to 90 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Arsenic and Manganese.
- Station 750+10 to Station 755+35 (CL I-80), 60 feet to 110 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(b)(1).
- Station 755+35 to Station 758+50 (CL I-80), 65 feet to 95 feet LT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Lead and Manganese.

At the ROW property, Arsenic was detected at concentrations exceeding the TACO Tier 1 Soil Remediation Objective for the Construction Worker Ingestion exposure route in soil boring I80-8, from the sample interval 0 to 4 feet deep, as noted in the Final Preliminary Site Investigation Report for this project, submitted September 24, 2024 by Weston Solutions, Inc. Procedures shall be implemented to protect site workers and observers from hazards encountered during construction activities in locations containing contaminated materials, pursuant to Article 669 of the Standard Specifications for Road and Bridge Construction manual.

Eastbound

- Station 354+60 to Station 355+30 (CL I-80), 125 feet to 190 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Manganese.
- Station 718+75 to Station 720+05 (CL I-80), 80 feet to 120 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: VOCs, SVOCs and Metals.
- Station 722+30 to Station 725+00 (CL I-80), 100 feet to 190 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Lead and Manganese.
- Station 725+00 to Station 725+80 (CL I-80), 125 feet to 205 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Lead and Manganese.
- Station 725+40 to Station 727+40 (CL I-80), 75 feet to 125 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(3). Contaminants of concern sampling parameters: Benzo(a)pyrene and Manganese.
- Station 727+40 to Station 729+60 (CL I-80), 70 feet to 105 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Lead and Manganese.
- Station 730+80 to Station 733+40 (CL I-80), 250 feet to 410 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(3). Contaminants of concern sampling parameters: Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene and Manganese.
- Station 733+40 to Station 739+80 (CL I-80), 80 feet to 310 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(3). Contaminants of concern sampling parameters: Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Lead and Manganese.
- Station 739+80 to Station 744+45 (CL I-80), 85 feet to 115 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameters: Benzo(a)pyrene and Lead.
- Station 744+45 to Station 749+20 (CL I-80), 70 feet to 110 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(3). Contaminants of concern sampling parameters: Benzo(a)pyrene, Lead and Manganese.

- Station 749+20 to Station 753+90 (CL I-80), 75 feet to 100 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Benzo(a)pyrene and Manganese.
- Station 753+90 to Station 758+60 (CL I-80), 70 feet to 90 feet RT. The Engineer has determined this material meets the criteria of and shall be managed in accordance with Article 669.05(a)(3). Contaminants of concern sampling parameters: Benzo(a)pyrene and Manganese.

Work Zones

Three distinct OSHA HAZWOPER work zones (exclusion, decontamination, and support) shall apply to projects adjacent to or within sites with documented leaking underground storage tank (LUST) incidents, or sites under management in accordance with the requirements of the Site Remediation Program (SRP), Resource Conservation and Recovery Act (RCRA), or Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or as deemed necessary. For this project, the work zones apply for the following ISGS PESA Sites: **None**

Engineered Barrier. An engineered barrier shall be installed in storm sewer, sanitary sewer, water main and/or other types of utility trenches, to limit the exposure and control the migration of contamination from the contaminated soil that remains within the trench excavation. It shall be placed beneath the trench backfill material at the following locations:

- Station 745+00 to Station 750+10 (CL I-80), 60 to 90 feet LT (ROW, PESA Site 2233V3-1) – non-special waste. Contaminants of concern sampling parameters: Arsenic.

The engineered barrier shall consist of a geosynthetic clay liner system, geomembrane liner, or equivalent material as approved by the Engineer. A geosynthetic clay liner shall be composed of a bentonite clay liner approximately 0.25 inches thick. The engineered barrier shall have a permeability of less than 10^{-7} cm/sec. Installation of the geosynthetic clay liner system shall be in accordance with the manufacturer's recommendations except that all laps shall face down-slope.

The geomembrane liner shall have a minimum thickness of 30 mils. The geomembrane liner shall line the entire trench and installed in accordance with the manufacturer's recommendations.

No equipment will be allowed on the engineered barrier until it is covered by a minimum of 1 foot of backfill. Any damage to the engineered barrier caused by the Contractor shall be repaired at no additional expense to the Department in accordance with the manufacturer's recommendations and as directed by the Engineer.

Method of Measurement: The engineered barrier will be measured for payment in place and the area computed in square yards.

Basis of Payment: The engineered barrier will be paid for at the contract unit price per square yard for ENGINEERED BARRIER.

TRAFFIC CONTROL PLAN

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:

701001, 701006, 701101, 701106, 701400, 701401, 701428, 701446, 701901

DETAILS:

TC-08 ENTRANCE AND EXIT RAMP CLOSURE DETAILS

TC-09 TRAFFIC CONTROL DETAILS FOR FREEWAY SINGLE & MULTIPLE-LANE
WEAVE

TC-17 TRAFFIC CONTROL FOR FREEWAY SHOULDER CLOSURES AND PARTIAL
RAMP CLOSURES

SPECIAL PROVISIONS:

CLEANING OF TRAFFIC CONTROL DEVICES

COOPERATION BETWEEN CONTRACTORS

FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC (D1)

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC (LANE CLOSURES ONLY)
KEEPING THE EXPRESSWAY OPEN TO TRAFFIC

MAINTENANCE OF ROADWAYS (D1)

PUBLIC CONVENIENCE AND SAFETY (D1)

SPEED DISPLAY TRAILER (D1)

TRAFFIC CONTROL PLAN

TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D1)

TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)

TRAFFIC CONTROL FOR WORK ZONE AREAS

VEHICLE AND EQUIPMENT WARNING LIGHTS (BDE)

WORK RESTRICTIONS

WORK ZONE TRAFFIC CONTROL DEVICES (BDE)

KEEPING THE EXPRESSWAY OPEN TO TRAFFIC

Effective: March 22, 1996

Revised: October 9, 2020

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

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

LOCATION: I-80: Kendall Co. to Center/Meadow

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

LOCATION: I-80: Center/Meadow to I-355

WEEKNIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
Sunday – Thursday	1 Lane	9:00 PM	to	5:00 AM
Friday	1 Lane	10:00 PM (Fri)	to	8:00 AM (Sat)
Saturday	1 Lane	9:00 PM (Sat)	to	10:00 AM (Sun)

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

Narrow Lanes and permanent shoulder closures will not be allowed between Dec. 1st and April 1st. Permanent shoulder closures per District Detail TC-17 will only be permitted if called for in the plans or as approved by the Expressway Traffic Operations Engineer.

Full Expressway Closures will only be permitted for a maximum of 15 minutes at a time during the low traffic volume hours of 1:00 A.M. to 5:00 A.M. Monday thru Friday and from 1:00 A.M. to 7:00 A.M. on Sunday. During Full Expressway Closures, the Contractor will be required to close off all lanes except one, using Freeway Standard Closures. Police forces should be notified and requested to close off the remaining lane at which time the work item may be removed or set in place. The District One Expressway Traffic Control Supervisor (847-705-4151) **shall be** notified at least 3 working days (weekends and holidays DO NOT count into this 72 hours notification) in advance of the proposed road closure and will coordinate the closure operations with police forces. Liquidated Damages as specified in the Failure to Open Traffic Lanes to Traffic for One lane or ramp blocked shall be assessed to the Contract for every 15 minutes beyond the initial 15 minutes all lanes are blocked.

All stage changes requiring the stopping and/or the pacing of traffic shall take place during the allowable hours for Full Expressway Closures and shall be approved by the Department. The Contractor shall notify the District One Expressway Traffic Control Supervisor at least 3 working days (weekends and holidays DO NOT count into this 72 hours notification) in advance of any proposed stage change.

A Maintenance of Traffic Plan shall be submitted to the District One Expressway Traffic Control Supervisor 14 days in advance of any stages changes or full expressway closures. The Maintenance of Traffic Plan shall include, but not be limited to: lane and ramp closures, existing geometrics, and equipment and material location.

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

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

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

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

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

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

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

Freeway to freeway (system interchange) full ramp closures for two lane ramps will not be permitted. Partial ramp closures of system ramps may be allowed during the 1-lane closure hours above. System ramp full closures for single lane ramps are only permitted for a maximum of four (4) hours

- between the hours of 1:00 a.m. and 5:00 a.m. on Monday thru Friday
- between the hours of 1:00 a.m. and 6:00 a.m. on Saturday, and
- between the hours of 1:00 a.m. and 7:00 a.m. on Sunday.

The Contractor shall furnish and install large (48" X 48") "DETOUR with arrow" signs as directed by the Engineer for all system ramp closures. In addition, one portable changeable message sign will be required to be placed in advance of the ramp closure. The cost of these signs and PCMS board shall be included in the cost of traffic control and protection (6 static signs maximum per closure).

Should the Contractor fail to completely open, and keep open, the ramps to traffic in accordance with the above limitations, the Contractor shall be liable to the Department for liquidated damages as noted under the Special Provision, "Failure to Open Traffic Lanes to Traffic (D-1)".

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

Effective: March 22, 1996

Revised: February 9, 2005

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

One lane or ramp blocked = \$ 4,400

Two lanes blocked = \$ 9,300

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

TRAFFIC CONTROL FOR WORK ZONE AREAS

Effective: September 14, 1995

Revised: January 1, 2007

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

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

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

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC (LANE CLOSURES ONLY)

Effective: January 22, 2003

Revised: August 10, 2017

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 lane closures not shown in the staging plans will not be permitted during **peak traffic volume hours**.

Peak traffic volume hours are defined as weekdays (Monday through Friday) from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 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.

SPEED DISPLAY TRAILER (D1)

Effective: April 1, 2015

Revised: April 1, 2021

Revise the third paragraph of Article 701.11 of the Standard Specifications to read:

"When not being utilized to inform and direct traffic, sign trailers, speed display trailers, arrow boards, and portable changeable message boards shall be treated as nonoperating equipment."

Add the following to Article 701.15 of the Standard Specifications:

"(m) Speed Display Trailer. A speed display trailer is used to enhance safety of the traveling public and workers in work zones by alerting drivers of their speed, thus deterring them from driving above the posted work zone speed limit."

Whenever the speed display trailer is not in use, it shall be considered non-operating equipment and shall be stored according to Article 701.11."

Add the following to Article 701.20 of the Standard Specifications:

"(k) "Speed Display Trailer will NOT be paid for by separate pay item, but its costs shall be included in the contract unit price of the various traffic control pay items.

Add the following to Article 1106.02 of the Standard Specifications:

- “(o) Speed Display Trailer. The speed display trailer shall consist of a LED speed indicator display with self-contained, one-direction radar mounted on an orange see-through trailer. The height of the display and radar shall be such that it will function and be visible when located behind concrete barrier.

The speed measurement shall be by radar and provide a minimum detection distance of 1000 ft (300 m). The radar shall have an accuracy of ± 1 mile per hour.

The speed indicator display shall face approaching traffic and shall have a sign legend of “YOUR SPEED” immediately above or below the speed display. The sign letters shall be between 5 and 8 in. (125mm and 200 mm) in height. The digital speed display shall show two digits (00 to 99) in mph. The color of the changeable message legend shall be a yellow legend on a black background. The minimum height of the numerals shall be 18 in. (450 mm), and the nominal legibility distance shall be at least 750 ft (250 m).

The speed indicator display shall be equipped with a violation alert that flashes the displayed detected speed when the posted limit is exceeded. The speed indicator shall have a maximum speed cutoff. On roadway facilities with a normal posted speed limit greater than or equal to 45 mph, the detected speeds of vehicles traveling more than 25mph over the work zone speed limit shall not be displayed. On facilities with normal posted speed limit of less than 45 mph, the detected speeds of vehicles traveling more than 15 mph over the work zone speed limit shall not be displayed. On any roadway facility if detected speeds are less than 25 mph, speed shall not be displayed. The display shall include automatic dimming for nighttime operation.

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

CLEANING OF TRAFFIC CONTROL DEVICES

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

GENERAL ELECTRICAL REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Within 30 calendar days after contract execution, the Contractor shall submit, for approval, through the 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 Manufacturer's current published information. Out of date submittal material will be grounds for rejection.

The submittal shall be properly identified by Pay Item Number, Contractor, route, section, county, and contract number.

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.

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 lighting and/or traffic control systems which may be affected by the work

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

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

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

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

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

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

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

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

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

Testing.

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
- 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 test 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 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.

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 0.34 dB at 1310 nm and 0.20 dB at 1550 nm per installed kilometer of single mode cable.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at 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
- Other useful information useful to locate and maintain the systems.

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

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

The inventory shall include:

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

The following electronic inventory forms are available from the Engineer:

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

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

When the work is complete, and seven days before the request for a final inspection, the set of contract drawings, 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

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 for each circuit.

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

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

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
FDSTR000	Test Results - Surveillance	Surveillance
FDTTR000	Test Results - Traffic Signal	Traffic Signal
FDITR000	Test Results - ITS	ITS
FDLINV00	Inventory - Lighting	Lighting
FDSINV00	Inventory - Surveillance	Surveillance

FDTINV00	Inventory - Traffic Signal	Traffic Signal
FDIINV00	Inventory - ITS	ITS
FDLGPS00	GPS - Lighting	Lighting
FDSGPS00	GPS - Surveillance	Surveillance
FDTGPS00	GPS - Traffic Signal	Traffic Signal
FDIGPS00	GPS - ITS	ITS

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

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

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

- All light poles and light towers.
- Handholes and vaults.
- Junction Boxes
- Conduit roadway crossings.
- Controllers.
- Control Buildings.
- Structures with electrical connections, i.e. DMS, lighted signs.
- Electric Service locations.
- CCTV Camera installations.
- Roadway Surveillance installations.
- Fiber Optic Splice Locations.
- Fiber Optic Cables. Coordinates shall be recorded along each fiber optic cable route every 200 feet.
- 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.

Datum to be used shall be North American 1983.

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

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

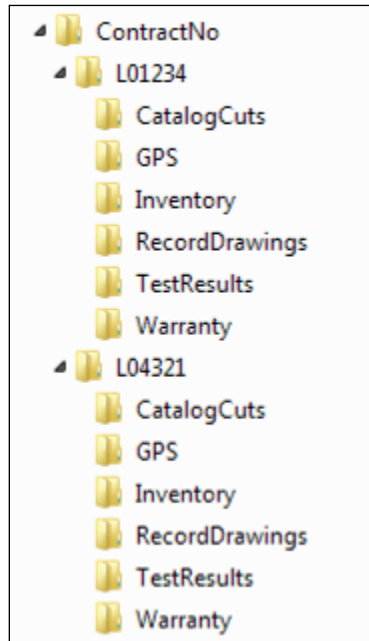
A spreadsheet template will be available from the Engineer for use by the Contractor.

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

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

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

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



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

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

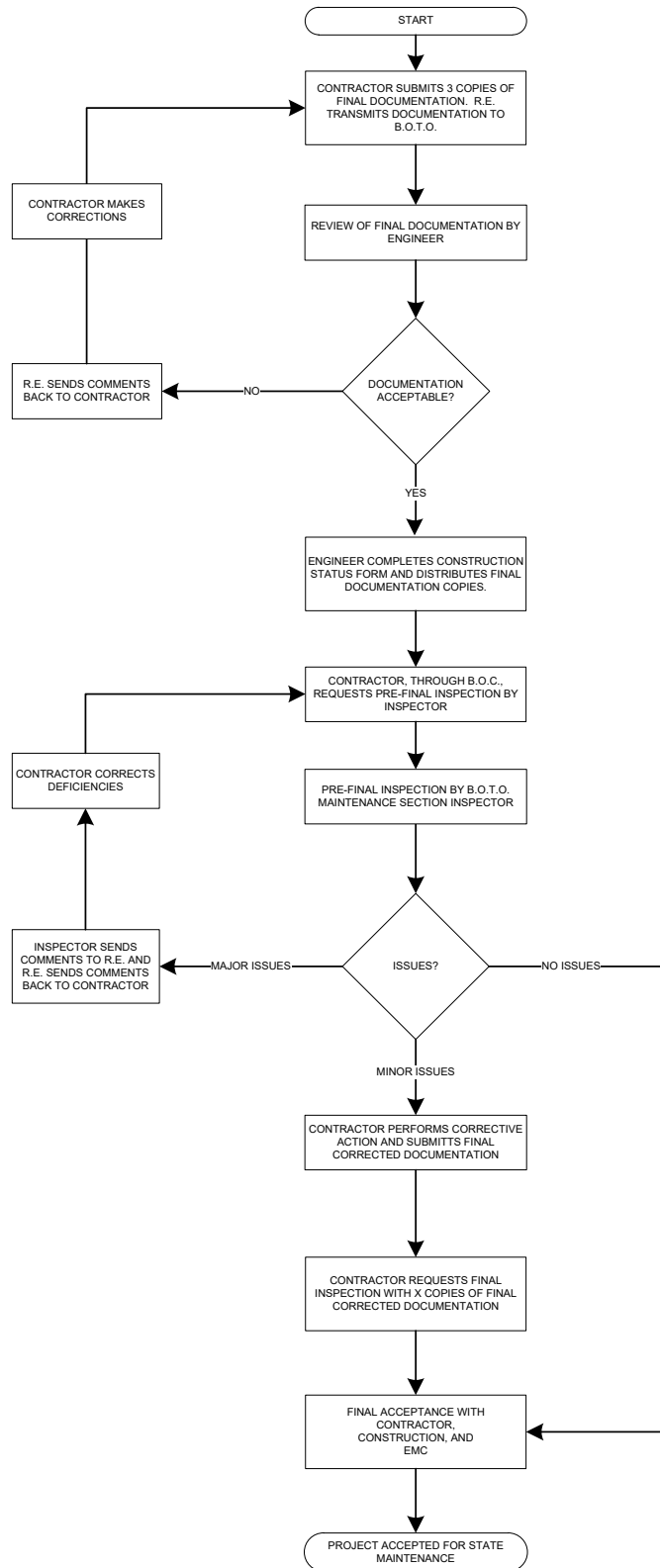
The Final Acceptance Documentation Checklist shall be completed and is contained elsewhere herein.

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)	☐	☐
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.

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.

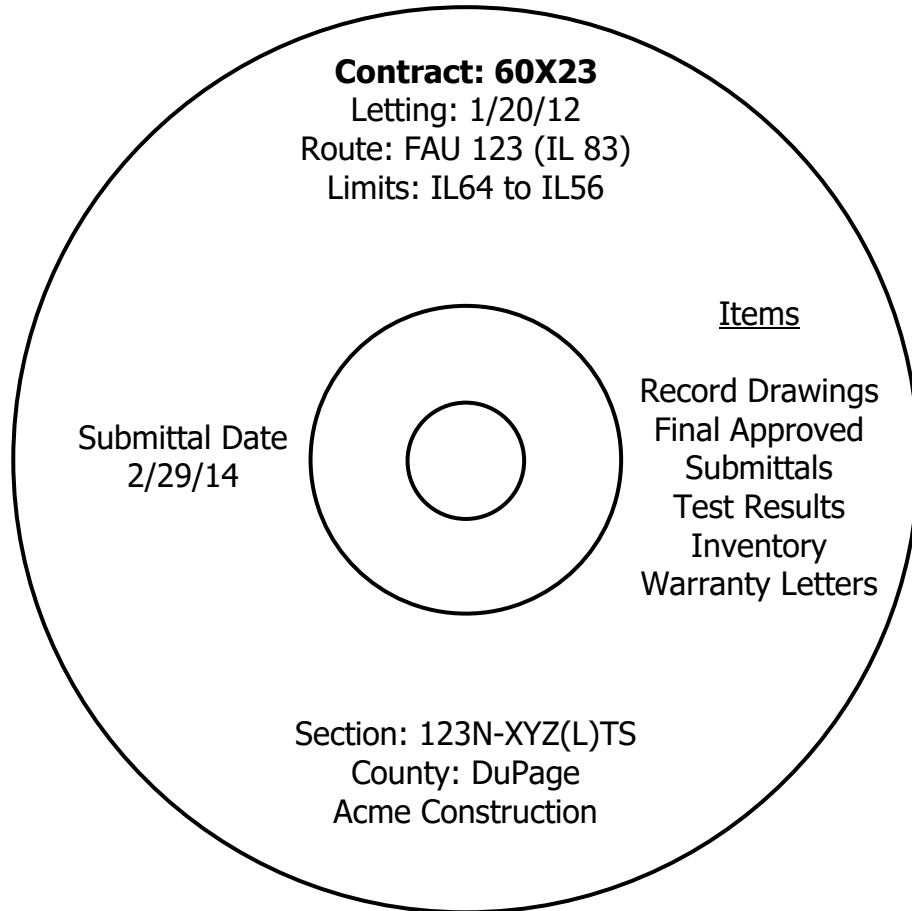
Lighting Inventory Form – Inventory form should include only proposed light poles, proposed light towers, proposed combination (traffic/light pole) lighting and proposed underpass luminaires.

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.



ELECTRIC SERVICE INSTALLATION

Effective: January 1, 2012

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

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

CONSTRUCTION REQUIREMENTS

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

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

Method Of Measurement. Electric Service Installation shall be counted, each.

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

ELECTRIC UTILITY SERVICE CONNECTION

Effective: July 1, 2025

Description. This item shall consist of payment for work performed by the Electric Service Provider (Utility Company) in providing or modifying electric service as indicated. THIS MAY INVOLVE WORK AT MORE THAN ONE ELECTRIC SERVICE LOCATION.

CONSTRUCTION REQUIREMENTS

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

For those locations served by ComEd; please contact ComEd, New Business Center Call Center, at 866 NEW ELECTRIC (1-866-639-3532) to begin the service connection process. The Call Center Representatives will create a work order for the service connection. The representative will ask the requestor for information specific to the request. The representative will assign the request based upon the location of project.

For locations served by other electric service providers, that utility shall be contacted.

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

Documentation. The Contractor shall provide copies of all correspondence with the Electric Service Provider including as a minimum:

- A copy of the request for service to the Electric Service Provider.
- Service Entrance Sketch
- Electric Service Account Number
- Electric Meter Number
- Size of Utility transformer and available fault current.
- GPS coordinates of the service, format as described in the General Electrical Provisions.

All correspondence for State owned and maintained installations must include the pertinent contract number and Electrical Maintenance database number

Certain state-maintained electrical systems may have energy paid by local agencies, but unless otherwise established, energy billing for state-maintained electrical systems shall be directed to:

Illinois Department of Transportation
District 1
201 West Center Court
Schaumburg, Illinois 60196
Attn: Financial Services

Electric service correspondence for Non-State owned systems shall be directed to the respective agency assuming maintenance with a copy of the final service agreement submitted to IDOT.

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

For bidding purposes, this item shall be estimated as \$100,000.

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

UNDERGROUND RACEWAYS

Revise Article 810.04 of the Standard Specifications to read:

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

Add the following to Article 810.04 of the Standard Specifications:

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

Add the following to Article 810.04 of the Standard Specifications:

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

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

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

Add the following to Article 810.04 of the Standard Specifications:

“For UNDERGROUND CONDUIT, COILABLE NONMETALLIC CONDUIT, 2” DIA. as shown on the Intelligent Transportation System (ITS) plans, the Contractor shall proof the conduit in the presence of the Engineer by pulling through a bullnose aluminum mandrel of 1.62 inch diameter and length between 2.4 and 6.0 inches. Any breaks in the duct line shall be excavated and repaired at the Contractor’s expense, and the proofing test repeated.

EXPOSED RACEWAYS

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 Listed (UL 6). The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations shall be UL Listed with PVC as the primary corrosion 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 1 mm (40 mils). The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above -1°C (30°F).
- e. An interior urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. The interior coating shall be applied in a manner so there are no runs, drips, or pinholes at any point. The coating shall not peel, flake, or chip off after a cut is made in the conduit or a scratch is made in the coating.
- f. Conduit bodies shall have a tongue-in-groove gasket for maximum sealing capability. The design shall incorporate a positive placement feature to assure proper installation. Certified test results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be submitted for review when requested by the Engineer.
- g. The PVC conduit shall pass the following tests:

Exterior PVC Bond test RN1:

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

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

Boil Test:

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

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

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

Heat/Humidity Test:

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

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

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

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

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

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

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

CONDUIT, RIGID NONMETALLIC

Description. This work shall consist of furnishing and installing conduit attached to structure or underground, including fittings, brackets, expansion joints, and all other accessories required for installation.

Materials. Materials shall be according to the following.

The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC). The conduit shall be manufactured using the single circuit filament winding process. Multi circuit windings are not allowed. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end only.

The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous E-glass roving. All additives for increasing flame spread and lowering smoke density, shall be halogen free, i.e. not contain chlorine or bromine.

Suitable material shall be used as ultraviolet inhibitor to protect the conduit and fittings during storage and exposure to the outdoors. Conduit and elbows shall be concrete gray 406 in color.

The internal conduit and elbow walls shall be smooth and all fibers embedded in the epoxy. Internal diameter percentages for passage of round ball or mandrel shall meet UL 2515A standards.

All elbows shall meet the nominal radius $\pm 2^\circ$.

All elbows shall have either straight ends or deep socket PVC couplings.

All conduits and elbows shall be durably and legibly marked in accordance to NEMA TC 14 and UL 2515A. In addition, the following information shall be included:

NEMA TC 14

UL 2515A

Manufacturer and Reseller (If the conduit was modified or bent other than by the manufacturer)

Date of Manufacturing of conduit and elbows

Elbows shall be marked with the angle and radius

All conduits, elbows and fittings shall be manufactured in the U.S.A. and marked as such.

(a) Listing. All conduits and fittings shall be listed by Underwriters Laboratories (UL).

(b) Dimensions. Conduit shall be manufactured with the following nominal dimensions:

Nominal Size	Average Outside Diameter (inches)	Minimum Inside Diameter (inches)	Nominal Wall Thickness
2"	2.50"	2.00"	0.25"
4"	4.50"	4.00"	0.25"

No taper shall be allowed for the conduit straight sections except for integral belled ends.

(c) Electrical Characteristics. Dielectric strength shall meet or exceed 500 volts/mil when tested in accordance with ASTM D-149.

(d) Mechanical Characteristics. The conduit shall have the following mechanical strength when tested in accordance with the referenced test method:

Characteristic	Mechanical Requirement	Strength	Test Method
Tensile Strength, Axial	11,000 psi		ASTM D2105
Compressive Strength	12,000 psi		ASTM D695
Coefficient of Thermal Expansion	1.2 – 1.4 x 10 ⁻⁵ in/in/°F		ASTM D696
Barcol Hardness	52 – 56		ASTM D2583
Glass Content	65 – 70%		ASTM 15LR
Water Absorption	1.5% maximum		ASTM D570
2" Conduit Impact Resistance	550 lbs/ft		ASTM D2444
4" Conduit Impact Resistance	1000 lbs/ft		ASTM D2444

(e) Fire Resistance and Flame Spread. Conduit shall meet specification UL 2515A.

- (f) Toxicity. The conduit shall not contain any compounds that can release halogens, e.g. chlorine, bromine, fluorine, and iodine, in more than trace amounts when burning. Following shall be the maximum values when tested in accordance to ASTM E-800

Gas	Value (Max PPM)
Hydrogen Chloride	0
Hydrogen Bromide	0
Hydrogen Cyanide	<1
Hydrogen Sulfide	0
Ammonia	0
Aldehydes as HCHO	<10
Oxides of Nitrogen	<50
Carbon Dioxide	<12,500
Carbon Monoxide	<250

- (g) Fittings and Accessories. Fiberglass conduit fittings, elbows, and accessories shall be manufactured using one of two manufacturing procedures. The first method shall use the same process, methods and components as used to manufacture the fiberglass conduit. The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacturer of the finished component. The SMC material shall be a vinyl ester resin with over 30% reinforcement of glass fiber. The glass fibers should be approximately 1" in length. The SMC material shall be fire resistant to UL 2515A specifications and shall be halogen free. Plastic duct plugs if required shall be manufactured from PVC.
- (h) Joining System. The conduit shall be supplied with an integral wound bell on one end and a machined end spigot on the other end. A two component epoxy adhesive shall be applied to the spigot end before joining the conduit together. The adhesive shall be supplied in 20 fl. oz. plastic cartridges. A plastic static mixer tip shall be attached to the cartridges and be applied with an adhesive gun. The adhesive shall be available for two different ambient temperatures, 70°F, 40°F. The adhesive shall be supplied from the same manufacturer of the conduit and fittings in order to retain the UL listing.
- (i) Mounting Hardware. All fastener and mounting hardware shall galvanized steel and shall be in accordance with Article 1088.03 of the Standard Specifications.
- (j) Environmental. The manufacturer shall have a current certificate, issued by an independent and accredited company, or compliance with an ISO 14001 Environmental Management Systems and Performance.
- (k) Quality Assurance Program. The manufacturer shall have a current certificate, issued by an independent and accredited company, or compliance with an ISO 9001 Quality Management System.

CONSTRUCTION REQUIREMENTS

Installation. Installation for conduit attached to structure shall be in accordance with applicable portions of Article 811.03 of the Standard Specifications and as recommended by the manufacturer. Slip collars shall be installed at each pipe clamp/strap to eliminate binding and allow unrestricted expansion/contraction movement of the fiberglass conduit.

Installation for underground conduit shall be in accordance with applicable portions of Article 810.04 and of the Standard Specifications.

To facilitate the most efficient and safe means of installation of fiber optic cable (by Others), the Contractor shall use 20-foot sections of conduit unless restricted by geometric constraints of the bridge structure. Exceptions for use of 20-foot sections of conduit shall be approved by the Engineer.

Use of flexible conduit will not be permitted.

Method of Measurement. This work will be measured for payment in feet in place. Measurements will be made in straight lines along the centerline of the conduit between ends and changes in direction. Changes in direction shall assume perfect straight line runs, ignoring actual raceway sweeps.

Expansion fittings will not be measured for payment.

Basis of Payment. This work will be paid for at the contract unit price per foot for CONDUIT ATTACHED TO STRUCTURE, RIGID NON-METALLIC of the diameter specified.

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.”

BREAKAWAY DEVICE

Effective: January 1, 2023

Revise the first sentence of Article 1070.04(b)(2) to read:

“The device shall be 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.”

GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8)

Effective: March 12, 2009

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

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

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

The grounded conductor (neutral conductor) shall be white color-coded. This conductor shall be bonded to the equipment-grounding conductor only at the Electric Service installation. All power cables shall include one neutral conductor of the same size as the phase (hot) conductors.

The equipment-grounding conductor shall be green color-coded. The following is in addition to Section 801.04 of the Standard Specifications.

Equipment grounding conductors shall be XLP insulated No. 6, unless otherwise noted on the Plans, and bonded to the grounded conductor (neutral conductor) only at the Electric Service Installation. The equipment-grounding conductor is paid for separately and shall be continuous. The Earth shall not be used as the equipment-grounding conductor.

Equipment grounding connectors shall be bonded, using a listed grounding conductor, to all ramp meters, DMS, and detector cabinets, handholes, and other metallic enclosures throughout the ITS subsystems, except where noted herein. A listed electrical joint compound shall be applied to all conductor terminations, connector threads, and contact points.

All metallic and non-metallic raceways containing ITS circuit runs shall have a continuous equipment grounding conductor, except raceways containing only detector loop lead-in circuits, circuits under 50 volts and/or fiber optic cable will not be required to include an equipment grounding conductor.

The grounding electrode conductor shall be similar to the equipment grounding conductor in color-coding (green) and size. The grounding electrode conductor is used to connect the ground rod to the equipment grounding conductor and is bonded to ground rods via exothermic welding, listed pressure connectors, listed clamps or other approved listed means.

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

CONCRETE FOUNDATION, TYPE A

Add the following to Article 878.03 of the Standard Specifications:

The minimum projection of the foundation above finished grade shall be 1".

All anchor bolts shall be according to Article 1006.09, with all anchor bolts hot dipped galvanized a minimum of 12 in. (300 mm) at the threaded end. Four (4) 3/4" anchor bolts with 3" hook, embedded a minimum of 18 inches in the foundation with an exposed threaded projection height of 4" above the foundation shall be provided to accommodate a pedestal base as shown on the Plans. Contractor shall coordinate the anchor bolts with the proposed pedestal base.

Foundations shall provide two (2) 2-inch raceways stubbed out of the foundation at a depth of 30" below finished grade. Unused raceways shall be stubbed and capped for future use.

The Contractor shall construct a PCC service pad adjacent to the foundation in accordance with the details shown on the Plans. The pad shall be constructed upon a 6" course aggregate base (CA 6).

No foundation is to be poured until the Resident Engineer gives his/her approval as to the depth of the foundation.

CONCRETE FOUNDATION, TYPE E 30-INCH DIAMETER

Add the following to Article 878.03 of the Standard Specifications:

Foundation diameter shall be 30". Foundation depth shall be a minimum of 13'-6" for soils meeting the minimum criteria as shown in IDOT Standard Drawing 878001-11.

The minimum projection of the foundation above finished grade shall be 2". The maximum projection of the foundation above finished grade will be dependent on the cross slope of the finished grade.

All anchor bolts shall be according to Article 1006.09, with all anchor bolts hot dipped galvanized over the full length. Four (4) 1" anchor bolts with 5" hook embedded a minimum of 5 ft. in the foundation, threaded a minimum of 6" with an exposed height of 4" above the foundation shall be provided in a 15" bolt circle configuration to accommodate an ITS pole as shown on the Plans. Contractor shall coordinate the anchor bolts with the proposed ITS pole.

Foundations shall provide two (2) 2-inch raceways stubbed out of the foundation at a depth of 30" below finished grade. Unused raceways shall be stubbed and capped for future use.

The Contractor shall construct a PCC service pad adjacent to the foundation in accordance with the details shown on the Plans. The pad shall be constructed upon a 6" course aggregate base (CA 6).

No foundation is to be poured until the Resident Engineer gives his/her approval as to the depth of the foundation.

CLOSED CIRCUIT TELEVISION DOME CAMERA, HD

Description. This work shall consist of furnishing, installing, and testing a High-Definition (HD) Closed-Circuit Television (CCTV) Dome Camera Assembly at a location as shown on the plans. The work shall include a color camera, dome assembly, all mounting hardware, connectors, cables, power injectors, surge protectors and related equipment necessary to complete the installation according to the manufacturer's specifications. Integration and licensing required for adding the camera to the IDOT District One's Video Distribution and Control System (Cameleon ITS) shall be provided under the BUDGETARY ALLOWANCE FOR CCTV INTEGRATION pay item.

Materials. The PTZ camera shall be one of the following models or approved equal:

- AXIS Q6075-E
- Bosch 7100i

The Contractor shall furnish the required number (minimum 1) of power injectors and Ethernet surge suppressors for the camera make and model selected, including operation of the camera heater, as well as all required mounting hardware, connectors, patch cables, power supplies and power cable (if required). The system shall have anonymous FTP capabilities disabled by the vendor/equipment supplier or provide a feature for the user to disable the functionality through the standard internal menu.

CONSTRUCTION REQUIREMENTS

Installation. The Contractor shall install the CCTV camera in accordance with manufacturer's instructions and as shown in the Plans. The camera firmware shall be the latest stable release available at the time of installation. The camera power injector and surge suppression device shall be securely mounted in the 336S cabinet or Communications Hut cabinet and wired in accordance with the manufacturer's installation instructions.

The camera shall be installed in one of four configurations as shown on the plans:

1. Attached directly to the CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT utilizing a camera mounting arm/bracket compatible with the CCTV camera. The camera mounting bracket/arm shall be installed with stainless steel straps. All holes drilled into the CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT shall require rubber grommets to prevent the chafing of wires.
2. Coordinated/installed with a camera lowering system (refer to LIGHT POLE, STEEL 50 FT. WITH CAMERA LOWERING SYSTEM).
3. Attached to an exterior wall of the ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE utilizing a parapet mount/mounting bracket compatible with the CCTV camera. Installation hardware shall be stainless steel.
4. Attached to an interior wall of the ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE utilizing a wall mounting bracket compatible with the selected CCTV camera.

The Contractor shall contact the Engineer prior to installing the camera and associated wiring, to receive final approval on the camera location. The Contractor shall coordinate with IDOT EMC Engineer for proper set up and IP configuration.

Testing. The Contractor shall test each CCTV camera in the presence of the Engineer after the camera and associated components are installed. This test may be done locally at the ITS cabinet.

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 PDF format.

Warranty. The CLOSED CIRCUIT TELEVISION DOME CAMERA, HD shall be warrantied, free from material and workmanship defects for a period of three years from final acceptance.

Method of Measurement. This work will be measured for payment per each CLOSED CIRCUIT TELEVISION DOME CAMERA, HD furnished, installed and tested.

Basis of Payment. This work will be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION DOME CAMERA, HD. The unit price shall include all associated equipment, hardware, cables, materials and labor required to install the complete system in place and in operation to the satisfaction of the Engineer. OUTDOOR RATED NETWORK cable between CCTV camera and cabinet will be paid for separately. Outdoor rated network cable between the CCTV camera and cabinet at sites with a camera lowering system will be paid for separately under LIGHT POLE, STEEL 50 FT. WITH CAMERA LOWERING SYSTEM.

ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE

Description. Provide fabrication, delivery, installation and testing of an Equipment Shelter to support Intelligent Transportation System (ITS) communication equipment. The shelter shall be used to house electronic communications equipment, power distribution, and related components necessary for the proper operating conditions of the equipment to be installed within a controlled environment.

Applicable Publications. The publications listed below form a part of these Specifications to the extent referenced. The publications are referred to the test by basic designation only. Conform to reference standards by date of issue in effect on the date of contract advertisement.

- ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
- ANSI/NETA ATS-2013 Section 7.15.2 Rotating Machinery, Synchronous Motors and Generators
- ANSI/NETA ATS-2013 Section 7.22.2, Emergency Systems, Uninterruptable Power Systems
- ANSI/NETA ATS-2013 Section 7.22.3, Emergency Systems, Automatic Transfer Switches
- ANSI/NETA ATS-2013 Section 7.25, Fiber-Optic Cables
- National Electrical Code (NEC).
- IEEE C37.90.1-2012 – IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- IEEE C62.41-1991 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Ac Power Circuits
- NFPA 780, Standard to the Installation of Lightning Protection Systems

Materials.

PREFABRICATED EQUIPMENT SHELTER.

The equipment shelter shall be pre-assembled, of reinforced solid concrete construction and of nominal dimensions as shown on the Plans. The shelter shall be a standard item provided by any of several manufacturers. The shelter shall come complete with a secure door; power distribution panels; a heating, ventilation, and air conditioning (HVAC) system; a grounding system; and any other necessary appurtenances to provide for an integrated communication shelter. The shelter shall be installed with a lightning protection system. The shelter shall be built and constructed to wind loads as required by local building codes. The shelter's exterior shall be provided with a concrete aggregate finish. The shelter shall have a bullet-resistant surface as required by UL 752 level 4. The shelter's exterior color shall be earth tone to blend into surroundings. The shelter's heat transfer coefficient shall not exceed 0.07 British Thermal Unit (BTU) per hour per square foot (hr/ft²) per degree Fahrenheit (°F).

- (A) Shelter floor. The equipment shelter's supporting floor shall be concrete or a concrete composite material. The equipment room's finished floor covering shall be industrial-grade vinyl flooring fastened to the sub floor with waterproof glue. The sub floor shall be 6-inch precast reinforced concrete, insulated, and equipped with integral lifting points, and shall contain a recessed step-joint, to prevent water intrusion into the shelter. The floor shall be designed and constructed to support a minimum live load of 150 pounds per square foot (lbs/ft²) while on foundation.
- (B) Shelter foundation. The communication shelter's foundation shall be a monolithic slab that serves as the shelter sub floor. The foundation for the communication shelter shall be evaluated for the specific requirements of the site, in consideration of disturbed soil conditions, communication shelter site pad, and local building restrictions. Shelter anchor locations shall be coordinated with shelter manufacturer. The top of the foundation slab shall be 6" above communication shelter site pad to prevent water from entering inside the shelter. Sufficient cross bracing shall be provided to prevent the equipment shelter's structure from bending or breaking during moving, towing, or hoisting, and to ensure minimum warping after the shelter has been placed on the foundation with the interior equipment installed. Contractor shall submit a foundation design, stamped by an Illinois Structural Engineer, which includes as a minimum the following data: shelter loading and connection details, IBC seismic and wind loading requirements, reinforcing details, entrance stoop connection details, and frost depth used to determine size of footing. Note – shelter anchorage varies between vendors and shelter sizes therefore foundation submittal must include shelter vendor's connection detail for proposed shelter. Foundation slab shall rest on a 6 mil plastic vapor barrier, which is installed over at least 6" of compacted CA-6. Footing shall rest on least 6" of compacted CA-6 that is at least twice as wide as the bottom of the footing. Footing must be installed below frost line. A continuous 0.5 inch pre-molded joint filler shall be installed between the shelter foundation slab and communication shelter site pad. Foundation slab shall extend past shelter face by at least six inches, these edges shall be installed with a 3% to 5% slope away from the shelter, and the three edges that are not against the entrance stoop must be chamfered for 1" at 45-degrees.
- (C) Shelter Door. The door shall be an exterior pre-hung, fully insulated, bullet-resistant, galvanized steel door with continuous hinge, and shall be provided with baked enamel finish, and a door check and doorstop. The exterior door shall be 36 inches in width by 84 inches in length with a mortised deadbolt security common-keyed lock, consistent with other Illinois Department of Transportation (IDOT) sites. The keys to the door's lock shall be provided to the Department. Doors shall have a hydraulic door closer, electric door strike, and a passage style lever handle on both the inside and outside for opening and closing. The door shall be compatible with a building access control system as detailed in the "Building Access Control System" section of this special provision. Door shall have a stainless steel door sill (secured with stainless steel bolts) and weather stripping around top and sides.

- (D) Walls. The walls shall be constructed of 4-inch thick reinforced concrete, with a two-step keyway joint, to prevent water intrusion into the shelter. The walls shall be insulated using a minimum insulating factor of R11. Interior surfaces shall be sheathed with 1.5 inches of high performance hard board insulation. The interior of the walls shall be finished with an aesthetically pleasing 0.75 inch plywood panel with a white laminate coating, and molding on all corners. Total wall system shall have a thermal insulation rating of R19. All floor/wall intersections shall have 4-inch vinyl baseboards installed using waterproof glue.

The ceiling structure shall be designed and constructed to support all of the proposed fixtures, cable trays, etc., or a minimum live load of 30 lbs/ft².

- (E) Roof. The roof sections shall be designed and constructed of a minimum 4 inch thick reinforced concrete, with a minimum 0.25-inch per foot pitch from the center for drainage. All voided areas between the roof and the ceiling shall be sheathed with 1.5 inches of high performance hard board insulation with a thermal performance of R11, covered with a layer of an aesthetically pleasing 0.5 inch white laminate wood panel with a vapor shield. The exterior of the roof shall be covered with an ultraviolet resistant, reflective elastomeric coating to prevent water intrusion. The roof shall be designed and constructed to support a minimum live load of 100 lbs/ft².

- (F) Entrance Stoop. The shelter's entrance shall have a reinforced concrete slab, installed so that the top of the slab aligns with the top of the foundation slab. The distance from the final grade to the shelter floor shall not exceed 6 inches. Dimensions of the entrance stoop are 5' deep and width equal to the shelter foundation slab. The entrance slab shall be installed as a separate slab from the shelter foundation, there shall be a continuous 0.5 inch pre-molded joint filler between the two. Stoop shall be installed with a 3% to 5% slope away from the shelter, and the three edges that are not against the shelter foundation must be chamfered for 1" at 45-degrees. Entrance stoop shall be installed on communication shelter site concrete pad.

- (G) Lighting. The equipment shelter shall utilize LED, 4,000K, surface-mounted fixtures. The luminaire shall provide 70% of initial lumen output after 50,000 hours of service (as per IESNA LM-80) and come with a 5-year warranty. The Contractor shall supply a sufficient quantity of light fixtures to provide an average light level of 30 foot-candles on the floor to avoid shadows throughout the building – minimum quantity of fixtures shall be four. The Contractor shall provide a photometric calculation with the shelter submittal showing the required average light level as well as 3:1 for average-to-minimum and 5:1 for maximum-to-minimum illumination uniformity ratios. Photometric calculation grid must not include equipment rack locations; that is, equipment racks must be included as solid objects of applicable dimensions. An interior light switch shall be mounted adjacent to the entry door. The Contractor shall furnish and install four vandal-resistant, wet-location, cast aluminum, floodlights mounted on each exterior wall of the shelter. LED shall be 4,000K, 1200 lumen minimum, 20 watt maximum on 120V circuit. The luminaire shall provide 70% of initial lumen output after 50,000 hours of service (as per IESNA LM-80) and come with a 5-year warranty. The security lights shall be controlled by integral photocell and motion detectors.

The Contractor shall also furnish and install an interior two-headed emergency light that is wired to the UPS distribution panel. The emergency light fixture shall be mounted above the exit door.

HEAT VENTILATION, AND AIR CONDITIONING SYSTEM.

The Contractor shall provide a single exterior vertical wall-mounted heating, ventilation, and air conditioning (HVAC) system for the communication shelter.

The HVAC unit shall have an adjustable time delay initially set to five minutes to prevent compressor damage or generator stall if utility power service is prematurely restored following a power failure. The unit shall also have a hard start device installed to reduce the starting current required during a cold start or under high-head pressure conditions. The unit shall be capable of safely operating when the outside temperature falls below 60°F, allowing continuous interior equipment cooling and dehumidification in cold weather. The unit shall have sufficient capacity to cool from a 95°F ambient temperature to 75°F, including the equipment heat load. The unit shall have sufficient capacity to heat from a -20°F ambient temperature to 65°F. The Contractor shall provide analysis with the submittal documenting that the HVAC system will perform within these requirements and include the equipment heat loads of ITS/other equipment to be installed in the shelter. A user-adjustable thermostat shall be used to provide separate equipment shelter temperature alarms for internal temperature lower than 60°F, or higher than 80°F. Shelter submittal shall include necessary HVAC vendor documentation to show feed breaker sizing coordination with the distribution panel.

The HVAC system shall provide alarms that indicate HVAC unit failure. The HVAC units shall communicate via MODBUS RTU. The Contractor shall provide all necessary mounting, and cabling to install, configure, and integrate a MODBUS RTU to SNMP Gateway to transmit SNMP HVAC alarm data to the IDOT network management software server, SolarWinds. The Contractor shall provide the MODBUS registry map for the HVAC controller as part of their submittal package and coordinate with the IDOT EMC Engineer to confirm the alarms to be integrated into SolarWinds. Gateway shall be connected to the ITS network switch as identified on the Plans with a Cat6 Ethernet cable.

BUILDING ACCESS CONTROL SYSTEM.

The Communications Shelter shall be equipped with a Building Access Control system that allows for local processing of entry requests made through an entry control unit. The unit shall perform both the RTU and ECU functions of a traditional building access system. It shall store its own access permissions locally and issues control logic for a single door. The unit shall have provisions for the use of a keypad and card entry. The integrated unit shall also have a camera enabled web access. The unit shall have a web interface which allows the end user to manually view the camera at the door and provide remote access to the building. The unit shall support SNMP V3 protocols for integration into the IDOT Network management software server, SolarWinds. The unit shall operate on 12 or 24 volts and be supplied with a relay to operate the electric door strike. Contractor shall supply the power supply or PoE injector to power the unit and electric door strike. The unit shall be supplied with an Ethernet interface. The unit shall be connected to the ITS network switch as identified on the Plans with a Cat6 Ethernet cable.

FIRE AND SMOKE DETECTION AND SUPPRESSION.

The equipment shelter shall include one ionization and one photoelectric smoke detector wired to the UPS distribution panel. The detectors shall be mounted on the ceiling and shall each include an auxiliary relay dry contact closure that will activate during detection conditions and provides an alarm consistent with the "Contact Closure to SNMP Gateway" section of this special provision. Smoke detection alarm contacts shall be wired such that either detector initiates an alarm signal. A hand-held carbon dioxide fire extinguisher suitable for use on electrical fires shall be mounted on the wall near the door. The extinguisher shall have a valid inspection tag and be refillable.

ELECTRICAL DISTRIBUTION.

The standard electrical configuration for the shelter site shall be single-phase 120/240 volts of alternating current (VAC at 60 hertz (Hz)) with a 200-amp service. The electric service and service meter pedestal for the shelter site are to be constructed by others under Contract 62R28. The Contractor shall provide the necessary conduit and conductors into the shelter as shown on the plans.

The Contractor shall coordinate all work with the electric utility company (ComEd) to schedule electric utility outages as needed, provide all additional material and work not included by other contract pay items but required to complete the electric service work in complete compliance with the requirements of the utility.

Provide a service entrance rated 240V, 200-amp fused disconnect switch. The disconnect switch shall be mounted to the interior wall of the shelter as shown on the plans.

Provide one service entrance rated 240V, 200-amp, 42 position distribution panel with an inner swing out door. The main breaker shall be 65 KAIC rated, breakers for any external load shall be rated 22 KAIC, breakers for loads internal to the shelter shall be rated for 10 KAIC; breaker ratings must be clearly visible without opening the inner door. Provide two spare breakers of all types used in the distribution panel, except for the main breaker.

Provide a laminated single line diagram for the shelter, attached to exterior of the main distribution panel.

In the main distribution panel provide a dedicated breaker for the HVAC unit, for any internal controls/sensors, for the internal lighting circuit, for the external security light, and for the internal convenience receptacles. Provide a dedicated breaker for each generator load (fuel tank indication panel, heaters, battery charger, etc.). Provide two breakers for the UPS distribution panel – one breaker shall be a normal feed to the UPS unit while the second shall bypass the UPS.

The UPS distribution panel shall be main-lug-only with a minimum of 18 spaces. Two UPS panel breakers shall be dedicated for each equipment rack, one breaker position shall be connected to the fire/smoke detectors, and one breaker position shall be connected to the exit light. The UPS outputs shall be wired to the UPS distribution panel.

Both distribution panels and the manual transfer switch shall be NEMA 12 (IP52) rated.

AC-POWERED TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICE.

The shelter shall have a primary AC Surge Suppression Device (SSD). The SSD device shall use field-replaceable modular technology and shall include a set of Normally Opened (NO) Normally Closed (NC) Form C contacts for remote alarm monitoring as detailed below in the "Contact Closure to SNMP Gateway" section of this special provision.

The Contractor shall ground the SSD device to the interior perimeter ground; conductor size as specified by equipment manufacturer, or #2 American Wire Gauge (AWG) if not specified by manufacturer. Connection to the perimeter ground to be completed using an exothermic weld. The SSD device shall consist of primary modules using silicon avalanche diode (SAD) technology and a secondary module using the metal oxide varistor (MOV) technology. The shelter shall have a spare MOV and SAD module with for the AC SSD device.

In addition, the Contractor shall submit unpotted samples of each module to the engineer for inspection. The modules shall be bolted in the SSD device. No plug-in modules shall be permitted. The equivalent of a minimum of two SAD modules and one MOV module shall be installed from each phase conductor to the neutral conductor. One or more separate MOV modules capable of handling at least 75 kiloamperes (kA) of surge current shall be installed between the neutral and ground.

A 200-kA ampere interrupting capacity (AIC) fused disconnect shall be installed in the SSD device. The SSD device shall have a surge counter on the front cover that counts the number of surge current transients that are being suppressed over 150 amps. Surges in any mode and phase shall be counted. The SSD device shall have a UL 1283 listed electromagnetic interference (EMI)/radio frequency interference (RFI) filter with a maximum attenuation of 75 decibels (dB) from 100 kilohertz (kHz) to 100 megahertz (MHz). Enclosure shall be NEMA 12 and shall be compliant with the UL 95 standard's Test 5V. The SSD device shall be listed in the second edition of the UL 1449 standard.

The SSD device shall comply with the specifications detailed herein, within the plan set, and/or in the Contract, including:

- A maximum surge current (8x20µs) for a SAD module that is greater than or equal to 24 kA;
- minimum energy absorption for a SAD module of 0.9 BTU [1,000 Joules];
- maximum surge current (8x20µs) for a MOV module that is 50 kA;
- minimum energy absorption for a MOV module of 4.7 BTUs [5,000 joules];
- maximum continuous operating voltage of 150 volts; and
- let-through voltage of 339 volts as required in the second edition of the UL 1449 standard.

CONDUIT AND GROUND WIRE ENTRY.

Communication and power conductors shall enter the shelter as shown on the Plans. Junction boxes or troughs within the shelter shall have a NEMA 12 rating. The plans show the minimum, nominal sizes; the contractor may install additional and/or larger enclosures for power and communications wiring provided. National Electric Code (NEC), NEMA, and manufacturer suggested wire bending radiuses are all to be adhered to. Contractor shall provide three-4" communications sleeves and two-2" power sleeves. After cable testing is complete, the Contractor shall seal the conduit openings with a removable plug (spare conduits) or removable duct sealing compound (around conductors); Contractor shall not use foam.

There shall be five ground wires leaving the shelter to connect to the shelter's ground ring: four from the halo ring and one from the SSD. Penetrations shall be formed, or core drilled through the slab flooring, between 2" and 4" from wall, as is necessary to avoid contact with slab reinforcing. Opening shall be sleeved with PVC conduit of size noted in the plans. After the ground wire is tested, the openings shall be sealed with grout.

LABELING AND SIGNS.

Contractor must provide white with black core laminated phenolic nameplates with 1/4-inch minimum lettering etched through the outer covering on all equipment; inscription must be made with all upper-case letters and must be the same inscriptions as shown on the Drawings or as directed by the Engineer. Use contact-type permanent adhesive or stainless steel screws to mount labels; embossed self-adhering plastic tape labels will not be accepted.

Provide equipment "warning" signs as required by OSHA and NFPA 70E.

Provide one polyethylene, 14" x 10", red core with white laminate warning sign that is attached to exterior of fence with stainless steel clamps. Sign shall indicate language as coordinated with Engineer.

CONTACT CLOSURE TO SNMP GATEWAY. The Contractor shall provide a contact closure to SNMP Gateway to provide alarm inputs to the IDOT ITS network management software, SolarWinds, for devices described herein that only can provide a contact closure upon failure or change of state.

The Contact Closure to SNMP gateway shall support SNMP V1 V2 & V3 protocols and have a web interface to allow for programming. The Contractor shall provide all the programming for the contact closure inputs to the Gateway. Contractor shall coordinate the integration of the SNMP data with the Engineer, the IDOT EMC Engineer and IDOT network administrator. The SNMP data shall be integrated in the IDOT network management software, SolarWinds, server. The Contractor shall provide a list of devices in the shelter that utilize contact closures and shall size the Gateway such that there are spare inputs for future expansion. The contractor shall provide 8 additional contact closure inputs at no additional cost.

The Gateway shall have an Ethernet interface for communications over the IDOT ITS network. The contractor shall connect the gateway with a Cat6 Ethernet cable to the network switch in the Communications Shelter.

(A) Terminal Blocks. Within the shelter, all external wiring interfacing with the building controls and automation shall terminate on easily accessible interposing terminal blocks. This wiring shall include but not be limited to: emergency power supply wiring, supervision contacts, interposing relay contacts, telemetering points and line wires. Terminal blocks shall be General Electric type EB-5 or approved equal. Self-extinguishing white vinyl marking strips shall be included on all interposing terminal blocks. All terminals to which battery or other high voltages are to be connected, shall be provided with protective covers. All terminal blocks shall be labeled and have corresponding identification on unit schematic prints.

(B) Wiring. All wiring shall be stranded and of suitable gauge and insulation to meet the intended use. Extra flexible stranded control wires shall be used for wiring between hinged and stationary portions of panels. All internal wiring to interposing terminal blocks shall be a minimum of No. 14 AWG stranded wire.

Input and output wiring shall be kept physically separate where possible. AC and low voltage DC wiring shall be kept physically separate where possible.

All wiring shall be clearly identified with designation at each end using white plastic slip-on markers with black lettering. The marker diameter shall be consistent with the wire diameter to insure a snug fit, but yet be able to be rotated for identification.

All wiring shall be secured into harnesses. All wiring including harnesses shall be routed in such a manner as to not obstruct the installation or removal of components and shall be secured to the cabinet where appropriate for neatness and to reduce strain on components.

INPUT/OUTPUT ISOLATION AND PROTECTION.

All inputs and outputs including power supply and circuit ports shall be capable of withstanding the IEEE surge withstand capacity test without damage.

COMPONENTS.

Proper mounting shall be employed for all components on printed circuit boards to prevent damage from shipping and vibration encountered in the IDOT "right-of-way" environments.

Circuit boards and their components shall be suitably protected from dampness and corrosion common to the exterior environments.

EQUIPMENT RACKS.

Equipment racks shall be 4-post, open frame type with provisions for the rack to be bolted to the Communications Shelter floor. The racks shall have maximum dimensions of 82 inches high by 24 inches wide by 36 inches deep and shall be capable of mounting 2,000 pounds of equipment and hardware. Each rack shall provide a minimum of 42 standard rack units of mounting space. The racks shall have a black, powder-coat paint finish.

Equipment racks shall be equipped with all hardware required to mount equipment that has been designed to mount in accordance with EIA-310-D and provided with cable management as shown in the Plans.

INTERCONNECTING CABLING.

- (A) 600-Volt cable. All 120 VAC distribution wiring that is entirely within the communication hut shall be made with NEC Type THHN/THWN cable rated for 600V, thermo-plastic insulated, 90° C dry and 75° C wet rated, with a minimum wire gauge of 12 AWG. All conduits shall be a minimum of electrical metallic tubing (EMT), and all EMT conduit fittings shall be compression, not set-screw type. All power wiring (600 volt cable) shall be in EMT. Outlet and junction boxes shall all be galvanized steel with galvanized steel faceplates or covers. All switches, receptacles, and other wiring devices shall be industrial specification grade. There shall be a minimum of one duplex receptacle on each short wall, and two receptacles on the longer walls.

Two 20-Ampere circuits from the UPS panel shall be dedicated to each equipment rack and provide a minimum of 2 duplex receptacles per circuit. Power to equipment racks will be conductors in conduit attached to the ceiling.

Plug Strips may be used within the equipment racks but shall not reduce the number of duplex receptacles required per circuit. The plug strip housing shall be all metal and shall mount in the rack using mounting brackets sized for the equipment racks in the communications shelter and occupy no more than 2 RU in height. Plug Strips shall be Tripp-Lite PDU-1220 or approved equivalent. If plug strips are utilized to provide power to the LAYER III (NETWORK) SWITCH, a minimum of two (2) plug strips shall be provided to ensure that the primary and secondary power supplies of each switch are powered from separate circuits.

Power Supplies for equipment requiring other than 120 VAC shall be manufactured by or approved in writing for that use by the maker of the equipment they are to serve. Power supplies shall be rack-mounted or bolted or otherwise mechanically attached to shelving designed for mounting in the equipment rack. Connections between the power supplies and the equipment they serve shall be made with PVC-jacketed cables. Unjacketed individual conductors shall not be permitted.

- (B) Ethernet Cable (including connectors). Ethernet Cable shall be ANSI/TIA/EIA-568-B.2 Category 6, UL verified. The cable shall be composed of 24 AWG solid bare copper conductors, twisted pairs, and polyolefin insulation. Each end of the cable shall be terminated with an RJ-45 connector compliant with manufacturer requirements of the associated devices.
- (C) Cable Identification Materials. All cables, fiber optic cables, and individual conductors and fiber strands when broken out from a cable assembly shall be uniquely labeled in accordance with the Contractor's interconnection diagram. Labels shall be computer-printed and shall be waterproof and non-smearing. Labels shall be polyester adhesive wrap labels produced by the Brady Corporation or approved equal. The labeling shall comply with ANSI/EIA/TIA -606-B.

(D) Cable Tray. Unless otherwise indicated on the plans, the Contractor shall furnish cable tray with 3/8" x 1-1/2" high tensile tubular steel stringers and 1" x 1-1/2"x1/8" channeled cross slats. The nominal width of the tray shall be 12" and the distance between cross slats shall be 8". The Contractor shall furnish all hangers, rods, straight splices, Unistrut, threaded rods, nuts, open clips, closed clips, wall anchors, J-bolt assemblies, straight clamps, corner clamps, and other hardware required to complete the assembly required by the plans. The Contractor shall include all necessary bonding and grounding hardware to bond and ground the cable tray.

ENGINE GENERATOR SET.

General. Each Generator Package shall consist of a prefabricated assembly of an external diesel engine generator set together with integral double walled fuel tank and all required auxiliary equipment mounted in a solidly-constructed weatherproof "skin-tight" housing on a structural steel frame including adjustment and testing. A directive set of operating instructions and a wiring diagram shall be mounted under or laminated within heavy clear plastic on the inside wall of the "skin tight" housing. Auxiliary equipment shall include all items specified herein and all items required or recommended by the manufacturer for a complete operating unit. Each package shall be completely pre-wired and pre-piped as specified herein requiring only field mounting and power input and output connections, alarm output connection and fuel input and overflow connections. All materials found in the generator package shall conform to all aspects of this specification except as otherwise provided for within the specification. These specifications include units suitable for mounting on an exterior concrete foundation. These specifications also include a separate remote annunciator.

Units shall be suitable for mounting on a permanent concrete pad. The concrete pad design shall be submitted with engine generator submittal.

Unless otherwise indicated, engine generator set ratings shall be based on 105 degrees C, characteristics and published data. Minimum generator size shall be 150% of maximum calculated load, however actual rating may be higher to achieve compliance with specification requirements.

The engine generator set shall recover rapidly from instantaneous changes between no load and full load, as well as the reverse changes of load, without damage.

Sizing. The engine generator set shall be sized to meet the required 50KW rating, as described above. Nominal KW ratings shall be not less than stand-by ratings equivalent to Fuel Stop Power ratings in accordance with ISO3046, AS2789, DIN6271 and BS5514, and all units shall accept 100% of nameplate KW rating in one step, in conformance with NFPA 110, paragraph 5-13.2.6. KW ratings shall be certified by the manufacturer, shall be based on published data, and unless otherwise indicated shall be based on 105 degree rise characteristics. Unless otherwise indicated, starting and loading requirements shall be single-phase, concurrent auxiliary loading shall be unity power factor. All engine generator sets shall achieve specified starting with no greater than 10% sustained RMS voltage dip during motor starting and shall achieve specified starting with no greater than the instantaneous RMS voltage dip (approximately 2-4 cycles) specified elsewhere herein for individual sizes.

Submittal. Prior to ordering any materials, the Contractor shall submit a complete generator submittal package to the Engineer for approval prior containing the following:

- Complete engine-generator set sizing calculations for all identified loading and starting condition cases. Submitted calculations shall include all reference information necessary to substantiate calculations, and if a vendor's software program is used to prepare the calculations, a copy of the program shall be included. Calculations shall clearly demonstrate all input assumptions and conditions as well as the adequacy of the unit proposed.
- Complete manufacturer catalog information sheets highlighted to indicate specified features and options for specification compliance.
- Complete manufacturer catalog information for annunciator panels highlighted to indicate specified features and options.
- Operation and maintenance manuals and wiring diagrams shall be furnished with submitted drawings.
- Manufacturer's anchoring details and pad recommendations.

Generator Engine.

- (A) Engine Type and Rating. The engine shall be for service as herein specified for stationary service with or without pre-combustion chambers, water-cooled, four cycle in line or V-type and a maximum operating speed of 1800 RPM. Units for sets above 125 KW shall be full diesel direct injection and those for sets 125 KW and below may be indirect injections.

The engine may be turbocharged. The engine may be aftercooled. Bid information shall indicate where specific sizes are either turbocharged or aftercooled to achieve specified ratings.

The engine shall be able to meet the specification when operating on a #2 diesel grade of fuel oil and at the altitude where installed (1000 feet MSL) at a temperature range between -20 degrees F and 105 degrees F.

The brake horsepower of the engine shall not be less than the brake horsepower to drive the engine auxiliaries plus 1.3 times the indicated KW rating of the generator divided by the generator's efficiency expressed as a decimal. Submittal information shall include verification of this calculation.

The engine shall be capable of a continuous two-hour over-load of 10% (but need not exceed a total of two hours out of any 24 consecutive hours of operation). The engine shall operate under such service without "wet stacking" excessive smoke, overheating or mechanical damage. The manufacturer shall so certify.

The engine shall be able to start cold in a 40 degrees F ambient while using No. 2 diesel oil without the use of starting aids such as glow plugs, additives or other injections.

The engine shall be complete with fuel system, cooling water system, lube oil system, governor and electric engine starting system as specified herein.

- (B) Fuel System. The fuel oil system shall be the unit/direct injector type with engine-driven fuel pumps, fuel filters and flexible fuel lines. Fuel lines between injection pumps and valves shall be heavy seamless tubing and shall be of the same length for all cylinders to eliminate irregularity of fuel injections.

Fuel injection shall be by individual injection pumps and nozzles for each cylinder. Each pump shall inject oil directly into its cylinder or pre-combustion chamber. Plungers shall be carefully lapped for precision fit and shall not require any packing. The injection system assemblies shall not contain any filters or screens which require replacement. The surplus oil shall return to the storage tank by gravity. The fuel system shall have an easily accessible fuel shut-off valve in case of emergency.

An engine-driven, positive-displacement fuel pump shall circulate fuel oil through the secondary fuel filters to the injectors and back to the tank. Pressure shall be limited by relief valves.

Fuel oil filters shall have filter elements of the cleanable or replaceable type which will entrap and remove water from the fuel oil. Filters shall be located to ensure that the fuel oil will be thoroughly filtered before it reaches the injector assemblies.

The fuel tank and internal baffling shall be designed and constructed as an integral part of the base assembly which shall provide a rigid support of the engine generator set package. For mobile units, the tank and base assembly shall also be an integral part of the trailer frame. The tank assembly shall be constructed of heavy gauge corrosion-resistant sheet steel.

The fuel storage tank shall be doubled-walled with an inner tank and an outer leak containment chamber. The fuel storage tank shall have a capacity to supply the engine for a minimum of 4 days at full rated load. The assembly shall have internal baffles where required and any associated baffles shall have fuel transfer holes large enough to allow fuel to flow freely. The tank shall be constructed with an interior bottom pitch and a drain line with a valve shall be connected to the lowest point of the tank. The drain valve shall be located inside the overall set enclosure and the tank drainage provisions shall be vandal-proof. The fuel tank filler pipe shall not be less than two inches inside diameter and it shall include a wire mesh strainer and shall be equipped with a SAE truck-type locking cap with five (5) keys. The fuel tank shall be vented in accordance with EPA regulations and it shall not create a vacuum condition when the tank is full. The vent shall be opposite the filler pipe to maintain proper ventilation during tank filling. The assembly shall be equipped with a fuel leak detector sensor within the leak containment chamber with an alarm and a fuel level sensor and indicator of the electronic type, both as referenced elsewhere herein. The tank assembly for fixed units shall be UL listed as a closed-top, diked generator base tank and is to be installed in accordance with NFPA 30 for flammable and combustible liquids. Tanks on mobile units shall be constructed to similar or more stringent standards and otherwise be in conformance with US DOT and National Highway Safety Administration standards, in compliance with the Code of Federal Regulations, Section 571.108. Tanks shall be factory tested, including pressure testing to 3 psi, and certified to be free of leaks.

The fuel leak detector sensor alarm point shall be connected to the generator alarm annunciator panel.

- (C) Lube Oil System. The engine shall be equipped with a pressure lubrication system to supply oil to all surfaces requiring lubrication. Circulation shall be by means of an engine-driven, positive displacement, lube oil pump.

The lube oil system shall include a heat exchange utilizing engine cooling medium.

- (D) Immersion Heaters. The engine shall be equipped with electric immersion heaters with protective jackets for maintaining the engine's cooling water and lube oil temperatures at valves recommended by the engine manufacturer. The heaters shall operate at 120, 208 or 240 volts single phase as selected and coordinated with the auxiliary panelboard and the associated supply to it. Unless otherwise designated, heaters shall be 120 volts single phase. The heaters shall operate continuously except when the engine is running or when the thermostats are satisfied.

- (E) Air Intake and Exhaust System. The engine intake air filter shall be of the engine-mounted dry type with restriction indicator and shall be securely braced against vibration. The filter element shall be cleanable or replaceable while the engine is running.

The exhaust muffler shall be of a design recommended by the engine manufacturer to provide critical type silencing. The muffler shall be mounted within the housing with exhaust pipe extension with suitable insulation extended through the outer skin, outside the housing. The muffler shall include a condensation drain plug. Venting via the cooling ventilation louver will not be acceptable.

The pressure drop in the entire exhaust system shall be small enough to insure satisfactory operation when the engine-generator set is operating at 110% of indicated generator output. Submittal information shall document compliance with this requirement by calculation.

- (F) Governor. The engine speed shall be controlled by a governor of the electronic type. The governor shall maintain frequency regulation not to exceed 0.5% from no load to full load. The governor shall have manual adjustments, which can be made with the engine running.

- (G) Engine Starting System. The engine starting system shall consist of a heavy duty, electric cranking motor with appropriate automatic engagement and drive mechanism, battery rack, battery cables and clamps and a battery charger.

The electric cranking motor shall have sufficient capacity to crank at a speed that will start the engine for four cranking cycles as specified hereinafter without overheating. The cranking motor shall be rigidly mounted on the engine and shall start the engine from any position of the flywheel.

The starting battery shall be a heavy duty, industrial lead acid type with the required number of cells assembled with connectors to provide proper voltage for the starting motor shall have high rate discharge performance and shall have sufficient capacity to provide two minutes total cranking time without recharging based on the specified temperature for the unit (-20 degrees F – 105 degrees F) without a battery heater.

Submittal information shall document battery type, battery capacity and temperature characteristics.

The battery charger shall be multiple rate temperature compensated and suitable for the battery shall have full wave silicon rectifiers, surge suppressers, charge rate potentiometers, charge rate indication, DC ammeter, DC voltmeter, input and output fuses and shall be self-regulated against shorted or reversed battery connections and overload currents. The charger shall have a high charging rate compatible with the battery capable of fully recharging a depleted battery in not more than 24 hours, and when the battery is brought up to full charge it shall automatically reduce the charge rate to a continuous trickle charge. The charger shall operate from a 120-volt, single phase, power source or shall operate from a transfer switch source when installed within. Submittal literature shall include complete, highlighted battery charger information

The charger shall generate the following alarm indications and outputs:

- Low DC voltage
- High DC voltage
- Battery Charger Malfunction

Charger alarms shall be wired to the generator alarm annunciator panel. The battery charger shall be installed in a NEMA 3R enclosure mounted on the set and connected to the auxiliary's panelboard.

(H) Engine Start-Stop and Safety Controls. The generator shall be equipped with two control panels, one mounted on the generator, and one remote panel located inside the shelter; the inside panel is also referred to as the alarm annunciator panel. Alarm points for the generator, generator control panel, transfer switch, and all generator ancillary equipment shall be wired to the annunciator panel. The annunciator panel shall be capable of displaying current system status as well as the last 128 alarm notices

The local engine start-stop and safety controls shall be installed in a generator control panel which shall have a NEMA 3R rating and will be mounted at the generator. The panel shall be a combination engine and generator control panel which shall house controls and instruments for the engine and the generators. All control instrument and alarm designations shall be in English text; symbols alone will not be acceptable.

The control system shall be the manufacturer's most current and complete microprocessor-based system for monitoring, metering and controlling the engine generator set. The controllers shall feature digital displays as well as analog meters for AC volts, AC amperes, and Frequency, as a minimum, **even if these functions are duplicated digitally**. Gauges for Engine functions, including Lube Oil Pressure and Cooling Water Temperature shall be supplied and may be incorporated in the panel or may separately mounted.

The control system shall incorporate a key-operated Run-Off-Auto switch. In the "Run" position, the engine shall start and operate at rated speed. The starting function shall include a cranking cycle of several alternate crank and rest periods in the event that several attempts are necessary. If the unit has not started by the end of the cranking cycle, the start controls shall terminate the attempts and actuate the over-crank alarm (transmitted as part of Generator Malfunction Alarm). In the "Stop" position, the engine shall be unable to start or run. The "Stop" position shall also reset lockout relays and alarm indications, or the panel may incorporate a "Reset" switch. In the "Auto" position, the engine shall start and operate at rated speed in response to a remote contact from a transfer switch or other control. When the switch is not in the AUTO position an alarm, wired in parallel with the output breaker's auxiliary contact, sends a "Generator Not in Auto" alarm to the MODBUS to SNMP Gateway.

The control panel shall include selectors for phase selection and for meter scale ranges, as appropriate.

The control system shall incorporate a non-reset-able running time indicator.

The external control panel shall, as a minimum, indicate alarms for the following functions:

- Overcrank (*)
- Overspeed (*)
- High Water Temperature – Pre-Alarm
- High Water Temperature (*)
- Lube Oil Low Pressure – Pre-Alarm
- Lube Oil Low Pressure (*)
- Low Fuel **
- Generator Switch Not in Auto

These alarms shall be wired to the generator alarm annunciator panel located inside the shelter. From there the alarms designated with an asterisk shall be reported through the MODBUS to SNMP Gateway. The Generator Controller shall talk MODBUS RTU. The Contractor shall provide, program, and test a MODBUS to SNMP Gateway. The MODBUS to SNMP Gateway will allow Generator alarms to be integrated into the IDOT network management software Solar Winds. The MODBUS to SNMP Gateway can read data from MODBUS RTU and present it as SNMP variables on the network. The Contractor shall provide the MODBUS registry map for the Generator controller allowing IDOT and their network administrator which alarms they want inputted into the network management software network. Gateway shall be connected to the ITS network switch as identified on the plans with a Cat6 Ethernet cable.

The panels shall provide for alarm acknowledge (silence) and test functions.

For units incorporating a unit-mounted battery charger, battery charger alarms shall also be indicated on the control panel or shall be annunciated on the battery charger. In any case, any of the battery charger alarms shall trigger the common "Generator Malfunction" alarm.

The control panels shall have all functions clearly visible in daylight or night conditions by incorporating internal and/or external lighting. The external control panel shall be environmentally hardened and suitable for operation in an outdoor environment in wet weather without the entry of moisture, dust or other airborne contaminants.

The control panels shall be UL508 and ISO 8528-4 listed and shall conform to the National Electrical Code and NFPA 110.

- (I) Engine Instruments. The engine shall be provided with an appropriate instrument panel with the following equipment mounted thereon all properly connected for the desired services:

- Pressure gauge-fuel oil (not panel mounted)
- Temperature indicator-cooling water
- Temperature indicator-lube oil

Generator.

- (A) Generator Type and Rating. The generator shall be single phase, 60 hertz, rotating field, synchronous type, with a permanent magnet exciter, a standard oversize alternator and shall have the output voltage of 240/120V and 50KW rating at 0.8 power factor as specified, shall be connected to the engine flywheel with a flexible coupling and shall have an open, drip- proof enclosure.

The generator and exciter shall have Class F insulation and shall be capable of withstanding an overspeed of 125% without damage. Bearings shall be ball, double shielded, cartridge type with grease fittings. The generator shall be re-connectable by means of reconfiguring conductive straps, bars or pre-made jumpers furnished with the unit and such reconnection shall be from an accessible location that does not require disassembly of other parts of the unit. Generator output shall be re-connectable as 240/120 Volt, 1 phase, 3 wire.

The generator and exciter shall be rated for operation continuously at 110% of rated load without exceeding insulation temperature limits of 105% rise (Celsius). Submittal information shall document compliance with this requirement.

- (B) Voltage Regulator. The voltage regulator shall be static type with surge protection and shall match the characteristics of the generator and exciter. A rheostat for a maximum of plus or minus 5% voltage adjustment shall be provided.

Digital voltage regulation for maximum calibration shall not be more than plus or minus 1% from no load to full load.

Stable operating conditions shall be re-established within two seconds following any sudden change in load between full and no load. Stable generator operation is defined as operation with terminal voltage held constant within plus or minus 1% of rated voltage.

Readily accessible voltage drop, voltage level and voltage gain controls shall be provided.

The set may supply non-linear loads such as UPS systems or DC drives. The set sizing and construction shall take this into account and the set shall be immune to negative effects from such loading.

- (C) Generator Instruments. The generator instrument shall be panel mounted in the generator control panel and shall include:

- AC Ammeter
- AC Voltmeter
- Voltmeter/Ammeter phase selector switch
- Frequency meter dial type
- Elapsed Time meter

- (D) Generator Circuit Breakers. Each engine generator set shall have two generator output circuit breakers mounted in an enclosure on the unit. The circuit breakers shall be a molded case, thermal magnetic type with an interchangeable trip, ambient compensated for installation outdoors in full sun. The circuit breakers shall have a frame size suitable for the maximum nominal output amperes available in the "worst-case" reconnect-able configuration. Alternate trip modules shall be provided within a tool box for all various output configurations. The circuit breakers shall be UL listed, molded case, rated for 600 volts and shall have an interrupting rating suitable for the available fault current of the unit.

The main breaker shall be wired to the automatic transfer switch. This breaker shall be furnished with an auxiliary contact to indicate that the generator is not switched to automatic position. The purpose of other breaker is for a connecting to a load bank for routine testing. The breaker enclosure shall provide terminals and a convenient means to attach cabling, up to #3/0 in size, to a portable load bank. The breakers shall be key locked so that only one may be closed at a time.

Portable load bank and cabling is not included in contract.

- (E) Housing. Each unit shall have an outdoor sound attenuating enclosure rated for 75db attenuation at 15 feet. The housing shall consist of a "skin tight" design prefabricated structure according to manufacturer's dimensions bolted and sealed on the structural steel frame for mounting on a concrete pad or steel grating. Insulation shall be mineral wool or fiberglass.

The size of the housing enclosure shall be sufficient for all items mounted within and shall have adequate space to allow sufficient clearances for access and maintenance of equipment. The housing shall have standard size heavy duty primed and painted steel access doors with outside padlocking provisions and door "hold open" latches.

It shall have a fabricated steel base assembly with integral fuel tank, motorized intake and exhaust louvers, ducted radiator exhaust assembly and environmental control system including lights, heaters and convenience receptacles.

The steel base shall incorporate an integral double walled fuel tank of not less than the capacity specified and shall provide adequate support and stiffness. The base shall be bolted to the concrete pad. The steel base shall be sand blasted to a commercial finish in accordance with the manufacturer's standards.

The housing shall be equipped with interior and exterior signs to warn of "Flammable Material" and "NO SMOKING".

The engine generator unit, base tank, and associated housing shall all be factory painted with a multi-coat, corrosion resistant finish.

- (F) Auxiliary Items. The package shall be equipped with lighting switched from an access door to provide general lighting for maintenance and inspections.

The package shall be equipped with two thermostatically controlled 120 volt electric space heaters to prevent condensation within the housing and to maintain the house at 50 degrees F while outside temperature is 0 degrees F. The thermostat shall be accessible for adjustment.

Conduit used for wiring within the housing may be electrical metal tubing except for flexible connections where liquid-tight flexible metal conduit shall be used. Assure ground continuity with equipment ground wires.

- (G) Alarm Annunciator Panel. Alarm Annunciator Panel shall be standard manufacturer compliments to the engine generator sets as specified herein, suitable to provide remote monitoring, and visual and audible alarm of engine generator status and malfunction conditions.

Annunciators shall comply with NFPA standards for Essential Electrical Systems for Health Care Facilities and Emergency and Standby Electric Power Systems as well as National Electrical Code requirements. The alarm annunciator panel shall be powered from the shelter's AC distribution system.

Annunciators shall be mounted in a metal enclosure, with a front suitable for flush or surface wall mounting.

Annunciators shall have space for not less than 20 alarm conditions, and it shall be possible to customize designations of each space. At least 18 of the alarm spaces shall be capable of initiating the audible alarm, and each shall have the audible alarm selectable as “on” or “off”. The annunciator shall be equipped with an audible alarm silence and a lamp test feature, and the vendor shall provide instructions on how to disable the audible alarm and how to substitute an output connection to a silent strobe or similar device.

Annunciators shall be of a modular design using replaceable and interchangeable LED lights. A supply of 10 green, 10 red and 10 yellow spare LEDs shall be provided with the unit. A supply of not less than 20 spare legend labels for customizing the configuration shall also be included.

Specific set alarms may be tailored to each specific installation, and specific alarm designations may be specified at the time any annunciator is ordered. In the absence of installation specific designations, each annunciator unit shall initially be shipped with the alarm functions specified herein for the engine generator set control panel; plus, the battery charger alarms; plus, a “Generator Running” indication; plus, an alarm for Fuel Leak to Rupture Basin, generally as follows:

<u>Condition</u>	<u>Color</u>	<u>Audible Horn</u>
Not in Auto	Red	No
Battery Charger Malfunction	Red	Yes
Generator Running	Red	No
Low Fuel	Red	Yes
Fuel Leak - Rupture Basin	Red	Yes
Pre-High Coolant Temp.	Red	Yes
High Coolant Temp.	Red	Yes
Low Engine Temp.	Red	Yes
Pre-Low Oil Pressure	Red	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Overcrank	Red	Yes
Generator Overload Pre-Alarm	Red	Yes
Generator Overload Shutdown	Red	Yes
Normal Power Present	Green	No
Emergency Power Present	Red	Yes
Transfer Switch in Normal	Green	No
Transfer Switch in Emergency	Red	No

Annunciators shall be UL listed.

Guarantees/Warranties. All equipment shall be furnished complete with the Manufacturer's standard year guarantee/warranty applicable to the Illinois Department of Transportation or other appropriate procuring agency from the date of delivery. Such guarantee shall accompany final record drawings and product data. The warranty shall begin on the date of final acceptance from the Department.

Local Service. The generator manufacturer shall have an ongoing business operation within the State of Illinois, shall provide 24-hour service capability and shall provide units for which factory-authorized service is available at various locales statewide to minimize emergency response times. A complete listing of factory-authorized service within Illinois (and adjacent bordering locales) shall be provided with the submittal.

Acceptable Products. The engine generator set shall be manufactured by Onan Cummins, Kohler, Caterpillar, Generac or approved equal.

Tests.

- (A) Engine Generator Factory Test. The engine generator set incorporated in the engine generator package must be fully tested, as specified herein at the factory and certified by the generator manufacturer. The factory test(s) shall be per manufacturer's standards. All tests shall be neatly recorded, and a copy of the test results shall be given to IDOT. The set serial number(s) shall be recorded on the test result forms.
- (B) Assembled Package Installed Tests. The completed package assembly shall be field tested to assure proper operations and connection of the engine generator set and all other components of the assembly. The tests shall include simulations of automatic, manual, and retransfer to normal simulation of all alarm functions as well as tests of the field tank and other package auxiliary items.

The manufacturer of the Engine Generator Package shall furnish the services of an experienced engineer/technician to check the equipment and witness testing and file reports and certification and such services shall be available within 10 days of notification that installation and connection is complete and ready for testing. The services manufacturer's representative shall be available to assist in the adjusting and testing of the engine generator set and the assembled package in the field. These adjustments shall be made in the presence of IDOT.

Tests shall demonstrate the proper operation of the set, including automatic starting and picking up of the load.

Except for the manufacturer's representative, all instruments, test equipment, fuel, lube oil, and personnel that are required for the test as confirmed with the manufacturer will be furnished by the installing Contractor. The manufacturer may provide supplemental test equipment.

The representative of the engine generator set manufacturer shall furnish certification in writing that the set has been properly installed at the site and that the trial operation has been satisfactory. Documentation shall include recorded test results. The certification shall be submitted to the owner in triplicate before final acceptance.

Submittals. The submittal shall include calculations and other detailed information showing compliance with all generator package specifications and appurtenances specified herein and they shall also include detailed drawings of the generator, dimension weights, lift points, and rigging recommendations, its wiring, the base, the superstructure, and any other information needed in the construction of the complete package shall also be provided to the extent practical for bidding.

In submitted calculations, contractors shall indicate all specified input parameters plus any assumed characteristics such as motor efficiency and power factor that may be germane to the calculation.

Component catalog information shall be included and highlighted.

The Contractor is responsible for highlighting and explaining any proposed deviations from specified requirements. Minor deviations relative to set appurtenances and accessories may be allowed, but deviations affecting set sizing, load capacity, noise rating, and other basic unit features will not be allowed.

Documentation. Each unit ordered shall be delivered with two (2) sets of catalog and shop drawing information, test results and vendor certification and two (2) sets of operating and maintenance manuals.

Commissioning. Included shall be on-site factory representative witness for commissioning activities and two on-site training sessions. In addition to hands-on operation of the equipment the training sessions shall use copied pages from the actual operational & maintenance documentation to be provided with the equipment.

As a condition for substantial completion the fuel tank must be filled by Contractor to capacity after commissioning is complete.

AUTOMATIC TRANSFER SWITCH.

The Transfer Switch shall be supplied by the same vendor as the Engine Generator Package. The vendor shall provide suitable interconnection reference diagrams.

- (A) Basic Transfer Switch Requirements. Automatic transfer switches shall be air break, double throw interrupter type, electrically operated and mechanically held in both the normal and emergency positions. The switch operators shall be momentarily energized by the source to which the load is transferred. Switches shall be capable of transfer in either direction on 70% of rated voltage. Switches composed of molded case breakers, contactors, or components not specifically designed as an automatic transfer switch will not be acceptable. Switches shall be listed to UL 1008 and all accessories shall be UL listed for factory or field installation. Equipment shall comply with applicable NEMA, NFPA, and CSA requirements and standards.

Transfer time in either direction shall not exceed 0.5 second.

Switch current ratings shall be the nominal switch size rating as indicated, as a minimum, but larger switches may be derated to achieve specification compliance on other factors. Each switch shall be rated for 600 volts. Main contacts and main current carrying parts shall be insulated for 600 volts. The rating of the switch shall be a 24- hour continuous rating in a non-ventilated enclosure for all classes of loads. Temperature rise shall conform to U/L –1008 and NEMA standards. The contact structure shall consist of a main current carrying contact which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes.

Main contacts shall be mechanically held in position by the operating linkage without the use of hooks, latches, magnets, or springs and the contacts shall be of silver alloy. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.

Not less than two auxiliary contacts, one closed on normal and one closed on emergency, rated not less than 5 amperes at 120 volts, shall be mounted and actuated by the same shaft as the main contacts. Additional relay contacts, timers, control keys, and associated wiring required for the functions indicated shall be front accessible. All wiring shall be tagged with tubular wire markers or other means approved by the state.

The Automatic Transfer switch shall be equipped with a network interface that supports SNMP V3 protocol. The Automatic Transfer Switch SNMP data, remote alarm status, shall be integrated into the IDOT network management software. The integration shall be included in the unit cost for the Communications shelter. The contractor shall coordinate the integration effort with the IDOT Electrical maintenance Engineer and IDOT network administrator. IDOT's network management software is SolarWinds.

The switch operation shall provide an adjustable period in a fully disconnected (neutral) position on both transfer and retransfer operations. Except for the normal functioning of the programmed neutral position, failure of any component shall not result in a neutral position where both normal and emergency contacts remain open. Also, the failure of any component shall not result in a condition where both normal and emergency contacts are closed or attempt to close at the same time.

Transfer switches shall not have integral overcurrent or short circuit protection.

Switch components shall be easily maintainable from the front without removal of the switch from its enclosure and without disconnecting the main power cables. Adequate safety baffles and barriers shall be provided, and all components shall be clearly identified.

(B) Operation. Operation shall be selectable as either manual or automatic.

Automatic operation shall be controlled by adjustable voltage sensing in each phase of both normal and emergency sources. Upon a fall in voltage on one or more phases of the normal source below the pre-set limit (roughly 70% of rated voltage) transfer operation shall be initiated. Delays and other transfer features shall be as specified herein. Upon restoration of voltage to all phases of the normal source (to roughly 90% of rated voltage) re-transfer to normal shall be initiated, also subject to delays and features specified herein.

Each transfer switch shall be equipped with a manual operator. Manual operation shall operate the switch in the same transfer time as normal electric operator transfer. Interlocking shall be provided to prevent electric operation of the switch when the manual operation is selected. The manual operator shall be arranged to provide adequate shielding and protection from live electrical parts for operating personnel. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.

(C) Withstand Rating, Tests and Certifications. Each switch shall have a UL-1008 withstand and closing current rating, when coordinated with circuit breakers, at 480 volts AC of not less than 42,000 RMS symmetrical amperes.

Submittal information shall include documentation that identical switches have met the requirements of UL standard 1008 for the specified ratings. In addition, the data shall include certified copies of test documentation of the 3-cycle withstand requirements of 42,000 amperes at 480 volts.

Test results shall include a dielectric test at the conclusion of the withstand and closing tests.

After installation, the vendor shall provide installed switch operations testing and start-up adjustments. A representative of the manufacturer/vendor shall check the installation and submit to the Engineer, three (3) certified, signed statements, addressed to IDOT for each installed switch, that the equipment has been properly installed and is in good working order.

A record of all auxiliary device settings, etc. shall be provided for each installed switch.

In addition, a record of these settings shall be within a clear, heavy-duty plastic sheet protector at an appropriate location within, or upon, the switch enclosure.

Start-up testing and operating personnel training shall be provided by the equipment supplier. Training shall cover basic switch operation, auxiliary device purposes and settings, maintenance requirements and remote alarms.

Plastic-laminated step-by-step operating and test procedures, complete with schematic wiring diagrams shall be permanently attached to automatic transfer switch enclosures.

Final record drawings, recommended spare parts, and maintenance manuals shall be available for start-up.

The transfer switch shall be equipped with a microprocessor-based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position and source availability. Control settings shall not be lost during a total power outage and switch position indications shall remain viable as well.

(D) Special Features. Each transfer switch shall include, as a minimum the following control features:

- Emergency Transfer Time Delay. This time delay (or delays) shall delay the transfer to the emergency source for a time to allow for momentary outages. This time delay shall be adjustable with a range of roughly 0 to 5 minutes. This delay shall also delay engine generator start.
- Test Switch. A test switch shall be mounted on the enclosure door to stimulate the failure of the normal source.

(E) Indicating Lights and Alarms. The switch shall have indicating lights mounted on the enclosure to indicate the switch position (normal to emergency) and the presence of power (normal and emergency). Each shall have an engraved nameplate and color as follows:

<u>Legend</u>	<u>Color</u>
Normal Power Present	Green
Switch in Normal Position	Green
Emergency Power Present	Red
Switch in Emergency Position	Red

ATS alarms shall be wired to the generator alarm annunciator panel. ATS alarms shall be integrated into the IDOT network management software via SNMP data interface as detailed above in this specification. Alarms include:

- Transfer Switch in Normal Position
- Transfer Switch in Generator Position
- Transfer Switch Bypassed
- Transfer Switch Normal Power Supply Fail
- Transfer Switch Malfunction

- (F) Adjustable Programmed Neutral Position. The switch operation shall have a programmed, adjustable time neutral position in which neither the normal or emergency sources are connected to the load. The time period shall be adjustable from roughly 0 to 20 seconds to prevent mechanical damage to motors which are running at the time of transfer.
- (G) Override Switch. The transfer switch shall have an override switch, mounted on the enclosure door to hold transferred switch in the emergency position regardless of the status of the normal source.
- (H) Auxiliary Contacts. The switch shall have not less than an auxiliary relay contact for each of the following functions:
- A contact closed when the normal source is connected to load (switch in “normal” position)
 - A contact closed when the emergency source is connected to load (switch in “emergency” position)
 - A contact to close to initiate engine generator start and stop
 - A contact closed on normal source undervoltage
 - A contact closed on emergency source undervoltage

Contacts shall be coordinated with a remote annunciator or the engine generator, as appropriate and the contacts shall be in addition to those required for specified indicating light on the switch.

- (I) Normal Retransfer Time Delay. The switch shall have a Normal Retransfer Time Delay. This delay shall delay re-transfer to normal for an adjustable time of 0-60 minutes. If the emergency source fails during the re-transfer time delay period, the transfer switch controls shall automatically bypass the time delay and immediately initiate re-transfer to the normal source position.

The switch shall be equipped with solid state control with all-phase monitoring on each power source, surge voltage isolation, relays for all outputs, isolation transformers for AC power inputs plus adjustable voltage sensors and time delays. Controls shall provide indicators or digital display of control status.

When ordered in a coordinated package with an engine generator unit, the transfer switch may house and be integrated with a DC control voltage supply and battery charger which may also power a coordinated DC remote annunciator. The supply shall derive power from the appropriate energized source at the switch and the charger shall then service in lieu of a generator-mounted unit. Coordinated wiring diagrams shall be provided.

The control panel shall be shielded from electrical noise.

Transfer switch controls shall allow the selection or non-selection of an automatic engine generator exercise mode.

A load/no load clock exercise shall be incorporated within the controls and shall be programmable to start the engine generator set and transfer the load (when selected) for exercise purposes on a periodic basis. The controls shall not lose settings during a power outage.

Each switch shall have a fully rated neutral bar with lugs isolated from the switch housing and other grounded parts. Each switch shall also have a suitable ground block, with lugs, and it shall be suitable for connection to a grounding electrode, equipment grounding conductors and an appropriate neutral-ground bonding jumper if both normal and emergency (generator) supplies are grounded via the transfer switch.

Each switch shall have a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.

All relays shall be continuous duty industrial type wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers, and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness ribbon connector and keyed disconnect plugs for maintenance.

(J) Enclosures. The switch shall be mounted in a NEMA 12 enclosure, with a hinged door.

(K) Submittals. A complete package submittal shall be furnished. The submittal shall include detailed information showing compliance with all transfer switch package specifications and appurtenances specified herein and they shall also include detailed drawings of the transfer switch, its wiring, the base, the superstructure, and any other information needed in the construction of the complete package. Also, component catalog information shall be included and highlighted.

The Contractor is responsible for all information contained herein and explaining any proposed deviations from specified requirements. Minor deviations relative to appurtenances and accessories may be allowed, but deviations affecting basic switch rating and function will not be acceptable.

(L) Guarantees/Warranties. The transfer switches shall have a guarantee to be free of defects in material and workmanship for one (1) year from date of equipment turn on.

- (M) Certification and Documentation. Not less than four (4) full sets of hardbound installation and operation and maintenance manuals, complete with any appropriate descriptive literature and any special tools required to service transfer switches shall be provided at time of delivery. The material furnished shall include complete wiring diagrams and contain final, approved shop drawings and product data sheets (including any field additions or modifications) as well as recommended installation, testing, operation, and maintenance procedures. This material shall also be furnished in PDF format of CD- ROM or USB drive.

Plastic-laminated step-by-step operating and test procedures, complete with schematic wiring diagrams shall be permanently attached to automatic transfer switch enclosures.

After installation, the vendor shall provide installed switch operations testing and start- up adjustments and shall provide documentation of these tests and adjustments.

A representative of the manufacturer/vendor shall check the installation and submit to the Engineer, three (3) certified, signed statements, addressed to IDOT for each installed switch, stating that the equipment has been properly installed and is in good working order. A record of all auxiliary device settings, etc. shall be provided for each installed switch.

- (N) Manufacturers. The vendor shall have an established local factory authorized 24-hour service capability within IDOT District 1. Submittal information shall confirm this capability.

- (O) Acceptable Products. The transfer switch shall be manufactured by Onan Cummins, Kohler, Caterpillar, Generac or approved equal.

UNINTERRUPTIBLE POWER SUPPLY (UPS).

- (A) Standards. The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

- IEEE C62.41, Category A & B
- ASME
- CSA 22.2, No. 107.1
- FCC Part 15, Sub Part B, Class A
- National Electrical Code (NFPA 70)
- NEMA PE-I
- OSHA
- UL Standard 1778

(B) General. The UPS system shall consist of the appropriate number of modules for capacity and/or redundancy. All modules are to be operating simultaneously and sharing the load. In a non-redundant system, all the modules making up the UPS are required to supply the full rated load. If a power or control module should malfunction, the load is to be transferred automatically to the bypass line. If a battery module should malfunction, it is to be isolated from the system resulting in reduced back up time. For redundant operation, the UPS will have one or more modules than what is required to supply the full rated load. The malfunction of one of the modules shall cause that module to be isolated from the system and the remaining module(s) shall continue to carry the load. Replacement of a module shall be capable without disturbance to the connected load.

(C) Modes of Operation. The UPS shall be designed to operate as a true on-line system in the following modes:

Normal - The critical AC load is continuously supplied by the UPS inverter. The input converter derives power from a utility AC source and supplies DC power to the inverter. The battery charger shall maintain a float-charge on the battery.

Back-up - Upon failure of utility AC power the critical AC load is supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

Recharge

- Upon restoration of utility AC power, after a utility AC power outage, the input converter shall automatically restart and resume supplying power to the inverter. Also, the battery charger shall recharge the battery.
- Automatic Restart - Upon restoration of utility AC power, after a utility AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load. Also, the battery charger shall automatically recharge the battery. This feature shall be enabled from the factory and shall be capable of being disabled by the user. The user shall also be able to program two auto restart delay settings: Battery capacity % level, Countdown timer.

Bypass - The bypass shall provide an alternate path for power to the critical load that shall be capable of operating in the following manner:

- Automatic - In the event of an internal failure or should the inverter overload capacity be exceeded; the UPS shall perform an automatic transfer of the critical AC load from the inverter to the bypass source.
- Manual - Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the bypass shall cause an immediate transfer of the critical AC load from the inverter to the bypass source. The input converter, inverter, and battery charging operations shall continue to operate, provided the control enable switch is in the "On" position.

(D) Performance Requirements.

System

- Configuration. The UPS system shall be a minimum 10 kVA, upgradeable to a 12-bayframe system, 12.0 kVA to 16 kVA.
- Isolation. Input to output isolation shall be provided, via the output transformer, regardless of operating mode. (UPS or bypass)
- Remote Stop. The UPS shall provide provisions for remote stop capability.

AC Input to UPS

- Voltage Configuration: 240/120 VAC nominal, single-phase, 3-wire-plus- ground. The input voltage range shall be 80V to 100V line to neutral.
- Frequency: 40 to 70 Hz.
- Input Current Distortion: 5% THD maximum at full load.
- Input Power Factor: 0.98 lagging at 100% rated load.
- Inrush Current: 150% of full load input current maximum for 3 cycles.
- Surge Protection: Sustains input surges without damage per criteria listed in IEEE C62.41, Category B.

AC Output

- Voltage Configuration: 240/120 VAC, single-phase, 3-wire-plus-ground.
- Voltage Regulation: +/- 3% steady state.
- Frequency Regulation: 60 Hz, +/- 0.5%.
- Frequency Slew Rate: 5.0 Hertz per second maximum.
- Bypass Frequency Synchronization Range: +/- 5.0 Hertz.
- Voltage Distortion: 3% total harmonic distortion (THD) maximum into a 100% linear load, 7% THD maximum into a 100% non-linear load with crest factor ratio of 3:1.
- Load Power Factor Range: 0.5 lagging to 1.
- Output Power Rating: Rated kVA at: 0.7 lagging power factor.
- Overload Capability: >100% - 110% indefinitely, 111% -150% for 10 seconds, 151% - 200% for 0.25 seconds. The load shall be transferred to bypass when any of the above conditions are exceeded. >201% for min. 2 cycles, then shut down of UPS. Immediate shutdown into a short circuit.
- Voltage Transient Response: +/- 7% maximum for any load step up to and including 100% of the UPS rating.
- Transient Recovery Time: To within 1% of steady state output voltage within 96 milliseconds.

Batteries

- Internal Battery: The battery shall consist of gas recombination, valve regulated, lead acid cells. Flame retardant batteries shall be provided, which renders the UPS suitable for installation inside a computer room per requirements of UL Standard 1778.
- Reserve Time: (with ambient temperature between 20 and 25 deg C) The UPS shall contain an internal battery system to provide a reserve time of 20 minutes at 100% load with an equal number of power and battery modules fitted. The UPS shall contain provisions to fit additional internal battery modules. The UPS shall also interface with an external battery cabinet to extend reserve time capabilities.
- Battery Recharge: To prolong battery life, the UPS shall contain temperature-compensated battery charging. When equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries to 90% charge in three to five hours at nominal input voltage and nominal ambient temperature.
- Battery Design Life: Battery shall have a minimum 10-year design life.

Environmental Conditions

- Ambient Temperature. Operating UPS 0 deg C to +40 deg C; battery 20 deg C to 25 deg C for optimum performance. Storage: UPS -20 deg C to +60 deg C; battery -20 deg C to 25 deg C for maximum 6 months.
- Relative Humidity. Operating: 5 to 95% non-condensing. Storage: 5 to 95% non-condensing.
- Altitude. Operating: To 10,000 feet. Derating or reduced operating temperature range required for higher altitudes. Storage: To 30,000 feet.
- Audible Noise. Noise generated by the UPS during normal operation shall not exceed 62 dBA measured at 1 meter from the surface of the UPS.
- Electrostatic Discharge. The UPS shall be able to withstand a minimum 15 kV without damage and shall not affect the critical load.

(E) User Documentation. The specified UPS system shall be supplied with one (1) user's manual. Manuals shall include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step by step operating procedures, and routine maintenance guidelines.

(F) Warranty. The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for two (2) years. With start-up provided by the manufacturer or the manufacture's authorized agent, the warranty shall cover all parts and onsite labor for two (2) years from the manufacturer start-up, accepted by the Department.

(G) Quality Assurance. Manufacturer Qualifications. A minimum of 20 years of experience in the design, manufacture, and testing of solid-state UPS systems is required.

(H) Factory Testing. Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on the internal battery to guarantee rated performance.

- (I) Fabrication. All materials and components making up the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.

Wiring. Wiring practices, materials, and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70) and other applicable codes and standards.

Cabinet. The UPS unit shall be comprised of a power module, battery module, control module, system interconnect module, and user interface module housed in a single free-standing enclosure and meets the requirements of IP20. The UPS system shall be designed such that the battery modules may be installed into any module bay in the cabinet and power modules into any module bay in the top half of the cabinet. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Casters and leveling feet shall be provided. UPS cabinet dimensions shall not exceed 20 inches wide, 29 inches deep, and 53 inches high (12 bay frame).

Cooling. The UPS shall be forced air cooled by internally mounted fans.

(J) Input Converter.

- General. Incoming AC power shall be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor and input current distortion correction.
- AC Input Current Limit. The input converter shall be provided with AC input over current protection.
- Input Protection. The UPS shall have built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy surges introduced on the primary AC source and the bypass source. The UPS shall sustain input surges without damage per criteria listed in IEEE C62.41, Category A & B. The UPS cabinet shall contain an input breaker sized to supply full 16kVA rated load and to recharge the battery at the same time.
- Battery Recharge. To prolong battery life, the UPS shall contain temperature-compensated battery charging. When an equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries to 90% charge in six hours at nominal input voltage and nominal ambient temperature.
- Charger Output Filter. The battery charger shall have an output filter to minimize ripple current into the battery.

(K) Inverter.

- General. The inverter shall convert DC power from the input converter output, or the battery, into precise regulated sine wave AC power for supporting the critical AC load.
- Overload. The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses. The load shall be transferred to bypass when any of the above conditions are exceeded.
- Maximum Load Alarm. The user can set the alarm point to a value less than 100% rating such that the UPS will alarm before an overload condition or loss of redundancy is reached.
- Output Frequency. The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall hold the inverter output frequency to +/- 0.5% for steady state and transient conditions. The inverter shall track the bypass continuously providing the bypass source maintains a frequency within the user selected synchronization range. If the bypass source fails to remain within the selected range, the inverter shall revert to the internal oscillator.
- Output Protection. The UPS inverter shall employ electronic current limiting.
- Battery over Discharge Protection. To prevent battery damage from over discharging, the UPS control logic shall control the shutdown voltage set point. This point is dependent on the rate of discharge.

(L) Display and Controls.

- General. The front panel will consist of multiple status LEDs, switches, and a four line by twenty character LCD display for additional alarm/configuration information. All mimic display LEDs shall be green in color and indicate the following: AC Input, On Battery, Load On/Off, On Inverter, On Bypass. The UPS fault indicator is used with additional indicators and audible alarms to notify the user that a UPS fault condition has occurred. The color of the fault indicator LED shall be amber in color and indicate the following: Replace Battery Module, Replace Power Module, Replace Control Module, On Bypass, Low Battery, OverTemp Warning, and UPS Shutdown. If there is a fault condition, the UPS shall attempt to maintain conditioned power to the load, or at minimum transfer to bypass. There shall also be indication on each module should the module fail and need to be replaced. In addition to a visual fault signal, the UPS shall also record fault occurrences in a rolling event log. The event log on the standard unit shall record up to 255 occurrences, with the oldest events discarded first, etc. The user shall have access to the event log through the LCD display. Every alarm and/or event recorded in the event log will contain a time and date stamp.

- Audible Alarms. The volume of all audible alarms shall be at least 65dBA at a distance of one meter (three feet). An audible alarm shall be used in conjunction with the LED/LCD indication to indicate a change in UPS status. The audible alarms shall enunciate for utility line loss, low battery (while on battery), and all other alarm conditions. For all alarm conditions, the user must look at the display to determine the cause of error/alarm. All alarm tones shall be a continual tone until the condition rectifies itself or the alarm is silenced. Once silenced, the audible alarm shall not sound until a new alarm condition is present.
- Alarm Silence Button. In addition to the load on/off switch, the user interface shall include an audible 'Alarm Silence' switch. If the alarm silence switch is pressed for one second, all current audible alarms shall be disabled. If a new alarm occurs, or a cancelled alarm condition disappears and then re-appears, the audible alarm is re-enabled.
- LCD Display. The LCD display shall be used to provide information to the user. The display shall also be used to program ALL information (voltage, frequency, etc.) into the UPS.

(M) Automatic Battery Test. The UPS shall initiate an automatic battery testing sequence periodically, at a programmed day and time of day, selectable by the end user. The user will be able to select the interval of the battery test and will be able to select 1, 2, 3, 4, or 6-week intervals, or can select to disable the automatic battery test.

Should a failure of the battery occur, the UPS will immediately return to normal mode and fault signals (visual, audible, and remote via serial) shall be communicated. No audible or remote (via serial/contact closures) indication of the battery test shall be communicated during the duration of the automatic battery test.

The automatic battery test factory default settings shall be enabled at a two-week interval and to occur on Wednesdays at 0600 hours (based on the twenty four hour clock).

(N) Remote Emergency Power Off (REPO). The remote emergency power off function (REPO) shall allow the user to disable all UPS outputs in an emergency situation. The REPO, in order to be flexible, shall be able to interface with either normally open (N.O.) or normally closed (N.C.) systems. The REPO shall be activated when a pair of 'SELV' contacts, external to the UPS, are activated. The REPO connection shall be through a simple terminal block type connector.

The REPO function shall not operate if no system control modules are present in the UPS or if the manual bypass switch is in the bypass position. The user must also supply a means of interfacing with the REPO circuit to allow disconnecting the UPS input feeder breaker to remove all sources of power to the UPS and the connected equipment to comply with local wiring codes/regulations.

Regardless of the UPS mode of operation when the REPO is activated, the UPS output shall not be re-enabled until the following occurs:

- REPO contacts are reset (closed if N.C. contacts are used and open if N.O. contacts are used)
- Input circuit breaker is closed
- Control enable switch is turned on
- User interface on/off switch is depressed

(O) Bypass.

General. A bypass circuit shall be provided as an integral part of the UPS. The bypass shall have an overload rating of 300% rated full load for 10 cycles and 1000% for sub-cycle fault clearing. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.

Automatic Transfers. The transfer control logic shall automatically activate the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

- Inverter overload capacity exceeded
- Inverter over temperature
- UPS fault condition

For inverter overload conditions, the transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if one of the following conditions exists:

- Inverter/Bypass voltage difference exceeding preset limits ($\pm 15\%$ of nominal)
- Bypass frequency out of preset limits ($\pm 5\%$ of nominal frequency)

Automatic Retransfer. Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

- Bypass out-of-synchronization range with inverter output
- Overload condition exists in excess of inverter full load rating
- UPS fault condition present

Manual Transfer. In addition to the internal bypass function, the UPS shall have a manual bypass function. The manual bypass function shall be provided via a switch mounted on the bottom-front of the UPS, removal of the lower front bezel shall be required. The actual AC break time between inverter and bypass shall be less than four milliseconds.

The manual bypass shall also be a partial 'wrap-around' bypass, and shall be configured to wrap around the rectifier, battery charger, inverter, and battery in the same manner as the automatic bypass. The manual bypass shall not wrap around the EMI filtering, overcurrent protection or isolation transformer.

The UPS shall initiate an audible alarm upon transfer to manual bypass. The audible alarm shall be capable of being silenced by the user. The alarm shall continue to sound (unless silenced) while in bypass mode. This shall provide a reminder to the user that the load continues to be powered from utility supply alone.

Internal Battery. Flame retardant, valve regulated, gas recombination, lead acid batteries shall be used as a stored-energy source for the specified UPS system. The battery shall be housed in separate replaceable modules that slide into any open bay of the UPS cabinet and sized to support the inverter at rated load and power factor, in an ambient temperature between 20° and 25°C, for a 30 minute reserve time. The expected life of the battery shall be 10 to 15 years or a minimum 250 complete discharge cycles. For extended battery reserve time, additional battery modules may be added, if the frame size allows, external battery cabinets shall be also be available as an option.

(P) Communications. The UPS shall allow for flexibility in communications. The UPS shall be able to communicate through two communications ports simultaneously; the media of either communications port may change without affecting the operation of the UPS. The use of relay contacts shall not affect the operation of the two communications ports.

Relay Contacts. The relay contacts shall be available through at least one DB-9F communication connector and shall include a system of hardware and software that enables the UPS to communicate with multiple computers regarding UPS status and to execute an orderly shutdown sequence to protect systems and data. The UPS shall communicate via relay contact closure the following information: Low Battery, On Battery. One connector to provide relay contacts shall be fitted on all UPS models as standard (designated comm port 1). Relay contacts shall be rated 48 VDC, 1 A. Additional signals (such as on bypass and summary alarm) shall be provided. The following pins for comm port 1 shall be used:

- Low Battery (normally open)
- Shutdown in battery mode (5 – 12 VDC for 1.5 in sec)
- Common
- Lower Battery common
- On Battery (normally open)
- On Battery common

Network Communications. The Contractor shall install an ethernet network communications interface card to provide SNMP V3 communication over a local area network. 10/100Mbps Ethernet support shall be supported to transmit SNMP alarm data over the ITS fiber optic network. The Contractor shall connect the UPS network interface card to the ITS network switch as shown on the plans. The Contractor shall use a Cat6 Ethernet cable to make the connection. The Contractor shall integrate the SNMP data from the UPS to the IDOT network management software server. IDOT uses SolarWinds for their network management software. The Contractor shall coordinate the integration with the IDOT Electrical Maintenance Engineer and the IDOT network administrator. The Contractor shall provide the Engineer a list of alarms the approved UPS can transmit over SNMP V3 protocols. IDOT Electrical Maintenance Engineer will select the alarms that shall be integrated.

UPS Status Information. The SNMP V3 software shall be able to retrieve all status information present in the UPS (and available on the display). Retrieval of data shall be through either serial communications or through a network connection.

External Battery Cabinets. The UPS shall have the capability to add external battery cabinets to the base product. These external battery cabinets with chargers and front access battery terminals, shall be installed in parallel to provide backup times as required. The connections between the UPS and the extended battery cabinets shall contain DC power only. All of these shall be able to be connected or disconnected safely by the user without interrupting power to the load.

Modular Extended Battery Cabinets. The Modular Battery Cabinet shall be pre- configured with 1 to 12 Battery Modules installed. Battery Cabinets with less than 12 Battery Modules shall be field upgradable using the standard Battery Module Expansion Kit. Each Extended Battery Cabinet shall include (2) Battery Cards and (2) 10-foot communications cables. Each Extended Battery Cabinet shall require one unused card slot on the UPS and a maximum of four Extended Battery Cabinets shall be used with one UPS.

Maintenance Bypass Cabinet with optional COD. The Maintenance Bypass Cabinet shall provide complete “wrap-around” protection and shall allow the UPS to be pulled from service without interrupting power to the loads. The Maintenance Bypass Cabinet controls shall include a manual break before make bypass transfer switch, UPS input disconnect switch, and a branch rated output circuit breaker. The Maintenance Bypass Cabinet controls shall be located behind a lockable front panel to provide operation security.

Maintenance Bypass Cabinet models shall be available with and without an isolation transformer in the bypass path. The Maintenance Bypass Cabinet with Transformer option shall provide isolation in the bypass path as well as total flexibility with utility voltages.

Every Maintenance Bypass Cabinet model shall be able to be ordered with up to 10 output options. These options shall include receptacles as well as conduit fittings with branch rated breakers. Each receptacle or conduit fitting shall include a power available indicator lamp.

(Q) Field Quality Control. The following inspections and test procedures shall be performed by factory trained field service personnel during the UPS start-up.

Visual Inspection

- Inspect equipment for signs of shipping or installation damage.
- Verify installation per drawings.
- Inspect cabinets for foreign objects.
- Verify neutral and ground conductors are properly sized and configured.

Mechanical Inspection

- Check all power modules are correctly fitted.
- Check all battery modules are correctly fitted.
- Check all terminal screws, nuts, and/or spade lugs for tightness.

Electrical Inspection

- Confirm input voltage and phase rotation is correct.
- Verify bypass voltage jumper is correct for voltages being used.

(R) Unit Start-Up and Site Testing. The manufacturer's field service personnel shall provide site testing if requested. Site testing shall consist of a complete test of the UPS system and the associated accessories supplied by the manufacturer. A partial battery discharge test shall be provided as part of the standard start-up procedure. The test results shall be documented, signed, and dated for future reference.

(S) Manufacturer's Field Service.

Service Personnel. The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory trained Customer Engineers dedicated to the start-up, maintenance, and repair of UPS and power equipment. The organization shall consist of factory-trained Customer Engineers working out of District Offices in most major cities. An automated procedure shall be in place to ensure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, and 365 days/year. If emergency service is required, call back response time from a local Customer Engineer shall be 20 minutes or less.

Replacement Parts Stocking. Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country. Local Customer Engineers shall stock replacement spare parts with back up available from District Service offices and the manufacturing location. Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

UPS Maintenance Training. Maintenance training courses for customer employees shall be available from the UPS manufacturer. This training is in addition to the basic operator training conducted as a part of the system start-up.

The training course shall cover UPS theory, location of subassemblies, safety, battery considerations and UPS operational procedures. The course shall include AC to DC conversion and DC to AC inversion techniques as well as control and metering, troubleshooting and fault isolation using alarm information and internal self-diagnostics shall be stressed.

CONSTRUCTION REQUIREMENTS

All materials shall be furnished with the most recently developed product versions that meet or exceed these specifications. It is the Contractor's responsibility to ensure that all components comply with the performance requirements specified herein, within the plan set, and/or in the Contract. In case of conflict between the requirements of the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the National Electrical Manufacturers Association (NEMA), the Underwriters Laboratories (UL) Incorporated, and local codes, permitting requirements, and requirements contained herein, within the plan set, and/or in the Contract, the most stringent specifications shall apply. All materials and practices shall comply with the applicable requirements of the United States Department of Labor's (USDOL) Occupational Safety and Health Standards.

Contractor Requirements. The Contractor is solely responsible for all designs, equipment, materials, and services proposed. The Contractor is responsible for verifying the completeness of the materials required and the suitability of devices used to meet these specifications. The Contractor shall provide and install, without claim, any additional equipment required for operation as required herein, within the plan set, and/or in the Contract.

The Contractor shall possess the qualifications, skills, and experience necessary to accomplish the work required herein, within the plan set, and/or in the Contract to construct, furnish, and install equipment shelter. The Contractor who performs the lightning protection system installation shall have documented experience and competency in the proper design and installation of lightning protection systems and be certified by the Lightning Protection Institute (LPI). This requirement is in addition to the normal contractor licensing requirements of the State of Illinois.

General Installation. Equipment shelter installation shall meet or exceed the design requirements contained herein, within the plan set, and/or in the Contract. The Contractor shall be responsible for identifying local facilities for the delivery, storage, and legal disposition of post-installation materials. The Contractor shall also be responsible for locating and protecting any existing underground utilities at the work site. The Contractor shall repair any damage to existing installations at no additional cost to the Department.

The Contractor shall submit detailed drawings of the proposed installation to the engineer for approval. All concrete work shall be performed in accordance with IDOT's Standard Specifications for Road and Bridge Construction.

The Contractor shall supply a concrete mix design to the engineer for approval. The concrete mix design shall be signed and sealed by a professional engineer registered in the State of Illinois. When the concrete is delivered on site, the Contractor shall provide the actual mix design to the engineer for approval. If the concrete mix design does not meet the requirements of the signed and sealed concrete mix design, the Contractor shall not be permitted to use the concrete. At a minimum, the Contractor shall take five samples (i.e., cylinders) of concrete from each truckload. The Contractor is responsible for performing concrete break tests on the samples at 3-, 7-, 14-, and 28-day intervals. The Contractor shall use a fifth sample as a spare in the event that one of the other samples becomes damaged. The Contractor shall submit all concrete break tests in writing to the engineer. No construction or installation may begin on a concrete foundation until the concrete break tests indicate that the concrete has reached its design strength.

The Contractor shall also perform slump and temperature tests for each truckload. If the concrete is beyond the limits of the design or IDOT requirements, the Contractor shall not be permitted to use the concrete. Some sites may be located in environmentally sensitive areas and require special treatment of the waste products associated with drilled shaft excavations.

Electrical Installation. The Contractor shall be responsible for connecting electrical power to the shelter. Routing of wires and cables shall be neat and orderly. Electrical connectors and all costs associated with providing power shall be the Contractor's responsibility.

The Contractor shall provide all electrical connections from the existing electrical service to the shelter's receptacles. The receptacles, switches, and light fixtures shall be wired using a minimum of #12 AWG copper wires. All wire shall be run in a minimum 0.50-inch electrical metallic tubing (EMT). The electrical loads shall be divided among as many load centers as necessary to contain the quantity of circuit breakers required to protect the communication shelter facility. The load centers shall contain separate, appropriately sized circuit breakers for the HVAC units as required for each major branch, receptacle, and remaining location in the 42-circuit panel. Power outlets consisting of quad receptacles shall be mounted on Unistrut fastened to the overhead cable tray, above the equipment cabinet racks. In addition, a minimum of eight duplex outlets shall be mounted in the equipment shelter walls as shown on the contract drawings: two on each wall. A separate 20-amp single-pole circuit breaker shall be provided to protect the lighting circuits.

All electrical conduits shall be installed in a neat and orderly fashion. Symmetry shall be employed wherever possible. The main power shall enter the equipment shelter at a primary power switch to allow for the disconnection of commercial power and shall then be routed to an automatic transfer panel that will switch to emergency generator power in the event commercial power is lost. Emergency generator power shall also enter the equipment shelter through a power switch prior to connection to the automatic transfer panel. The main power from the automatic transfer switch shall be routed to a manual transfer switch with the mobile emergency generator connection installed on the outside of the shelter. The emergency generator connection shall allow IDOT personnel to power the site from a portable generator in the event that both the commercial power and emergency power is lost. The resulting main power shall then be routed to a 42-circuit distribution panel and through the associated AC SSD devices as described herein, within the plan set, and/or in the Contract.

Grounding. The grounding system shall comply with the specifications detailed herein, within the plan set, and/or in the Contract, and with National Electrical Code (NEC) requirements and National Fire Protection Agency (NFPA) standards detailed in NFPA-70, as well as all local grounding-related building codes.

The equipment shelter's exterior grounding system shall function as the primary ground sink. The grounding system for the surge protection devices shall be installed according to the manufacturer's recommendations and shall be connected to the grounding system with no less than the minimum wire size specified herein, within the plan set, and/or in the Contract, or the manufacturer's recommended wire size, whichever is larger, typically a #2 AWG stranded copper wire. The grounding system shall be bonded at a single point so that the communication cables, AC power, generator, signaling equipment, and equipment frames are connected by the shortest practical route to the grounding system. Lead lengths from each device to the device shall be protected and grounding shall be minimized for all devices according to installation requirements. The SSD device's lead lengths shall not exceed 10 inches. Any variance from the IDOT requirements shall be submitted in writing and pre-approved by the engineer for acceptance.

All below ground connections shall use an exothermic bonding process.

All above ground exterior connections shall use an exothermic bonding process to bond ground conductors on the exterior of the equipment shelter. Grounding connections to interior ground bus shall be mechanical connections using two bolts on a double lug connector. After a firm connection has been made to the connectors, an application of an anti-oxidant compound shall be required.

All connections to fence posts shall be exothermic bonds. Connections to top rails and fabric shall be mechanical connections. After a firm connection has been made to the connectors, an application of an anti-oxidant compound shall be required. See IDOT Fence Grounding Specifications for additional details.

Connection of conductors to interior equipment, such as panels and cable trays, shall use tow bolts on a double lug connector, or clamps appropriate to the size and type of wire, and the requirements of the equipment being grounded. Wires connected to lugs or clamps shall be crimped and soldered for reliable electrical contact. All non-conducting surface coatings shall be removed before each connection is made. Application of an anti-oxidant compound shall be required. Star washers, or another means that accommodates the fasteners used, shall be installed to ensure reliable electrical connections. The objective is to provide reliable, low-maintenance electrical and mechanical connections that will not deteriorate.

Ground Conductor Bending. Ground conductors shall be downward coursing and vertical and shall be as short and straight as possible. The minimum bending radius for interior shelter grounds shall be 8 inches. Sharp bends and multiple bends in conductors shall be avoided in all cases. Any deviation shall be submitted in writing and pre-approved in writing by the engineer.

Interior Grounding. Contractor shall install One "halo" ground system consisting of an interior copper ground bus bar 15 feet x 0.25 inch x 2 inch, approximately 6 inches below the ceiling, with a vertical #2 AWG stranded copper drop through the floor at each corner, with a sufficient length of coiled wire slack at the drop to allow attachment to an exterior ring ground system.

The cable trays shall be mechanically connected to the upper interior perimeter ground using #2 AWG stranded copper wires with bolted terminal connectors at the cable tray ends. All points where cable tray sections meet shall be made electrically continuous by use of a short jumper wire with terminals attached at each end. All other metallic objects, such as door frames and doors, air conditioners, alarm systems, wall-mounted communication equipment, etc., shall be directly bonded to the closest interior upper or lower perimeter ground with the shortest possible #2 AWG stranded copper wire. The door shall be bonded to the doorframe using flexible welding cable. A bond shall be made between the lower and upper internal perimeter grounds using #2 AWG stranded copper wires at each corner of the room and shall continue to provide a bond between the internal and external grounding systems. Bonds made to electrical equipment shall be completed using mechanical connections to bus bars or grounding lugs. Bonds made to other equipment shall be made with mechanical lugs whenever possible but shall always be made to bare metal that is covered with anti-oxidant compound after installation.

Exterior Grounding. The shelter's exterior grounding system shall consist of a ground ring consisting of four ground rods placed a minimum of approximately 2 feet from the building foundation corners. Ground ring shall extend to encircle the generator foundation with two more ground rods installed halfway between the fence and generator. Pre-fabricated 10-inch ground inspection wells shall be installed at every exterior ground rod; the top of the ground rod within the inspection well shall be 6" below grade. All ground rods shall be bonded together using #4/0 AWG stranded copper wires and an exothermic bonding process. The bonding wires shall be buried a minimum of 2 feet below the finished grade. The following items shall also be bonded to the shelter's external grounding system using #4/0 AWG stranded copper wires:

- Ground rods provided by power or telephone utilities for grounding of AC power or surge protection devices, as permitted by local codes; and any metal object greater than 4 ft².
- There shall be two connections made to fence grounding
- There shall be a connection to the SDD
- There shall be two connections to the lightning protection system
- There shall be four connections to the shelter's halo ground

Fence Grounding. The fence shall be electrically grounded to prevent shock hazards from lightning or other electrical sources. Two (2) metal fence or gate post located adjacent to the exterior ground ring shall be grounded to one of three ground rods with #4/0 AWG stranded copper wire. The ground wire shall be buried two feet below finished grade. The gate and gatepost shall be bonded together with a flexible ground, such as welding cable wires. All connections to the ground wire shall be exothermically bonded. The fence's top rail shall be connected to the post.

Grounding Lead. Ground leads shall be #4/0 AWG stranded copper wires and shall be required for all above and below ground grounding wire installations.

Site Preparation. IDOT shall provide site space for shelter installations. The Contractor shall install the shelter and other necessary facilities and equipment in the provided space and make all necessary electrical and mechanical connections. General site preparation, specific building tie-downs, and landscaping shall be the Contractor's responsibility. The Contractor shall comply with all environmental protection requirements and shall contact the engineer for specific information regarding shelter site preparation. The Contractor shall provide a weed barrier mat and concrete cover in the fenced-in compound as shown in plans.

Land Clearing. The Contractor shall be responsible for the clearing of brush, trees, or any other obstructions, including the removal of asphalt or concrete. The Contractor shall coordinate with the engineer as to the extent and schedule for all land clearing activities to ensure that there is no interference with concurrent operations at the site. Any tree stumps resulting from clearing shall be grubbed. The Contractor shall comply with all environmental protection requirements. The engineer shall pre-approve in writing any site clearing and tree trimming.

Debris Removal. After installation, inspection, and approval by the engineer as specified herein, within the plan set, and/or in the Contract, the Contractor shall remove all onsite debris, backfill, and compact all excavations, and return the grounds to their original condition. The Contractor shall comply with all environmental protection requirements.

Sanitary Provision. The Contractor shall provide and maintain neat and sanitary accommodations for the use of its employees as required for compliance with the Illinois Department of Health and all applicable county regulations. No nuisances shall be permitted.

Excess Garbage and Clutter Removal. The trash generated from the installation, including lunch bags and drinks, shall be stored in a neat manner until disposed of properly. The Contractor shall be responsible for removing and legally disposing of trash in a timely manner. Trash shall not be allowed to blow around or away from any construction site.

Fencing. The Contractor shall include and install galvanized steel fencing to provide complete perimeter security at the shelter site. The fence and access gate are identified in the Plans and identified under separate items. A hardened, four-digit combination gate lock shall be provided by the Contractor, and the combination shall be set to the IDOT specifications.

Weed Prevention. The fenced compound area at all sites shall be treated with an IDOT-approved herbicide and covered with weed prevention material. The Contractor shall apply gravel or crushed rock to the area to a depth of 6 inches, so that mowing and other requirements are minimized, unless otherwise specified herein, within the plan set, and/or in the Contract. A woven plastic weed barrier shall be placed on the ground before gravel installation. The barrier shall be installed according to the manufacturer's recommendations. The manufacturer's recommendations shall describe the minimum 10% overlap for each section and the method of securing the edges of the mat with stakes. See gravel section detail on contract drawings.

Compound Concrete Pad. The Contractor shall install a concrete pad within the fenced compound as per plans.

Documentation. Operation and maintenance manuals shall be provided for all equipment systems installed associated with the communications shelter, including, but not limited to: HVAC system, Generator Set, Automatic Transfer Switch, Manual Transfer Switch, Surge Suppression Device, Contact Closure SNMP Gateway, MODBUS RTU SNMP Gateway, Building Access Control System, and UPS. A minimum of two (2) hard copies shall be provided. This material shall also be furnished in PDF format via USB drive.

Warranty. The Communications Shelter shall carry a manufacturer's warranty of one year from the date of final IDOT acceptance. Said warranty shall be transferable from the Contractor to the IDOT upon the anniversary of the Contractor's one-year warranty period.

Local Field Acceptance Tests. Perform local field acceptance test in accordance with the approved test procedures and furnish a report of each test and for each system described herein.

- (A) Integration Testing. Integration testing of the SNMP data into the IDOT network management software shall consist of exercising the overall SNMP data transmission from the Communications shelter locally to verify all is operational and shall be done in accordance with the equipment Manufacturer's recommended System Testing. Contractor shall ensure the SNMP data is transmitted to the SolarWinds network management server, processed, and the appropriate alarms are emailed and texted to the designated Department personnel. The Contractor shall provide a testing plan to test the alarms locally with the Engineer and a IDOT EMC Engineer to ensure the alarms are in fact transmitted and received through text and email on their personal devices.

Inspection and Verification. The inspection shall be performed by the Contractor and witnessed by the Engineer or a designated IDOT representative. The Contractor shall notify the Engineer at least 10 calendar days prior to completion of the installation. Following shelter equipment installation, the Contractor, in conjunction with the engineer or designated IDOT personnel, shall verify that all equipment is correctly installed and functional.

For ground system inspections, the Contractor shall notify the Engineer at least 2 calendar days prior to completion of the installation. Below-grade ground installations and ground connections shall not be backfilled until inspected and approved by the Engineer. All test results shall be recorded in a standardized format to be determined by the Contractor and approved by the Engineer prior to testing. All recorded test report data shall be dated, witnessed, and signed by at least one representative of IDOT and the Contractor. The Contractor, at no cost to IDOT shall remedy all deficiencies.

- (A) Mechanical Inspection. Equipment that is to be mounted to the shelter walls shall be inspected to ensure adequate support has been provided. The HVAC system shall be tested for adequate heating, cooling, and dehumidification. The building shall be inspected for the proper sealing of conduit ports, cables, and ground wire penetrations. The Contractor shall be responsible for correcting any deficiencies.
- (B) Electrical Inspection. The shelter lights and smoke detectors shall be verified for proper operation. The Contractor shall verify proper power load balances and provide a report to the engineer prior to acceptance of the site. The Contractor shall be responsible for correcting any deficiencies.
- (C) Grounding Inspections. The grounding system shall be inspected for proper connection types, tightness, workmanship, as well as conformance to the approved design. Any exothermic bonds that are deemed unsatisfactory shall be repaired with new bonds. Any mechanical connections that are deemed unsatisfactory shall be repaired or replaced.
- (D) Site Inspection. The site shall be inspected and shown to be free of debris, and proof that excavations are backfilled and restored shall be provided.
- (E) Performance Testing. Following the completion of all acceptance testing and inspections, the installed site shall be subjected to a minimum 30-day performance period. For the purpose of a successful performance period, failure of operation is defined as the failure of a major site component (i.e., HVAC systems, etc.). Degradation of performance is not a failure if function and proper operation is maintained. Upon acceptance of the test criteria by the Engineer, the 30-day performance period shall begin. Performance verification shall be determined by the Department.

This requirement shall be accomplished during a period of time not to exceed 45 consecutive calendar days after equipment installation, testing, and inspection. If a successful performance period cannot be accomplished within 45 consecutive calendar days after the equipment testing and inspection, IDOT reserves the right to deem the Contractor in default and enforce the provisions set forth in the contract.

Method of Measurement. The ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE shall be measured for payment on a lump sum basis for all work furnished, installed, configured, warranted, made fully operational, and tested according to the specifications detailed herein, within the plan set, and/or in the Contract.

ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE does not include work associated with site grading, access road, or fencing around the compound, nor does it include the CCTV dome cameras and associated equipment.

Basis of Payment. This work will be paid for at the lump sum price for ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE.

CABINET, MODEL 334

Description. This work shall consist of furnishing, installing, and testing a ground-mounted Model 334 cabinet at locations as shown in the Plans. The cabinet shall be used to house DMS controller equipment and any associated Ethernet switches, and other communications devices or infrastructure as shown on the plans. The furnishing and installation of DMS controller equipment shall be paid for separately.

Materials. Materials shall be according to the following.

General

Cabinet, Model 334 shall be a durable, weatherproof enclosure, constructed of 3/16 inch thick aluminum or 1/8 inch thick aluminum lined with bullet resistant fiberglass panels that shall be UL listed and tested for UL752 Level 3 with a nominal thickness of 1/2 inch maximum, and a nominal weight of 5.0 lbs. per square foot maximum. The cabinet shall have a nominal outside dimension of 66 inches height x 24 inches wide X 30 inches deep. The cabinet shall consist of the following components: double door each equipped with a Corbin # 2 Brass lock or equal for front and rear cabinet entry, housing, mounting cage, rack mounted sliding laptop shelf, power distribution assembly/service panel (including RFI filter surge suppression, outlets, circuit breakers, terminal blocks, and neutral and ground bus bars), thermostatically controlled fan, door switch, LED light, power data unit, and all necessary mounting hardware and wiring, and other equipment, as shown in the Plans and specified in these special provisions.

All bolts, nuts, washers, screws, hinges, and hinge pins shall be stainless steel unless otherwise specified. All equipment under this item shall be in accordance with Section 1074.03 of the Standard Specifications except as modified herein.

Cabinet Components

The cabinet housing mounting cage, and all components applied in this project shall conform to those of the Model 334 cabinet provisions of the "Transportation Electrical Equipment Specifications" (TEES) 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 of air per minute. 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 100 cubic feet of free air delivery per minute of ventilation. The fan shall be thermostatically controlled and activated when the temperature inside the cabinet is between 32° F and 140°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 inch 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.

The power distribution assembly shall consist of a load center, one 60A, 240V, two-pole main circuit breaker, one 40A, 240V, two-pole secondary breaker, one 35A, 240V, two-pole secondary breaker, four 15A, 120V single pole secondary circuit breakers, two duplex outlets 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. 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.

One side panel shall be provided and mounted on the right cabinet sidewall. In viewing from the front door, 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. 4/0 conductors shall be furnished for the service terminal block. The terminal block shall be rated for 60 A at 600 V peak, minimum.

The 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, at a minimum, a surge arrestor, which shall reduce the effect of power line voltage transients and be mounted to the service panel. The surge arrestor and RFI filter shall meet UL 1449 requirements and 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.

Power Data Unit. The power data unit shall be installed in the cabinet and allow the DMS controller to be remotely rebooted. The power data unit shall meet the minimum requirements:

- 1) Minimum of eight individually switched 120V, 15-amp outlet circuits
- 2) Ethernet Interface: 10/100 autosensing, static IP, TCP port selectable, RJ-45 w/internal FCC filtering
- 3) Operating Temperature: -30°F to 170°F
- 4) Power Dissipation: 3.9W Typ Max (all on) <3W idle
- 5) Power Fail Hold-Over: 350ms minimum (all relays on)
- 6) Surge protection of 3600 J metal oxide varistor

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).

Ground and Neutral Bus Bars. Separate ground and neutral bus bars, mounted on the equipment panel shall be provided. The neutral bus bar shall be isolated from the cabinet and equipment ground. Compression lugs, plus 2 spare lugs, shall be sized to accommodate the cables with the heads of the connector screws painted green for ground connections and white for neutral connections.

Each cabinet shall be equipped with one rack mounted sliding laptop shelf designed to support 20 pounds. Shelf guides shall be designed to allow full extension from the rack frame.

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 existing 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.

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 grounded service conductor 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 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 permanent marker. Marker strips shall be located immediately below the item that they are to identify and must be clearly visible with the items installed.

The cabinet shall be grounded in accordance with the GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8 special provision). A ground well shall be constructed as shown in the plans a minimum of 10' from the existing 334 cabinet foundation. The Contractor shall expose and subsequently backfill the 1" grounding conduit stubbed out from the existing foundation as part of this work in order to complete the grounding system for the cabinet.

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 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 801.04 and 806 Standard Specifications and the GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8) special provision
- Measurement of the voltage at the input panel

Documentation. Shop drawings and wiring lists/diagrams 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 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 in order to provide overall maintenance of this item.

Method of Measurement. This work will be measured for payment in units of each CABINET, MODEL 334 furnished, installed and tested.

Basis of Payment. This work will be paid for at the contract unit price per each for CABINET, MODEL 334 which price shall be payment in full for furnishing and installing the cabinet and all connections, testing, labor, tools, equipment, transportation, and incidentals necessary to complete this item of work.

CLOSED CIRCUIT TELEVISION CABINET

Description. This work shall consist of removing an existing ITS surveillance cabinet IE25A from a high-mast lighting tower, installing a new, larger closed circuit television cabinet in its place, and relocating designated cabinet equipment from the existing cabinet to the new cabinet as shown in the Plans and detailed in this specification.

Materials.

Cabinet. The cabinet shall be a NEMA 4X stainless steel enclosure of minimum nominal dimensions 20" H x 24" W x 8" H. The cabinet shall be fabricated of 14-gauge Type 304 or Type 316L stainless steel. All seams shall be continuously welded and ground smooth with no holes or knockouts. The cabinet shall be fabricated with a rolled lip around three sides of the door and on all sides of the enclosure openings to exclude liquids and contaminants. A stainless-steel door clamp assembly shall ensure a watertight seal. A seamless gasket shall be included to ensure a watertight and dust tight seal. The cabinet shall have provisions for padlocking in the closed position. The cabinet shall be unpainted. Cover, sides, top, and bottom shall have a smooth brushed finish.

The cabinet shall be furnished with a stainless-steel panel backboard panel. Collar studs shall be provided with the cabinet for mounting a stainless-steel backboard panel.

A data pocket of high impact thermoplastic material shall be provided. The nominal dimensions of this pocket shall be 12 inches by 12 inches.

Cabinet Mounting Hardware. All mounting hardware, including U-bolts, bolts, nuts, lock nuts, washers, Unistrut, or other hardware required to secure the cabinet to the high mast lighting tower shall be Type 316 stainless steel.

Power Data Unit. A new power data unit shall be installed in the cabinet as shown in the plans. The power data unit shall be a web-controlled relay and DC power supply to allow for remote switching of power to select devices in the ITS surveillance cabinet. The power data unit shall be mountable on standard 35mm DIN rail. The power data unit shall have 8 Single Pole Double Throw (SPDT) relay outputs, accept power supply voltages between 12-28 VDC and draw a maximum of 6 watts power. The power data unit shall have a web interface accessible from any standard web browser. The power data unit shall have maximum dimensions of 6" x 5" x 3". The operating temperature of the unit shall be at least -30° to 170°F.

Circuit Breakers. Circuit breakers shall be single pole and with amperage rating as shown on the Plans. Breakers shall be suitable for mounting to the equipment panel of the cabinet. Rating of breakers shall be shown on face of breaker. Breaker function shall also be labeled below breakers on front panel. Breakers shall have a rated voltage of 277V AC.

Terminal Blocks. 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. The terminal block shall be rated for 60 A at 600 V peak, minimum.

CONSTRUCTION REQUIREMENTS

General. Prior to any work being performed by the Contractor, the Contractor shall, in the presence of the Engineer and the EMC Engineer, conduct an inspection of the existing cabinet equipment, making note of any parts which are found broken, missing, defective, or malfunctioning. The EMC Engineer will test the equipment as deemed necessary by the Engineer. Any problems noted will be resolved as directed by the Engineer and the EMC Engineer.

The Contractor shall contact the IDOT Electrical Maintenance Engineer a minimum of 2 weeks in advance of planned work to obtain approval for the work and an allowable down time window for the site. The Contractor shall notify the IDOT Traffic Systems Center at 708-524-2145 at the beginning of the approved work date prior to completing any work on site.

The Contractor shall prepare and submit a shop drawing to the Engineer for approval detailing the complete cabinet layout, including all proposed equipment make/models, a wiring diagram, and equipment layout. A plastic laminated cabinet layout diagram, circuit schematic, and bill of materials with catalog numbers used shall be provided in the cabinet data pocket.

Equipment Removal. The Contractor shall remove the existing ITS surveillance equipment from the high mast lighting tower. Prior to removal of the cabinet, the existing power feed to the ITS cabinet site shall be shut off and lockout/tagout. Existing power, fiber, and camera cables shall be disconnected within the cabinet and protected during cabinet removal and reinstallation.

All existing cabinet equipment not being transferred to the new cabinet shall be salvaged back to IDOT, including the cabinet. The Contractor shall assume full responsibility for the equipment during removal, transportation, and shipping/transfer to the Department facility. Equipment shall be removed, boxed in new containers, approved by the Engineer, and delivered to the Department facility. The contractor is responsible for all packaging, transportation, and delivery.

The Contractor shall handle the equipment in such a manner as to prevent damage. Any damage resulting from the removal and/or transportation/shipping of the traffic surveillance equipment to be salvaged shall be repaired or replaced in kind at the Contractor's expense. The Engineer will be the sole judge to determine the extent of damage and the suitability of repair and/or replacement.

Equipment Installation. The new cabinet shall be installed on the high mast lighting power, aligning with the existing cable entry point(s). Existing equipment shall be transferred from the removed cabinet to the back panel of the new cabinet as indicated on the Plans. New equipment, including the power data unit, circuit breakers, and terminal block(s) shall be installed on a standard 35mm DIN rail secured to the cabinet back panel. New power outlets shall be secured directly to the cabinet back panel. Installation of other new equipment in the cabinet, including Layer II network switch and fiber optic patch panel will be paid for separately. After installation of the new cabinet, power, fiber and camera cables shall be pulled back in and reterminated.

Method of Measurement. This work will be measured for payment per each CLOSED CIRCUIT TELEVISION CABINET.

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

LAYER II (DATALINK) SWITCH, FIBER OPTIC TERMINATION PANEL, 12F, and TERMINATE FIBER IN CABINET will be paid for separately.

ATMS INTEGRATION

Description. This item includes integrating all Wireless Vehicle Detection System (WVDS) and Dynamic Message Sign (DMS) installations shown on the plans into the IDOT Advanced Traffic Management System (ATMS). Data from the detector stations and DMS will be collected and integrated via the existing iNET interface to the ATMS. This item includes all software, programming, miscellaneous devices, cabinets, racks, and cables necessary to provide the successful integration of the existing stations in the project to the existing expressway traffic monitoring system. This item shall provide data to the Gateway Traveler Information System (see Gateway Integration special provision).

Work as necessary will be performed at the:

Illinois Department of Transportation
Bureau of Traffic Operations/Electrical Field Office
445 W. Harrison Street
Oak Park, Illinois 60304

Integration. The Contractor shall subcontract with the development and maintenance contractor for the ATMS to perform all ATMS software and hardware modifications. Contact information is:

Parsons
Preston Judkins
650 E Algonquin Rd, Suite 104
Schaumburg, IL 60173
Phone: (847) 485-1062

The ATMS system shall be upgraded and expanded to add all detector stations and DMS shown on the plans. The integration must be made to make this expansion a seamless transition, and function in an identical manner as the existing expressway surveillance. Work under this item includes but is not limited to the following:

- Integrate data from the additional detector stations through the existing iNET interface at the existing rate of once every 20 seconds.
- Create new Vehicle Detection Station (VDS) display, data table, description and control panel display, and travel time tables.
- Modify the existing graphic user interface, report generators, data bases, broadcast feeds (both subscriber and internal), and data tables for the dynamic message sign control.
- Display on the Traffic Systems Center ATMS maps, and all user interfaces the new Roadside Detector stations data (as applicable) including volume, occupancy, speed, vehicle classification (length), and operational status.

- Display the operational status of vehicle detectors on the Traffic Systems Center ATMS maps and all user interfaces.
- Create new segments and groupings used to display travel time and congestion data to the Dynamic Message Signs.
- Provide the Gateway XML data feeds for presentation of the additional data to the Gateway web page and user interfaces (see Gateway Integration special provision).
- Update the Lake Michigan Interstate Gateway Alliance (LMIGA) data feeds for presentation of the additional data to the web page and user interfaces.
- Develop an integration acceptance test plan and conduct said test to verify that all Roadside Detector stations have been properly integrated according to the requirements. This acceptance plan shall conclude with a 30-day burn-in period. During the burn-in period, the subcontractor shall identify and resolve any problems identified with the integration.
- Coordinate with the Roadside Detector manufacturer, ATMS Integration Programmer, and Gateway Integration Programmer.

Method of Measurement. The ATMS Integration shall be measured as lump sum.

Basis of Payment. This item shall be paid for at the contract lump sum price for ATMS INTEGRATION, which price shall be payment in full for the work described for a complete seamless integration of the new vehicle detector stations and DMS into the existing IDOT ATMS System. Acceptance shall be granted after integration and after passing an acceptance test proposed by the Subcontractor, and agreed upon by the Engineer.

CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT

Description.

This work shall consist of furnishing and installing a conventional type round tapered aluminum pole and all required hardware including bolt covers as specified.

Materials.

Pole Shaft

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

Unless otherwise indicated, the pole shall be designed and manufactured to withstand equipment dead loadings of up to and a 350 pound cabinet having an effective projected area of 8 ft², two (2) 5 lb vehicle detection radios with an effective projected area of 0.25 ft², a 7.5 lbs camera having an effective projected area of 1.6 ft² on a single 2-foot arm, and shall also be able to withstand loadings of up to and including the same camera on each of two 4-foot arms oriented at any angle from 45 to 180 degrees apart, meeting the criteria of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals (2015) with 2017 & 2018 Interim Revisions for 120 mph wind zone. These loading requirements shall include all camera and arm orientations possible for the given pole height, up to and including the limits given. Information submitted for approval shall document satisfaction of this requirement.

The mounting heights for the cabinet, camera and detection equipment shall be taken from the bottom of the pole shaft base plate as shown on the plans and shall be obtained with a nominal arm rise of 12 inches as specified elsewhere herein. This shall determine the required length of the pole shaft regardless of the actual mounting method of the pole.

Unless otherwise indicated, poles shall have a 10 inch outside bottom diameter tapering to 6 inch outside top diameter. The shaft shall be designed to accommodate loading of the arm configuration indicated, with a minimum wall thickness of 0.312 inch. Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements. Field drilling of holes will not be allowed.

At the top portion of the shaft, one 1½ inch diameter opening shall be made and one 1¼ inch inside diameter rubber grommet shall be provided, for wiring purposes through the arm(s). The grommet openings shall be at 90 degree angles from the position of the handhole, i.e., there shall be one (1) grommet opening for each shaft, and at 90 degrees apart from the handhole, unless otherwise indicated. For the vehicle detection equipment one 1½ inch diameter opening shall be made and one 1¼ inch inside diameter rubber grommets shall be provided, for wiring purposes 12 inches above the proposed equipment mounting location.

Handhole

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

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

Pole Cap

The top of the pole shaft shall be enclosed with a removable aluminum pole cap of the same thickness as the pole shaft. The pole cap shall be secured in place with 300 series galvanized steel screws. The design of the pole cap shall be such that it shall not permit entry of water into the shaft. A J-hook type assembly shall be provided to allow for cable strain relief.

Base Plate

The bottom portion of the shaft shall be fitted with a base. The base shall be a permanent mold casting of aluminum alloy conforming to current Aluminum Association designations A356 with final temper T6. The base shall be welded to the shaft by the inert gas shielded arc method. All welds shall be free from cracks and pores. All shafts with base plates shall be heat treated after welding. The base shall not be equipped with anchor bolt covers. Four anchor bolt slots shall be provided in the base to accommodate the required bolt circle diameter. Unless otherwise indicated, poles shall have 15 inch bolt circles. The size of the slots shall be 1¼ inch by 2 inches as detailed on the pole drawing.

Conduit Routing

At the bottom portion of the shaft two openings shall be provided to allow for the installation of 2" aluminum mogul conduit body (LB) for routing of cables into/out of the CABINET, MODEL 336S. The openings shall be positioned as shown on the plans. The mogul conduit body (LB), insulated throat bushing, locknut, and neoprene seal gasket shall be included as part of this pay item.

Rodent Guard

The space between the finished top of the foundation and the bottom of the base plate of the pole 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.

Vibration Damper

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

Bundling

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

Vibration Requirements

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

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

Certification and Guarantee

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

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

CONSTRUCTION REQUIREMENTS

Prior to construction and ordering materials, the Contractor shall conduct a survey of the existing pole foundations, as described in SURVEY OF EXISTING ITS INFRASTRUCTURE special provision.

The structure shall be set plumb on the foundation without the use of shims, grout or any other leveling devices under the pole base. The camera arm shall be set at right angles to the centerline of the pavement. This item shall be coordinated with the applicable CABINET, MODEL 336S and CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER, which shall be provided under separate pay items.

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

Method of Measurement.

This work will be measured for payment per each CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT installed.

Basis of Payment.

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

CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER

Description. This work shall consist of constructing a concrete foundation for a closed circuit television camera (CCTV) pole.

Materials. Materials shall be in accordance with Article 878.02 of the Standard Specifications.

CONSTRUCTION REQUIREMENTS

The foundation shall be constructed in accordance with the "Type E" foundation under Highway Standard 878001-11 except as modified herein and as shown in the plans.

Installation. Installation shall be in accordance with Article 878.03 of the Standard Specifications with the following additions:

All anchor bolts shall be according to Article 1006.09, with all anchor bolts hot dipped galvanized over the full length. Four (4) 1 ¼" anchor bolts with 5" hook embedded a minimum of 5 ft. in the foundation, threaded a minimum of 6" with an exposed threaded height of 4" above the foundation shall be provided in an 18 ½" bolt circle configuration to accommodate a future ITS pole as shown on the Plans. Contractor shall coordinate the anchor bolts with the proposed ITS pole.

Foundations shall provide two (2) 2-inch raceways stubbed out of the foundation at a depth of 30" below finished grade. Unused raceways shall be stubbed and capped for future use.

The Contractor shall construct a PCC service pad adjacent to the foundation in accordance with the details shown on the Plans. The pad shall be constructed upon a 6" course aggregate base (CA 6).

No foundation is to be poured until the Resident Engineer gives his/her approval as to the depth of the foundation.

Method of Measurement. The foundation will be measured for payment in feet in place. The length measured will be limited to that shown on the plans or authorized by the Engineer. Excavation in rock will be measured for payment according to Article 502.12.

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

Excavation in rock will be paid for according to Article 502.13. Obstruction mitigation will be paid according to Article 109.04.

STEP-DOWN TRANSFORMER

Description. This item shall consist of furnishing and installing a step-down transformer in a disconnect switch assembly cabinet or 336S cabinet as shown in the plans.

Materials. The step-down transformer shall comply with the following:

- A. Transformer shall be a 2KVA, NEMA 3R, outdoor single phase dry-type transformer of the two winding type, and self-cooled.
- B. Transformers must be designed for continuous operation for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSIC57.96.
- C. The core and coil assembly must be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture- proof, shock resistant seal.
- D. Each transformer must be provided with a suitable terminal compartment to accommodate the required primary and secondary wiring connections and side or bottom conduit entrance.
- E. Transformer enclosures shall be made of heavy gauge steel and shall be degreased, cleaned, primed and finished with ANSI 61 grey weather-resistant enamel.
- F. Transformer shall be UL listed.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall prepare and submit a shop drawing detailing the step-down transformer. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer.

Prior to energization, check for the following:

- A. Electrical continuity
- B. Short circuits
- C. Improper grounds
- D. Compliance with manufacturer's torque tightening specifications

Method of Measurement. Step-down transformer switch will be measured for payment per each unit furnished and installed by the contractor and accepted by IDOT.

Basis of Payment. This work will be paid for at the Contract unit price each for STEP-DOWN TRANSFORMER furnished and installed at the locations shown on the plans including all accessories as specified herein and shown on the plans.

WEED CONTROL, NATIVE LANDSCAPE ENHANCEMENT

Modified: January 5, 2018

Description

This work shall consist of controlling and/or removing weeds growing within native landscapes (prairies, savannahs, woodlands, wetlands, etc.). Various methods of weed control (hand weeding, hand trimming, spot spraying, wicking, etc.) may be required depending on the location, type of weeds, and size of weed infestation. These selective weed control areas may not be able to be treated with typical large roadside herbicide spraying equipment. Locations for selective weed control enhancement shall be as shown on plans and as designated by the Engineer.

The undesirable weeds (tree saplings, teasel, thistle, *Phragmites*, cattails, etc.) shall be removed and/ or treated with the appropriate weed control method approved by the Engineer prior to the start of work per location. Multiple weed species may be treated during each site visit. All herbicides shall be approved by the Engineer prior to the start of work.

All selective weed control enhancement areas shall be completed to the satisfaction of the Engineer with equipment, method, and/or herbicide approved by the Engineer. Disposal of material shall be done in accordance with Article 202.03.

Schedule

Individual weed species may be targeted and shall be spot sprayed during the appropriate growth stage. Weed control must be completed in a timely manner. When the Engineer directs the Contractor to control the weeds, the Contractor must begin the weed control operation within 7 days of notice.

Equipment and Herbicides

Special equipment such as backpack sprayers, hand sprayers, and hand pruners may be required to conduct spot herbicide treatments and manual removal of weeds in small areas. All equipment shall be approved by the Engineer. The Contractor shall submit a certificate for all herbicides, including the following, prior to starting work:

1. The chemical names of the compound and the percentage by weight of the ingredients.
2. A statement that the material 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 manufacturer. 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.

Application Rate

Follow manufacturer's recommendation for the various herbicides.

Method

All weed control operations are to proceed in the direction of traffic flow.

If weeds or other undesirable vegetation threatens to introduce seed into naturalized areas, smother planted species, or in case of weeds exceeding growth of planted species, at the direction of the Engineer, the weeds shall be: spot sprayed, wicked, hand trimmed or uprooted, raked and removed from the area. Weeds shall be removed in a manner that does not damage the underlying native grasses and forbs.

The cut material from common reed (*Phragmites australis*), teasel species (*Dipsacus* spp.), and thistle species (*Cirsium* spp.) shall be removed and disposed of according to Article 202.03.

Remove litter, including plastic bags, paper, bottles, etc. prior to weed control. All weeds, litter, and debris removal must be complete to the satisfaction of the Engineer and disposed of according to Article 202.03. Damage to the native vegetation, such as ruts or wheel tracks more than 2 inches in depth, other plantings, or highway appurtenances caused by the weed control remediation operation shall be repaired at the Contractor's expense and to the satisfaction of the Engineer.

Method of Measurement

The work will be measured in acres of surface area cared for to the satisfaction of the Engineer 15 calendar days after the work authorization date.

If the inspection discloses any work as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same, and the Contractor shall immediately comply with such instructions and correct the unsatisfactory work within 7 calendar days. Removal and disposal of debris will not be measured separately but shall be considered included.

Areas not meeting the satisfaction of the Engineer shall not be measured for payment. Plan quantities are estimates only. Actual quantities will be measured in place. Agreement to plan quantities will not be allowed.

Basis of Payment

This work will be paid for at the contract unit price per ACRE for WEED CONTROL, NATIVE LANDSCAPE ENHANCEMENT. Payment for Weed Control, Native Landscape enhancement shall include all materials, equipment, labor, removal, disposal and incidentals required to complete the work as specified herein and to the satisfaction of the Engineer.

BUDGETARY ALLOWANCE FOR CCTV INTEGRATION

Description. This item provides for the integration of the proposed CCTV video into IDOT's video distribution system (VDS). A budgetary allowance has been established since the final cost is unknown.

This allowance shall 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.

Video Distribution System. The existing video distribution system is Teledyne FLIR's 360 Cameleon ITS camera control. Included in this item, the Contractor shall provide 40 primary and 40 backup enterprise software license units. The Contractor shall configure the cameras within the video distribution system. This work shall be coordinated with the IDOT Electrical Maintenance Contract (EMC) Engineer.

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 part of this item and this coordination will require technical services of the existing system integrator and coordination with the State District 1 Electrical Maintenance Contractor. This work shall be included in the item and will not be paid for separately.

Method of Measurement. This work will not be measured for payment.

This item shall be bid at a price of \$150,000.00.

Basis of Payment. This work will be paid for at the contract lump sum price or fraction thereof for BUDGETARY ALLOWANCE FOR CCTV INTEGRATION, which shall include all work as described herein.

BUDGETARY ALLOWANCE FOR NETWORK DESIGN AND INTEGRATION

Description. This item provides for network design and integration into the existing District One ITS network. This integration will extend the current network design to include a new shelter located at I-80 and I-55 and integrate new ITS devices through the new shelter and new layer III switches at the I-80 and I-355 fiber interconnect cabinet. This item also provides for expansion of the existing IDOT Wireless Vehicle Detection System Manager (SENSYS Networks Linux server with SNAPS software) if required to integrate the new WIRELESS VEHICLE DETECTION SYSTEM sites installed under this contract.

The new shelter will be connected to the I-55 Bolingbrook Weigh Station Shelter. This work establishes the network extension to the new shelter, IP Scheme, VLAN, hardware requirements, network security requirements, placement, configurations, and installation of Collapsed Core & Distribution Layer, and access layer hardware, licenses.

New ITS devices east of the Des Plaines River shall be integrated into the new layer III switches at the existing I-80 and I-355 fiber interconnect cabinet. New ITS devices from Ridge Rd to Wheeler shall be integrated into the new shelter located in the I-80 and I-55 interchange.

Configuration of layer III switches shall be configured by the IDOT network administrator through the current District One Electrical Maintenance Contract.

This item establishes an account from which funds will be distributed for the payment for equipment, configuration, programming, integration, and network testing. A budgetary allowance has been established because the final cost is unknown.

This allowance shall 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.

CONSTRUCTION REQUIREMENTS

The new shelter will be integrated with the existing District One ITS network. The scope includes configuring the collapsed core/distribution layer III switches and access layer III switches, and configuration/modification of existing elements within the existing network for the additional shelter to be integrated into the District One ITS network.

Field devices shall be packaged and delivered to the IDOT network administrator for configuration. Devices shall be labeled and numbered according to the building or field cabinet these devices are to be installed. The IDOT network administrator shall configure and test the device to make sure the device functions within the IDOT network environment as intended and is ready for installation. Any device that is deemed nonconforming/functional shall be removed and returned to the contractor. It is the contractor's responsibility to get the device repaired or replaced and reconfigured by the IDOT network administrator prior to installation in the field. Once configuration has been completed and verified operational within the IDOT network environment the contractor shall plan to pick up the ITS field devices from the IDOT network administrator for installation. The contractor shall coordinate the field installation and turn on of ITS field devices with the Engineer, TSC Engineer, and IDOT network administrator.

There shall be a 30 day burn in period for the new shelter layer III switches to ensure there are no issues that could affect the existing network operations. Any major issues shall be grounds for restarting the burn in period. A major issue would be the loss of communications that can be directly related to the infrastructure and hardware within the contract limits.

There shall be a 30 day burn in period for network communications to all field devices installed and integrated into the new shelter and the new layer III switches at I-80 and I-355. Any major issues shall be grounds for restarting the burn in period. A major issue would be loss of communications that can be directly related to the infrastructure and hardware within the contract limits

Contractor shall provide all miscellaneous hardware, licensing, operating systems, programming, memory, storage, and wiring to make sure the topology of the new shelter meets or exceeds the topology and design infrastructure of the other shelters with in the IDOT ITS network.

Licensing shall be provided for security and other network appliances that reside on the network that are used in the background but are necessary to carry out the safe and efficient day-to-day operation of the IDOT ITS network. The contractor shall request from IDOT a summary of all extraneous software and hardware that require an update or upgrade to the existing configurations and additional licenses to accommodate the new shelter and additional devices added to the network.

The contractor shall provide the properly sized SFP's and fiber jumpers for the field device connections at the shelter and the datacenters (Schaumburg and Oak Park). The contractor shall request from IDOT the fiber paths to be utilized for the new shelter. If additional regeneration stations are required to connect the new shelter to the 2 data centers the regeneration switches, SFPs, fiber jumpers, and any other ancillary components required shall be supplied as part of this pay item.

Method of Measurement. This work will not be measured for payment.

This item shall be bid at a price of \$250,000.00.

Basis of Payment. This work will be paid for at the contract lump sum price or fraction thereof for BUDGETARY ALLOWANCE FOR NETWORK DESIGN AND INTEGRATION, which shall include all work as described herein.

OUTDOOR RATED NETWORK CABLE

Description. This work shall consist of furnishing and installing a network cable and ancillary components from the 336S cabinet or from within the ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE to the associated field device as shown on the plans.

Materials. The outdoor rated network cable shall be a black Category 6 cable, meeting the TIA/EIA 568-B.2 telecommunication standards. The cable shall be composed of 24 AWG solid bare copper conductors, twisted pairs, polyolefin insulation, inner LLPE jacket, overall shield (100% coverage), 24 AWG stranded TC drain wire, industrial grade sunlight- and oil-resistant LLPE jacket. The cable shall be capable of performing from -40 °F to 160 °F.

Each end of the cable shall be terminated with an RJ-45 connector compliant with manufacturer requirements of the associated field devices and installed according to the TIA/EIA 568B standard. The drain wire at the cabinet end shall be terminated with a ring lug and attached to a suitable ground point.

The work shall be performed according to the applicable portions of Section 873 of the "Standard Specifications", and details as shown on the plans.

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

Basis of Payment. This work will be paid for at the contract unit price per foot for OUTDOOR RATED NETWORK CABLE.

WIRELESS VEHICLE DETECTION SYSTEM

Description. This work shall consist of furnishing, installing, configuring and testing a Wireless Vehicle Detection System components at the location identified in the Plans or as directed by the Engineer.

Materials.

Wireless In Pavement Detector

The WIRELESS IN PAVEMENT DETECTOR shall:

- Be designed for flush installation in pavement.
- Detect volume, occupancy and speed as shown in the plans and may be adjusted based on each deployment.
- Be battery powered with minimum battery life of 10 years.
- Have firmware capable of being upgraded through wireless connection.
- Transmit wireless vehicle detection and other output data to a Radio Assembly or Repeater.
- Be NEMA 6P rated.
- Operate within a temperature range of -40° F to +176° F (ambient).
- Have the ability to provide and record pavement temperatures.
- Have a maximum diameter of 2-1/2".
- Be encased in a cup to allow for removal, replacement, or relocation.
- Require a pavement core hole a maximum of 3-1/8" diameter and 3-1/2" depth.
- Have a transmission range of up to 150' to the WIRELESS VEHICLE DETECTION RADIO or WIRELESS VEHICLE DETECTION SOLAR REPEATER based on a 20 foot mounting height of the radio or repeater.
- Include epoxy (typ. orange) as recommended by the manufacturer.

Wireless Vehicle Detection Radio

The WIRELESS VEHICLE DETECTION RADIO shall:

- Be a 2.4 GHZ radio
- Receive wireless output from In Pavement Detectors and Wireless Solar Repeaters.
- Operate within the temperature range of -40° F to +176° F (ambient).
- Have a minimum of 16 frequency channels.
- At a mounting height of 20', have a transmission range of up to 150' to the WIRELESS IN PAVEMENT DETECTOR and up to 1,000' to the WIRELESS VEHICLE DETECTION SOLAR REPEATER.
- Be designed for mounting to a proposed pole as shown in the Plans The mounting kit and all ancillary brackets/mounting hardware shall be included in this item. At sites with camera lowering devices, a pipe-to-pipe or pipe standoff adapter may be required to

Ethernet cable between the WIRELESS VEHICLE DETECTION RADIO and the in-cabinet isolation unit shall be paid for separately as OUTDOOR RATED NETWORK CABLE.

Wireless Vehicle Detection System Processor Module

The wireless vehicle detection system processor module shall be an in-cabinet central processor unit including power supply.

- The processor module shall include manufacturer's license and capability for Ethernet connection to the IDOT Traffic Systems Center.
- The processor module shall be powered via a 9-28 VDC input.
- The processor module shall operate within a temperature range of -40° F to +176° F (ambient).
- The processor shall be DIN rail mountable.
- The processor shall be capable of generating traffic data statistics.
- The processor shall be capable of interfacing with two WIRELESS VEHICLE DETECTION RADIO.
- All required cabling and cabinet wiring needed from the processor module to the IDOT network communications switch and to power the processor module shall be included as part of this item.

Wireless Vehicle Detection System Isolation Module

The wireless vehicle detection system isolation module shall be an in-cabinet surge-suppression and isolation device powered by an in-cabinet processor module.

- The isolation module shall be used between each WIRELESS VEHICLE DETECTION RADIO and the Processor Module.
- The isolation module shall support two WIRELESS VEHICLE DETECTION RADIO.
- The isolation module shall provide electrical isolation of 2500 Vrms.
- The isolation module shall provide surge protection of up to 12A.
- The isolation module shall operate within a temperature range of -40° F to +176° F (ambient).
- The isolation module shall be DIN rail mountable.
- All required cabling and cabinet wiring needed from the Processor Module shall be included as part of this item.

Wireless Vehicle Detection Solar Repeater

The WIRELESS VEHICLE DETECTION SOLAR REPEATER shall:

- Provide a communications relay
 - To/From a WIRELESS IN PAVEMENT DETECTOR (downlink)
 - To/From a WIRELESS VEHICLE DETECTION RADIO (uplink)
 - To/From another WIRELESS VEHICLE DETECTION SOLAR REPEATER (uplink or downlink)
- Be capable of tandem operation to sensors and to another access point or repeater.
- At a mounting height of 20', have a transmission range of up to 150' to the WIRELESS IN PAVEMENT DETECTOR and up to 1,000' to the WIRELESS VEHICLE DETECTION RADIO.
- Have an operating temperature range -40° F to +176° F (ambient).
- Be powered by integrated solar panels with rechargeable lithium ion battery and a backup battery.
- Be designed for mounting to an existing or proposed pole as shown in the Plans. The mounting kit and all ancillary brackets/mounting hardware shall be included in this item.
- Include an external antenna for additional coverage range at locations shown in the Plans.

The Wireless Vehicle Detection System shall interface with the existing IDOT System Manager, which is a SENSYS Networks Linux server with the SNAPS software. The Contractor shall provide technical services for the integration of new WVDS sites into the System Manager as part of this work.

CONSTRUCTION REQUIREMENTS

All work will require close coordination with the Engineer and the IDOT EMC Engineer. This includes a pre-installation meeting with the Engineer and the IDOT EMC Engineer. At the conclusion of the contract the system shall be turned over to the IDOT District One EMC Engineer.

Pre-Procurement Documentation

The Contractor shall submit catalog cut sheets for all system materials to the Engineer within 30 days of the date of the Notice to Proceed. The Contractor must obtain approval of the catalog cut sheets from the Engineer prior to purchasing the Wireless Vehicle Detection System components and performing any installation accordingly.

Design locations of each sensor system component including wireless in-pavement detectors, radios, and repeater locations shall be field verified and recommended for construction by the Contractor.

Pre-Installation Requirements

The Contractor and subcontractor employees assigned to work on the wireless vehicle detection system component installation shall be required to attend installation training by the wireless vehicle detection system manufacturer prior to the installation of equipment. Training certificates shall be submitted to the Engineer for record. The Contractor is advised that the Contractor's failure to request training sufficiently in advance of when the employee is required on the work site shall not be cause for relaxing the requirement for installation training. Contractor and subcontractor personnel shall renew their installation trainings annually by successfully completing installation training again. Contractor or subcontractor personnel who fail to maintain a valid sensor installation certificate are not permitted to work on sensor installation sites. The costs incurred by the Contractor for sensor installation training will not be reimbursed. Thirty (30) days prior to the scheduled field installation of each wireless vehicle detection system/in-pavement sensors the Contractor shall notify the Engineer of the anticipated delivery date of the systems(s) and name of the certified field installation personnel.

Installation

Each device (radio, repeater, in-pavement detector, processor module) shall be first upgraded to the latest firmware version, then configured in the field by the Contractor using the manufacturer's configuration software and its installation parameters documented on the installation record form attached.

The contractor shall request IP addresses for the in-cabinet processor module from the Engineer in writing a minimum of two weeks prior to installation.

The Contractor shall install in-pavement detector units in the pavement at locations shown in the plans following manufacturer recommended procedures for installation. The in-pavement detector units shall not extend above the top of pavement. Final in-pavement sensor location shall be approved by the Engineer prior to installation. Any costs resulting from damage incurred shall be the sole responsibility of the Contractor.

The Contractor shall mount the radio and repeater units to the structures indicated on the plans or other nearby locations as directed by the Engineer and as recommended by the manufacturer, using manufacturer approved brackets and/or bandings or mountings. Poles penetrated to install the OUTDOOR RATED NETWORK CABLE shall be environmentally sealed to prevent water entry. OUTDOOR RATED NETWORK CABLE installed between the radio and in-cabinet processor module shall utilize the ITS pole J-hook assembly and strain relief.

The Contractor shall configure appropriate RF channels and aim all radios and repeaters to provide a greater than -79dBm signal strength and greater than 90 LQI on all wireless RF path segments unless approved by the Engineer. The Contractor is responsible for the choice of communication channels for programming each wireless device.

The Contractor shall coordinate with the IDOT TSC Electrical Maintenance Engineer to ensure that the Wireless Vehicle Detector System can communicate back to the Oak Park TSC to the SENSYS Networks Linux server with the SNAPS software.

The Contractor shall provide documentation to the Engineer during acceptance of the equipment showing the equipment, each specific serial number, and the field location of each piece of equipment. Documentation shall include signature lines to be signed by both the Engineer and Contractor upon completion of acceptance testing.

Testing

The Contractor shall be required to perform the following tests after the installation of the Wireless In-Pavement Detection System. The Contractor shall use the test plans within this special provision to conduct the following tests in the presence of the Engineer.

- Local Field Test
- Subsystem Test
- System Test
- 30-Day "Burn-in" Period

Local Field Test

The purpose of the Local Field Test is to have the Contractor demonstrate to the Engineer that all Wireless In-Pavement Sensor System components have been installed, connected, labeled, and configured correctly as per contract plans and as per the manufacturer's requirements. This installation shall result in the reviewing of accurate (per manufacturer's specification) volume and speed data at the site. The site testing also requires monitoring the speed and vehicle count manually for the specified duration. For the Local Field Test to be accepted, the Contractor shall demonstrate to the Engineer:

- The installation has been performed as per contract plans and as per the manufacturer's recommendations
- All connections are tight and cannot be dislodged by incidental contact from the Engineer
- Verify installation of specified cables, connections and wireless links between the Wireless Vehicle Detector System devices and the IDOT communications system.
- Use a local laptop running the manufacturer's software to verify that the In-Cabinet Processor Module is receiving vehicle detection data from each sensor.
- Verify presence and quality of Wireless Vehicle Detector System device data through visual checks to verify volume, occupancy, and speed as determined by the required functionality.
- The In-Cabinet Processor Module's Ethernet port Cat6 cable is plugged into the communication network's assigned switch port.
- Configure each In-Cabinet Processor Module and sensor to achieve the accuracy specified below:
 - A minimum 40 vehicle count (manual and via the Sensor System) has been conducted, per lane, has accurately recorded the counts on the Volume Verification Sheet (attached to this specification). Counting error shall be no more than 5.0 percent.
 - A LIDAR gun shall be used to verify actual vehicle speed in each lane. A minimum sample of 40 cars shall be recorded on a data sheet along with the detection data as read from the System Manager server report. Speed error shall be no more than 10.0 percent. The LIDAR gun shall have been calibrated within the past 12 months. Documentation shall be provided.
- The Wireless In-Pavement Sensor System Detection Local Field Test Form has been fully completed, signed by the Engineer at the finish of the site test.

Subsystem Test

Following the Local Field Test, the Contractor shall conduct a Subsystem Test in the presence of the Engineer. This requirement is meant to ensure that all data collected by the Wireless Vehicle Detector System stations are properly and accurately transmitted to the existing Wireless Vehicle Detector Servers at IDOT Oak Park TSC. The Subsystem Test shall be performed based on the Engineer approved Contractor testing schedule. The Contractor shall notify the Engineer in writing the scheduled date of the Subsystem Test 14 calendar days prior to the commencement of said test. The Subsystem Test shall not be performed without prior written approval from the Engineer.

The Contractor shall perform the Subsystem Test, which will involve personnel on-site at the Wireless Vehicle Detector System stations and at the IDOT Oak Park TSC to confirm that data collected by the Wireless Vehicle Detector System devices is being properly and accurately received by the existing Wireless Vehicle Detector Servers. During the Subsystem Test, the Contractor shall provide qualified personnel to support the diagnosing and repair of Wireless Vehicle Detector System devices and ancillary components. These personnel shall be available for this support within 24 hours of notification of the need for their services.

The APDIAG application shall be run by the Contractor once every 30 minutes over a 6-hour period and all available parameters shall be recorded on a test data sheet. The parameters include average RSSI, LQI, number of reboots (of each sensor), stuckHi, blips, and total counts by sensor, as well as average speed. This speed data is to be compared with nearby detector data by the Contractor and any significant differences explained. The Subsystem test data sheet and test report is to be delivered to the Engineer for approval prior to proceeding with the 30 day burn in test.

System Test

The System Test will be conducted by the Department. The System Test shall demonstrate:

- Communications connectivity from the from each Wireless In-Pavement Detection System device to the existing Wireless Vehicle Detector Servers at IDOT Oak Park TSC
- Accurate volume, occupancy and speed data is being received at IDOT Oak Park TSC to the satisfaction of the Department.

30-Day “Burn-in” Period

Following the System Test and before Final System Acceptance, the Contractor shall oversee a 30-Day Burn-in Period. This requirement is meant to demonstrate full monitoring capabilities of the Wireless Vehicle Detector System devices from the TSC via the installed/existing communications channels. The 30-day Burn-In Period shall be conducted based on the Engineer and approved Contractor testing schedule. The 30-Day Burn-in Period shall not commence without prior written approval from the Engineer.

The Contractor shall correct all failures during the 30-Day Burn-in Test at no additional cost. The system may be shut down for purposes of testing and correcting identified deficiencies. For each period of system shut down, the scheduled 30-day Subsystem Test shall be extended for the same period of time plus 1 day unless otherwise directed by the Engineer. Shutdown of equipment that has been integrated into the IDOT Oak Park TSC network must be coordinated ahead of time as it may affect TSC operations. The Engineer will provide written approval upon successful completion of the 30-Day Burn-In period.

Final System Acceptance and Training

Final acceptance of the work associated with this project will be made after satisfactory completion of the required 30-Day "Burn-in" Test period and on the basis of the final inspection of the entire system. The final inspection of the entire system will be performed by the Engineer in the presence of a representative of the Contractor.

All "record" documents shall be submitted to the Engineer at the time of Final Acceptance and include an electronic computer file including a sketch of each Wireless Sensor, Radio Assembly, Repeater, and associated ITS cabinet; listing each device's location, identification number, wireless channel information and GPS coordinates. The Contractor shall provide two hard copies and an electronic of the operation and maintenance manuals for the wireless in-pavement detection system.

The Contractor shall coordinate with the manufacturer, IDOT TSC Electrical Maintenance Engineer and Engineer and provide a (two) 2-day training session to include IDOT personnel at a location provided by IDOT. The IDOT TSC Electrical Maintenance Engineer shall determine the number of attendees to be included for the training.

Notification of Final Acceptance will be in writing from the Engineer.

Warranty

All equipment shall be warranted and guaranteed against defects and/or failure in design, materials and workmanship. The Contractor shall submit the warranty terms as part of the shop drawing submittal for each material item.

System components shall be warranted against all defects and/or failure in design, materials and workmanship for a minimum of one (1) year from the date of Final Acceptance, as recorded by the Engineer.

The warranty shall provide that, in the event of a malfunction during the warranty period, the defective system component shall be repaired or replaced with a new component by the manufacturer or representative within five (5) working days.

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

Any repairs made by a manufacturer or representative shall be documented and that documentation shall be returned with the warranty repaired units. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number.

The warranty period shall not begin until the date that the Engineer issues final acceptance to the project, as recorded by the Engineer.

Method of Measurement. WIRELESS VEHICLE DETECTION SYSTEM will be measured per each complete system as shown in the plans, in place and accepted. The WIRELESS VEHICLE DETECTION SYSTEM shall contain the following major components:

- One (1) Wireless Vehicle Detection Radio
- One (1) Wireless Vehicle Detection System Processor Module
- One (1) Wireless Vehicle Detection System Isolator Module

WIRELESS VEHICLE DETECTION RADIO will be measured per each radio that is not part of a WIRELESS VEHICLE DETECTION SYSTEM. This will occur at locations as shown in the Plans that have two (2) radio units installed on a single ITS pole.

WIRELESS VEHICLE DETECTION SOLAR REPEATER will be measured per each repeater installed as shown in the plans, in place and accepted.

WIRELESS IN PAVEMENT DETECTOR will be measured per each detector installed as shown in the plans, in place and accepted.

Basis of Payment. Payment for WIRELESS VEHICLE DETECTION SYSTEM, will be made at the contract unit price per each, which price shall be payment in full upon Final Acceptance for the work described herein.

Payment for WIRELESS VEHICLE DETECTION RADIO will be made at the contract unit price per each, which price shall be payment in full upon Final Acceptance of the associated WIRELESS VEHICLE DETECTION SYSTEM.

Payment for WIRELESS VEHICLE DETECTION SOLAR REPEATER, will be made at the contract unit price per each, which price shall be payment in full upon Final Acceptance of the associated WIRELESS VEHICLE DETECTION SYSTEM.

Payment for WIRELESS IN PAVEMENT DETECTOR, will be made at the contract unit price per each, which price shall be payment in full upon Final Acceptance of the associated WIRELESS VEHICLE DETECTION SYSTEM.

OUTDOOR RATED NETWORK CABLE is paid for separately.

Wireless Vehicle Detection System Local Field Test Form

Site & Test Information

Route & Direction*: _____

Site ID / Station: _____

Date / Time: _____

Contractor: _____

**Direction with respect to the location of the main cabinet for the site.*

Installation

- ☐ The installation has been performed as per contract plans and as per the manufacturer's recommendations
- ☐ All connections are tight and cannot be dislodged by incidental contact from the Engineer
- ☐ Verify installation of specified cables, connections and wireless links between the Wireless Vehicle Detector System devices and the IDOT communications system.
- ☐ Use a local laptop running the manufacturer's software to verify that the In-Cabinet Processor Module is receiving vehicle detection data from each sensor.
- ☐ Verify presence and quality of Wireless Vehicle Detector System device data through visual checks to verify volume, occupancy, and speed as determined by the required functionality.
- ☐ The In-Cabinet Processor Module's Ethernet port Cat6 cable is plugged into the communication network's assigned switch port.

Equipment Firmware

In-Cabinet Processor Firmware Version: _____

Radio Firmware Version: _____

Repeater Firmware Version: _____

In-Pavement Sensor Firmware Version: _____

Radio Communication Path Information

No. of Repeater Paths	
1 st Path Channel #	
1 st Path RSSI (>-79dBm)	
1 st Path LQI (>90)	
2 nd Path Channel #	
2 nd Path RSSI (>-79dBm)	
2 nd Path LQI (>90)	

Fill out "N/A" if there are no repeaters installed at the site.

In Pavement Sensor Speed Data Verification Work Tables

Route/Ramp, Direction & Lane:

Vehicle Observation No.	LIDAR Speed (mph)	Sensor Speed (mph)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
Average		

Route/Ramp, Direction & Lane:

Vehicle Observation No.	LIDAR Speed (mph)	Sensor Speed (mph)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
Average		

In Pavement Sensor Data Verification

Serial #	Route/ Ramp	Direction	Lane	Manual Count	Sensor Count	Count % Difference	LIDAR Avg. Speed	Sensor Avg. Speed	Speed % Difference

Test Conducted By: _____ Date: _____

Engineer*: _____ Date: _____

*The Local Field Test shall not be official until the Engineer signs and dates this sheet.

LIGHT POLE, SPECIAL

Description. This work shall consist of furnishing and installing a conventional-type round tapered aluminum pole and all required hardware including bolt covers as specified herein.

Materials. Materials shall be according to applicable portions of Section 1069 of the Standard Specifications and the following:

- (a) The pole shall be designed to AASHTO design criteria for 90 MPH wind loading and a minimum 50 year design life
- (b) The pole shall be designed such that the deflection of the pole from the vertical axis does not exceed one degree per 10 feet of nominal light pole height, as caused by the dead weight moment of design Wireless Vehicle Detection Solar Repeater, at height recommended by the Manufacturer of the Wireless Vehicle Detection Solar Repeater.
- (c) The pole shall be coordinated with the Wireless Vehicle Detector Solar Repeater being provided on this project to be free of susceptibility to harmful harmonics with vibration dampener. The pole shall incorporate an integral vibration dampener. The document submitted for approval shall address this requirement.
- (d) The shaft shall be of smooth circular cross section, seamless tapered aluminum alloy, type 6063-T6. It shall be free of dents, kinks, ripples, scratches or other defects. The outer wall shall have a satin ground finish, 100 grit or finer.
- (e) The shaft shall have a cast aluminum base plate conforming to ASTM designation B108 and SG70A for aluminum alloy, welded to the pole shaft. All welding shall be performed by the inert gas shielded arc method, and all welds shall be free from cracks and pores. The base plate shall have slots suitable for 1 inch diameter anchor bolts and 11.5 inch nominal bolt circles.
- (f) The height of the pole shall be 30 feet, or as otherwise noted on the plans.
- (g) The shaft shall have a nominal wall thickness of not less than 0.25 inches.
- (h) The shaft shall have a 4-inch by 8-inch handhole with rounded ends. The handhole shall be reinforced and shall have a cover of the same materials as the pole, held in place with 1/8"-20 steel core nylon screws. The holes for the screws shall be tapped with the appropriate thread configuration. The handhole shall be located 18-inches from the bottom of the pole to the centerline of the handhole.
- (i) The shaft shall be equipped with a ground lug, welded inside the shaft, suitable for No. 8 and No. 4 wires, located adjacent to and accessible from the handhole.
- (j) The Wireless Vehicle Detection Solar Repeater shall be mounted at a height recommended by the manufacturer of the detector equipment for the application as shown in the plans.

CONSTRUCTION REQUIREMENTS

Installation. The pole shall be set plumb on the breakaway device without the use of shims, grout or any other leveling devices under the pole base.

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 for each LIGHT POLE, SPECIAL, 30'.

LAYER II (DATALINK) SWITCH

Description. This work shall consist of furnishing and installing a Layer II Ethernet switch at locations as shown on the plans.

Materials. The Layer II switch shall be environmentally hardened with a minimum of (2) 1-Gbps SFP ports and a minimum of (8) 100-Mbps copper RJ-45 ports. Two SFP ports shall be populated with optical modules of the type specified herein. A manufacturer recommended, environmentally hardened power supply with input of 120 VAC and sufficient wattage for the switch shall be provided.

The switch shall conform to the following minimum specifications:

- Forwarding Bandwidth 3.8Gbps
- Switching Bandwidth 7.6Gbps
- Forwarding rate: 5.66Mpps with 64-byte packets (Line-rate at all packet sizes)
- Egress buffer: 2 MB
- Unicast MAC addresses: 8000
- Internet Group Management Protocol (IGMP) multicast groups: 255
- Virtual LANs (VLANs): 1005
- IPv4 MAC security ACEs: 384 (default Ternary Content-Addressable Memory [TCAM] template)
- Bidirectional, 128 NAT translation entries
- IPv4 routing: 3500 routes, IPv6 routing: 1750 routes
- Layer 2 switching: IEEE 802.1, 802.3, 802.3at, 802.3af standard (see Table 8), VTPv2, NTP, UDLD, CDP, LLDP, Unicast MAC filter, Resilient Ethernet Protocol (REP), Media Redundancy Protocol (MRP) Ring (IEC 62439-2)
- Security: SCP, SSH, SNMPv3, TACACS+, RADIUS Server/Client, MAC Address Notification, BPDU Guard, SPAN session
- Multicast: IGMPv1, v2, v3 Snooping, IGMP filtering, IGMP Querier
- Safety certifications:
 - UL/CSA 60950-1
 - EN 60950-1
 - CB to IEC 60950-1 (with country deviations)
 - NOM to NOM-019-SCF1 (through partners and distributors)
 - CE Marking

- Hazard location:
 - ANSI/ISA 12.12.01 (Class1, Div2 A-D)
 - EN 60079-0, -15 ATEX Certificate (Class 1, Zone2 A-D)
- EMC emissions and immunity compliance:
 - FCC 47 CFR Part 15 Class A
 - EN 55022A Class A
 - VCCI Class A
 - RoHS compliance
 - AS/NZS CISPR 22 Class A, AS/NZS CISPR 24
 - CISPR11 Class A, CISPR22 Class A
 - ICES 003 Class A
 - CE Marking
 - IEC/EN/EN61000-4-2 (Electro Static Discharge), 15kV air/8kV contact
 - IEC/EN 61000-4-3 (Radiated Immunity, 10 and 20 V/m)
 - IEC/EN 61000-4-4 (Fast Transients - 4kV power line, 4kV data line)
 - IEC/EN 61000-4-5 (Surge 2 kV/1 kV)
 - IEC/EN 61000-4-6 (Conducted Immunity, 10 V/emf)
 - IEC/EN 61000-4-8 (Power Frequency Magnetic Field Immunity)
 - IEC/EN 61000-4-9 (Pulse Magnetic Field Immunity)
 - IEC/EN 61000-4-10 (Oscillatory Magnetic Field Immunity)
 - IEC/EN 61000-4-11 (AC power Voltage Immunity)
 - IEC/EN 61000-4-29 (Voltage Dips Immunity)
 - IEC/EN 61000-6-1 (Immunity for Light Industrial Environments)
 - IEC/EN 61000-6-2 (Immunity for Industrial Environments)
 - IEC/EN 61000-6-4 Class A
 - EN 61326
- Shock and vibration:
 - IEC 60068-2-27 (Operational Shock: 30G 11ms, half sine)
 - IEC 60068-2-27 (Non-Operational Shock 55-70G, trapezoidal)
 - IEC 60068-2-6, IEC 60068-2-64, EN 61373 (Operational Vibration)
 - IEC 60068-2-6, IEC 60068-2-64, EN 61373 (Non-operational Vibration)
- Industry standards:
 - UL508
 - CSA C22.2 No. 142
 - EN 61131-2 (EMC/EMI, environmental, mechanical)
 - Substation KEMA (IEEE 1613, IEC 61850-3)
 - EN50121-3-2
 - EN50121-4
 - NEMA TS-2 (EMC, environmental, mechanical)
 - ABB Industrial IT certification
 - IP30
 - ODVA Industrial Ethernet/IP support
- Corrosive testing:
 - ISO-12944-6
 - IEC-60068-2-60

- Humidity:
 - IEC 60068-2-52 (salt fog mist, test Kb) marine environments
 - IEC 60068 -2-3
 - IEC 60068-2-30
 - Relative humidity: 5% to 95% non-condensing
- Operating temperature:
 - -40C to +70C (vented enclosure - 40 LFM Air Flow)
 - -40C to +60C (sealed enclosure – 0 LFM Air Flow)
 - -34C to +75C (fan or blower-equipped enclosure – 200 LFM Air Flow)
 - -40C to +85C (IEC 60068-2-2 Environmental Type Testing – 16 hours)
- Operational altitude: Up to 15,000 ft
- Storage temperature:
 - -40 C to +85 C (storage temperature)
 - IEC 60068-2-14
- Storage altitude: Up to 15,000 ft
- Mean time between failure: 374,052 hours (42.7 years)
- Warranty: Five-year

The equipment listed in the table below is compliant with this specification. Other manufacturers that comply with this specification are allowed with Department approval.

The Layer II Datalink switch and associated equipment/licenses per location shall be as follows:

Vendor	Model No.	Description	Quantity
Cisco	IE-3100-8T2C-E	Catalyst IE3100 w/8 Ports GE Copper and 2 GE Combo uplinks, NE	1
Cisco	PWR-IE65W-PC-AC=	65W AC to DC or High DC to DC power supply	1*
Cisco	PWR-IE65W-PC-DC=	65W DC to DC power supply	1**
Cisco	IE3100-DNA-E-L	Cisco Catalyst Center Essentials license for IE3100 Series (up to 12 ports)	1
Cisco	IE3100-DNA-E-L-10Y	IE3100 Cisco Catalyst Center Essentials (up to 12 Ports), 10 Year Term license	1

*Only one power supply is required for each Layer II Datalink Switch. This power supply is required for AC powered sites.

**Only one power supply is required for each Layer II Datalink Switch. This power supply is required for solar powered sites.

Optical Patch Cords

The optical patch cords shall comply with the following:

- The fiber optic jumpers shall be approximately 6.5 foot (2 meters) SMFO duplex LC-LC jumper cables manufactured by Corning, model number 040402R5820002M or approved equivalent.
- Be compliant with the TIA/EIA-568-A and TIA/EIA-604 standards, as applicable.
- Tested according to the Telcordia/Bellcore GR-326-CORE standard. When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)-171 (TIA/EIA-455-171).
- The connectors shall test to an average insertion loss of 0.4 decibel and a maximum loss of 0.75 decibel.
- The connectors shall be tested as detailed in FOTP-107 (TIA/EIA-455-107) to reflectance values of -58 decibels.
- The connector material shall be Ceramic with UPC polish.
- The contractor shall provide the quantity of optical patch cords as listed in the table below.

Fiber Optic Transceivers

The fiber optic transceivers installed in the switch shall be from the same manufacturer as the switch or shall be from a manufacturer approved list. Recommended fiber optic transceiver types shall be the following models or approved equal.

- GLC-LH-SMD (1 Gbps single mode transceivers for links under 10 km)
- GLC-EX-SMD (1 Gbps single mode transceivers for links over 10 km and under 40 km)
- GLC-ZX-SMD (1 Gbps single mode transceivers for links over 40 km)

Table 1. Communications Equipment — Parts List

Location	SFP Transceiver		Patch Cable, 2M
	GLC-LH-SMD	GLC-EX-SMD	Quantity
IE40A	2		2
IE40	2		2
IE39B	2		2
DMS-46	2		2
IE39A	2		2
IE39	2		2
IE38B	2		2
IE38A	2		2
IE38	2		2
IE37D	2		2
Comm Hut	1		1
IE37	1	1	2

IE36B	1	1	2
IE36A	1	1	2
IE36	1	1	2
IE35A	1	1	2
IE35	1	1	2
IE34B	1	1	2
IE34A	1	1	2
DMS-48	1	1	2
IE34	1	1	2
IE33A	1	1	2
IE33	1	1	2
IE32D	1	1	2
IE32C	1	1	2
IE32B	1	1	2
IE32A	1	1	2
DMS-47	1	1	2
IE32	1	1	2
IE30A		2	2
IE30		2	2
IE29B		2	2
IE29A		2	2
IE29		2	2
IE28B	1	1	2
IE28A	1	1	2
IE28	1	1	2
IE27A	1	1	2
DMS-41	1	1	2
DMS-47	1	1	2
IE27	1	1	2
IE26B	1	1	2
IE26A	1	1	2
CAB 61	1	1	2
CAB 59/IE25B	1	1	2
CAB 58	1	1	2
IE25A	1	1	2
IE25/CAB 57	1	1	2
IE24	1	1	2
CAB 55	1	1	2
CAB 53	1	1	2
CAB 51	1	1	2

IE23A	1	1	2
CAB 49	1	1	2
CAB 47	1	1	2
IE23	1	1	2
I-355/I-80 EX FO CAB	1		1
TOTALS	62	50	112

CONSTRUCTION REQUIREMENTS

Installation. The Layer II switch and its power supply shall be mounted to either a standard DIN rail or an equipment mounting channel in the cabinet or equipment rack. The power supply shall be power, plugged into one of the cabinet's dedicated power outlets as shown on the plan details. The Contractor shall submit a shop drawing showing the location where the switch will be installed in the cabinet and the means of mounting for approval by the Engineer.

Configuration Design Document. A configuration design document shall be submitted within 60 days after contract award. It shall be prepared by a designer with a minimum of CCNP certification – and shall include proof of currently active CCNP credentials. The document shall contain actual configuration files for each switch to be delivered under this Contract.

The configuration design document is required to be accepted by the Engineer prior to beginning any physical device configuration. High level guidance (IP Scheme / VLANs / routing protocols, etc.) will be provided by IDOT. Contractor shall coordinate with IDOT Electric Maintenance Contractor's Network Administrator for proper set up and IP configuration.

Integration. The Layer II switch shall be integrated by the Contractor into the IDOT D1 field network per the approved configuration document. Configuration, integration, functionality, and compatibility with the existing network are the responsibility of the Contractor.

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 LAYER II (DATA LINK) SWITCH, the price of which shall include all equipment, materials, and labor required to furnish, configure 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.

TERMINATE FIBER IN CABINET

Description. This work shall consist of terminating fibers in cabinets or buildings as indicated in the Plans or as directed by the Engineer.

Materials.

Pigtails. Singlemode fiber terminations shall utilize pre-fabricated, factory-terminated (LC compatible with ceramic ferrules) pigtails fusion spliced to bare fibers. Pigtails shall comply with the following:

- The factory installed connector furnished as part of the pigtails shall meet or exceed the requirements for approved connectors specified herein.
- The fiber portion of each pigtail shall have a single, jacketed fiber and match the color of the fiber strand jacket it will be spliced to.
- The fiber portion of each pigtail shall have optical properties (microfiber or regular) identical and/or compatible with the optical cable being spliced to and furnished under this contract.
- Pigtails shall be a minimum of one meter in length.

All equipment and ancillary materials needed to make fiber optic fusion splices between fiber strands and pigtails shall be included in the cost of TERMINATE FIBER IN CABINET.

Connectors. Connectors shall comply with the following:

- All connectors shall be factory installed LC compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB.

CONSTRUCTION REQUIREMENTS

General. All Singlemode fiber terminations shall utilize pre-fabricated, factory-terminated (LC compatible with ceramic ferrules) pigtails fusion spliced to bare fibers. The splicing of pigtails for singlemode fibers is included in the cost of TERMINATE FIBER IN CABINET. The prefabricated pigtails shall have all their fibers color coded to match the singlemode fibers in the fiber optic cable. All fusion splices shall be secured on aluminum splice trays capable of accommodating the required number of fusion splices, including necessary splice holders, a compatible splice tray cover, heat shrink, and stainless steel backer rod, and any other ancillary components required to support/complete the fusion splice. All fibers that are terminated with a connector shall be plugged into the backside of the fiber patch panel. Unused fibers at the termination panel shall be protected with a plastic cap to eliminate dust and moisture.

The quality of all fiber splices and terminations shall be verified by OTDR and power meter testing and documented according to Article 801.13(d) of the "Standard Specifications," to the satisfaction of the Engineer. The Contractor at no additional cost to the Department shall replace any splice not satisfying the required objectives.

All bulkhead connectors / adapters shall be labeled with the fiber numbers and direction (i.e. 13-14N, 1-2W, etc.) with a laminated machine printed label.

All spliced fibers and pigtails shall be trained in splice cassettes securely fastened inside of a fiber optic interconnect center. Fibers and buffer tubes not terminated shall be coiled neatly in the interconnect center. The ferrule end of the pigtail shall be connected to a patch panel module as shown in the Plans.

Method of Measurement. This work will be measured for payment in units of each for each individual fiber strand terminated.

Basis of Payment. This work will be paid for at the contract unit price per each for TERMINATE FIBER IN CABINET, the unit price shall include all equipment, materials, connectors, pigtails, documentation, and labor required to terminate each required fiber.

DIRECTIONAL BORING THROUGH ROCK

Description. This work shall consist of boring through rock material in accordance with Section 810 of the Standard Specifications. This will include all work in addition to the equipment, labor, and materials required to bore through earth material in order to directionally bore through rock. This will also include identifying and providing the required information to the Engineer as described herein to prove that directional boring through rock is required.

CONSTRUCTION REQUIREMENTS

The Contractor shall locate and provide the Engineer physical samples of bored rock material. When rock is encountered, the Contractor is required to inform the Engineer immediately, upon which the samples will be analyzed by the Engineer onsite during the boring operations. Each sample shall be provided at a maximum spacing of 25 linear feet along the directional boring path. Lengths meeting the requirements of directional boring through rock are defined as directional boring sections between two samples provided to the Engineer both of which show rock material. Lengths of directional boring through rock will not be interpolated between a rock material sample and a non-rock material sample. It is the Contractor's responsibility to provide additional physical samples to account for all bored rock material. The Engineer shall be the sole judge of which earth samples are classified as rock material.

Method of Measurement. This work will be measured for payment per foot along the entire length of directional boring performed through rock material.

Basis of Payment. This work will be paid for at the contract unit price per foot for DIRECTIONAL BORING THROUGH ROCK. Payment for this work is in addition to payment for the UNDERGROUND CONDUIT, of the type and size specified.

CABINET, MODEL 336S

Description. This work shall consist of furnishing, installing, and testing a pole mounted Model 336S cabinet at locations as shown in the Plans. The cabinet shall be used to house wireless vehicle detection system and/or CCTV camera equipment and any associated Ethernet switches, and other communications devices or equipment as shown on the plans.

Materials. Material shall be according to the following.

General

Cabinet, Model 336S shall be a durable, weatherproof enclosure constructed of 3/16 inches thick aluminum or 1/8 inch (3.175 mm) thick aluminum lined with bullet resistant fiberglass panels that shall be UL listed and tested for UL752 Level 3 with a nominal thickness of 1/2 inch maximum, and a nominal weight of 5.0 lbs. per square foot (24.5 kg per square meter) maximum. The cabinet shall be sized to adequately house all required components with extra space for arrangement and termination of wiring. The minimum size of the cabinet shall have a nominal outside dimension of 46 inches height, 24 inches wide, and 24 inches deep. The cabinet shall consist of the following components: single door each equipped with a Corbin # 2 Brass lock or equal for cabinet entry, housing, manufacturer recommended mounting hardware for pole-mount application, mounting cage, rack mounted sliding laptop shelf, power distribution assembly/service panel (including RFI filter surge suppression, outlets, circuit breakers, terminal blocks, and neutral and ground bus bars), thermostatically controlled fan, door switch, LED light, power data unit, and all necessary mounting hardware and wiring, and other equipment, as shown on the Plans and specified in these special provisions.

All bolts, nuts, washers, screws, hinges, and hinge pins shall be stainless steel unless otherwise specified. All equipment under this item shall be in accordance with Section 1074.03 of the Standard Specifications except as modified herein.

Cabinet Components

The cabinet housing, mounting cage, and all components applied in this project shall conform to those of the Model 336 cabinet provisions of the "Transportation Electrical Equipment Specifications" (TEES) 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. All exterior seams for the enclosure and doors shall be continuously welded and shall be smooth.

The cabinet shall have a single front door, 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 handle on the door shall have provisions for padlocking in the closed position. When the door is closed and latched, the door shall be locked. The lock and handle shall be on the right side of the door. The lock and lock support shall be rigidly mounted to the door. The lock 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 door 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 26 cubic feet of air per minute. 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 100 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 inch 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.

The power distribution assembly shall consist of a load center, one 30A, 240V, two-pole main circuit breaker, three 15A, 120V single pole secondary circuit breakers, one duplex 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. 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.

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. The terminal block shall be rated for 60 A at 600 V peak, minimum.

The 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 and RFI filter, which shall reduce the effect of power line voltage transients and be mounted to the service panel. The surge arrestor and RFI filter shall meet UL 1449 requirements 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.

Power Data Unit. The power data unit shall be installed in the cabinet and allow the CCTV camera PoE and wireless vehicle detection controller and isolator to be remotely rebooted. The power data unit shall meet the minimum requirements:

- 1) Minimum of eight individually switched 120V, 15-amp outlet circuits
- 2) Ethernet Interface: 10/100 autosensing, static IP, TCP port selectable, RJ-45 w/internal FCC filtering
- 3) Operating Temperature: -30°F to 170°F
- 4) Power Dissipation: 3.9W Typ Max (all on) <3W idle
- 5) Power Fail Hold-Over: 350ms minimum (all relays on)
- 6) Surge protection 3600 J metal oxide varistor

Ground and Neutral Bus Bars. Separate ground and neutral bus bars, mounted on the equipment panel shall be provided. The neutral bus bar shall be isolated from the cabinet and equipment ground. Compression lugs, plus 2 spare lugs, shall be sized to accommodate the cables with the heads of the connector screws painted green for ground connections and white for neutral connections.

Each cabinet shall be equipped with one rack mounted sliding laptop shelf designed to support 20 pounds. Shelf guides shall be designed to allow full extension from the rack frame.

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).

Identification

The Cabinet, Model 336S 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

Installation. The cabinet shall be installed on the CLOSED CIRCUIT TELEVISION POLE STRUCTURE, 50 FT. MOUNTING HEIGHT or LIGHT POLE STEEL 50 FT. WITH CAMERA LOWERING SYSTEM as shown on the plans. 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.

All conduit entrances into the cabinet installation shall be sealed with a pliable waterproof material.

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 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 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.

The cabinet shall be grounded in accordance with the GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8 special provision).

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 installed shall consist of the following:

- Visual inspection of the cabinet and its contents for workmanship
- Verification of the cabinet grounding in accordance with Articles 801.04 and 806 of the Standard Specifications and the GROUNDING OF ITS SUBSYSTEMS (TSC T 420#8) special provision
- Measurement of the voltage at the input panel

Documentation. Shop drawings and wiring lists/diagrams 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 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 in order to provide overall maintenance of this item.

Method of Measurement. This work will be measured for payment per each CABINET, MODEL 336S furnished, installed and tested.

Basis of Payment. This work will be paid for at the contract unit price each for CABINET, MODEL 336S, which price shall be payment in full for furnishing and installing the cabinet and all connections, testing, labor, tools, equipment, transportation, and incidentals necessary to complete this item of work.

MODIFY EXISTING FIBER OPTIC CABINET

Description. This work shall consist of modifying an existing fiber optic interconnect cabinet as shown on the Plans and detailed in this specification. Modifications include removal of existing cabinet equipment and installation of new cabinet equipment. This work also includes furnishing, installing, configuring, and integrating new Layer III network switches, associated equipment/licenses and fiber optic transceiver and fiber jumpers as detailed in the ETHERNET MANAGE SWITCH special provision.

Materials.

Layer III Network Switch. Layer III network switches, associated equipment/licenses and fiber optic transceiver and fiber jumpers shall be as per the ETHERNET MANAGE SWITCH special provision.

Cable Management. The cable management system shall be compatible with the existing fiber optic interconnect cabinet equipment racks and shall be a minimum of 1 rack unit per switch.

CONSTRUCTION REQUIREMENTS

General. Prior to any work being performed by the Contractor, the Contractor shall, in the presence of the Engineer and the EMC Engineer, conduct an inspection of the equipment to be salvaged, making note of any parts which are found broken, missing, defective, or malfunctioning. The EMC Engineer will test the equipment as deemed necessary by the Engineer. Any problems noted will be resolved as directed by the Engineer and the EMC Engineer.

The Contractor shall contact the IDOT Electrical Maintenance Engineer a minimum of 2 weeks in advance of planned work to obtain approval for the work and an allowable down time window for the site. The Contractor shall notify the IDOT Traffic Systems Center at 708-524-2145 at the beginning of the approved work date prior to completing any cabinet modifications work.

The Contractor shall prepare and submit a shop drawing to the Engineer for approval detailing the complete cabinet layout, including all proposed equipment make/models, a wiring diagram, and equipment layout. A plastic laminated cabinet layout diagram, circuit schematic, and bill of materials with catalog numbers used shall be affixed to the interior side of the cabinet door.

Equipment Removal. The Contractor shall remove ITS surveillance equipment as indicated in the plans:

- Existing network switch
- Existing media converter
- Existing power supplies
- Existing fiber jumpers and network cables

All equipment removed shall be salvaged back to IDOT. The Contractor shall assume full responsibility for the equipment during removal, transportation, and shipping/transfer to the Department facility. Equipment shall be removed, boxed in new containers, approved by the Engineer, and delivered to the Department facility. The contractor is responsible for all packaging, transportation, and delivery.

The Contractor shall handle the equipment in such a manner as to prevent damage. Any damage resulting from the removal and/or transportation/shipping of the traffic surveillance equipment to be salvaged shall be repaired or replaced in kind at the Contractor's expense. The Engineer will be the sole judge to determine the extent of damage and the suitability of repair and/or replacement.

Equipment Installation. Layer III network switches, associated equipment/licenses and fiber optic transceiver and fiber jumpers shall be as per the ETHERNET MANAGE SWITCH special provision, including configuration and integration. A cable management system shall be installed below each Layer III network switch as shown on the plans. Layer II network switch, fiber optic patch panels and fiber optic terminations will be paid for separately.

Existing Device Migration. Existing devices shall be migrated from the existing communications devices to the new Layer II or Layer III switches as shown in the plans. The Contractor shall coordinate with the IDOT Electrical Maintenance Engineer for port assignments prior to device migration. In order to minimize downtime of existing equipment, the new Layer III and Layer II switches shall be fully installed, configured, and tested prior to migration taking place.

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 each for MODIFY EXISTING FIBER OPTIC CABINET location.

LAYER II (DATALINK) SWITCH, FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT, and TERMINATE FIBER IN CABINET will be paid for separately.

MODIFY EXISTING CABINET EQUIPMENT AND APPURTENANCES

Description. This work shall consist of modifying an existing ITS surveillance cabinet as shown in the Plans and detailed in this specification. Existing ITS surveillance cabinets as shown in the plans will have varying sizes, power sources, and equipment layouts. Modifications include removal of existing cabinet equipment, installation of new cabinet equipment, and re-arranging existing cabinet equipment as necessary to make space for new cabinet equipment.

Materials.

Power Data Unit. A new power data unit shall be installed in the cabinet as shown in the plans. The power data unit shall be a web-controlled relay and DC power supply to allow for remote switching of power to select devices in the ITS surveillance cabinet. The power data unit shall be mountable on standard 35mm DIN rail. The power data unit shall have 8 Single Pole Double Throw (SPDT) relay outputs, accept power supply voltages between 12-28 VDC and draw a maximum of 6 watts power. The power data unit shall have a web interface accessible from any standard web browser. The power data unit shall have maximum dimensions of 6" x 5" x 3". The operating temperature of the unit shall be at least -30° to 170°F.

Circuit Breakers. Circuit breakers shall be single pole and with amperage rating as shown on the Plans. Breakers shall be suitable for mounting to the equipment panel of the cabinet. Rating of breakers shall be shown on face of breaker. Breaker function shall also be labeled below breakers on front panel. Breakers shall have a rated voltage of 277V AC.

Terminal Blocks. 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. The terminal block shall be rated for 60 A at 600 V peak, minimum.

CONSTRUCTION REQUIREMENTS

General. Prior to any work being performed by the Contractor, the Contractor shall, in the presence of the Engineer and the EMC Engineer, conduct an inspection of the existing cabinet equipment, making note of any parts which are found broken, missing, defective, or malfunctioning. The EMC Engineer will test the equipment as deemed necessary by the Engineer. Any problems noted will be resolved as directed by the Engineer and the EMC Engineer.

The Contractor shall contact the IDOT Electrical Maintenance Engineer a minimum of 2 weeks in advance of planned work to obtain approval for the work and an allowable down time window for the site. The Contractor shall notify the IDOT Traffic Systems Center at 708-524-2145 at the beginning of the approved work date prior to completing any cabinet modifications work.

The Contractor shall prepare and submit a shop drawing to the Engineer for approval detailing the complete cabinet layout, including all proposed equipment make/models, a wiring diagram, and equipment layout. A plastic laminated cabinet layout diagram, circuit schematic, and bill of materials with catalog numbers used shall be affixed to the interior side of the cabinet door.

Equipment Removal. The Contractor shall remove ITS surveillance equipment as indicated in the plans. Equipment removal will vary by location and may include the following components:

- Existing network switch
- Existing media converter
- Existing power supplies
- Existing fiber optic patch panel
- Existing fiber jumpers and network cables

All equipment removed shall be salvaged back to IDOT. The Contractor shall assume full responsibility for the equipment during removal, transportation, and shipping/transfer to the Department facility. Equipment shall be removed, boxed in new containers, approved by the Engineer, and delivered to the Department facility. The contractor is responsible for all packaging, transportation, and delivery.

The Contractor shall handle the equipment in such a manner as to prevent damage. Any damage resulting from the removal and/or transportation/shipping of the traffic surveillance equipment to be salvaged shall be repaired or replaced in kind at the Contractor's expense. The Engineer will be the sole judge to determine the extent of damage and the suitability of repair and/or replacement.

Equipment Layout Modifications. The location of existing equipment to remain in the cabinet may need to be relocated to adequately fit new proposed equipment. Any relocation of equipment is included in this pay item. The Contractor shall include any proposed equipment relocations within the cabinet on their proposed shop drawings submitted to the Engineer for approval.

Equipment Installation. The power data unit, circuit breakers, and terminal block(s) shall be installed on a standard 35mm DIN rail secured to the cabinet back panel. Quad-outlets shall be secured directly to the cabinet back panel. Installation of other new equipment in the cabinet, including Layer II network switch and fiber optic patch panel will be paid for separately.

Method of Measurement. This work will be measured for payment per each MODIFY EXISTING CABINET EQUIPMENT AND APPURTENANCES cabinet.

Basis of Payment. This work will be paid for at the contract unit price each for MODIFY EXISTING CABINET EQUIPMENT AND APPURTENANCES.

LAYER II (DATALINK) SWITCH, FIBER OPTIC TERMINATION PANEL, 12F, and TERMINATE FIBER IN CABINET will be paid for separately.

DMS SIGN CONTROL EQUIPMENT

Description. This work shall consist of furnishing and installing equipment for the control and power distribution of DMS signs. This work includes, disconnect switches, transformers, junction boxes, and conduit and wiring attached to the DMS structure and other miscellaneous components necessary to control the sign.

Materials. The DMS control and power distribution equipment shall be attached to the DMS structure. The equipment shall be securely mounted on a stainless steel mounting back panel.

Power Distribution

- (1) A NEMA 4X stainless steel non-fused, lockable disconnect shall be furnished and installed on the DMS structure at locations as shown in the Plans. Disconnect shall be service entrance rated, minimum size 100 amps, 600 volt rated.

- (2) For 480 volt electrical service, a single phase, dry-type step down transformer (10KVA) shall be furnished and installed at locations as shown on the Plans. Transformer shall conform to Article 1068.02 and be encapsulated in a NEMA 4X enclosure. Transformer shall be UL listed, and designed for continuous operation for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSIC57.96. Each transformer must be provided with a suitable terminal compartment to accommodate the required primary and secondary wiring connections and side or bottom conduit entrance.

Junction Boxes

Junction boxes shall be stainless steel and in accordance with Article 813 of the Standard Specifications.

Conduit and Wiring

Conduit attached to the DMS structure shall be PVC coated, galvanized steel conduit. The PVC coated, galvanized steel conduits shall be in accordance with the EXPOSED RACEWAYS special provision. Wiring shall be in accordance with the WIRE AND CABLE special provision.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall prepare and submit a shop drawing detailing the mounting of disconnects/transformers and routing of conduits on the DMS sign structure. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer.

Installation. The contractor shall install the power equipment and disconnects/transformers and pull new conductors as shown on the plans. The Contractor shall make all necessary power connections to the transformer and disconnect switch needed for a fully operational Dynamic Message Sign. Conduit installation shall be in accordance with the EXPOSED RACEWAYS special provision.

Method of Measurement. This work will be measured for payment for each installation.

Basis of Payment. This work will be paid for at the contract unit price each for DMS SIGN CONTROL EQUIPMENT. This work shall include all conduit, wiring, mounting devices and hardware for a complete functioning system at each location.

LAYER III (NETWORK) SWITCH

Description. This work shall consist of furnishing and installing a Layer III network switch and associated equipment/licenses in the ILLINOIS DEPARTMENT OF TRANSPORTATION COMMUNICATIONS NODE as shown on the plans.

Materials.

Collapsed Core and Distribution Layer Switch

The Cisco Catalyst 9500-24Y4C-A comprise the distribution layer switches and the equipment as outlined in the table below. The contractor shall verify the equipment and licenses as outlined in the table below with IDOT Electric Maintenance Contractor's Network Administrator and provide the proper IOS, licensing such as DNA, Smart Net, Cisco ISE, etc. in keeping with the existing shelter and data center switches in the ITS network.

The Layer III switch and associated equipment/licenses shall be as follows:

Table 1. Layer III Network Switch — Parts List

Vendor	Model No.	Item Description	Quantity
CISCO	C9500-48Y4C-A	Catalyst 9500 48-port x 1/10/25G + 4-port 40/100G, Advantage	1
CISCO	C9K-PWR-650WAC-R	Cisco Power Supply	1
CISCO	C9K-PWR-650WAC-R/2	Cisco Redundant Power Supply	1
CISCO	Stackwise	Cisco stacking cable	1
CISCO	CAB-9K12A-NA	Cisco Power cords	2
CISCO	C9K-F1-SSD-BLANK	Cisco blank Pluggable SSD Storage	1
CISCO	C9500-DNA-A-7Y	Cisco DNS 7-year Advantage License	1
CISCO	SMARTNET	Cisco SMARTNET 8X5XNBD Service Agreement	1
CISCO	C9500-NW-A	Cisco Network Stack, Advantage	1
Cisco	S9500UK9-168	UNIVERSAL	1

Fiber Jumpers

The fiber jumpers shall comply with the following:

- The fiber optic jumpers shall be approximately 10 foot (3 meters) SMFO duplex LC-LC jumper cables manufactured by Corning, model number 040402R5820003M or approved equivalent.
- Be compliant with the TIA/EIA-568-A and TIA/EIA-604 standards, as applicable.
- Tested according to the Telcordia/Bellcore GR-326-CORE standard. When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)-171 (TIA/EIA-455-171).
- The connectors shall test to an average insertion loss of 0.4 decibel and a maximum loss of 0.75 decibel.
- The connectors shall be tested as detailed in FOTP-107 (TIA/EIA-455-107) to reflectance values of -58 decibels.
- The connector material shall be Ceramic with UPC polish.
- The contractor shall provide the quantity of optical patch cords as listed in the table below.

Fiber Optic Transceivers

The fiber optic transceivers installed in the switch shall be from the same manufacturer as the switch or shall be from a manufacturer approved list. Recommended fiber optic transceiver types shall be the following models or approved equal.

- GLC-LH-SMD (1 Gbps single mode transceivers for links under 10 km)
- GLC-EX-SMD (1 Gbps single mode transceivers for links over 10 km and under 40 km)
- GLC-ZX-SMD (1 Gbps single mode transceivers for links over 40 km)
- GLC-TE= (1 Gbps copper transceivers)

Table 2. Communications Equipment — Parts List

Location	Application	SFP Transceiver	Transceiver Quantity	Fiber Jumpers, 3M
Communications Hut	DCF	GLC-LH-SMD	40	40
	TCF	GLC-ZX-SMD	2	2
		GLC-TE=	3	
Fiber Interconnect Cabinet, Sta 205+08	DCF			20

Note: The equipment listed in Table 2, row 1 is a total for the Communications Hut. The equipment listed in Table 2, row 2 is a total for the Fiber Interconnect Cabinet at Station 205+08 to facilitate connections back to the Layer III switches at the Communications Hut.

CONSTRUCTION REQUIREMENTS

Installation. The Layer III network switch and its associated equipment supply shall be mounted to an equipment rack as shown on the plans. The Contractor shall submit a shop drawing showing the location where the switch will be installed in the building and the means of mounting for approval by the Engineer.

Configuration. Field devices shall be packaged and delivered to the IDOT network administrator for configuration. Devices shall be labeled and numbered according to the building or field cabinet these devices are to be installed. The IDOT network administrator shall configure and test the device to make sure the device functions within the IDOT network environment as intended and is ready for installation. Any device that is deemed nonconforming/functional shall be removed and returned to the contractor. It is the contractor's responsibility to get the device repaired or replaced and reconfigured by the IDOT network administrator prior to installation in the field.

Once configuration has been completed and verified operational within the IDOT network environment the contractor shall plan to pick up the ITS field devices from the IDOT network administrator for installation. The contractor shall coordinate the field installation and turn on of ITS field devices with the Engineer, TSC Engineer, and IDOT network administrator.

Integration. The Layer III switch shall be integrated by the Contractor into the IDOT D1 field network per the approved configuration document. Configuration, integration, functionality, and compatibility with the existing network are the responsibility of the Contractor.

Method of Measurement. This work will be measured for payment in units of each. Each LAYER III NETWORK SWITCH will include all the components as detailed in Table 1 above. The Communications Equipment listed in Table 2 will not be measured separately for payment.

Basis of Payment. This work will be paid for at the contract unit price per each for LAYER III NETWORK SWITCH, the price of which shall include all equipment, materials, and labor required to furnish, configure and install the switches, including all necessary connectors, cables, fiber jumpers, fiber optic transceivers, hardware, software, and other peripheral equipment required to place the switches in operation to the satisfaction of the Engineer.

TREE REMOVAL, ACRES (SPECIAL)

Modified: August 9, 2021

Project objectives and general requirements:

- 100% removal via mechanical and/or hand cutting methods of woody plant material (trees and shrubs).
- Disposal of all cut trees, shrubs, and chips should be hauled off-site.
- Wood chips shall be removed and not blown back onto the site.
- Preservation of all native shrubs and trees that are marked with green flagging.
- Damages to existing vegetation to remain, such as broken limbs, frayed limbs, or other plantings or roadside appurtenances caused by the Contractor's tree removal or trimming operations shall be repaired at the Contractor's expense to the satisfaction of the Engineer.
- Protection of soils from compaction, erosion, and disturbance are the Contractor's responsibility prior to start of work. Any damage caused by Contractor including but not limited to tire ruts, damage to turf, damage to drainage swales, damage to trails, damage to road pavement, etc. shall be repaired by the Contractor at the Contractor's expense to the satisfaction of the Engineer. This work shall consist of the removal of the existing woven wire fence, which may or may not include barb wired strands at those locations shown on the plans.
- Tree Removal, Acres (Special) shall include removal of typical amounts of litter and debris encountered during tree removal operations.
- No slash shall be left in drainage ways and be blocking drainage structures. No slash shall be left in piles.
- The Engineer shall have the ultimate authority to approve the final condition of slash. In areas where seeding will take place the use of a forestry mower to manage minor woody vegetation, grind slash, stumps under 6", and any remaining woody plant debris down to the surface of the soil to prepare the site for future seeding.
- The Engineer shall have the ultimate authority to approve the final condition of slash. In areas where seeding will not take place, slash is acceptable at a maximum depth of no more than two (2) inches to act as a mulch. • Tree debris, logs, equipment, etc. should not be stored within clear zone.
- All cut trees and shrubs shall be removed off site within 24 hours.

Project Preparation. This shall include preparation of a clearing access plan and identification of sensitive natural resources. Mechanical clearing operations shall not begin until the Engineer indicates that ground conditions are appropriate to commence mechanical work.

Contractor shall contact the Roadside Development Unit at 847-705-4171, at least 2 weeks prior to beginning forestry work for layout.

Contractor shall furnish at time of layout the following as requested: wooden lathe, neon pink ribbon, neon green ribbon, pink marking paint.

A site visit prior to work shall be arranged with the Contractor, Tree Removal Contractor, the Engineer, and the Roadside Development Unit to do a walk through to review vegetation to protect and remain. Extreme care shall be taken when conducting work within the work site to lessen damage to native vegetation to remain.

Submittals. Contractor shall provide the Engineer with a list of herbicides, surfactants, water conditioners, dyes, pH balancers, and other chemicals and adjuvants to be used for implementation of this project for prior approval.

Prior to commencement of any work, submit to the Engineer a written description of all mechanical equipment and its intended use during the execution of the work for prior approval.

Tree Removal and Initial Cut Stump Treatment. All cutting of material shall be completed via mechanical (e.g., tracked skid-loaders, forestry mowers) and/or hand cutting (chain saws, clearing saws) methods. Any mechanized clearing equipment must be approved for use on the work site prior to its implementation.

In general, mechanical cutting equipment with all steel tracks or a ground pressure rating of greater than 9.0 psi will not be allowed unless the Contractor can adequately demonstrate that the use of such equipment will not cause adverse rutting/soil compaction to the work site and will not damage the pavement adjacent to the work site.

The Engineer may specify certain areas as "HAND CLEAR ONLY" to be avoided by mechanical equipment or access paths. In these areas, the Contractor is prohibited from using mechanical clearing equipment due to sensitive site conditions.

All woody trees and shrubs over two (2) feet in height of any diameter, including protruding stumps or fallen trees within the defined area shall be removed. Any woody vegetation under two (2) feet in height shall be treated with a foliar herbicide or resprout herbicide.

Branches on remaining trees shall be pruned off up to eight (8) feet from the ground.

All stumps shall be cut flat with no sharp points, and no less than two (2) inches of surrounding grade shall be treated with an approved resprout herbicide mixed with a marking dye within twenty-four (24) hours of the tree being cut to prevent regrowth from those stumps.

All herbicides shall be applied according to the manufacturer's label specifications. Contractor personnel applying the resprout herbicide shall have a valid pesticide applicator license issued by the Illinois Department of Agriculture.

The resprout herbicide shall be approved by the Engineer. Resprout herbicide shall be labeled to control woody species present within clearing areas. Resprout herbicide shall be included in the cost of TREE REMOVAL, ACRES (SPECIAL).

The Contractor shall maintain copies at the project site of all current pesticide herbicide labels and Material Safety Data Sheets (MSDS) for all chemicals utilized during completion of the work.

Method of Measurement. TREE REMOVAL, ACRES (SPECIAL) will be measured in units of 1 square acre. Plan quantities are estimates only. Actual quantities will be measured in place. Agreement to plan quantities will not be allowed.

If the inspection discloses any work as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same, and the Contractor shall immediately comply with such instructions and correct the unsatisfactory work within forty-eight (48) hours. Work that is not acceptable on the inspection date will not be measured for payment. Individual areas will not be measured for payment if any portion of the area has not been completed to the satisfaction of the Engineer.

Basis of Payment. Tree removal shall be paid for at the contract unit price per acre for TREE REMOVAL, ACRES (SPECIAL). Payment for TREE REMOVAL, ACRES (SPECIAL) shall include the cost of all material, equipment, labor, removal, herbicide application, disposal, cleanup, and incidentals required to complete the work as specified herein and to the satisfaction of the Engineer.

Special attention is called to this item since the Contractor will, in this case, be required to remove stumps only. The trees have previously been removed by others. All excess chips and debris from this operation shall be removed from State right-of-way. This work shall be done in accordance with Section 201 of the Standard Specifications. The entire tree stump shall be removed to the satisfaction of the Engineer.

DYNAMIC MESSAGE SIGN, WALK-IN ACCESS, FULL MATRIX, COLOR, NTCIP 1203

General Requirements

This special provision shall govern the furnishing and installation of a Walk-In Access, Full matrix, Color, NTCIP 1203 Dynamic Message Sign (DMS) and associated equipment cabinets as shown in the plans and as detailed in this special provision. The high resolution, full color display shall be a full matrix configuration of 96 pixels high by 400 pixels wide. The size of the sign shall be as shown in the plans. All display elements and modules shall be solid state. No mechanical or electromechanical elements or shutters shall be used.

Equipment to be furnished at each dynamic message sign field site shown in the plans shall include, but not be limited to the following: LED DMS, sign controller, cabling, sign enclosure, documentation, warranties, mounting hardware, latest vendor maintenance diagnostic software with 20 licenses to load software on Department/Department's maintenance forces laptops, and five (5) units of FLIR 360 Cameleon Client ITS site license for each installed DMS.

The Central Controller resides at the Traffic Systems Center. The DMS Central Software was developed by 360 Surveillance, Inc. The successful sign vendor shall perform an on-site working sample demonstration test to prove their product is compatible with the 360 Cameleon Client/Server Software. The Working Sample demonstration test criteria are outlined in Section 2.0 of this document.

Each DMS assembly shall consist of a LED DMS sign case including contents, mounting brackets, its associated sign controller unit (SCU), and communication unit, cabling between the DMS case and the sign controller unit, optically coupled interface from controller to sign, and DMS walkway platforms with permanent safety and mounting brackets and hardware.

Each LED DMS shall be capable of displaying three lines of text. Each line shall consist of a string of 18 alphanumeric characters. Each character shall be composed from a luminous dot matrix system. The matrix system for a high resolution, full color display shall consist of 384 dots composed of 24 columns and 16 rows. A luminous pixel shall consist of a LED pixel array. All display elements and modules shall be solid state.

All characters, symbols, and digits shall be 18 inch nominal character size and shall be clearly visible and legible at a distance of 900 feet within a 30 degree cone of vision centered on the optical axis of the pixel.

The signs shall be capable of displaying the following:

- A static message
- A flashing message
- Two alternating messages, either flashing or static

The changing from one message to another shall be instantaneous.

The total weight added to the sign structure shall be no greater than 4000 pounds. The dimensions of the sign housing will not exceed 8'0" tall, 3'0" wide, and 4' deep and access to the electronics shall be achieved through the inside of the DMS. Larger signs may be submitted, but they will require additional review time to evaluate the structural adequacy of the Department's standard sign trusses.

The Contractor shall provide structure mounted service equipment to provide power to each sign as required by the Plans. This work shall be paid for separately under DMS SIGN CONTROL EQUIPMENT.

The Contractor shall be responsible to have a Licensed Structural Engineer in the State of Illinois design the sign attachment to the DMS sign truss and stamp the drawings. These drawings shall be submitted to the Engineer for approval before work can commence. These drawings will describe the mounting required to attach the DMS to the Structure. Shop drawings for the structures may be available upon request. The contractor shall supply all mounting hardware necessary to attach the DMS to the structure. The cost of this work shall be included in the contract bid price for the item. No additional compensation will be allowed for any modifications that may be required to the structure.

All field equipment shall remain fully functional over an ambient temperature range of -40°F to +149°F with relative humidity of up to 95%. All field equipment enclosures shall be designed to and shall withstand the effects of sand, dust, and hose-directed water. All connections shall be watertight.

Working Sample Demonstration (Dynamic Message Sign)

To ensure timely delivery for installation, it is imperative that the DMS manufacturer be regularly engaged in the manufacture of the specified equipment and capable of immediately demonstrating a sample DMS that is in clear compliance with the key portions of the specifications. Delay from the specified timeline, and failure to present the sample in a timely manner may result in termination of the contract, at the discretion of the Engineer.

The DMS manufacturer shall provide a satisfactory, approvable demonstration of a working sample DMS within 14 calendar days after contract execution. The sample shall be a complete mock-up of a working DMS based on the proposed equipment to be furnished under this contract and identified in the submittal material. The sample demonstration may utilize a portable sample at the IDOT Traffic Systems Center, or it may be at the manufacturer's production facility if located within District 1. A demonstration of an identical installed unit for some other contract will be acceptable.

The sample demonstration will be for purposes of review and approval by the engineer. The Engineer will issue review comments based on examination of the unit and its operation at the time of the demonstration, and the Engineer may require a subsequent revised sample demonstration if, in the Engineer's judgment, the comments warrant re-work of the sample unit.

For a demonstration to be held at the IDOT Traffic Systems Center, the manufacturer shall coordinate the exact date, time, demonstration location, and power requirements with the IDOT Electrical Maintenance Engineer.

The sample unit shall be in substantial compliance with the contract requirements. The Engineer may elect to waive minor deviations for purposes of the demonstration, or may waive minor deviations completely if alternative provisions are judged superior to specified requirements, but deviations from key specified requirements will not be accepted.

Materials.

All materials furnished, assembled, fabricated or installed under this item shall be new, corrosion resistant and in strict accordance with the details shown in the plans and as detailed in this specification. All details and functionality listed in this specification will be thoroughly inspected and tested by the department. Failure to meet all details and functionality detailed in this specification shall be grounds for rejection of the equipment.

Terminology

Due to the varying definitions used in Dynamic Message Sign technology, this section defines specific terms as they apply to this specification.

- Sign: The sign housing and its contents.
- Sign Controller: Located in a ground cabinet (as detailed in this specification), the sign controller specifies the message to be displayed. Messages can be selected either remotely from the central controller, locally from a laptop computer or from the front panel of the sign controller.
- Central Controller: The MS Windows Server computer system and related software, which operates the system from a remote control site.
- Workstation: This computer operates as a remote client to the central controller. A workstation operator may dial-in to the central controller and gain access to the functions of the central by using the appropriate access codes.
- LED: Light Emitting Diode
- Pixel: Any of the small discrete elements that, when arranged in a pixel matrix, create a character. A pixel contains a cluster of LEDs.
- Pitch: Distance measured from center to center of adjacent pixels within a matrix. This distance is measured both horizontally and vertically.
- Poll: The central controller and laptop computer are said to "poll" a sign when they request the sign's status information. The term is derived from the periodic status polling, which a central can perform, but is loosely used to refer to any status request.
- Message: Text; the information shown on the sign.
- Display: The message seen by the motorist. A display may include more than one page of text (an alternating display). Any character or set of characters of a display may be flashed (a flashing display).
- Neutral State: Sign is blank, or displaying a predefined message that is displayed regularly.
- WYSIWYG: What You See IS What You Get. In this specification, this is the functionality of the LED DMS system where the central, workstation or laptop display mimics the actual message that is visibly displayed on the sign on an individual pixel basis.

DMS Manufacturer Requirements

The company that designs and manufactures the LED DMS shall be currently ISO 9001 certified as of the bid date for this project and shall have received its ISO 9001 certification a minimum of three years prior to the bid date for this project. The scope of this company's ISO 9001 certification shall be for the Design, Manufacture, Installation, Maintenance and Sales of Dynamic Message Sign Systems. The facility where this company actually designs and manufactures the LED DMS shall be ISO 9001 certified. This company, this scope and the address of this facility shall all be listed on the ISO 9001 certificate. This ISO 9001 certificate shall be provided with the bid. The name, phone number and address of both the Authorized ISO 9001 Registrar that certified this company and the Authorized ISO 9001 Accreditation Body that accredited this Registrar shall be provided with the bid. Failure to fully comply with these requirements and to provide all this information will cause this company's equipment and software to be rejected. ISO 9002 and ISO 9003 certifications are not adequate and do not meet this requirement.

Experience Requirements

The LED DMS Manufacturer shall submit a State Department of Transportation reference for a minimum of three (3) different states that have been successfully operating a highway full color LED dynamic message sign system and that completely meets these specifications, manufactured and supplied by this manufacturer for a period of no less than five (5) years.

The LED DMS Signs and System shall be fabricated by an established DMS manufacturer having the minimum of:

- 10 years of experience, under the current corporate name, in the design and manufacturing of State Highway or Interstate Highway, permanently-mounted, overhead dynamic message signs and central control systems installed in freeway service. These 10 years of experience shall include the complete design and manufacturing of all aspects of the dynamic message signs, including the electronic hardware, software and sign housings.
- 100 State Highway or Interstate Highway, permanently-mounted, overhead dynamic message signs installed in freeway service, under the current corporate name.
- 50 State Highway or Interstate Highway, permanently-mounted, overhead LED dynamic message signs that completely meet this specification with three lines of 18-inch characters and Walk-In Access housings installed in freeway service, under the current corporate name.
- The manufacturer of the LED DMS Signs and System shall submit documentary evidence and reference data for the above requirements. Reference data shall include the name and address of the organization, and the name and telephone number of an individual from the organization who can be contacted to verify the above requirements. The name of the DMS manufacturer that meets these experience requirements shall have the same corporate name as the DMS manufacturer that meets the ISO 9001 requirements stated elsewhere in this specification. This information shall be provided prior to documentation submittal. Failure to furnish the above references will be sufficient reason for rejection of the supplier's equipment.
- The Contractor shall submit the information described in this section to the Engineer within 15 days of award of the contract. Review of the submittal information by the Engineer shall not relieve the Contractor of the contractor's obligation to furnish and install the work in accordance with the contract documents. No time extensions will be granted to the Contractor as a result of the need to resubmit various items to review.
- Shop drawings shall be submitted in accordance with Article 105.04 of the Standard Specifications and as specified in these special provisions.
- Prior to purchase or fabrication of any equipment or materials for use in this project, the Contractor shall submit, for review by the Engineer, appropriate catalog cuts sheets, and specifications for all standard, off-the-shelf items and shall submit shop drawings and other necessary data for all non-catalog or custom-made items.
- The Contractor shall furnish five sets of submittal data in accordance with GENERAL ELECTRICAL PROVISIONS special provision.

- If reprinted literature, such as catalog cut sheets, is used to satisfy the submittal data requirements, there shall be no statements on the literature which conflict with the requirements of the contract documents. Any such statements shall be crossed off and initialed by the Contractor. Explanation of how specifications shall be met pertaining to items changed from the literature shall be documented in writing and included with the submittal information.
- All items shall be submitted together.
- Each submittal shall contain sufficient information and details to permit full evaluation of each item, and its interrelationships among the various items shall be carefully addressed.
- The Contractor shall prepare and submit detailed shop drawings for each sign type indicating types of materials proposed for each component of each sign, parts lists, assembly techniques, layout of all display elements and wiring schematics. The shop drawings shall also illustrate in detail how the Contractor proposes to mount and connect the DMS sign case to the sign support structure (truss). The DMS sign case shall include any support mechanism necessary for the installation of the DMS sign case that is not included in the truss. These drawings shall be submitted to the Engineer for review and approval prior to fabrication of any sign. Parts lists shall include circuit and board designation, part type and class, power rating, component manufacturer and mechanical part manufacturer.
- As part of the submittals for the DMS assembly, the Contractor shall submit an engineering drawing illustrating the DMS character set including 26 upper case letters, 10 numerals, a dash, a plus sign (+), and slash. The Contractor shall also submit complete technical information, shop drawings, photographs, graphs, circuit diagrams, instruction manuals, security provisions, and any other necessary documents to fully describe the DMS assembly and associated equipment.

Product Testing

The DMS manufacturer shall provide documentation indicating that the DMS product has been tested to the following standards. It shall be acceptable for the testing to be performed on scale-sized versions of the actual DMS provided that the test unit is functionally and structurally equivalent to the full size DMS.

Failure to conform to these testing requirements shall be grounds for rejection. Rejected equipment may be offered for test or retest provided all non-compliant items have been corrected and tested or retested by the DMS manufacturer. Any corrections deemed necessary by the Engineer shall be made by the DMS manufacturer, at no additional cost to the Department.

Third Party Testing

Third party test reports shall be submitted for the following testing:

- NEMA Standards Publication TS 4, Hardware Standards for Dynamic Message Signs (DMS), with NTCIP Requirements – Section 2, Environmental Requirements. Test report shall detail results of mechanical vibration and shock, electrical noise and immunity, temperature, and humidity.
- Underwriters Laboratories (UL), UL 48 Standard for Electric Signs, UL 50 Enclosures for Electrical Equipment, and UL 1433 Standard for Control Centers for Changing Message Type Electric Signs. The UL report number(s) for all DMS and control equipment manufactured by the DMS manufacturer shall be submitted and the products shall bear the UL mark.

The supplier shall provide a record of each test performed including the results of each test. The report shall include a record of the 3rd party test laboratory and the test lab's representative that witnessed the tests, including the signature of the lab's representative. The test reports shall be provided to the Engineer for review as part of the technical submittal.

Self Certification

The DMS manufacturer shall provide self-certification, including a statement of conformance and copies of test reports, indicating that the following tests have been performed and passed.

Third party test reports shall be submitted for testing of the following National Transportation Communication for ITS Protocol (NTCIP) standards:

- NTCIP 1201:1996, NTCIP Global Object Definitions (including Amendment 1)
- NTCIP 1203:1997, Object Definitions for Dynamic Message Signs (including Amendment 1)
- NTCIP 2101:2001, Point to Multi-Point Protocol Using RS-232 Subnetwork Profile.
- NTCIP 2103 (Draft v1.13), Point-to-Point Protocol over RS-232 Subnetwork Profile.
- NTCIP 2104 V01.11 Ethernet Subnetwork Profile

The NTCIP testing shall have been completed using industry accepted test tools such as the NTCIP Exerciser, Trevilon's NTester, Intelligent Devices' Device Tester, and/or Frontline's FTS for NTCIP. The NTCIP test report(s) shall include testing of sub-network communications functionality, all mandatory objects in all mandatory conformance groups, and a subset of the remaining objects.

Physical Construction

Wiring and Power Distribution

Power and Signal Entrances. Two threaded conduit hubs shall be located on the rear or side wall of the DMS housing. One hub shall be for incoming AC power and the other shall be for incoming DMS signal cabling or a communications line.

Panel Board. The DMS shall contain a power panel board and circuit breakers that meet the following minimum requirements:

- Service entrance-rated
- Minimum of 20 circuit breaker mounting positions
- Short circuit ratings of 22,000 amps and 10,000 amps for the main and branch circuits, respectively
- UL listed panel board and circuit breakers

Internal Wiring. Wiring for LED display module control, environmental control circuits and other internal DMS components shall be installed in the DMS housing in a neat and professional manner. Wiring shall not impede the removal of display modules, power supplies, environmental control equipment, and other sign components. Wires shall not make contact with or bend around sharp metal edges. All wiring shall conform to the National Electrical Code.

Earth Grounding

The DMS manufacturer shall provide one earth ground lug that is electrically bonded to the DMS housing. The lug shall be installed near the power entrance location on the DMS housing's rear wall. The DMS installation contractor shall provide the balance of materials and services needed to properly earth ground the DMS, including ground rods and grounding wire between the DMS, grounding triad, and ground mounted controller cabinet. All earth grounding shall conform to the National Electrical Code.

DMS Enclosure

The LED DMS shall enable the display of text, consisting of a string of alphanumeric and other characters. The size of the sign shall be as shown in the plans, and elsewhere in the specification. Each character shall be formed by a matrix of luminous pixels. The matrix of a standard character shall consist of 345 pixels over 15 columns and 23 rows.

The equipment design and construction shall utilize the latest available techniques with a minimum number of different parts, subassemblies, circuits, cards and modules to maximize standardization and commonality. The equipment shall be designed for ease of maintenance. All component parts shall be readily accessible for inspection and maintenance. Test points shall be provided for checking essential voltages.

The sign shall be designed for a minimum life of 20 years.

The sign shall be designed and constructed so as to present a clean and neat appearance. Poor workmanship shall be cause for rejection of the sign.

All cables shall be securely clamped or tied in the sign housing. No adhesive attachments will be allowed.

The dynamic message sign, including the sign housing and all modules and assemblies, shall be designed and manufactured in the USA.

The complete sign housing shall be designed and manufactured in-house by the LED DMS Sign Manufacturer.

A registered structural engineer in the State of Illinois shall analyze the DMS structure and certify that the DMS will withstand the temporary effects of being lifted by the provided eye bolts, will comply with the applicable requirements of the most current edition with revisions of the AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaries and Traffic Signals, and will support a front face ice load of 4 lbs. per square foot.

The equipment within the sign housing shall be protected from moisture, dust, dirt and corrosion. The sign shall be constructed of aluminum alloy 5052-H32 or 3003-H14 which shall not be less than 1/8" thick, unless otherwise specified in this document. Framing structural members shall be made of aluminum alloy 6061-T6 or 6063-T5.

All welding shall be by an inert gas process in accordance with the American Welding Society (AWS) Standards, ANSI/AWS D1.2-97. The LED DMS manufacturer's welders and welding procedures shall be certified by an ANSI/AWS Certified Welding Inspector to the 1997 ANSI/AWS D1.2-97 Structural Welding Code for Aluminum. Proof of certification of all the LED DMS manufacturer's welders and applicable welding procedures shall be supplied with the submittals. The name, phone number and address of the ANSI/AWS Certified Welding Inspector that certified the LED DMS manufacturer's welders and procedures shall also be provided with the submittals.

The DMS housing's right, left, and rear walls shall be vertical. The top and bottom sides shall be horizontal.

The sign housing shall be capable of withstanding a wind loading of 120 M.P.H. without permanent deformation or other damages.

All 120/240 VAC wiring located inside the sign housing shall be run in conduit pull-boxes, handy-boxes, power supply boxes, control cabinets, and circuit breaker boxes.

The performance of the sign shall not be impaired due to continuous vibration caused by wind, traffic or other factors. This includes the visibility and legibility of the display.

The presence of power transients or electromagnetic fields, including those created by any components of the system, shall have no deleterious effect on the performance of the system. The system shall not conduct or radiate signals which will adversely affect other electrical or electronic equipment including, but not limited to, other control systems, data processing equipment, audio, radio and industrial equipment.

All DMS structural hardware shall be stainless steel and appropriately sized for the application.

The DMS Manufacturer shall provide a signed and sealed copy of these certifications by the registered Structural Engineer as part of the catalog cut submittal.

Electronic Components. All electronic components, except printed circuit boards, shall be commercially available, easily accessible, replaceable and individually removable using conventional electronics repair methods.

All workmanship shall comply with ANSI/IPC-1-610B Class 2 titled "Acceptability of Electronic Assemblies", ANSI/IPC-7711 titled "Rework of Electronic Assemblies", and ANSI/IPC-7721 titled "Rework and Modification of Printed Boards and Electronic Assemblies".

All electronic components shall comply with Section Electronic Materials and Construction Methods, located in this document.

All Printed Circuit Boards (PCBs) shall be completely conformal coated with a 0.010 inch (10 MIL) minimum thickness silicone resin conformal coat. The LED mother boards shall be completely conformal coated, except at the pixels on the front of the PCB, with a 0.010 inch (10 MIL) minimum thickness silicone resin conformal coat. The material used to coat the PCBs shall meet the military specification: MIL-I-46058C Type SR.

Mechanical Components. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping screws shall be used. All parts shall be made of corrosion resistant materials, such as plastic, stainless steel or aluminum. All materials used in construction shall be resistant to fungus growth and moisture deterioration. An inert dielectric material shall separate dissimilar metals.

Convenience Outlets. The DMS housing shall contain a utility outlet circuit consisting of a minimum of three (3) 15-A NEMA 15-R, 120 VAC duplex outlets, with ground-fault circuit interrupters. One outlet shall be located near each end of the DMS housing interior and the third outlet shall be located near the housing's center.

Front Face Construction

The DMS front face shall be constructed with multiple rigid panels, each of which supports and protects a full-height section of the LED display matrix. The panels shall be fabricated using aluminum sheeting on the exterior and polycarbonate sheeting on the interior of the panel.

Front face panels shall provide a high-contrast background for the DMS display matrix. The aluminum mask of each panel shall be painted black and shall contain an opening for each pixel. Openings shall be large enough to not block any portion of the viewing cones of the LEDs.

Face panels shall be attached to each other using stainless steel hardware. Seams that separate adjacent panels shall be sealed. Panels shall not be welded or otherwise permanently mounted to the DMS housing.

Each panel shall have a single polycarbonate sheet attached securely to the inside of the aluminum panel. The polycarbonate sheet shall cover all of the pixel openings. The polycarbonate shall be sealed to prevent water and other elements from entering the DMS. The polycarbonate shall contain UV inhibitors that protect the LED display matrix from the effects of ultraviolet light exposure and prevent premature aging of the polycarbonate itself. The use of a plastic lens system will not meet the requirements and will be cause for rejection.

LED display modules shall mount to the inside of the DMS front face panels. No tools shall be needed for removal and replacement of LED display modules.

DMS front face borders (top, bottom, left side and right side) which surround the front face panels and LED display matrix, shall be painted black to maximize display contrast and legibility.

In the presence of wind, the DMS front face shall not distort in a manner that adversely affects LED message legibility.

Service Access. The DMS housing shall provide safe and convenient access to all modular assemblies, components, wiring and subsystems located within the DMS housing. All of those internal components shall be removable and replaceable by a single technician.

At least one (1) 80" vertically hinged door shall be located on each end (left, right or left and right side) of the DMS housing. Each access door shall be mounted to an integral doorframe. A vertical stainless steel hinge shall support each door and all doors shall open outward. In the closed position, each door shall latch to its frame with a three-point draw-roller mechanism. The latching mechanism shall include an internal handle and release lever. Door release levers shall be located so that a person with no key and no tools cannot become trapped inside the housing.

Access doors, when open at a 90-degree angle from the DMS housing end wall, shall not extend more than 38-inches (965 mm) from the housing. The bottom edge of each door shall be at least 3.5-inches (89 mm) from the bottom edge of the DMS housing. This will provide clearance for the doors to swing open over external access platform.

Doorframes shall be double flanged on all sides to shed water. Each door shall close around its flanged frame and compress against a closed-cell foam gasket, which adheres to the door. All doors shall contain a stop that retains the door in a 90-degree open position. When a door is open, the door and its stop shall not be damaged by a 40 mph (64 km/h) wind.

Each door shall be furnished with a lock that is keyed to a Corbin #2 lock.

The DMS must be equipped with an OSHA compliant safety rail assembly, which prevents service personnel from falling out of the DMS when closed across an open access door. A rail assembly must be provided for each door in the display. The safety rail shall consist of a top rail that extends 42-inches (1,067 mm) above the interior walkway and a mid-rail that extends 21-inches (533 mm) above the interior walkway. The rail assembly shall require no tools to open and close.

The DMS cabinet shall be equipped with an OSHA compliant anchor point at each entrance location for the connection of a personal fall arrest system. These anchorages integrated to the support structure must be strong enough to withstand a force of 5,000 pounds (22.2 kilonewton(s)) as required by OSHA. The anchorages must be located such that they will not allow a person to free-fall more than 6 feet when a 6 foot lifeline is used. The anchorages must be located just inside each access door within easy reach from the outside.

Interior work area, minimum headroom of 72-inches (1,829 mm) shall be provided. This free space shall be maintained across the entire width of the DMS housing, with the exception of structural frame members. Structural members shall be designed not to obstruct the free movement of maintenance personnel throughout the DMS.

A level aluminum walkway shall be installed in the bottom of the DMS housing. The walkway shall be a minimum of 24-inches (610 mm) wide and it shall run the entire length of the housing, from one side to the other side. The walkway's top surface shall be non-slip and shall be free of obstructions that could trip service personnel. The walkway shall support a load of 500 pounds (136 kg) per two (2) linear feet per AASHTO STA specifications for Highway Signs section 3.6 Live Loads and it shall be constructed of multiple aluminum removable panels.

Face Panels. Front face panels shall provide a high-contrast background for the DMS display matrix. The aluminum mask of each door panel shall be painted black and shall contain an opening for each pixel. Openings shall be large enough to not block any portion of the viewing cones of the LEDs.

Each panel shall have a single polycarbonate sheet attached securely to the inside of the aluminum panel. The polycarbonate sheet shall cover all of the pixel openings. The polycarbonate shall be sealed to prevent water and other elements from entering the DMS. The polycarbonate shall contain UV inhibitors that protect the LED display matrix from the effects of ultraviolet light exposure and prevent premature aging of the polycarbonate itself. Polycarbonate sheets shall have the following characteristics:

- Tensile Strength, Ultimate: 10,000 PSI
- Tensile Strength, Yield: 9,300 PSI
- Tensile Strain at Break: 125%
- Tensile Modulus: 330,000 PSI
- Flexural Modulus: 330,000 PSI
- Impact Strength, Izod (1/8", notched): 17 ft-lbs/inch of notch
- Rockwell Hardness: M75, R118
- Heat Deflection Temperature Under Load: 264 PSI at 270F and 66 PSI at 288F
- Coefficient of Thermal Expansion: 3.9×10^{-5} in/in/F
- Specific Heat: 0.30 BTU/lb/F
- Initial Light Transmittance: 85% minimum
- Change in Light Transmittance, 3 years exposure in a Southern latitude: 3%
- Change in Yellowness Index, 3 years exposure in a Southern latitude: Less than 5%

LED display modules shall mount to the inside of the DMS front face panels. Common hand tools shall be used for removal and replacement.

DMS front face borders (top, bottom, left side, and right side), which surround the front face panels and LED display matrix, shall be painted black to maximize display contrast and legibility.

In the presence of wind, the DMS front face shall not distort in a manner that adversely affects LED message legibility.

Exterior Finish

DMS front face panels and front face border pieces shall be coated with semi-gloss black Kynar 500 resin or an equivalent brand of oven-fired fluoropolymer coating, which has an expected outdoor service life of 20 years.

All other DMS housing surfaces, including the DMS mounting brackets, shall be natural mill-finish aluminum.

Heating

The lens panel shall use heated, forced air to prevent fogging and condensation. An eight watt-per-foot, self-regulating, heat tape shall be provided along the bottom of the message area, between the glazing and the display modules. The sign controller shall control the heat tape. All heat tape terminal blocks shall be covered for safety.

Humidity Control

A humidity sensor shall be provided and sensed by the sign controller from zero percent to 100 percent relative humidity in one percent or fewer increments. The sensor shall operate and survive from 0 percent to 100 percent relative humidity.

The sensor shall have an accuracy that is better than +/- five percent relative humidity.

The sign controller shall read the internal temperature sensors, external ambient temperature sensor and the humidity sensor. The sign controller shall use these readings in an algorithm that turns on the heat tape and/or the fans at the appropriate times to reduce both frost on the face of the sign and condensation on the display modules and other electronic circuitry.

Drain Holes

The bottom panel of the housing shall contain small drain holes. The drain holes shall be screened to prevent the entrance of insects and small animals and shall be replaceable.

Ventilation System

The DMS shall contain systems for cabinet ventilation and safe over-temperature shutdown.

The DMS shall contain an electronically controlled ventilation system and a failsafe thermostat designed to keep the internal DMS air temperature lower than +140°F (+60°C), when the outdoor ambient temperature is +115°F (+46°C) or less.

The ventilation system shall consist of two or more air intake ports. Intake ports shall be located near the bottom of the DMS rear wall. Each intake port shall be covered with a filter that removes airborne particles measuring 500 microns in diameter and larger. One or more ball bearing-type fans shall be mounted at each intake port. These fans shall positively pressure the DMS cabinet.

Fans and air filters shall be removable and replaceable from inside the DMS housing.

Each ventilation fan shall contain a sensor to monitor its rotational speed, measured in revolutions per minute. The fan speed shall be reported to the sign controller upon request.

The ventilation system shall move air across the rear of the LED modules in a manner such that heat is dissipated from the LED's. The airflow shall move from the bottom of the cabinet towards the top to work with natural convection to move heat away from the modules.

Each exhaust port shall be located near the top of the rear DMS wall. One exhaust port shall be provided for each air intake port. All exhaust port openings shall be screened to prevent the entrance of insects and small animals.

An aluminum hood attached to the rear wall of the DMS shall cover each air intake and exhaust port. All intakes and exhaust hoods shall be thoroughly sealed to prevent water from entering the DMS.

The DMS shall automatically shut down the LED modules to prevent damaging the LEDs if the measured internal cabinet air temperature exceeds a maximum threshold temperature. The threshold temperature shall be configurable and shall have a default factory setting of 140°F (+60°C). The factory default setting shall be overridden if the selected message priority is set above 200 or is selected as an emergency message.

Alternate sign ventilation systems can be submitted to the Engineer for approval. Extra time and additional demonstration testing and documentation of the proposed alternate system may be needed to secure the necessary approval from the Engineer. No extra compensation shall be awarded to the Contractor for the alternate design but if the alternate design is rejected, liquidated damages may apply.

LED Display Modules

The DMS shall contain LED display modules that include an LED pixel array, LED driver circuitry, and mounting hardware. These modules shall be mounted adjacently in a two-dimensional array to form a continuous LED pixel matrix. Each LED display module shall be constructed as follows:

- Each LED display module may consist of one or two circuit boards. If two boards are used, they shall be mounted physically to each other using durable corrosion resistant hardware. They shall be electrically connected via one or more header-type connectors. The header connectors shall be keyed such that the boards cannot be connected incorrectly.
- All LED modules shall be manufactured using laminated fiberglass printed circuit boards.
- Each LED display module shall be mounted to the rear of the display's front face panels using durable corrosion resistant hardware. No tools shall be required for module removal and replacement. The modules shall be mounted such that the LEDs emit light through the face panel's pixel holes and such that the face panel does not block any part of the viewing cone of any of the LEDs in any pixels.
- LED display module power and signal connections shall be a quick-disconnect locking connector type. Removal of a display module from the DMS, or a pixel board or driver circuit board from its display module, shall not require a soldering operation.
- All exposed metal on both sides of each printed circuit board, except connector contacts, shall be protected from water and humidity exposure by a thorough application of conformal coating. Bench level repair of individual components, including discrete LED replacement and conformal coating repair, shall be possible.
- Individual addressing of the each LED display module shall be configured via the communication wiring harness and connector. No on-board addressing jumpers or switches shall be allowed.
- Removal or failure of any LED module shall not affect the operation of any other LED module or sign component. Removal of one or more LED modules shall not affect the structural integrity of any part of the sign.
- It shall not be possible to mount an LED display module upside-down or in an otherwise incorrect position within the DMS display matrix.
- All LED display modules, as well as the LED pixel boards and driver circuit boards, shall be identical and interchangeable throughout the DMS.

LED Pixels

Each LED module shall contain a printed circuit board to which LED pixels are soldered. The LED pixel matrix shall conform to the following specifications:

- Each LED module shall contain a minimum of 256 LED pixels configured in a two dimensional array. The pixel array shall be a minimum of sixteen (16) pixels high by sixteen (16) pixels wide.
- The distance from the center of one pixel to the center of all adjacent pixels, both horizontally and vertically, shall be 0.81-inches (20.6mm).
- Each pixel shall consist of a minimum of one (1) independent string of discrete LEDs for each color. All pixels shall contain an equal quantity of LED strings.
- The failure of an LED string or pixel shall not cause the failure of any other LED string or pixel in the DMS.
- Each pixel shall contain the quantity of discrete LEDs needed to output white colored light at a minimum luminous intensity of 12,400 candelas per square meter when operated within the forward current limits defined in these specifications.
- Each pixel shall also be capable of displaying amber colored light with a minimum luminous intensity of 7,440 candelas per square meter when operated within the forward current limits defined in these specifications.
- Each LED pixel shall not consume more than 1.5 watts.
- The circular base of the discrete LEDs shall be soldered so that they are flush and parallel to the surface of the printed circuit board. The longitudinal axis of the LEDs shall be perpendicular to the circuit board.

Discrete LEDs

DMS pixels shall be constructed with discrete LEDs manufactured by Avago Technologies (formerly Agilent Technologies), Toshiba Corporation, Nichia Corporation, OSRAM, or equivalent. Discrete LEDs shall conform to the following specifications:

- All LEDs shall have a nominal viewing cone of 30 degrees with a half-power angle of 15 degrees measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer's product specifications and shall not exceed +/- 3 degrees.
- Red LEDs shall utilize AlInGaP semiconductor technology and shall emit red light that has a peak wavelength of 615 – 650 nm.
- Green LEDs shall utilize InGaN semiconductor technology and shall emit green light that has a peak wavelength of 525 – 535 nm.
- Blue LEDs shall utilize InGaN semiconductor technology and shall emit blue light that has a peak wavelength of 464 – 470 nm.
- The LED lenses shall be fabricated from UV light resistant epoxy.

- The LED manufacturer shall perform color sorting of the bins. Each color of LEDs shall be obtained from no more than two (2) consecutive color “bins” as defined by the LED manufacturer.
- The LED manufacturer shall perform intensity sorting of the bins. LEDs shall be obtained from no more than two (2) consecutive luminous intensity “bins” as defined by the LED manufacturer.
- The various LED color and intensity bins shall be distributed evenly throughout the sign and shall be consistent from pixel to pixel. Random distribution of the LED bins shall not be accepted.
- LED package style shall be either through-hole flush-mount or surface-mount. Through-hole LEDs with standoffs will not be accepted.
- All LEDs used in all DMS provided for this contract shall be from the same manufacturer and of the same part number, except for the variations in the part number due to the intensity and color bins.
- The LEDs shall be rated by the LED manufacturer to have a minimum lifetime of 100,000 hours of continuous operation while maintaining a minimum of 70% of the original brightness.

Pixel Drive Circuitry

One (1) electronic driver circuit board shall be provided for each LED pixel module and shall individually control all pixels on that module. The driver circuit board may be integral to the LED pixel module. The driver circuit boards shall conform to the following specifications:

- Each LED driver board shall be microprocessor-controlled and shall communicate with the sign controller on a wire or fiber optic communication network using an addressable network protocol. The microprocessor shall process commands from the sign controller to display data, perform diagnostic tests, and report pixel and diagnostic status.
- Constant current LED driver ICs shall be used to prevent LED forward current from exceeding the LED manufacturer’s recommended forward current whenever a forward voltage is applied. To maximize LED service life, LED drive currents will not be allowed that exceed the manufacturer’s recommendations for the 100,000-hour lifetime requirement.
- The LED pixels shall be directly driven using pulse width modulation (PWM) of the drive current to control the display intensity. This LED driver circuitry shall vary the current pulse width to achieve the proper display intensity levels for all ambient light conditions. The drive current pulse shall be modulated at a frequency high enough to provide flicker-free operation and a minimum of 200 brightness levels.
- The LED driver circuitry shall receive updated display data at a minimum rate of ten (10) frames per second from the sign controller.

- Each LED driver circuit shall be powered by 24 VDC from external regulated DC power supplies. Each driver circuit shall receive power from a minimum of two (2) independent power supplies. Indicator LEDs shall be provided to indicate the status of each power source.
- Each LED driver circuit shall contain a microprocessor-controlled power regulation circuit that controls the voltage applied to the LED strings. The power circuit shall automatically adjust the voltage supplied to the LEDs to optimize power consumption efficiency as the temperature changes.
- The voltage of each power input shall be measured to the nearest tenth of a volt and reported to the sign controller upon request. Each driver circuit shall also contain one status LED for each power source that indicates if the power source is present or not.
- The LED driver circuitry shall be able to detect that individual LED strings or pixels are stuck off and shall report the pixel status to the sign controller upon request.
- The LED driver board shall contain a seven segment numeric LED display that indicates the functional status of the driver and pixel boards. At a minimum, it shall indicate error states of the LED pixels and communication network. The indicator shall be positioned such that a maintenance technician can easily view the status code for diagnostic purposes. The status codes shall also be reported to the sign controller upon request.

Characters Displayed

The signs shall be capable of displaying ASCII characters 32 through 126 (including all upper and lower case letters and digits from 0 to 9) at any location in a message line.

The display area shall be 96 pixels high by 400 pixels wide.

The sign shall normally display 18-inch characters using triple-stroke (23 x 15) characters with four-column spacing between characters. The operator shall be able to change the default spacing between characters. The spacing options shall be one, two or three pixel columns. Font access privileges shall be assigned by the system supervisor.

The full matrix display shall be capable of displaying other sized character, graphics/symbols, and other number of lines depending on the height of the character utilized.

The separation between the last column of one module and the first column of the next shall be equal to the horizontal distance between the columns of a single display module. The separation between the last row of one module and the first row of the next shall be equal to the horizontal distance between the rows of a single display module.

18-inch characters shall be legible under all light conditions at a distance of 900 feet within a 30 degree cone of vision centered on the optical axis of the pixel. The cone perimeter shall be defined by its 50% intensity points.

The sign shall be the proper brightness in all lighting conditions for optimum legibility. It shall be bright enough to have a good target value, but not be the point where the pixels bloom, especially in low ambient light level conditions.

The brightness and color of each pixel shall be uniform over the entire face of the sign within the 30 degree cone of vision from 900 feet to 200 feet in all lighting conditions. Non-uniformity of brightness or color over the face of the sign under these conditions shall be cause for rejection of the sign.

Display of Graphic Images

The DMS control software shall support the inclusion of graphics in messages in accordance with NTCIP 1203 v3 standard.

Regulated DC Power Supplies

The LED pixel display modules shall be powered with auto-ranging regulated switching power supplies that convert the incoming AC to DC at a nominal voltage of 24 volts DC. Power supplies shall be wired in a redundant parallel configuration that uses multiple supplies for the DMS display matrix.

Power supplies shall be redundant and rated such that if one supply fails, the remaining supply(s) shall be able to operate 100% of the pixels in that display region at 100% brightness when the internal DMS air temperature is +140°F (60°C) or less.

Each power supply shall receive 120VAC power from separate circuits on separate circuit breakers, such that a single tripped breaker will not disconnect power from more than one supply.

The power supplies shall be sufficient to maintain the appropriate LED display intensity throughout the entire operating input voltage range.

The output of each power supply shall be connected to multiple circuits that provide power to the LED modules. Each output circuit shall not exceed 15 amperes and shall be fused.

Each power supply shall be monitored by a microprocessor-controlled circuit. This circuit shall monitor the voltage of each power supply. The power supply voltages shall be reported to the sign controller upon request. The power supplies used to power the LED pixel modules shall be identical and interchangeable throughout the DMS.

Regulated DC power supplies shall conform to the following specifications:

- Nominal output voltage of 24 VDC +/- 10%
- Nominal maximum output power rating of 1000 watts
- Operating input voltage range shall be a minimum of 90 to 260 VAC
- Operating temperature range shall be a minimum of -30°F to +165°F (-34°C to +74°C)
- Maximum output power rating shall be maintained over a minimum temperature range of -30°F to +140°F (-34°C to +60°C)
- Power supply efficiency shall be a minimum of 80%
- Power factor rating shall be a minimum of 0.95
- Power supply input circuit shall be fused
- Automatic output shut down and restart if the power supply overheats or one of the following output faults occurs: over-voltage, short circuit, or over-current
- Power supplies shall be UL listed
- Printed circuit boards shall be protected by an acrylic conformal coating

Photoelectric Sensor Devices

Three (3) photocells shall be installed on the sign. These devices shall permit automatic light intensity measurement of light conditions at each sign location.

These photocells shall be mounted in a manner to measure front, rear and ambient light conditions.

Brightness Control

Automatic adjustment of the LED brightness shall occur in small enough increments so that the brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. Provision shall be made to prevent perceivable brightening of the sign due to stray headlights shining upon the photo sensors at night.

Pixel brightness shall be controlled by pulse width modulation of the DC current. The pixel current waveform shall have a frequency of 100 +/-5 Hertz at nighttime brightness levels and 2400 ± 120 Hertz at daytime brightness levels with an adjustable duty cycle of 0.03 to 99.9% in 0.5% or finer increments. Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in 1% increments. Brightness control shall be able to be returned to automatic from the sign controller front panel and the central computer.

Pixel Status Feedback

Two separate types of pixel status feedback shall be provided to the central controller from the local sign controller. These include a pixel test and a pixel read:

Pixel Test: The pixel test shall be performed from the central controller on command and automatically once a day. During a pixel test, the full operational status of each string of LEDs in each pixel shall be tested and then transmitted to the central controller or laptop computer. This pixel status test shall distinguish the difference between half out, full out, half stuck-on and fully stuck-on pixels. A list of defective pixels shall be provided, listing pixel status, line number, module number, column number and row number for each defective pixel. The pixel test may briefly disturb the displayed message for less than 0.5 seconds.

Pixel Read: The pixel read shall be performed during both message downloads and during every sign poll from the central controller or laptop computer. The pixel read shall perform a real-time read of the displayed message and shall return the state of each pixel to the central controller as it is currently displayed to the motorist, including any errors. This shall allow the central controller operator to see what is visibly displayed to the motorist on an individual pixel basis. During a pixel read, the state of each pixel (full-on, half-on or off) in the sign shall be read by the sign controller to allow the central controller or laptop computer to show the actual message, including static flashing and alternating messages, that is visibly displayed on the sign in a WYSIWYG format. This pixel reading shall take place while a message is displayed on the sign without disturbing the message in any way. Any flashing, flickering, blinking, dimming, or other disturbance of the message during this pixel read shall be cause for rejection of the sign.

The pixel read shall be an actual real-time read of the current flowing through each string of LEDs at the time of the associated sign poll or message download and shall not be accomplished by simulating errors based on the last pixel test.

Environmental Operating Parameters

All DMS components shall be capable of operating without any decrease in performance over a temperature range of -40°C (-40°F) to $+70^{\circ}\text{C}$ ($+158^{\circ}\text{F}$) with a relative humidity of up to 95% non-condensing, unless otherwise noted in this specification.

Sign Controller

General Requirements

Each DMS shall be controlled and monitored by its own sign controller. The sign controller shall be a stand-alone microprocessor-based system, which does not require continuous communication with DMS control software in order to perform most DMS control functions.

The sign controller shall meet the following operational requirements:

- Communicate using the NTCIP protocol
- Contain memory for storing changeable and permanent messages, schedules, and other necessary files for controller operation
- Include a front panel user interface with LCD and keypad for direct operation and diagnostics as described herein
- Contain a minimum of three (2) NTCIP-compliant RS232 communication ports
- Contain a minimum of two (2) NTCIP-compliant Ethernet port with RJ45 connector
- Contain a minimum of two (2) fiber ports
- Contain DMS-specific control firmware (embedded software) that shall monitor all external and internal sensors and communication inputs and control the display modules as directed by external control software and the front panel interface NTCIP shall be natively supported in the DMS controller. External protocol converter or translator devices shall not be allowed.

Controller Location

The sign controller and associated communication equipment shall be installed inside the ground mounted cabinet as shown on plans.

Environmental

The sign controller shall meet the following environmental requirements defined in NEMA Standards Publication TS 4, Hardware Standards for Dynamic Message Signs (DMS), with NTCIP Requirements.

Mechanical and Electrical

The sign controller shall meet the following electrical and mechanical requirements:

- Mount in a standard EIA 19-inch (480 mm) equipment rack with a maximum 4U space requirement
- Weigh no more than 10 pounds, including its enclosure
- Consume no more than 30 watts of power
- Powered by an internal regulated DC power supply capable of operating on 120VAC or 240VAC at both 50Hz and 60Hz
- All printed circuit boards shall be sealed with an acrylic conformal coating

Operational Requirements

Front Panel User Interface. The sign controller's front panel shall include a menu driven, 16 button keypad and a 280x472 graphical LCD. These devices shall be used to perform the following functions with the sign controller and DMS:

- Monitor the current status of the sign controller, including the status of all sensors and a RGB what-you-see-is-what-you-get (WYSIWYG) representation of the message visible on the display face
- Perform diagnostics testing of various system components, including pixels, power systems, sensors, and more
- Activate, create, preview and delete messages stored in memory
- Blank the sign.
- Start and stop the schedule.
- Configure display parameters, including display size and color technology
- Configure date and time.
- Configure communications port settings and NTCIP options
- Configure level of password protection per user.
- Select automatic or manual brightness mode of operation.

The front panel interface shall also include:

- Power switch to turn the controller on and off
- LED power "on" indicator
- Local/remote selection from LCD interfaces.
- LED to indicate when any of the NTCIP communication channels are active

Memory

The sign controller shall have non-volatile electronically changeable memory. This memory shall be formed by flash or battery-backed static RAM integrated circuits that retain the data in memory for a minimum of 30 days following a power loss. This changeable memory shall be used to store messages and schedules. The controller memory shall be capable of storing a minimum of 500 changeable text based messages in non-volatile RAM. There shall be a minimum of 2 GB RAM and 8 GB of storage.

Internal Clock

The DMS sign controller shall contain a computer-readable clock that has a battery backup circuit. The battery shall keep the clock operating properly for at least 5 years without external power, and the clock shall automatically adjust for daylight savings time and leap year using hardware, software, or a combination of both. The clock shall be set electronically by the sign controller microprocessor and shall be accurate to within one (1) minute per month.

Communications

All remote communication ports shall be NTCIP-compatible as defined in the "Requirements for NTCIP Compatibility" section of these specifications.

Communication Modes

The DMS sign controller shall be able to receive instructions from and provide information to a computer containing DMS control software using the following communication modes:

- Remotely via direct or dial-up communications with a remotely located computer. The system communications backbone, as well as all field modems or signal converters, shall provide the DMS sign controller with an RS232 signal.
- Locally via direct connection with a laptop computer that is connected directly to the sign controller using an RS232 null modem connection.

Serial Communication Ports

The DMS sign controller shall contain a minimum of three (3) NTCIP-compatible RS232 communication ports. These ports shall support multiple communication interfaces, including, but not limited to, direct null-modem (for local laptop control), dial-up and leased-line modems, radio systems, cellular modems, and fiber optic modems. The RS232 ports shall all have standard DB9M connectors.

The baud rate, connection type, and NTCIP communication protocol shall be configurable. Each port must support all typical serial baud rates ranging from 1200 to 115,200 baud. All three ports shall be capable of supporting either of the following sub network profiles: NTCIP 2101 (PMPP) or NTCIP 2103 (PPP). They shall also be capable of supporting either NTCIP 2201 (Null) or NTCIP 2202 (Internet) transport profiles. Only one each of the transport and sub network profiles shall be active at any time on each port.

Ethernet Port

The DMS sign controller shall contain a minimum of two (2) 10/100Base-T Ethernet communication port. This port shall be available for use for communicating from the central control system to the DMS sign controller when an Ethernet network is available. The Ethernet port shall have a standard RJ45 connector.

Communications on the Ethernet port shall be NTCIP-compatible using the NTCIP 2202 Internet transport profile and the NTCIP 2104 Ethernet sub network profile. This shall permit the controller to be operated on any typical Ethernet network using the TCP/IP and UDP/IP protocols.

Controller Addressing

Thirty (30) days prior to the scheduled field installation of each DMS controller, the Contractor shall deliver the controller to the Traffic Systems Center (TSC) for network configuration prior to installation by the Contractor. The controller shall be clearly identified as to which location it is to be installed for proper configuration. The controller's MAC address shall be clearly identified. After the controller is configured, the Contractor shall retrieve the controller from the TSC and install it.

Transient Protection

The DMS and sign controller signal and power inputs shall be protected from electrical spikes and transients as follows:

Sign AC Power

The AC power feed for all equipment in the sign cabinet shall be protected at the panel board by a parallel-connection surge suppresser rated for a minimum surge of 50 kA. This device shall conform to the following requirements:

- Withstand a peak 100,000-ampere surge current, 50kA L-N, 50kA L-G
- Designed, manufactured, & tested consistent with: ANSI/IEEE C62.41.1-2002, C62.42.2-2002, C62.45-2002, NEMA LS-1, NEC 285 and IEC 61643, CE
- Less than 1 nanosecond response time
- Temperature range of -15°F to +140°F (-26°C to +60°C)
- Approximate dimensions of 3-inches (76 mm) wide by 8-inches (203 mm) long by 3-inches (76 mm) high
- High Energy Parallel Design for Category C3 & C-High Application
- UL listed to: UL 1449 Third Edition 200kA & 100kA SCCR

Control Equipment AC Power

- Withstand a peak 100,000-ampere surge current, 50kA L-N, 50kA L-G
- Designed, manufactured, & tested consistent with: ANSI/IEEE C62.41.1-2002, C62.42.2-2002, C62.45-2002, NEMA LS-1, NEC 285 and IEC 61643, CE
- Less than 1 nanosecond response time
- Temperature range of -15°F to +140°F (-26°C to +60°C)
- Approximate dimensions of 3-inches (76 mm) wide by 8-inches (203 mm) long by 3-inches (76 mm) high
- High Energy Parallel Design for Category C3 & C-High Application
- UL listed to: UL 1449 Third Edition 200kA & 100kA SCCR

Communication Signals

Transient voltage surge suppressors shall protect all communication signals connecting to the control equipment from off-site sources using copper cables. Transient voltage surge suppressors shall protect all copper communication lines used to pass data between the sign controller and sign.

Protection

A series/parallel two-stage suppression device shall protect the modem communication port from over-voltage and over-current conditions. This surge protection shall be integrated internally within the controller.

Local User Auxiliary Interface

Auxiliary Control Panel

The DMS shall include an auxiliary control panel that will provide a secondary user interface panel for DMS control, configuration, and maintenance. The auxiliary control panel shall meet the same electrical, mechanical, and environmental specifications as the DMS controller. It shall be powered independently from a 120 VAC outlet. There also shall be a 120 VAC convenience outlet for maintenance personnel lap top computers and a hinged shelf which folds from inside the DMS Enclosure and is suitable for the laptop computer to rest on.

Interface Panel

The auxiliary control panel shall have an LCD panel and keypad identical to those found on the DMS controller. It shall also contain a local/remote control switch; reset switch, status LEDs, and one NTCIP compatible RS232 communication port that meet the same specifications as the DMS controller.

DMS Control Interface

The auxiliary control panel shall include an identical menu system to the DMS controller with all of its features and functionality.

Location

The Auxiliary Control Panel shall be installed within the DMS housing in a location that is safe and easy for maintenance personnel to access.

Controller Signal Interface

The auxiliary control panel shall interface to the DMS controller using fiber optic. It shall be capable of operating up to 4000 feet from the DMS controller.

Sign Controller Functions

The sign controller shall be capable of being controlled from the central controller or the laptop computer.

The controller software shall be capable of displaying a message, including static messages, flashing messages, and alternating messages.

Messages shall be capable of displaying text, graphics or a combination of both. The graphics area shall be downloaded from the central controller with each message.

It shall be possible to separately vary the flashing and alternating frequencies.

Flashing messages shall have the following adjustable timing:

- Message time on from 0.5 to 5.0 seconds in 0.1 second increments.
- Message time off from 0.5 to 5.0 seconds in 0.1 second increments

It shall be possible to flash any character or set of characters in a static message.

Alternating messages shall have the following adjustable timing:

- Primary message time on from 0.5 to 5.0 seconds in 0.1 second increments.
- Primary message time off from 0 to 5.0 seconds in 0.1 second increments.
- Alternative message time on from 0.5 to 5.0 seconds in 0.1 second increments.
- Alternate message time off from 0 to 5.0 seconds in 0.1 second increments.

It shall be possible to flash any character or set of characters in an alternating message at the adjustable frequencies listed above for flashing messages. The flashing period shall be a sub-multiple of the alternating on-time it is associated with.

Report errors and failures, including:

- Power failure
- Power recovery
- Pixel string failure
- Fan failure
- Over a user selectable critical temperature
- Power supply failure
- Data transmission error
- Receipt of invalid data
- Communication failure recovery

Message and status monitoring

The sign controller shall respond to the central controller whenever it receives a request for status (a poll). The return message shall be capable of providing the following information:

- Actual message that is visibly displayed on the sign on an individual pixel basis (full-on, half-on or off)
- Current sign illumination level
- Local Control Panel switch position (central, local or local override mode)
- Error and failure reports
- Temperature readings
- LED power supply voltage levels
- Origin of display message transmission (laptop, manual or central)
- Heater status
- Address of sign controller
- Uninterruptible power supply status
- AC Surge protection status
- Communication line protection status
- Operational status of the following sensors
 - Each temperature sensor
 - Each photocell
 - Each airflow sensor
 - Humidity sensor
 - Each power supply sensor
 - Severe error condition response

Each time the sign controller is polled by the IDOT Central Computer or laptop computer, the sign controller shall test the operation status of the sensors listed below and return this information to the IDOT Central Computer. This operational status test shall determine if each of the following sensors are functioning properly:

- Each temperature sensor
- Each photocell
- Humidity sensor
- Each LED power supply

The sign controller shall provide a library with a minimum of 50 permanent messages, consisting of 30 or less characters per line, stored in PROM. The sign controller shall also be able to accept a downloaded library from the central or laptop computer of a minimum of 25 changeable messages stored in non-volatile RAM. These messages may be called for display on the sign from the keypad on the front panel of the DMS Controller.

The sign controller shall also be capable of displaying messages on the sign that are downloaded from the central controller or laptop computer, but are not located in the library stored in non-volatile memory of the sign controller.

The sign shall normally display triple stroke (23 x 15) characters with four-column spacing between characters. The sign shall also be able to display single stroke (5 X 7), expanded (6 X 7) or double-stroke (7 X 7) nominal character fonts or change the default spacing between characters. The spacing options shall be one, two or three pixel columns. Each font may be edited and downloaded to the sign controller from the central controller or laptop computer at any time without any software or hardware modifications.

The full matrix display shall also be capable of displaying other sized characters, graphics/symbols, and other number of lines depending on the height of the character utilized. The interline spacing shall be variable.

The sign controller shall monitor the photo cell circuits in the sign and convert the measured light intensity into the desired pixel brightness. The photo circuit readings shall be correlated with a brightness table in the sign controller. The brightness table shall have a minimum of 255 brightness levels. Automatic adjustment of the LED driving waveform duty cycle shall occur in small enough increments so that brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. The brightness table in each individual sign controller shall be adjustable from the central controller and can be customized according to the requirements of the installation site. Each sign shall have its own, independent brightness table.

Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in one percent increments from one to 99%.

There shall be a means to adjust how rapidly the sign responds to changes in ambient light as measured by the photocells. This can be used, for example, to prevent the sign from changing its brightness due to a vehicle's headlight momentarily hitting the sign. The adjustment shall be made from the central controller or laptop computer and shall have two different settings, one for daytime control and one for nighttime control, with the day/night ambient light threshold also being an adjustable value. In addition, there shall be a means to specify different weighting factors for each photocell, to specify how prominently each photocell figures in the calculation of nighttime ambient light.

In the event of a power failure, the sign controller shall activate a programmable default message (which shall be a blank message) and shall report the AC power failure to the central controller.

The operational status of each pixel in the sign shall be automatically tested once a day and tested when a pixel test is requested from the IDOT Central Computer or laptop computer. A list of defective pixels shall then be transmitted to the IDOT Central Computer or laptop computer, listing pixel status test shall distinguish the difference between half-out, full-out, half-stuck on and fully stuck-on pixels. This test shall not affect the displayed message for more that 0.5 seconds.

When the sign controller is polled and when messages are downloaded from the central controller or laptop computer, each pixel in the sign shall be read and its current state (full-on, half-on or off), for the currently displayed message, shall be returned to the central controller. This will allow the central controller or laptop computer to show the actual message that is visibly displayed on the sign on an individual pixel basis in a WYSIWYG format. (This is different from the pixel test listed above.) This pixel status read shall not affect the displayed message in any way. The pixel read shall be an actual real-time read of the current flowing through each string of LEDs at the time of the associated sign poll or message download and shall not be accomplished by simulating errors based on the last pixel test.

The operational status of the fans shall be automatically tested once a day and tested on command from the central controller or laptop computer. Any failure will cause an error message to be sent to the central controller or laptop when the sign controller is polled by the central controller or laptop computer.

The sign controller shall read the internal temperature sensors, external ambient temperature sensor and the humidity sensor. The sign controller shall use these readings in an algorithm that turns on the heat tape and/or the fans at the appropriate times to reduce both frost on the face of the sign and condensation on the display modules and other electronic circuitry.

Temperature sensors shall be continuously measured and monitored by the sign controller. A temperature greater than a user selectable critical temperature shall cause the sign message to go to blank and the sign controller shall report this error message to the central controller. This user selectable critical temperature shall be capable of being changed by the central controller or laptop computer. The central controller and laptop computers shall have the ability to read all measurements from the sign controller.

All LED module power supply voltages shall be continuously measured by the sign controller. The sign controller shall provide these voltage readings to the central controller or laptop computer when the sign controller is polled by the central controller or laptop computer.

There shall be no perceivable blinking, flickering or ghosting of the pixels at any time, except during a pixel test as described above. The displayed message will not be affected in any way at any time for the pixel status read as described above.

In the event the central controller fails to communicate with the sign controller within a programmable time limit, the sign shall activate a programmable default message (which shall be a blank). This function shall apply only when the sign controller is in central control mode.

Failure of any sign shall not affect the operation of any other sign in the system.

The sign controller shall perform a consistency check of messages downloaded from the central controller or laptop computer to ensure that the message will fit in the display area of the sign. If any part of the message fails this check, the downloaded message shall not be displayed and an error message shall be displayed on the operator's GUI.

The sign controller internal time clock shall ensure that a message is taken down at the correct time, even in the event of a communications loss.

The sign controller shall allow a moving arrow to be displayed by the central controller or laptop computer. The moving arrow shall be on one line with a standard message on the other lines. The moving arrows shall be from the left or right and shall start from one end or in the middle of the sign and continue to the end of the sign.

The sign controller shall blank the sign in the event of a communication failure or power failure. The controller shall blank the sign if failure lasts greater than 5 minutes. Communication failures are either on the field transmit, field receive, or both.

The sign controller shall be capable of being remotely reset from the central controller.

The system power shall be protected by two stages of transient voltage suppression devices as required in the AC Power Section of this specification. Tripping of each stage (or both if tripped simultaneously) of the surge protection shall cause the sign controller to call central and report the error condition (for dial-up operation) or report the error condition to central on the next poll (for multi-drop operation). There shall be an option that is either enabled or disabled and is selected and downloaded from the central controller to the sign controller. When this option is enabled, tripping of the second stage of surge protection shall prevent power from reaching any components of the sign until the surge protection has been replaced. When this option is disabled, the sign will continue to function normally after the second stage of surge protection is tripped.

Communication lines shall be protected by two stages of transient voltage suppression devices as required in the Sign Controller Communication Interface Section of this specification. Tripping of each stage (or both if tripped simultaneously) of the surge protection shall cause the sign controller to call central and report the error condition (for dial-up operation) or report the error condition to central on the next poll (for multi-drop operation). There shall be an option that is either enabled or disabled and is selected and downloaded from the central controller to the sign controller. When this option is enabled, tripping of the second stage of surge protection shall disconnect the communication lines until the surge protection has been replaced. When this option is disabled, tripping of the second stage of surge protection shall disconnect the communication lines until the surge protection has been replaced. When this option is disabled, the sign will continue to function normally after the second stage of surge protection is tripped.

Modes of Operation

The mode of operation determines which level of control governs the DMS message selection. The three modes of operation are:

- Central Mode: The local control panel switch is off and the central controller controls and monitors the sign
- Local Mode: The local control panel switch is on and the laptop computer is used to locally control the sign. The central controller only monitors the sign (i.e. status poll).
- Local Override: The local mode has been overridden by the central to allow the central to control the sign in case the local control panel switch was unintentionally left in local mode.

AC Power

The sign and its sign controller shall be capable of operating with 120/240 VAC, 50 amp per leg, 60 hertz, single-phase power.

The sign shall have a 50 amp per leg, 120/240 VAC, two-pole load center with 16 circuit capability. Each circuit in the sign shall be powered from a separate circuit breaker. The system shall be protected by two stages of transient voltage suppression devices including MOVS and spark gap arrestor. If enabled by the central controller, tripping of the second stage shall prevent power from reaching any components of the sign until the surge protection has been replaced. Tripping of each stage of the surge protection shall cause the sign controller to call central and report the error condition (for dial-up operation) or report the error condition to central on the next poll (for multi-drop operation).

Transient Test Requirements

The sign housing electronics and the control cabinet shall be separately capable of withstanding a high-energy transient having the following characteristics repeatedly applied to the AC input terminals: a ten microfarad oil filled capacitor charged to 1000 VDC $\pm$ 5% shall be discharged into the power input terminals a minimum of three times for each polarity. Immediately following this test the unit under test shall perform all of its defined functions upon the restoration of normal AC power.

Electronic Materials and Construction Methods

Printed Circuit Boards

Printed Circuit Boards (PCB) design shall be such that components may be removed and replaced without damage to boards, traces or tracks. Only FR-4 0.062 inch material shall be used. Inter-component wiring shall be copper clad track having a minimum weight of 2 ounces per square foot with adequate cross section for current to be carried. Jumper wires will not be permitted, except from plated-through holes to component. The maximum number of jumper wires allowed per circuit board is two.

All PCBs shall be finished with a solder mask and a component identifier silk screen.

Components

All components shall be of such design, fabrication, nomenclature, or other identification so as to be purchased from a wholesale electronics distributor, or from the component manufacturer, except for printed circuit board assemblies: Circuit design shall be such that all components of the same generic type, regardless of manufacturer, shall function equally in accordance with the specifications. All discrete components, such as resistors, capacitors, diodes, transistors, and integrated circuits shall be individually replaceable. Components shall be arranged so they are easily accessible for testing and replacement.

DMS Controller Uninterruptible Power Supply

A UPS shall be provided to allow the sign controller to notify the central controller when an improper power condition at the DMS persists for longer than 30 seconds. The UPS shall meet the following minimum specifications:

- Line Transient Protection: Passes ANSI/IEEE C62.41 Category A testing
- Safety Compliance: UL listed to UA1778
- EMC Compliance: FCC Class B
- Efficiency: >95% on line
- Capacity VA/Watts @ 0.60 PF : 500VA/300W
- Voltage Nominal: 120 VAC
- Voltage Range: 90-139 VAC
- Typical run time (minutes): Full load: 3 minutes. Typical load: 5 minutes
- Transfer time: 4 ms typical
- Battery: Sealed, maintenance-free, valve regulated, UL 924 recognized.
- Battery recharge time (to 95% of capacity): 8 hours with output fully loaded
- Over current protection (on line): circuit breaker
- Input fault current (maximum): 10A
- Operating temperature: Range minimum -10°F -140°F (-23°C to 60°C)
- Humidity: 5% - 95% RH (non-condensing)
- Network Interface module with SNMP interface
- 10-foot power cord with NEMA 5-15P plug connects to any compatible 15 amp AC outlet.

Overhead Sign Structure Hardware

New mounting hardware as required shall be in accordance with Article 733.02 of the Standard Specifications.

CONSTRUCTION REQUIREMENTS

Technical Assistance

The DMS manufacturer's technical representative shall provide on-site technical assistance in following areas:

- Sign to structure installation
- Sign controller cabinet installation
- Sign to controller cabling

The initial powering up of the sign(s) shall not be executed without the permission of the DMS manufacturer's technical representative.

The Contractor shall have the DMS manufacturer commission the DMS per the manufacturer's recommendation.

Overhead Sign Structure

It is the Contractor's responsibility to inspect the existing overhead sign structure prior to installation and note any missing or damaged hardware. Any structural issues, functional issues, or cosmetic damage to the overhead sign structure shall be immediately noted, and correspondence provided to the Engineer. The Engineer will then provide direction on each issue brought by the Contractor. The Contractor shall also inspect the existing walkways of the overhead sign structure to ensure that they coordinate with the proposed DMS. If modifications to the existing walkway(s) are required, the Contractor shall notify the Engineer in writing. Modifications shall be paid for in accordance with Article 109.04

The Contractor's Illinois Licensed Structural Engineer shall certify that all structural attachments to the overhead sign structure satisfy the Department's criteria and are adequate to support the loads indicated. As required by the Department, this certification shall include the signature and seal of a Structural Engineer registered in the State of Illinois.

The Contractor shall remove the existing sign panel from the overhead sign structure, included as part of this item. The existing sign panel shall not be removed until immediately prior to the installation of the DMS on the overhead sign structure. Sign panel mounting hardware shall not be reused and shall be disposed of by the Contractor.

If the Contractor elects to remove the superstructure of the existing overhead sign structure as part of the DMS installation, the following shall apply:

- All hardware shall be new. Reuse of existing hardware will not be allowed.
- Storage and re-erection of the superstructure shall be in accordance with Article 738 of the Standard Specifications.

Installation

The Contractor shall install the DMS on the mounting structure, as noted on the Plans or as per the manufacturer's recommendations, including the rotation away from the mounting structure for DMS legibility.

- The material for attaching the DMS to the mounting structure shall include all mounting hardware, conduit, and cable from the DMS Controller cabinet up to the DMS.
- The DMS shall be aligned such that the DMS message can be legible from a minimum of 1000 feet.
- All associated conduit, wire, circuit breakers, brackets, etc. as shown on the Plans, and all items and workmanship required to successfully pass the Site Test stated within this specification, shall be the sole responsibility of the Contractor.
- The DMS housing interior shall have a label affixed above the door warning of a step down if the catwalk is not flush with the door.

Erection Plan

The Contractor shall retain the services of an Illinois Licensed Structural Engineer, experienced in the analysis and preparation of erection plans, for the completion of a site-specific Erection Plan for DMS to be installed. The Structural Engineer shall sign and seal the Erection Plan, drawings and calculations for the proposed erection.

The erection plan shall be complete in detail for all phases, stages, and conditions anticipated during erection. The erection plan shall include structural calculations and supporting documentation necessary to completely describe and document the means, methods, temporary support positions, pickup and delivery, site storage, and loads necessary to safely erect the structure in conformance with the contract documents and as outlined herein.

The erection plan and procedure shall provide complete details of the erection process including:

- 1) Falsework, struts, bracing, tie cables and other devices, material properties and specifications for temporary works, requirements prior to releasing the gantry from cranes (if required), connection details and attachments to other structure components or objects;
- 2) Procedure and sequence of operations, including a schedule with completion times for work items that comply with the working hour limitations;
- 3) Minimum load chart lift capacity, outrigger size and reactions for each crane;
- 4) Locations of cranes, trucks carrying the gantry, and the location of cranes and outriggers relative to other structures, including retaining walls, wingwalls, and utilities, overpasses.
- 5) Calculated loads and weights, lift points, lifting devices, spreaders, and angle of lifting cables.
- 6) Stresses at critical points during progressing stages of erection shall be evaluated to assure that structural integrity and stability is maintained at all times. Stresses at lift points induced as a result of lifting shall be evaluated and if required, adequate bracing provided as indicated by the analysis.
- 7) Stability and structural adequacy of the structure during all sequence of work.
- 8) Drawings, notes, catalog data showing the manufacturer's recommendations or performance tests, and calculations clearly showing the above listed details, assumptions and dimensions;
- 9) Contingency plans detailing what measures the Contractor will take in case of inclement weather (forecast or actual), equipment failure, and slower than planned production.

The erection plans and procedures shall be submitted to the Engineer for review and acceptance two (2) weeks prior to starting the work. Review and acceptance by the Engineer shall not be construed to guarantee the safety and acceptability of the work.

Any changes to the erection plan must be reviewed and accepted by the Engineer before implementation.

A Pre-Erection meeting shall be held at least one week prior to the commencement of erection. The Engineer, Contractor, Erection Contractor, and the Contractor's Engineer shall attend the meeting. The intent of the meeting is to develop a mutual understanding of the proposed implementation of the Contractor's erection plan. Revisions or adjustments to the plan, and potential revisions or adjustment to the implementation of the erection plan shall be discussed.

The erection subcontractor shall demonstrate their knowledge and familiarity of where the piece marks are located on the components to be erected, their orientation on the structure, and the shop drawing piece mark convention used by the fabricator at the Pre-Erection meeting. Additional Pre-Erection meetings may be required for subsequent phases of construction, or for phases that differ from the original construction plan, as directed by the Engineer. Additional meetings may also be requested by the Contractor and approved by the Engineer.

Testing Requirements

The equipment covered by this specification shall be subjected to design approval tests (DAT), factory demonstration tests (FDT), stand-alone tests, systems tests and 72 hour and 90 day test periods to determine conformance with all the specification requirements. The Engineer may accept certification by an independent testing lab in lieu of the design approval tests to verify that the design approval tests have previously been satisfactorily completed. The DMS vendor shall arrange for and conduct the tests in accordance with the testing requirements stated herein. Unless otherwise specified, the DMS vendor is responsible for satisfying all inspection requirements prior to submission for the Engineer's inspection and acceptance. The contract periods will not be extended for time lost or delays caused by testing prior to final Department approval of any items. The Engineer reserves the right to have his representative witness any and all tests. The results of each test shall be compared with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and the equipment shall be subject to rejection by the Engineer. Rejected equipment may be offered again for a retest provided that all non-compliances have been corrected and retest by the DMS vendor and evidence thereof submitted to the Engineer.

Final inspection and acceptance of equipment shall be made after installation at the designated location as shown on the plans, unless otherwise specified herein.

Test Procedures

The DMS vendor shall provide five (5) copies of all design approval, factory demonstration, stand-alone and system test procedures and data forms for the Engineer's approval at least sixty (60) days prior to the day the tests are to begin.

The test procedures shall include the sequence in which the tests will be conducted. The test procedures shall have the Engineer's approval prior to submission of equipment for tests.

The DMS vendor shall furnish data forms containing all of the data taken, as well as quantitative results for all tests. The data forms shall be signed by an authorized representative (company official) of the equipment manufacturer. At least one copy of the data forms shall be sent to the Engineer.

The DMS vendor shall be responsible for providing the test fixtures and test instruments for all of the tests.

Design Approval Tests

Design approval tests shall be conducted by the DMS vendor on one or more samples of equipment of each type, as approved by the Engineer, to determine if the design of the equipment meets the requirements of this Specification. The test shall be conducted in accordance with the approved test procedures as described under the Factory Demonstration Test section of this special provision.

If the design approval tests have not previously been satisfactorily completed by an independent testing lab and accepted by the Engineer, the Engineer shall be notified a minimum of thirty (30) calendar days in advance of the time these tests are to be conducted.

The design approval tests shall cover the following:

Temperature and Condensation. The DMS sign system equipment shall successfully perform all the functionality requirements listed in this specification under the following conditions in the order specified below:

- The equipment shall be stabilized at -40°F (-40°C). After stabilization at this temperature, the equipment shall be operated without degradation for two (2) hours.
- Moisture shall be caused to condense on the equipment by allowing it to warm up to room temperature in an atmosphere having relative humidity of at least 40% and the equipment shall be satisfactorily operated for two (2) hours while wet.
- The equipment shall be stabilized at 149°F (65°C). After stabilization, the equipment shall be satisfactorily operated for two (2) hours without degradation or failure.

Primary Power Variation. The equipment shall meet the specified performance requirements when the nominal input voltage is 115 V ± 15 V. The equipment shall be operated at the extreme limits for at least 15 minutes during which the operational test of the FDT shall be successfully performed.

Power Service Transients. The equipment shall meet the performance requirements, specified in the parent specification, when subjected to the power service transient specified in 2.1.6 "Transient, Power Service", of the NEMA standard TS1. The equipment shall meet the performance requirements specified in the parent specification.

Relative Humidity. The equipment shall meet its performance requirements when subjected to a temperature of (149°F 65°C) and a relative humidity of 90%. The equipment shall be maintained at the above condition for 48 hours. At the conclusion of the 48 hour soak, the equipment shall meet the requirements of the operational test of the FDT within 30 minutes of beginning the test.

Vibration. The equipment (excluding cabinets) shall show no degradation of mechanical structure, soldered components, or plug-in components and shall operate in accordance with the manufacturer's equipment specifications after being subjected to the vibration tests as described in Section 2.2.5, "Vibration Test", of the NEMA standard TS1.

Consequences of Design Approval Test Failure. If the unit fails the design approval test, the design fault shall be corrected and the entire design approval test shall be repeated. All deliverable units shall be modified without additional costs to the Department, to include design changes required to pass the design approval tests.

Factory Demonstration Tests

The DMS vendor shall be responsible for conducting Factory Demonstration Tests on all units at the DMS Vendor's Manufacturing Facility. These tests shall be performed on each unit supplied. The Engineer shall be notified a minimum of sixty (60) calendar days before the start of tests. The DMS Vendor shall pay for all travel expenses, including airfare, rental car, hotel, meals, etc., for up to three (3) department personnel or designated representatives for the Engineer to witness the Factory Demonstration Tests on the first unit at the vendor's manufacturing facility. All tests shall be conducted in accordance with the approved test procedures of Section 17.0. All equipment shall pass the following individual tests:

Examination Tests

All equipment shall be examined carefully to verify that the materials, design, construction, markings and workmanship comply with the requirements of the Specification.

Continuity Tests

The wiring shall be checked to determine that it meets the requirements of the appropriate paragraphs in the Specifications.

Operational Test. All equipment shall be operated long enough to permit equipment temperature stabilization, and to check and record an adequate number of performance characteristics to ensure compliance with the requirements of this Specification.

Consequences of Factory Test Failure. If any unit fails to pass its demonstration test, the unit shall be corrected and another unit substituted in its place and the test successfully repeated.

If a unit has been modified as a result of a demonstration test failure, a report shall be prepared and delivered to the Engineer prior to shipment of the unit. The report shall describe the nature of the failure and the corrective action taken.

If a failure pattern develops, the Engineer may direct that design and construction modifications be made to all units without additional cost to the Department or extension of the contract period.

Stand-Alone Tests

The DMS vendor shall conduct an approved stand-alone test of the equipment installation at the field site. The test shall, as a minimum, exercise all stand-alone (non-network) functional operations of the field equipment with all of the equipment installed as per the plans, or as directed by the Engineer.

Approved data forms shall be completed and turned over to the Engineer as the basis for review and rejection or acceptance. At least thirty (30) working days' notice shall be given prior to all tests to permit the Engineer or his representative to observe each test.

Consequences of Stand-Alone Test Failure

If any unit fails to pass its stand-alone test, the unit shall be corrected or another unit substituted in its place and the test successfully repeated.

If a unit has been modified as a result of a stand-alone test failure, a report shall be prepared and delivered to the Engineer prior to the re-testing of the unit. The report shall describe the nature of the failure and the corrective action taken.

If a failure pattern develops, the Engineer may direct that design and construction modifications be made to all units without additional cost to the Department or extension of the contract period.

System Test

The DMS vendor shall conduct approved DMS system tests on the field equipment with the central equipment. The tests shall, as a minimum, exercise all remote control functions and display the return status codes from the controller.

Approved data forms shall be completed and turned over to the Engineer as the basis for review and for rejection or acceptance.

Consequence of System Test Failure

If system tests fail because of any components(s) in the subsystem, the particular components(s) shall be corrected or substituted with other components(s) and the tests shall be repeated. If a component has been modified as a result of the system test failure, a report shall be prepared and delivered to the Engineer prior to retest.

72 Hours and 90 Days Test Failure

After the installation of the DMS system is completed and the successful completion of the System Test, the DMS vendor shall conduct one continuous 72-hour full operating test prior to conducting a 90-day test period. The type of test to be conducted shall be approved by the Engineer, and shall consist primarily of exercising all control, monitor and communications functions of the field equipment by the central equipment.

The 90-day test period shall commence on the first day after the successful completion of the approved 72-hour continuous full operating test period.

During the 90-day test period, downtime, due to mechanical, electrical and/or other malfunctions, shall not exceed five (5) working days. The Engineer may extend the 90-day test period by a number of days equal to the downtime in excess of five (5) working days.

The Engineer will furnish the DMS vendor with a letter of approval stating the first day of the 90-day test period.

Final System Acceptance

Final system acceptance shall be defined as when all work and materials provided for in this item have been furnished and completely installed, and all parts of the work have been approved and accepted by the Engineer and the Dynamic Message Sign System has been operated continuously and successfully for ninety (90) calendar days with no more than five (5) working days downtime due to mechanical, electrical and/or other malfunctions.

Center to Field Communications NTCIP Requirements

This section describes the minimum specifications for the NTCIP communication capabilities of the DMS controller and DMS control software. The contractor shall provide all the software, firmware, and services necessary to operate a dynamic message sign (DMS) system that fully complies with the NTCIP functional requirements specified herein, including incidental items that may have been inadvertently omitted.

References

These specifications reference standards through their NTCIP designated names. The following list provides the current versions of each of these standards.

Each NTCIP device covered by these project specifications shall implement the version of the standard that is specified in the following table. Refer to the NTCIP library at www.ntcip.org for information on the current status of NTCIP standards.

Document Number and Version	Document Title	Document Status
NTCIP 1101:1996 and Amendment 1	Simple Transportation Management Framework (STMF)	Approved Standard with Amendment
NTCIP 1102:2004	Octet Encoding Rules (OER) Base Protocol	Approved Standard
NTCIP 1103 v1.26a	Transportation Management Protocols	Recommended Standard
NTCIP 1201:1996 and Amendment 1	Global Object (GO) Definitions	Approved Standard
NTCIP 1203:1997 and Amendment 1	Object Definitions for Dynamic Message Signs	Approved Standard with Amendment
NTCIP 2001:1996 and Amendment 1	Class B Profile	Approved Standard
NTCIP 2101:2001	Point to Multi Point Protocol (PMPP) Using RS-232 Subnetwork Profile	Approved Standard
NTCIP 2103:2003	Point-to-Point Protocol Over RS-232 Subnetwork Profile	Approved Standard
NTCIP 2104:2003	Ethernet Subnetwork Profile	Approved Standard
NTCIP 2201:2003	Transportation Transport Profile	Approved Standard
NTCIP 2202:2001	Internet (TCP/IP and UDP/IP) Transport Profile	Approved Standard
NTCIP 2301:2001	Simple Transportation Management Framework (STMF) Application Profile	Approved Standard

Table 1: NTCIP Document References

Subnetwork Profiles

Each serial or modem port on each NTCIP device shall be configurable to support both NTCIP 2101 and NTCIP 2103. Only one of these profiles shall be active at any given time. Serial ports shall support external dial-up modems.

Each Ethernet port on the NTCIP device shall comply with NTCIP 2104. The NTCIP device(s) may support additional Subnet Profiles at the manufacturer's option. At any one time, only one subnet profile shall be active on a given port of the NTCIP device. All response datagram packets shall use the same transport profile used in the request. The NTCIP device shall be configurable to allow a field technician to activate the desired subnet profile and shall provide a visual indication of the currently selected subnet profile.

Transport Profiles

Each serial or modem port on each NTCIP device shall be configurable to support both NTCIP 2201 and NTCIP 2202.

Each Ethernet port on the NTCIP device shall comply with NTCIP 2202.

The NTCIP device(s) may support additional transport profiles at the manufacturer's option. Response datagrams shall use the same transport profile used in the request. Each NTCIP device shall support the receipt of datagrams conforming to any of the supported transport profiles at any time.

Application Profiles

Each NTCIP device shall comply with NTCIP 2301 and shall meet the requirements for Conformance Level 1.

An NTCIP device may support additional application profiles at the manufacturer's option. Responses shall use the same application profile used by the request.

Each NTCIP device shall support the receipt of application data packets at any time allowed by the subject standards.

Object Support

Each NTCIP device shall support all mandatory objects of all mandatory conformance groups as defined in NTCIP 1201 and NTCIP 1203.

Each NTCIP device shall support all mandatory objects in all optional conformance groups required herein. All optional objects listed in these specifications shall be supported.

The NTCIP device(s) are required to support the following optional conformance groups.

Conformance Group	Reference
Time Management	NTCIP 1201
Timebase Event Schedule	NTCIP 1201
Report	NTCIP 1201
PMPP	NTCIP 1201
Font Configuration	NTCIP 1203
DMS Configuration	NTCIP 1203
MULTI Configuration	NTCIP 1203
MULTI Error Configuration	NTCIP 1203
Illumination/Brightness Control	NTCIP 1203
Scheduling	NTCIP 1203
Sign Status	NTCIP 1203
Status Error	NTCIP 1203
Pixel Error Status	NTCIP 1203

Table 2: Required Optional Conformance Groups

The following table indicates objects that are considered optional in the NTCIP standards, but are required by this specification. It also indicates modified object value ranges for certain objects. Each NTCIP device shall provide the full, standardized object range support (FSORS) of all objects required by these specifications unless otherwise indicated below.

Object	Reference	Project Requirement
moduleTable	NTCIP 1201 Clause 2.2.3	Shall contain at least one row with moduleType equal to 3 (software).
maxTimeBaseScheduleEntries	NTCIP 1201 Clause 2.4.3.1	Shall be at least 28
maxDayPlans	NTCIP 1201 Clause 2.4.4.1	Shall be at least 20
maxDayPlanEvents	NTCIP 1201 Clause 2.4.4.2	Shall be at least 12
maxEventLogConfig	NTCIP 1201 Clause 2.5.1	Shall be at least 50
eventConfigMode	NTCIP 1201 Clause 2.4.3.1	The NTCIP Component shall Support the following Event Configuration: onChange, greaterThanValue, smallerThanValue
eventConfigLogOID	NTCIP 1201 Clause 2.5.2.7	FSORS
eventConfigAction	NTCIP 1201 Clause 2.5.2.8	FSORS
maxEventLogSize	NTCIP 1201 Clause 2.5.3	Shall be at least 200
maxEventClasses	NTCIP 1201 Clause 2.5.5	Shall be at least 16
eventClassDescription	NTCIP 1201 Clause 2.5.6.4	FSORS
maxGroupAddresses	NTCIP 1201 Clause 2.7.1	Shall be at least 1

communityNamesMax	NTCIP 1201 Clause 2.8.2	Shall be at least 3
numFonts	NTCIP 1203 Clause 2.4.1.1.1.1	Shall be at least 12
maxFontCharacters	NTCIP 1203 Clause 2.4.1.1.3	Shall be at least 255
defaultFlashOn	NTCIP 1203 Clause 2.5.1.1.1.3	The DMS shall support flash "on" times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultFlashOff	NTCIP 1203 Clause 2.5.1.1.1.4	The DMS shall support flash "off" times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultBackgroundColor	NTCIP 1203 Clause 2.5.1.1.1.1	The DMS shall support the black background color
defaultForegroundColor	NTCIP 1203 Clause 2.5.1.1.2	The DMS shall support the amber foreground color
defaultJustificationLine	NTCIP 1203 Clause 2.5.1.1.1.6	The DMS shall support the following forms of line justification: left, center, and right
defaultJustificationPage	NTCIP 1203 Clause 2.5.1.1.1.7	The DMS shall support the following forms of page justification: top, middle, and bottom
defaultPageOnTime	NTCIP 1203 Clause 2.5.1.1.1.8	The DMS shall support page "on" times ranging from 0.1 to 25.5 seconds in 0.1 second increments
defaultPageOffTime	NTCIP 1203 Clause 2.5.1.1.1.9	The DMS shall support page "off" times ranging from 0.1 to 25.5 seconds in 0.1 second increments
defaultCharacterSet	NTCIP 1203 Clause 2.5.1.1.1.10	The DMS shall support the eight bit character set
dmsMaxChangeableMsg	NTCIP 1203 Clause 2.6.1.1.1.4	Shall be at least 100.
dmsMessageMultiString	NTCIP 1203 Clause 2.6.1.1.1.8.3	The DMS shall support any valid MULTI string containing any subset of those MULTI tags listed in Table 3 (below)
dmsControlMode	NTCIP 1203 Clause 2.7.1.1.1.1	Shall support at least the following modes: local, central, and centralOverride
dmsSWReset	NTCIP 1203 Clause 2.7.1.1.1.2	FSORS
dmsMessageTimeRemaining	NTCIP 1203 Clause 2.7.1.1.1.4	FSORS
dmsShortPowerRecoveryMessage	NTCIP 1203 Clause 2.7.1.1.1.8	FSORS

dmsLongPowerRecoveryMessage	NTCIP 1203 Clause 2.7.1.1.1.19	FSORS
dmsShortPowerLossTime	NTCIP 1203 Clause 2.7.1.1.1.10	FSORS
dmsResetMessage	NTCIP 1203 Clause 2.7.1.1.1.12	FSORS
dmsCommunicationsLossMessage	NTCIP 1203 Clause 2.7.1.1.1.12	FSORS
dmsTimeCommLoss	NTCIP 1203 Clause 2.7.1.1.1.12	FSORS
dmsEndDurationMessage	NTCIP 1203 Clause 2.7.1.1.1.15	FSORS
dmsMemoryMgmt	NTCIP 1203 Clause 2.7.1.1.1.16	The DMS shall support the following Memory management Modes: normal and clearChangeableMessages
dmsMultiOtherErrorDescription	NTCIP 1203 Clause 2.4.1.1.1.20	If the vendor implements any vendor-specific MULTI tags, the DMS shall provide meaningful error messages within this object whenever one of these tags generates an error
dmsIllumControl	NTCIP 1203 Clause 2.8.1.1.1.1	The DMS shall support the following illumination control modes: Photocell, and Manual
dmsIllumNumBrightLevels	NTCIP 1203 Clause 2.8.1.1.1.4	Shall be at least 100
dmsIllumLightOutputStatus	NTCIP 1203 Clause 2.8.1.1.1.9	FSORS
numActionTableEntries	NTCIP 1203 Clause 2.9.1.1.1	Shall be at least 200
watcdogFailureCount	NTCIP 1203 Clause 2.11.1.1.1.5	FSORS
dmsStatDoorOpen	NTCIP 1203 Clause 2.11.1.1.1.6	FSORS
fanFailures	NTCIP 1203 Clause 2.11.2.1.1.8	FSORS
fanTestActivation	NTCIP 1203 Clause 2.11.2.1.1.9	FSORS
tempMinCtrlCabinet	NTCIP 1203 Clause 2.11.4.1.1.1	FSORS

tempMaxCtrlCabinet	NTCIP 1203 Clause 2.11.4.1.1.2	FSORS
tempMinSignHousing	NTCIP 1203 Clause 2.11.4.1.1.5	FSORS
tempMaxSignHousing	NTCIP 1203 Clause 2.11.4.1.1.6	FSORS

Table 3: Modified Object Ranges and Required Optional Objects

Multi Tags

Each NTCIP device shall support the following message formatting MULTI tags. The manufacturer may choose to support additional standard or manufacturer-specific MULTI tags.

MULTI Tag	(E) DESCRIPTION
f1	Field 1-time (12 hr)
f2	Field 1-time (24 hr)
f8	Field 8- day of month
f9	Field 9-month
f10	Field 10-2 digit year
f11	Field 11-4 digit year
fl (and /fl)	Flashing text on a line-by-line basis with flash rates controllable in 0.1-second increments.
Fo	Font
jl2	Justification- line-left
jl3	Justification- line-center
jl4	Justification- line- right
jp2	Justification- page- top
jp3	Justification- page- middle
jp4	Justification- page- bottom
mv	Moving text
nl	New line
np	New page up to 5 instances in a message (i.e. up to 6 pages/frame in a message counting first page)
pt	Page times controllable in 0.1-second increments

Table 4: Required MULTI Tags

Documentation

NTCIP documentation shall be provided on a CD-ROM or USB device and will contain ASCII versions of the following Management Information Base (MIB) files in Abstract Syntax Notation 1 (ASN.1) format:

- The relevant version of each official standard MIB modules referenced by the device functionality.
- If the device does not support the full range of any given object within a standard MIB Module, a manufacturer specific version of the official standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE macro. The filename of this file shall be identical to the standard MIB Module except that it will have the extension “man”.
- A MIB module in ASN.1 format containing any and all manufacturer specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.
- A MIB containing any other objects supported by the device

Acceptance Testing

The vendor will provide certification of NTCIP-compliance as part of the vendor’s pre-build submittal documentation. This certification shall be in the form of a comprehensive test plan and completed test report as performed by either the vendor or a third-party testing agency. The testing shall have been completed using industry accepted test tools such as the NTCIP Exerciser, Trevilon’s NTester, Intelligent Devices’ Device Tester, and/or Frontline’s FTS for NTCIP. Data capture files from the FTS software during the performance of the above testing shall be furnished upon request of the Engineer.

The Engineer can elect to perform additional NTCIP testing if desired. This testing shall be conducted on a production DMS in the vendor’s facility during the factory acceptance test. The vendor shall provide a written NTCIP test procedure to the Engineer a minimum of 30 days prior to the NTCIP testing.

Interpretation Resolution

If the Engineer or DMS manufacturer discovers an ambiguous statement in the standards referenced by this procurement specification, the issue shall be submitted to the NTCIP DMS Working Group for resolution. If the Working Group fails to respond within 90 days, the engineer shall provide an interpretation of the specification for use on the project.

As-Built Documentation

The Contractor shall provide to the Engineer the following documentation of the complete installed equipment prior to testing. Sufficient documentation shall be provided to reflect “as-built” conditions and to facilitate operation, maintenance, modification and expansion of the system or any of its individual components. Manufacturer supplied documentation which covers the intent of this requirement may be used, subject to the approval of the Engineer.

Operator's Manuals

A manual containing a general description and detailed operating and installation instructions shall be provided for each different type or model of equipment. Five hard copies and an electronic copy of the manual shall include the following information:

- A general description of the equipment including all information necessary to describe the basic use or function of the system components. This shall include a general block diagram presentation of the equipment. Where auxiliary equipment is required, tabular charts shall be included, list such equipment. These charts shall include the nomenclature physical and electrical characteristics and functions of the auxiliary equipment, unless such information is contained elsewhere in an associated manual. In the latter case, a reference shall be made to the location of the information pertaining to the auxiliary equipment.
- The theory of operation of the system components in a clear, concise manner supported by simplified schematics, logic, data flow diagrams, one-function diagrams, etc. Timing and waveform diagrams and voltage levels shall be shown as required. A logical development shall be used starting with a system block level and proceeding to a circuit analysis. Circuit analysis shall be detailed whenever circuits are not normally found in standard text books. This application of new theoretical concepts shall be fully described. Where the design allows operation in a number of different modes, an operational description of each mode shall be included.
- In simple, clear language, the routine of operation, from necessary preparations for placing the equipment into operation, to securing the equipment after operation. This section shall contain appropriate illustrations, with the sequence of operations presented in tabular form wherever feasible.
- The manufacturer's recommended procedures and checks necessary for preventive maintenance. This shall be specified for pre-operation, weekly, monthly, quarterly, semi-annual, annual and "as required" checks as necessary to assure reliable equipment operation. Specification, including tolerances, for all electrical, mechanical, and other applicable measurement, adjustments, or both, shall be listed.
- Data necessary for isolation and repair of failure or malfunctions, assuming the maintenance technicians to be capable of analytical reasoning using the information provided in the submittal information. Accuracies, limits, and tolerances for all electrical, physical or other applicable measurements shall be described. General instructions shall be included for disassembly, overhaul and reassembly, including shop specifications or performance requirements.
- Detailed instructions shall be given only where failure to follow special procedures would result in damage to the equipment, improper operation, danger to operating or maintenance personnel. Consumption of excessive person hours, etc. Such instructions and specifications shall be included only for such maintenance as maybe accomplished by specialized technicians and engineers in a modern electromechanical shop. The instructions shall describe special test set-up, components fabrication, the use of special tools, jigs and test equipment.

- A detailed physical description of size, weight, special mounting requirements, electrical connections, and all other pertinent information necessary for proper installation and use of the equipment shall be provided.
- The parts list shall contain all information required to describe the characteristics of the individual parts, as required for identification. It shall include a list of all equipment within a group and list all assemblies, sub-assemblies and replacement parts of units. The tabular arrangement shall be an alphanumerical order of the schematic reference symbols and shall give the associated description, manufacturer's name and part number. A table of contents or some other convenient means shall be provided for the purpose of identifying major components, assemblies, etc.
- Schematic diagrams shall be complete and accurate as required to supplement the text material and to allow the books to be a self-contained technical information source. Maximum size of these diagrams shall be limited to allow their use in close proximity to the equipment, in the class room, etc., part reference symbols, test voltages, waveforms and other aids to understanding of the circuits function shall be included on the diagrams. Test voltages, waveforms and other aids to understanding of the circuits function may be shown on either simplified schematics or other drawings (as required in the above sections) on theory of operation or maintenance or on the schematic diagrams required for this section. The overall scope of information shall not be less, however, than that stated for the schematic diagrams.

Software Manuals

The DMS vendor shall provide manuals and data for the computer software system and components thereof. These shall include the following (5 hard copies and 1 electronic copy):

- Computer programmer's manuals and computer user's manuals. Include manuals for any CPU language used by the Contractor for this project. Include instructions for performing a back-up of all software and message libraries.
- Two original copies of the computer's operating system manual and compiler and assembly language manuals and an instruction manual for translating source to object code.
- Manufacturer's documentation (including schematics) for all plug in circuit cards used in the microcomputer chassis.
- Computer program logic in flow chart form.
- Narrative descriptions of programs and input output formats.
- Two copies of source programs, for IDOT Central Computer and sign controller software, shall be provided on CD-ROM. An unrestricted license for software use by the Department shall be provided to the Engineer.
- DMS vendor shall provide the communication protocol used between the IDOT Central Computer and the DMS sign controller for use by the Department without any restrictions.

Final Documentation

Final documentation shall reflect all field changes and software modifications and shall be provided before installation. Final documentation shall be approved prior to final system acceptance has begun. This document shall include drawings of conduit layouts, cable diagrams, wiring lists, cabinet layouts, wiring diagrams and schematics for all elements of the communications system. This shall also include detailed drawings identifying by cable type, color-coded function, the routing of all conductors (pairs) in the communications system. Upon completion of the installation, the Contractor shall submit these plans, maps, and/or drawings to reflect an as built condition, incorporating all changes made during installation, such as in pair identification and routing.

Spare Parts Requirements

The Contractor shall provide additional parts to create two (2) additional character matrixes, two (2) load modules to drive a character module, one (1) LED power supply, and one complete sign controller unit. The cost of additional parts/equipment shall be considered incidental to the price for each DMS.

DMS Training

Operational and maintenance training for the entire system shall be provided to designated personnel during installation, testing and debugging. This training shall be provided through practical demonstrations and other related technical procedures. Training shall be limited to a maximum of 15 people and shall be provided at a time and location approved by the Engineer. The training shall include, but not be limited to, the following:

- Hands-on operation of all sign control hardware
- Explanation of all system commands, their function and usage.
- Insertion of data
- Required preventative maintenance
- Servicing procedures
- System trouble-shooting or problem identification procedures

A minimum of 8 hours of instruction shall be provided for the operational and maintenance procedures for the system. The DMS vendor shall submit an agenda for the training and one complete set of training materials along with the qualification of proposed instructors to the Engineer for approval at least 30 days before the training is to begin. The Engineer will review material and approve or request changes. After approval, the vendor shall provide a minimum of 5 copies of the training material that will become the property of the Department after training period is over.

The DMS vendor shall record the entire training on DVDs and shall provide the recordings to the Engineer for later use. The training shall be conducted at the Contractor's or the District One Traffic Systems Center building, after the completion of all system integration tests. The schedule of training sessions shall be established by the DMS vendor, with the approval of the Engineer.

Warranty

The equipment and parts furnished for the DMS and DMS control system shall be new, of the latest model, fabricated under high quality standards.

Equipment and parts furnished for the DMS shall be warranted by the manufacturer to be free of defects in assembly or fabrication and materials for a minimum of five years from the date of acceptance and shall be warranted for quality of work for twelve months from the date of final acceptance. If component manufacturer's warranties are for a longer period, they shall apply. Any parts or equipment found to be defective during the warranty period shall, upon the concurrence of the defect by the manufacturer, be replaced free of charge.

The Engineer shall be furnished with a certification stating that the equipment, parts and material furnished for the DMS and DMS control system complies with all the provisions of this special provision. If there are any items which do not comply with this special provision, then a list of those exceptions shall be detailed on the certification.

All manufacturer's warranties and guarantees for the dynamic message sign system shall be transferred to the Department on the date of final acceptance.

Method of Measurement

The DYNAMIC MESASGE SIGN, WALK-IN ACCESS, FULL MATRIX, COLOR, NTCIP 1203 shall be paid for at the contract unit price as each which cost shall include the cost of furnishing all labor, materials, documentation, warranties, tools and equipment to install, test, and make the location operational with the specified DMS in this pay item.

Basis of Payment

This work shall be paid for at the contract unit price each for DYNAMIC MESASGE SIGN, WALK-IN ACCESS, FULL MATRIX, COLOR, NTCIP 1203 which price shall include furnishing and installing the DMS sign, documentation, warranties, spare parts, training, and diagnostic software as directed by the engineer.

TEMPORARY CONSTRUCTION FENCE

Description: This work shall consist of furnishing, installing and removing temporary chain link fence, gates and accessories as shown on the plans, as specified herein and in accordance with Section 664 of the Standard Specifications.

Fence that is determined by the Engineer to be damaged, rendering it ineffective for its intended use, shall be immediately replaced by the Contractor. No additional compensation will be provided for replacing damaged fence.

When the fence is no longer required for its intended use, the fence, including concrete foundations, shall be completely removed and disposed of by the Contractor. Holes shall be backfilled and the ground surface restored to preconstruction conditions, including a 4" topsoil surface and seeding, using materials and methods approved by the Engineer.

Method of Measurement: TEMPORARY CONSTRUCTION FENCE will be measured for payment in feet, 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 TEMPORARY CONSTRUCTION FENCE.

ENGINEER'S FIELD OFFICE TYPE A (SPECIAL) (D1)

Effective: December 1, 2011

Revised: May 1, 2013

Revise the first paragraph of Article 670.02 to read:

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

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

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

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

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

Revise the fifth paragraph of Article 670.02 to read:

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

Revise subparagraph (a) of Article 670.02 to read:

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

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

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

Revise subparagraph (d) of Article 670.02 to read:

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

Revise subparagraph (e) of Article 670.02 to read:

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

Revise subparagraph (h) of Article 670.02 to read:

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

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

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

Revise subparagraph (j) of Article 670.02 to read:

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

Revise subparagraph (k) of Article 670.02 to read:

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

Revise subparagraph (l) of Article 670.02 to read:

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

Revise subparagraph (m) of Article 670.02 to read:

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

Add the following subparagraphs to Article 670.02:

- (s) One 4 foot x 6 foot chalkboard or dry erase board.
- (t) One 4 foot x 6 foot framed cork board.

Add the following to Article 670.07 Basis of Payment.

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

TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D-1)

Specific traffic control plan details and Special Provisions have been prepared for this contract. This work shall include all labor, materials, transportation, handling and incidental work necessary to furnish, install, maintain and remove all traffic control devices required as indicated in the plans and as approved by the Engineer.

When traffic is to be directed over a detour route, the Contractor shall furnish, erect, maintain and remove all applicable traffic control devices along the detour route according to the details shown in the plans.

Maintenance. All maintenance of the traffic control devices shall be the responsibility of the Contractor until removal is directed by the Engineer.

Method of Measurement: All traffic control (except "Traffic Control and Protection (Expressways)" and temporary pavement markings) indicated on the traffic control plan details and specified in the Special Provisions will be measured for payment on a lump sum basis.

Basis of Payment: All traffic control and protection will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (SPECIAL).

Temporary pavement markings will be paid for separately unless shown on a Standard.

TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)

Effective: March 8, 1996

Revised: January 25, 2024

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

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

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

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

Additional requirements for traffic control devices shall be as follows.

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

(b) Sign Requirements

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

- (c) Drums/Barricades. Check barricades shall be placed in work areas perpendicular to traffic every 1000', one per lane and per shoulder, to prevent motorists from using work areas as a traveled way. Check barricades shall also be placed in advance of each open patch, or excavation, or any other hazard in the work area, the first at the edge of the open traffic lane and the second centered in the closed lane. Check barricades, either Type I or II, or drums shall be equipped with a flashing light.

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

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

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

Basis of Payment.

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

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

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

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

Where: "X" =	$\frac{\text{Difference between original and final sum total value of all work items for which traffic control and protection is required}}{\text{Original sum total value of all work items for which traffic control and protection is required.}}$

The value of the work items used in calculating the increase and decrease will include only items that have been added to or deducted from the contract under Article 104.02 of the Standard Specifications and only items which require use of Traffic Control and Protection.

Temporary traffic control costs due to delay will be paid for according to the Compensable Delay Costs (BDE) Special Provision.

- (b) The Engineer may require additional traffic control be installed in accordance with standards and/or designs other than those included in the plans. In such cases, the standards and/or designs will be made available to the Contractor at least one week in advance of the change in traffic control. Payment for any additional traffic control required will be in accordance with Article 109.04 of the Standard Specifications.
- (c) Revisions in the phasing of construction or maintenance operations, requested by the Contractor, may require traffic control to be installed in accordance with standards and/or designs other than those included in the plans. Revisions or modifications to the traffic control shown in the contract shall be submitted by the Contractor for approval by the Engineer. No additional payment will be made for a Contractor requested modification.

- (d) Temporary concrete barrier wall will be measured and paid for according to Section 704.
- (e) Impact attenuators, temporary bridge rail, and temporary rumble strips will be paid for separately.
- (f) Temporary pavement markings shown on the Standard will be measured and paid for according to Section 703 and Section 780.
- (g) All pavement marking removal will be measured and paid for according to Section 703 or Section 783.
- (h) Temporary pavement marking on the lower slope of the temporary concrete barrier wall will be measured and paid for as TEMPORARY PAVEMENT MARKING, 6".
- (i) The Changeable Message Sign required for Full Expressway Closures shall not be paid for separately.

UNDERGROUND CONDUIT, MULTI-DUCT, 7-18MM MICRODUCTS

Description. This work shall consist of furnishing, installing, splicing, connecting and demonstrating continuity of a fiber optic conduit micro-duct system of the size specified herein and as shown on the Plans.

Materials. The conduit and fittings shall meet the requirements of Article 1088.01(c) of the Standard Specifications, except as modified herein. The conduit system shall consist of 7, 18 mm outside diameter (O.D.), 14 mm inside diameter (I.D.) micro-ducts contained inside an HDPE protective outer sheath with a minimum thickness of 0.07 in. The outer sheath for IDOT microduct shall be orange. The outer sheath for Third Party microduct shall be slate. The conduit system shall be designed for direct burial.

The overall conduit shall have a nominal 2.27 in. outside diameter with a supported bend radius of 31 in., an unsupported bend radius of 52 in., and a safe working pull strength of 3,500 lbs.

Conduit shall be free from holes, blisters, inclusions, cracks, or other imperfections that would affect the performance or serviceability of the product.

Conduit 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	Value
Density	D1505	0.940-0.950 g/cm ³
Melt Index (E)	D1238	0.10 - 0.35 g/10 Minutes
Environmental Stress Crack Resistance (ESCR)	D1693	192.0 hrs (per ASTM D3350)
Tensile @ Yield (min)	D638	2500 - 3200 psi (1,700 - 2,200 N/cm ²)
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)

Micro-ducts shall be smooth on the outside and ribbed on the inside. The inside shall have a co-extruded permanent layer of low friction boundary layer between the micro-duct and the fiber optic cable for the anticipated service life of the micro-duct.

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 micro-duct colors shall be blue, orange, green, brown, grey, white, and red, or other colors as approved. Micro-ducts 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.

All 18/14 mm micro-ducts shall have a minimum safe pull strength of 3,500 lbs., a minimum sustained air pressure of 300 PSI, and a minimum burst pressure of 475 PSI.

The micro-duct system shall be equipped with an integrated 20 AWG (minimum) copper wire, insulated and installed within the oversheath that is designed to be used for underground utility locating purposes. Continuity of the tracer wire must be maintained at all points. Submittal information shall demonstrate how the tracer wire continuity will be maintained throughout the micro-duct run. Connection devices used shall be as approved by the tracer wire manufacturer, except wire nuts of any type are not acceptable and shall not be used.

The Contractor shall perform a locate or conductivity test as a part of the final documentation.

Conduit shall be supplied on 3,500 ft reels (or larger as equipment and installation techniques permit) in order to minimize the number of conduit splices. Fittings shall be mechanical or glued splices that preserve the 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.

CONSTRUCTION REQUIREMENTS

Installation. The micro-duct shall be installed according to Section 810 of the Standard Specifications, in accordance with manufacturer's specifications, and as specified herein.

Conduit shall be buried a minimum of 42 inches below final grade throughout its entire length. Conduit 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 conduit shall be limited to the bend radius specified herein.

Micro-duct shall not be permitted to enter the side wall of the communications vault. A three foot (3') "tail" of micro-duct, along with a strain relief assembly shall be installed at each communications vault to prevent contraction of the micro-duct system. The Contractor shall not trim the micro-duct to the three foot (3') "tail" until a minimum of 24 hours after installation.

The micro-duct system shall be sealed at all times during construction to eliminate the ingress of dirt and moisture. The Contractor shall utilize caps that are approved for use by the duct manufacturer. All micro-ducts shall be capped within communications vaults. 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.

The Contractor shall perform post installation testing on all micro ducts prior to installing fiber optic cable. As a minimum, tests shall include: an air test, a foam sponge test, a plastic sphere test, a pressure test, and a tracer wire continuity test between Communication Vaults.

Each micro-duct shall be tested for continuity by blowing a sponge and then a plastic sphere (approximately 80% 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 micro-ducts in accordance with the manufacturer's recommended practices. Testing, at a minimum shall demonstrate that the micro-ducts are installed and assembled correctly, are air-tight, and have had no reduction of the interior diameter. Each micro-duct 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. The Contractor shall submit testing results to the Department. The Contractor shall correct deficiencies to the satisfaction of the Engineer.

The Contractor shall submit testing information and procedures to the Department for review and approval included in the micro-duct submittal prior to ordering material.

A cable marking tape shall be installed above the conduit system according to Article 810 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 micro-duct every 100' 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 communications duct, micro-ducts, 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 conduit 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 18 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, 7-18MM MICRODUCTS.

LIGHT POLE, STEEL 50 FT. WITH CAMERA LOWERING SYSTEM

Description. This work shall consist of furnishing and installing a light pole structure complete with external camera lowering system. The lowering device system shall be configured to support a high definition camera with the appropriate cable connections.

Materials.

Pole. The pole shall be designed in accordance with 2015 AASHTO LRFD Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals with 2017 & 2018 Interim Revisions for a 120 mph wind zone. The pole shall be designed for use with a single arm camera lowering device with a total effective area of 2 square feet and total weight of 95 lbs. The structure shall not exceed 1" deflection in a 30 mph (non-gust) wind.

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

The steel pole shaft shall be made of one section. The pole shaft shall be a round cross section and meet the requirements of ASTM A572 or A1011 with a minimum yield strength of 50,000 psi. The pole base plate shall meet the requirements of ASTM A572 or A1011. Anchor bolts shall conform to ASTM F1554 gr. 55. The pole shaft shall also meet or exceed the following minimum requirements:

- Pole Diameter at Base: 14.75"
- Minimum Bottom Section Wall Thickness: 0.3125" (10/32")
- Overall Pole Height: 50'
- Base Plate Thickness: 1.25"
- Bolt Circle Diameter: 18.5"
- Anchor Bolts: (4) 1.25"

- (A) Handhole. There shall be an oval shaped opening in the side of the shaft for the purpose of a handhole. Unless otherwise indicated, the centerline of the handhole shall be 18 inches from the bottom of the shaft. The handhole shall be 4 inch x 8 inch in size with the 8 inch dimension being situated vertically and in the same plane as any one of the sides of the base. The opening in the shaft shall be reinforced with a handhole frame situated on the inside of the shaft and welded to the shaft. A 1/2"-13 tapped hole shall be provided in the frame for attaching a mechanical grounding connector. The handhole cover shall be fastened to the frame with 1/4"-20 size steel core nylon hex-head screws and nickel anti-seize lubricant; the holes for the screws shall be tapped to match the screws. Unless otherwise indicated, the orientation of the handhole shall be such that its pole face shall be oriented on a face 90 degrees from the camera arm orientation as shown on the plans.
- (B) Conduit Routing. At the bottom portion of the shaft two openings shall be provided to allow for the installation of 2" aluminum mogul conduit body (LB) for routing of cables into/out of the CABINET, MODEL 336. The openings shall be positioned as shown on the plans. The mogul conduit body (LB), insulated throat bushing, locknut, and neoprene seal gasket shall be included as part of this pay item.
- (C) Vibration Requirements. The detailed design and fabrication of the shaft and of the arms shall be such as to withstand 120 mph AASHTO criteria for wind and vibrations, caused by the wind pressure. There shall be no excessive vibrations in the shaft, arm(s) under moderate wind pressure, where damage may result to the camera and/or its component parts, and/or arms, the cabinet, and lowering device system. A dampening device, as an integral part of the shaft, shall be installed in the shaft to alleviate such excessive vibrations. The proposed vibration dampening device shall be submitted for Engineer's approval. No information contained herein shall be construed to relieve the Contractor of the above requirements.

(D) Certification and Guarantee. The submittal information shall include a written certification of compliance with the contract requirements from the Manufacturer. The certification shall specifically identify the project route, location, section number, and contract number, as applicable and shall identify specifically the equipment covered by the certification. The certification shall be made on the Manufacturer's corporate stationary and it shall be dated and signed by a responsible officer of the company, with the signee's title listed. In addition, submittal information shall include the guarantee as specified under General Electrical Provisions. 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 Structural 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
- 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.

Camera Lowering System. The Camera Lowering System shall be designed to support and lower a high-definition (HD) closed circuit television (CCTV) dome camera, cabling, connectors and other supporting field components without damage or causing degradation of the camera operations. The Camera Lowering System shall be exterior to the pole and consist of the following major components:

- (A) Camera Junction Box. The camera junction box shall be provided with a factory tapped 1½ inch NPT thread to accept the CCTV camera housing. The camera junction box shall be two-piece clamshell design with one hinged side and one latched side opposite the hinge. A neoprene ring gasket shall fit between the clamshell halves to seal out moisture. The junction box shall meet IP55 ingress protection rating.
- (B) Camera Cables. Category 6 Ethernet cable shall meet the requirements of the camera manufacturer and TIA/EIA 568-B.2 telecommunication standards. The CAT 6 cable shall be composed of a minimum 24 AWG solid bare copper conductors, twisted pairs and polyolefin insulation. The CAT 6 cable shall be capable of performing from -40°F to 160°F. Power cables (if required) shall meet the requirements of the camera manufacturer.

- (C) Disconnect Unit. The disconnect unit shall include MIL-SPEC electrical connection, that is self-aligning with a tracking guide or mechanism that ensures the disconnect unit body and camera align in the same position every time the camera is raised into its "locked" position. The disconnect unit shall be capable of providing the required cable connection(s) to the camera. When in its "locked" position the disconnect unit shall provide a continuous data connection feed with the camera. All communication connections between the fixed and lowerable portion of the contact block shall be protected from exposure to the weather with a waterproof seal to prevent degradation of the electrical contacts. The disconnect unit load capacity shall have a minimum load capacity of 400 pounds with a minimum of 6 to 1 safety factor.
- (D) Lowering Cable. The Control Cable shall be a minimum of 5/32" diameter 316 Stainless Steel, 7x19 cable. The lowering cable shall be of sufficient length to fully lower the camera to the ground level with a minimum of 5 feet of lowering cable remaining on the winch drum. The lowering cable shall wind evenly on the winch drum and not bind during operation. The lowering cable shall be the only cable in movement during camera lowering and raising operation.
- (E) Divided Support Arm. The disconnect unit fitter shall be designed to completely isolate the Control Cable from the Camera Cables.
- (F) Pole Connection Box. The pole connection box shall provide a transition between the Divided Support Arm and conduit attached to the pole structure. The pole connection box shall provide strain relief for the Camera Cables.
- (G) Conduit. 1-1/2" galvanized steel conduit shall be provided between the pole connection box and lower winch box and shall be in accordance with Article 1008.01 of the Standard Specifications.
- (H) Winch Cabinet. The winch cabinet shall house the permanently mounted winch assembly. The cabinet shall have one hinged side with provisions for a padlock.
- (I) Winch Assembly. The camera lowering device system shall utilize a permanently mounted winch assembly (the installation and removal of a portable device shall not be allowed). The permanently mounted winch shall be operable by a manual hand crank, as well as an electric drill. One hand crank (with handle extension) per camera installed on the project and two (total) electric drill with adapter chucks shall be provided to the Department. All pulleys for the camera lowering device shall have sealed, self-lubricated bearings, oil tight bronze bearings, or sintered bronze bushings.

Banding to attach the conduit, pole connection box, lower winch box and any other required components to the pole structure shall be stainless steel.

All other ancillary components required by the manufacturer to provide a fully operational Camera Lowering System shall be included as part of this item.

CONSTRUCTION REQUIREMENTS

Prior to construction and ordering materials, the Contractor shall conduct a survey of the existing ITS infrastructure as described in the SURVEY OF EXISTING ITS INFRASTRUCTURE special provision.

Installation. The structure shall be set plumb on the foundation without the use of shims, grout or any other leveling devices under the pole base. The camera arm shall be set at right angles to the centerline of the pavement. This item shall be coordinated with the applicable CABINET, MODEL 336S and CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER, which shall be provided under separate pay items.

The space between the finished top of the foundation and the bottom of the base plate of the pole 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.

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

The lowering device manufacturer shall furnish an authorized factory representative to assist the Contractor with the assembly and testing of the first camera lowering system onto the pole assembly. The manufacturer shall also furnish documentation certifying that the Contractor has been instructed on the installation, operation and safety features of the camera lowering system.

Testing. The Contractor shall demonstrate operation of the Camera Lowering System by lowering and raising the camera in the presence of the Engineer to verify that the Camera Lowering System operates as required and that camera operations are reinstated upon the camera housing being fully raised into a "locked" position.

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

Basis of Payment. This work shall be paid at the contract unit price each for LIGHT POLE, STEEL 50 FT. WITH CAMERA LOWERING SYSTEM, which price shall be payment in full for furnishing and installing system as described herein. Installation of the camera lowering system shall be included as a part of this item and shall not be paid for separately.

DISCONNECT SWITCH

Description. This item shall consist of furnishing and installing an electric service disconnect switch assembly as shown in the plans.

Materials. The disconnect switch assembly shall consist of the following materials:

- A. Pedestal Base. The pedestal base shall be cast iron with an access handhole cover. The contractor shall coordinate the pedestal base bolt circle with the existing and proposed CONCRETE FOUNDATION, TYPE A.
- B. Post. The post shall be 4" carbon steel, anchored to the pedestal base. The post shall be primed and painted, with two epoxy finish coats of ANSI-61 gray.
- C. Cabinet. The cabinet shall be 36"H x 20"W x 15"D, fabricated from aluminum, with a minimum thickness of 0.125". The cabinet shall be NEMA 3R rated and have a mounting back plate. The cabinet shall be primed and painted, with two epoxy finish coats of ANSI-61 gray. The interior shall be painted white.

The cabinet door shall have a continuous hinge that is bolted to the cabinet and door with 1/4-20 stainless steel carriage bolts and NY-lock nuts. The hinge shall be installed on the right side when facing the cabinet and be made of stainless steel with a 0.25-inch diameter stainless steel hinge pin. The hinge pin shall be capped top and bottom by weld to render it tamper-proof.

The cabinet shall have a gasket that forms a weather-tight seal between the cabinet and door. The door latching mechanism shall be a 3-point draw roller type. When the door is closed and latched, it will be locked with a #2 Corbin lock. The latching handle shall be fabricated from a 0.75-inch stainless steel round bar and shall have a provision for padlocking in the closed position.

The cabinet shall be equipped with two adjustable "C" mounting channels welded on both side walls and back wall of the enclosure, allowing versatile positioning of shelves or panels. Mounting channels shall be factory painted same color as interior of cabinet.

The cabinet door shall not have compartment doors or louvers. Interior of cabinet door shall have a plastic pocket for wiring schematic.

- D. Circuit Breaker. The cabinet shall be equipped with a circuit breaker(s) for incoming power as shown on the plans. Circuit Breakers shall be thermal magnetic bolt on type with a minimum interrupting capacity of 10,000 symmetrical amperes at 240 volts line to line service or 14,000 at 480 Volt rated at line to line service. They shall be lockable in the "off" position for compliance with OSHA lockout/tagout requirements. Handles shall be tripped free. Circuit Breakers shall be rated for 600 volts for use on 480-volt circuits, 240 volts for use on 240, 208 and 120, volt circuits. Circuit Breakers shall be suitable for mounting to the equipment panel of the cabinet. Rating of breakers shall be shown on the face of breaker or handle. Breaker function shall also be labeled below circuit breaker.

- E. Neutral and Ground Bus. Bus bars connectors and lugs shall be copper insulated and isolated and configured to prevent shorted conditions from tightening terminations, etc. The overall bus section shall be configured behind an insulating barrier shield which is removable for access to connections.
- F. Wire and cable. Wire and cable shall be in accordance with Article 1066 of the Standard Specifications.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall prepare and submit a shop drawing detailing the complete disconnect switch assembly installation, including a wiring diagram and equipment layout. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer.

The equipment assembly shall be assembled by a UL508A industrial control panel fabricator. The panel assembly shall be UL labeled and suitable for use as service equipment.

All equipment shall be grounded and bonded in accordance with the National Electrical Code and the National Electrical Safety Code.

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.

A plastic laminated cabinet layout diagram, circuit schematic, and bill of materials with catalog numbers used shall be affixed to the interior side of the enclosure door.

The cabinet shall be identified and labeled with external markings as specified in Article 1069.06 of the Standard Specifications and as shown in the Plans.

Method of Measurement. Disconnect switch will be measured for payment per each unit furnished and installed by the contractor and accepted by IDOT.

Basis of Payment. This work will be paid for at the Contract unit price each for DISCONNECT SWITCH furnished and installed at the locations shown on the plans including all accessories as specified herein and shown on the plans.

FIBER OPTIC CABLE 12 FIBERS, SINGLE MODE

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, 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	
	1	$32 \pm 2 \text{ mm}$	$< 0.05 \text{ at } 1550 \text{ nm}$
	100	$50 \pm 2 \text{ mm}$	$< 0.05 \text{ at } 1310 \text{ nm}$
	100	$50 \pm 2 \text{ mm}$	$< 0.10 \text{ at } 1550 \text{ nm}$
	100	$60 \pm 2 \text{ mm}$	$< 0.05 \text{ at } 1550 \text{ nm}$
	100	$60 \pm 2 \text{ mm}$	$< 0.05 \text{ at } 1625 \text{ nm}$
Cable Cutoff Wavelength (λ_{ccf})		(nm)	< 1260
Zero Dispersion Wavelength (λ_0)		(nm)	$1302 \leq \lambda_0 \leq 1322$
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 $\pm$ 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 swellable 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 swellable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellable 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 swellable tape shall be applied longitudinally over both the inner and outer layer. The water swellable 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 aramid yarn 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 used for 12 fibers 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 (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 $+70^{\circ}\text{C}$. The installation temperature range of the cable shall be -30°C to $+70^{\circ}\text{C}$.

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 $+70^{\circ}\text{C}$) 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 $+60^{\circ}\text{C}$. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears, or other openings. The change in attenuation shall not exceed 0.30 dB at 1550 nm for single mode fiber and 0.50 dB at 1300 nm for multimode fiber.

Quality Assurance Provision. All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel. The cable manufacturer shall be TL 9000 registered.

Packaging. Top and bottom ends of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:

- Cable Number
- Gross Weight
- Shipped Cable Length in Meters
- Job Order Number
- Product Number
- Customer Order Number
- Date Cable was Tested
- Manufacturer Order Number
- Cable Length Markings
 - Top (inside end of cable)
 - Bottom (outside end of cable)

The reel (one flange) marking shall include:

- Manufacturer
- Country of origin
- An arrow indicating proper direction of roll when handling
- Fork lift-handling illustration
- Handling Warnings.

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

- Manufacturer Cable Number
- Manufacturer Product Number
- Manufacturer Factory Order Number
- Customer Name
- Customer Cable Number
- Customer Purchase Order Number
- Mark for Information
- Ordered Length
- Maximum Billable Length
- Actual Shipped Length
- Measured Attenuation of Each Fiber

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers.

The cable shall meet all of specified requirements under the following conditions:

Shipping/storage temperature: -58° F to +158° F (-50° C to +70° C)

Installation temperature: -22° F to +158° F (-30° C to +70° C)

Operating temperature: -40° F to +158° F (-40° C to +70° C)

Relative humidity from 0% to 95%, non-condensing

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 vault, 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.

Prior to cable installation, the Contractor shall "proof" all innerducts or conduits that will be utilized for fiber installation. At a minimum, a plastic sphere test shall be completed to confirm continuity. The test shall consist of blowing a plastic sphere (approximately 80% of the inside innerduct or conduit diameter) from one end to the other. If any innerduct or conduit fails this testing, the Contractor shall notify the Engineer.

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 vault 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.

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

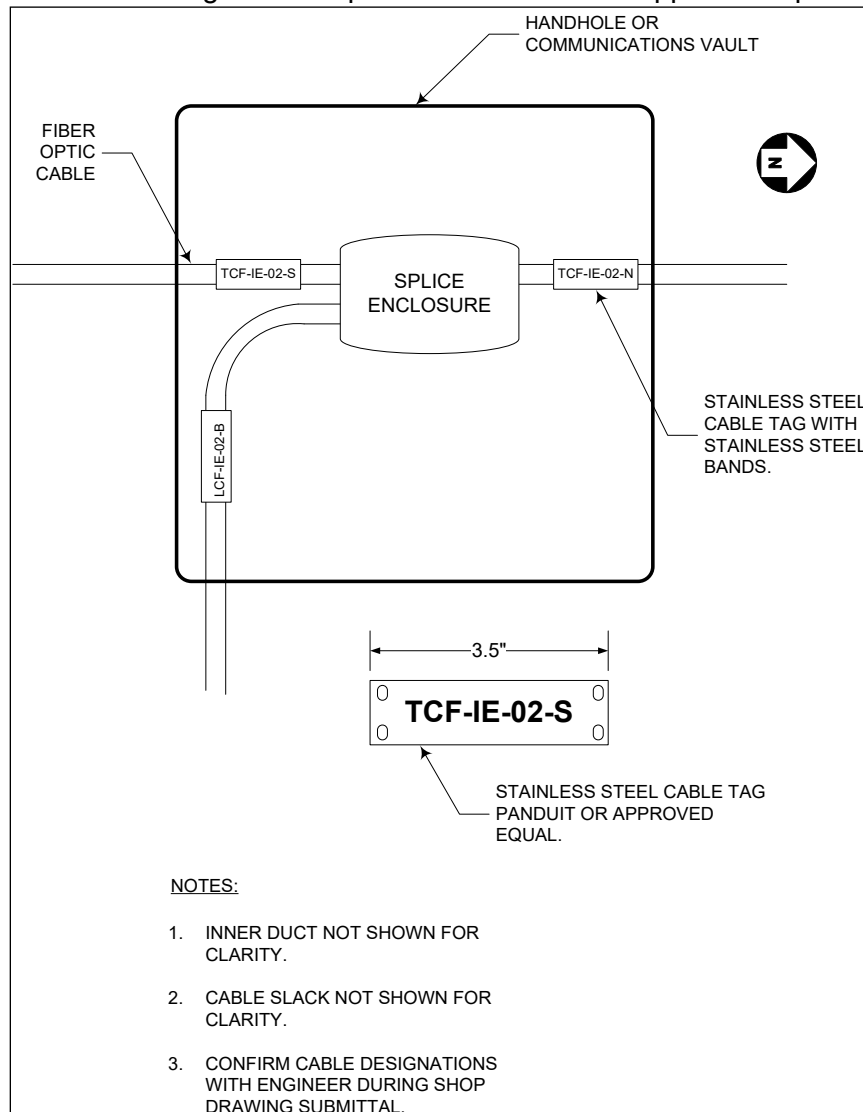
- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- Final copies of all approved test procedures
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
- Complete parts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

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 vault, communications vault, interconnect cabinet, or any other type of enclosure, shall be dead ended in a splice closure.

Slack Storage of Fiber Optic Cables. Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in vaults 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 vaults 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:



Method of Measurement. FIBER OPTIC CABLE 12 FIBERS, SINGLE MODE 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 12 FIBERS, SINGLE MODE. Payment shall not be made until the cable is installed, spliced, and tested in compliance with these special provisions.

FIBER OPTIC TERMINATION PANEL

Description. This specification shall govern the furnishing and installing of termination panels for fiber optic cable in designated field locations and associated equipment cabinets as shown in the Plans and as detailed in this specification.

Materials.

The fiber optic termination panel installed in a Type 336S and Type 334 cabinets shall consist of an Enclosure and Optical Splice Panel and comply with the following requirements:

Enclosure

- a) Shall be Corning part number CCH-01U or approved equivalent.
- b) Be capable of being installed in 19" TIA rack(s) mounted the cabinets and be sized to take up no more than one (1) rack unit (RU).
- c) Meets or exceeds ANSI/TIA/EIA-568A and 606, tested in accordance with Telecordia GR-63-CORE and UL1863 - Communication Circuit Accessories.
- d) Be Powder-coated metal and polycarbonate tray.
- e) Be capable of accepting a variety of up to two (2) optical splice panels as described below.
- f) Be equipped with external and internal strain-relief brackets.
- g) Be equipped with a removable front door.
- h) Be capable of accepting documentation labels.
- i) Have front and rear slidable access.
- j) Be free of hazardous substances according to RoHS 2011/65/EU.
- k) Installation kit to include mounting screws and any accessories to mount the panel to the rack.

Optical Splice Panels

- a) Shall be Corning part number CCH-CS and CCH-CP12-A9 bulkheads or adapter modules having twelve (12) fiber duplex LC connectors or approved equivalent.
- b) An additional optical splice panel with twelve (12) fiber duplex LC connectors shall be installed in the 334 cabinets to accommodate vendor specified fiber cable (Singlemode or multimode) between the DMS sign and the DMS controller.
- c) Meets and/or exceeds ANSI/TIA/EIA-568A and 606
- d) Be free of hazardous substances according to RoHS 2011/65/EU.
- e) Provide splice holder or splice organizer.
- f) Provide strain relief and storage for incoming fiber buffer tube and pigtail fiber cables.
- g) See TERMINATE FIBER IN CABINET for pigtail and fiber termination requirements.

The fiber optic termination panel installed in Lighting Cabinets shall consist of an Enclosure and Optical Splice Panel and comply with the following requirements:

Enclosure

- a) Shall be Corning part number WCH-02P or approved equivalent.
- b) The Enclosure shall be Wall-Mountable.
- c) Be free of hazardous substances according to RoHS 2011/65/EU.
- d) Be equipped with a jumper door.
- e) Be equipped with strain-relief brackets.
- f) Be capable of accepting documentation labels.
- g) Installation kit to include mounting screws and any accessories to mount the enclosure to the cabinet.

Optical Splice Panels

- a) Shall be Corning part number CCH-CS and CCH-CP12-A9 bulkheads or adapter modules having twelve (12) fiber duplex LC connectors or approved equivalent.
- b) Meets and/or exceeds ANSI/TIA/EIA-568A and 606
- c) Be free of hazardous substances according to RoHS 2011/65/EU.
- d) Provide splice holder or splice organizer.
- e) Provide strain relief and storage for incoming fiber buffer tube and pigtail fiber cables.
- f) See TERMINATE FIBER IN CABINET for pigtail and fiber termination requirements.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall label all cables and ports using permanent cable tags. These labels shall identify the function of the cables and the ports the cables are connected to.

Installation. The fiber optic termination panel shall be installed in the cabinets or IDOT facilities as specified on the Plans. All work shall be neat and in a workmanlike manner. Particular care shall be taken as to not crush or kink the fiber optic cable. If, in the opinion of the Engineer, the cable has been damaged, the entire cable span shall be removed and replaced at the Contractor's expense.

Method of Measurement. The FIBER OPTIC TERMINATION PANEL bid item will be measured for payment in units of each, for the actual number of FIBER OPTIC TERMINATION PANEL assemblies furnished, installed, activated, tested, and accepted.

Basis of Payment. This Work will be paid for at the Contract unit price each for FIBER OPTIC TERMINATION PANEL, 12F OR 24F.

FIBER OPTIC CABLE, MICRO, SINGLE MODE

Description. This work shall consist of furnishing and installing loose-tube, single-mode fiber optic high density micro cable that is intended for use in miniaturized cabling applications, of the number of fibers shown in the plans and as directed by the Engineer. The fiber optic micro cable shall be optimized for blowing into 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, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

Materials.

Fiber Optic Micro Cable

The single-mode, fiber optic micro cable shall incorporate a loose, buffer-tube design. The cable shall be ordered in minimum reel lengths sufficient to install fiber optic cable segments as shown on the plans with no additional mainline splices.

The cable shall meet designed and tested to

- IEC 60794-5-10 requirements for outdoor fiber optic micro cables.
- Full industry standards for both ITU G.657.A1 BIF and G.652.D SMF industry standards,
- Meet or exceed IEC 60793-2-50 B-657.A1 and B-652-D SMF fiber standards, Telcordia GR20 & GR409, ICEA fiber cable standards including ICEA 640, 696, and 596.
- Compliant with RUS 7 CFR 1755.900 fiber requirements.
- Full backward compatibility with ITU G.652.D SMF, compliant with ITU G.652.D and IEC 60793-2-50 B-652.D low water peak SMF specifications.
- Compatible with equipment designed for G.652 fibers; fully transparent from a transmission perspective, splice compatible with ITU G.652 SMF using standard single mode machine settings.
- Full 1260-1625 nm low water peak compliance.
- The single-mode fiber shall meet EIA/TIA-492-CAAA, "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."

(A) Physical Construction. Physical construction shall meet the following requirements:

Requirement	Units	Value
Cable Diameter	µm	8.2 (max)
Buffer Tube Diameter	mm	1.4
Colored Fiber Nominal Diameter	µm	200 ±5
Mode Field Diameter (1310 nm)	µm	9.2 ± 0.4
Mode Field Diameter (1550 nm)	µm	10.4 ± 0.5
Minimum Bending Radius	mm	10

(B) Optical Characteristic. Optical Characteristics shall meet the following requirements:

Requirement	Wavelength	Units	Value
Cabled Fiber Attenuation	1310 nm	dB/km	0.34
	1550 nm		0.20
Point Discontinuity	1310 nm	dB	< 0.05
	1550 nm		< 0.05
Total Dispersion	1550 nm	ps/(nm•km)	< 3.5
	1285-1330 nm		< 17.5
	1625 nm		< 21.5

Requirement	Units	Value
Cable Cutoff Wavelength (X_{ccf})	nm	< 1260
Zero Dispersion Wavelength (X_0)	nm	$1304 < X_0 < 1324$
Zero Dispersion Slope (S_0)	ps/(nm ² •km)	< 0.088
Cabled Polarization Mode Dispersion	ps/km ⁻²	< 0.04

Macroband Attenuation

Turns	Mandrel OD	Value
1	10 mm	< 0.05 dB at 1550 nm
1	10 mm	< 1.5 dB at 1625 nm
10	15mm	< 0.10 dB at 1550 nm
10	15mm	< 0.05 dB at 1625 nm
100	25 mm	< .01 dB at 1310 nm

(C) 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 1.4 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.

The central member shall consist of a dielectric central element. 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.

The micro fiber optic cable shall be water blocked and meet industry standards water penetration requirements for outdoor cables per IEC 60794-1-22, Method F5B.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process.

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 1334 N (299.99 lbf) during installation (short term) and 400 N (90 lbf) long term installed. It is not recommended that the microfiber optic cable be pulled in or out of the duct since micro cable do not have the tensile strength rating of a traditional fiber optic cable assembly. Special handling will be required during the installation of the microfiber optic cable. Microfiber optic cable is designed to be blown and pushed through a micro duct using specially designed equipment.

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 15 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

(D) 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.

(E) Packaging. Top and bottom ends of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:

- Cable Number
- Gross Weight
- Shipped Cable Length in Meters
- Job Order Number
- Product Number
- Customer Order Number
- Date Cable was Tested
- Manufacturer Order Number
- Cable Length Markings
 - Top (inside end of cable)
 - Bottom (outside end of cable)

The reel (one flange) marking shall include:

- Manufacturer
- Country of origin
- An arrow indicating proper direction of roll when handling
- Fork lift-handling illustration
- Handling Warnings.

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

- Manufacturer Cable Number
- Manufacturer Product Number
- Manufacturer Factory Order Number
- Customer Name
- Customer Cable Number
- Customer Purchase Order Number
- Mark for Information
- Ordered Length
- Maximum Billable Length
- Actual Shipped Length
- Measured Attenuation of Each Fiber

CONSTRUCTION REQUIREMENTS

Experience Requirements. Personnel involved in the installation, splicing and testing of the micro fiber optic cables shall meet the following requirements:

- A minimum of three (3) years experience in the installation of microfiber optic cables, including fusion splicing, terminating and testing single mode fibers.
- Install two systems where microfiber optic cables are outdoors in micro 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 microfiber 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 microfiber optic 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 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 for blowing each cable segment.
- Identify mid span locations where the cable is slacked out of a handhole, coiled in a figure eight, and blown back into the hand hole.
- The plan shall address the physical protection of the microcable 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.

Prior to cable installation, the Contractor shall "proof" all micro ducts, innerducts, or conduits that will be utilized for micro fiber installation. At a minimum, a plastic sphere test shall be completed to confirm continuity. The test shall consist of blowing a plastic sphere (approximately 80% of the inside micro duct, innerduct, or conduit diameter) from one end to the other. If any micro duct, innerduct, or conduit fails this testing, the Contractor shall notify the Engineer.

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, minimum tension applied to 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 into the microduct. The Contractor shall use a micro cable blowing machine designed for use with the microfiber cable being installed. A Compressed air cooler shall be used when ambient air temperatures reaches 68°F or more.

Where cable is to be blown through existing conduit which contains existing cable(s), optical or other, the existing cable(s) shall stay in place. In addition, the Contractor shall be required to obtain a Watch and Protect from the IDOT District 1 Electrical Maintenance Contractor during the work.

Construction Documentation Requirements. 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. 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 12 months. 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 (minimum 1 kilometer) 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. 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.

The quality of all fiber splices and terminations shall be verified by OTDR and power meter testing and documented according to Article 801.13(d) of the "Standard Specifications," to the satisfaction of the Engineer. The Contractor at no additional cost to the Department shall replace any splice not satisfying the required objectives.

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 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
- Measured Length (Cable Marking)
- Total Length (OTDR)
- Optical Source/Power Meter Total Attenuation (dB/km)
- Events >0.10 Db

Sample OTDR Summary:

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>

Sample Power Meter Tabulation Table:

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 following shall be the criteria for the acceptance of the cable:

The average optical loss of each splice shall not exceed 0.10 dB. In addition, no event shall 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.

For connectors, maximum attenuation shall be 0.4 dB. Typical attenuation is 0.2dB.

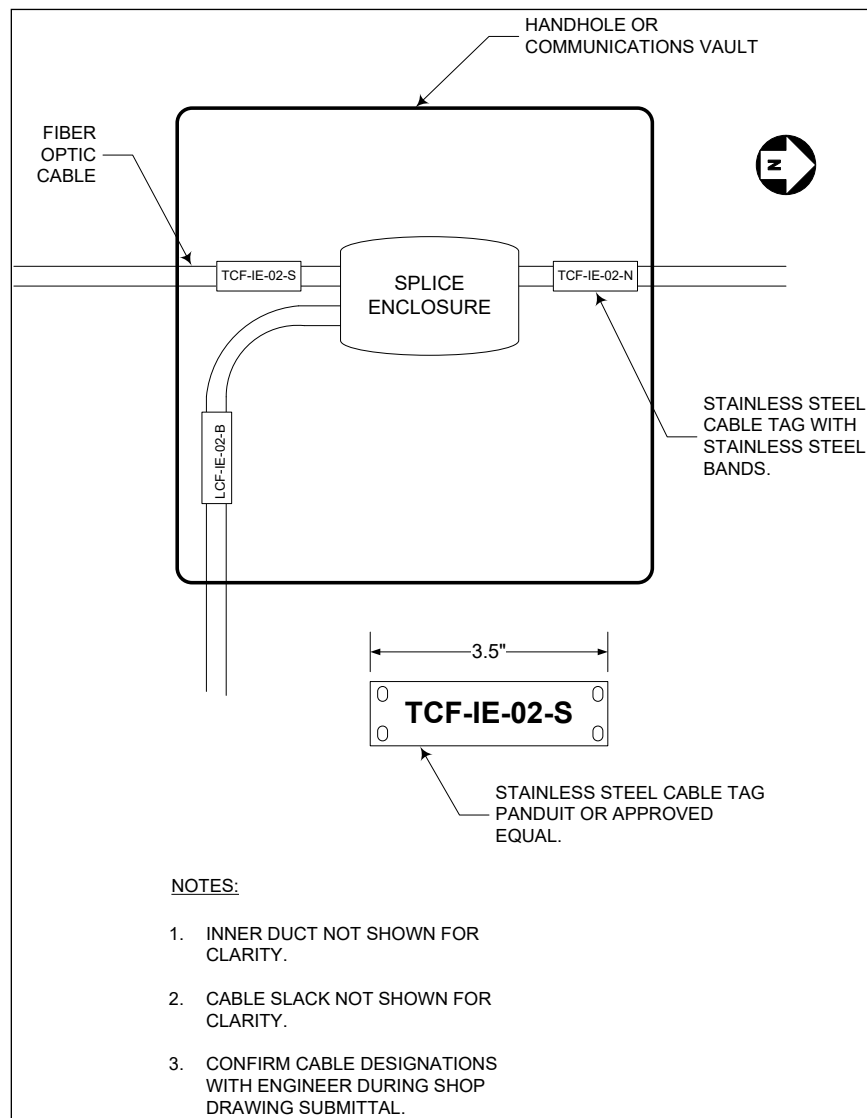
The total loss of the cable (dB), less events and connectors, shall not exceed the manufacturer's production specifications as follows: 0.34 dB/km at 1310 nm and 0.20 dB/km at 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to the Department, 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 Department, including labor and materials.

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 closure.

Slack Storage of Fiber Optic Cables. Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in handholes or in the raised base adapters of ground mounted cabinets in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be 100 feet for each cable at each splice location, above or below ground. Fiber optic cable slack shall be 50 feet for each cable at access points, above or below ground, where splicing is not involved. If the micro duct or innerduct is cut, the ends of the duct 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, MICRO, 144 FIBERS, SINGLE MODE and FIBER OPTIC CABLE, MICRO, 288 FIBERS, SINGLE MODE 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, MICRO, 144 FIBERS, SINGLE MODE or FIBER OPTIC CABLE, MICRO, 288 FIBERS, SINGLE MODE. Payment shall not be made until the cable is installed, spliced and tested in compliance with these special provisions.

FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT

Description. This work shall consist of furnishing and installing a termination panel as shown on the plans or as directed by the Engineer in the IDOT interconnect cabinet and Communications Hut.

Materials.

The fiber optic termination panel shall consist of an Enclosure and Optical Splice Panels and comply with the following requirements:

Enclosure

- a) Shall be Corning part number CCH-04U or approved equivalent.
- b) Be capable of being installed in 19" TIA rack(s) mounted the cabinets and be sized to take up no more than four (4) rack unit (RU).
- c) Meets or exceeds ANSI/TIA/EIA-568A and 606, tested in accordance with Telecordia GR-63-CORE and UL1863 - Communication Circuit Accessories.
- d) Be Powder-coated metal and polycarbonate tray.
- e) Be capable of accepting up to twelve (12) optical splice panels as described below.
- f) Fiber cable capacity of a minimum of 144 fibers.
- g) Be equipped with external and internal strain-relief brackets.
- h) Be equipped with a removable front door.
- i) Be capable of accepting documentation labels.
- j) Have front and rear slidable access.
- k) Be free of hazardous substances according to RoHS 2011/65/EU.
- l) Installation kit to include mounting screws and any accessories to mount the panel to the rack.

Optical Splice Panels

- a) Shall be Corning part number CCH-CS and CCH-CP12-A9 bulkheads or adapter modules having twelve (12) fiber duplex LC connectors or approved equivalent.
- b) Include twelve (12) splice panels with adapter modules
- c) Meets and/or exceeds ANSI/TIA/EIA-568A and 606
- d) Be free of hazardous substances according to RoHS 2011/65/EU.
- e) Provide splice holder or splice organizer.
- f) Provide strain relief and storage for incoming fiber buffer tube and pigtail fiber cables.
- g) See TERMINATE FIBER IN CABINET for pigtail and fiber termination requirements.
- h) Allow termination of a fiber optic jumper to interconnect outside plant fibers to fiber optic communication equipment.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall label all cables and ports using permanent cable tags. These labels shall identify the function of the cables and the ports the cables are connected to.

Installation. The fiber optic termination panel shall be installed in the cabinets or IDOT facilities as specified on the Plans. All work shall be neat and in a workmanlike manner. Particular care shall be taken as to not crush or kink the fiber optic cable. If, in the opinion of the Engineer, the cable has been damaged, the entire cable span shall be removed and replaced at the Contractor's expense.

Method of Measurement. The FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT will be measured for payment in units of each, for the actual number of FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT assemblies furnished, installed, activated, tested, and accepted.

Basis of Payment. This work will be paid for at the Contract unit price each for FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT.

ETHERNET MANAGE SWITCH

Description. This work shall consist of furnishing and installing a Layer III network switch and associated equipment/licenses at the existing I-80 & I-355 fiber interconnect cabinet as shown on the plans.

Materials. The network switch and associated equipment/licenses shall be as outlined below or approved equal. The contractor shall verify the equipment and licenses as outlined in the table below with IDOT Electric Maintenance Contractor's Network Administrator and provide the proper IOS, licensing such as DNA, Smart Net, Cisco ISE, etc. in keeping with the existing shelter and data center switches in the ITS network.

Manufacturer	Model No.	Item Description	Quantity
Cisco	IE-9320-22S2C4X-A Switch	Catalyst IE9300 w/ 24 Ports GE SFP Downlinks and 4 Ports 10G SFP+ uplinks, Stackable, NA, Conformal Coating	3
Cisco	PWR-RGD-AC-DC-H	Hazloc Power Supply High AC/DC 85-264VAC/88-300VDC (Primary)	3
Cisco	PWR-RGD-AC-DC-H	Hazloc Power Supply High AC/DC 85-264VAC/88-300VDC (Secondary)	3
Cisco	CAB-TA-NA=	AC power cord for Cisco Catalyst (North America (Primary)	3
Cisco	CAB-TA-NA=	AC power cord for Cisco Catalyst (North America (Secondary)	3
Cisco	CAB-STK-0.5M=	Stacking Cable	3
Cisco	IE9300-NW-A=	Network Advantage License for IE9300, Perpetual	3
Cisco	IE9300-NW-A=	Network Advantage license	3

Cisco	IE9300-DNA-A-7Y	IE9300 DNA Advantage 7 Year Term License	3
Cisco	CON-SNTP-IE932CXA	Smartnet 24x7x24 24 Port SFP Downlinks w/ 10G Uplinks License	3

Optical Patch Cords

The optical patch cords shall comply with the following:

- The fiber optic jumpers shall be approximately 10 foot (3 meters) SMFO duplex LC-LC jumper cables manufactured by Corning, model number 040402R5820003M or approved equivalent.
- Be compliant with the TIA/EIA-568-A and TIA/EIA-604 standards, as applicable.
- Tested according to the Telcordia/Bellcore GR-326-CORE standard. When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)-171 (TIA/EIA-455-171).
- The connectors shall test to an average insertion loss of 0.4 decibel and a maximum loss of 0.75 decibel.
- The connectors shall be tested as detailed in FOTP-107 (TIA/EIA-455-107) to reflectance values of -58 decibels.
- The connector material shall be Ceramic with UPC polish.
- The contractor shall provide the quantity of optical patch cords as listed in the table below.

Fiber Optic Transceivers

The fiber optic transceivers installed in the switch shall be from the same manufacturer as the switch or shall be from a manufacturer approved list. Recommended fiber optic transceiver types shall be the following models or approved equal.

- GLC-LH-SMD (1 Gbps single mode transceivers for links under 10 km)
- GLC-EX-SMD (1 Gbps single mode transceivers for links over 10 km and under 40 km)
- GLC-ZX-SMD (1 Gbps single mode transceivers for links over 40 km)

Application	SFP Transceiver	Transceiver Quantity	Patch Cable, 3M
DCF	GLC-LH-SMD	24	24
DCF	GLC-EX-SMD	6	6

CONSTRUCTION REQUIREMENTS

Installation. The network switch and its associated equipment supply shall be mounted to an equipment rack as shown on the plans. The Contractor shall submit a shop drawing showing the location where the switch will be installed in the building and the means of mounting for approval by the Engineer.

Configuration. The switch shall be packaged and delivered to the IDOT network administrator for configuration. The switch shall be labeled and numbered according to the building or field cabinet these devices are to be installed. The IDOT network administrator shall configure and test the switch to make sure the device functions within the IDOT network environment as intended and is ready for installation. Any device that is deemed nonconforming/functional shall be removed and returned to the contractor. It is the contractor's responsibility to get the device repaired or replaced and reconfigured by the IDOT network administrator prior to installation in the field.

Once configuration has been completed and verified operational within the IDOT network environment the contractor shall plan to pick up the switch from the IDOT network administrator for installation. The contractor shall coordinate the field installation and turn on of ITS field devices with the Engineer, TSC Engineer, and IDOT network administrator.

Integration. The switch shall be integrated by the Contractor into the IDOT D1 field network per the approved configuration document. Configuration, integration, functionality, and compatibility with the existing network are the responsibility of the Contractor.

Method of Measurement. This work will not be measured for payment.

Basis of Payment. This work will not be paid for separately and shall be included in the cost of the MODIFY EXISTING FIBER OPTIC CABINET pay item.

FIBER OPTIC SPLICE

Description. This work shall consist of the Contractor splicing optical fibers from different cable sheaths and protecting 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 a particular location.

Materials. Materials shall be according to the following.

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:

- (a) 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 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.).

(b) Factory Testing

- (1) 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.
- (2) 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%.
- (3) 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.
- (4) 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.
- (5) Water Immersion Test. The closure shall be capable of preventing a 3 m (10 ft) water head from intruding into the splice compartment for a period of 7 days. Testing of the splice closure is to be accomplished by the placing of the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent 3 m (10 ft) on the closure and cable. This process shall be continued for 30 days. Remove the closure and open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a failure.

- (6) 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.

Ancillary Components. Contractor shall provide all ancillary components required to complete the fusion splice, including splice organizer trays, heat shrink and stainless steel backer rod.

CONSTRUCTION REQUIREMENTS

Experience Requirements. Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

- (a) A minimum of three (3) years experience in the installation of microfiber optic cables, including fusion splicing, terminating and testing single mode fibers.
- (b) Install two systems where microfiber 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.
- (c) One microfiber 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 Requirements. 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.

Splicing 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.

When splicing into existing fiber optic cables that are supporting operations, the Contractor shall take additional precautions to avoid disrupting Communications Center and Traffic System Center operations. The specific timeframes for performing the work shall be dictated by the Engineer, but are anticipated to be Sunday through Thursday night between 9:00 pm and 5:00 am or Friday/Saturday night between 9:00 pm and 9:00 am. The Contractor shall commit adequate resources to finish the work during the authorized periods. In addition, the Contractor shall exercise additional precautions to ensure that only the fibers, conductors, or equipment that are assigned to this project, are accessed by the Contractor's technicians.

Prior to splicing or re-terminating any existing cables or fibers, the Contractor shall provide specific details of the work to be done to the Engineer with an anticipated timeframe to complete the work. This must be done a minimum of fourteen calendar days prior to commencing the work. The Engineer will grant approval for any operations 72 hours in advance of their commencement. In addition, the Contractor shall be required to obtain a Watch and Protect from the IDOT District 1 Electrical Maintenance Contractor during the work.

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.

Testing Requirements. The Contractor shall test and document all fiber optic cable testing in accordance with the requirements found in the FIBER OPTIC CABLE, MICRO, SINGLE MODE. The average optical loss of each splice shall not exceed 0.10 dB. In addition, no event shall 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. The Contractor at no additional cost to the Department shall replace any splice not satisfying the required objectives.

Method of Measurement. FIBER OPTIC SPLICE of the type identified in the Plans 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.

FIBER OPTIC SPLICE, LATERAL includes splicing of 12 fiber strands between two fiber optic cables at locations identified in the Plans.

FIBER OPTIC SPLICE, MAINLINE, includes splicing between 96 and 144 fiber strands between two fiber optic cables at locations identified in the Plans.

Basis of Payment. This work will be paid for 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.

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 847-705-4612". Lettering on the Third Party markers shall read "IDOT 847-705-4612". 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.

CONSTRUCTION REQUIREMENTS

Installation. Fiber optic utility marker posts shall be installed along the path of microduct conduit installation between communications vaults 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, a single fiber optic utility marker post shall be installed.

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 of each for FIBER OPTIC UTILITY MARKER.

FIBER OPTIC INNERDUCT 1 ¼" DIA.

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.

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

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

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

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

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

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

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

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

CONSTRUCTION REQUIREMENTS

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 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.

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 not 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 assure smooth installation.

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

HDPE coilable non-metallic conduit to non-HDPE coilable non-metallic conduit joints shall be either made with an approved mechanical connector or with a chemical compound. Both methods must be specifically designed for joining HDPE coilable non-metallic conduit. Minimum pullout force for the chemical compound shall be 540 pounds.

Method of 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 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 shall be paid at the contract unit price per foot installed for FIBER OPTIC INNERDUCT 1 1/4" DIA. which price shall be payment in full for all material and work as described herein.

CONCRETE FOUNDATION (SPECIAL)

Description. This work shall consist of constructing a concrete foundation for a closed circuit television camera (CCTV) pole.

Materials. Materials shall be in accordance with Article 878.02 of the Standard Specifications.

CONSTRUCTION REQUIREMENTS

The foundation shall be constructed in accordance with the "Type E" foundation under Highway Standard 878001-11 except as modified herein and as shown in the plans.

Installation. Installation shall be in accordance with Article 878.03 of the Standard Specifications with the following additions:

All anchor bolts shall be according to Article 1006.09, with all anchor bolts hot dipped galvanized over the full length. Four (4) 1" anchor bolts with 5" hook embedded a minimum of 5 ft. in the foundation, threaded a minimum of 6" with an exposed threaded height of 4" above the foundation shall be provided in an 15" bolt circle configuration to accommodate an ITS pole as shown on the Plans. Contractor shall coordinate the anchor bolts with the proposed ITS pole.

Foundations shall provide two (2) 2-inch raceways stubbed out of the foundation at a depth of 30" below finished grade. Unused raceways shall be stubbed and capped for future use.

The Contractor shall construct a PCC service pad adjacent to the foundation in accordance with the details shown on the Plans. The pad shall be constructed upon a 6" course aggregate base (CA 6).

Handrails shall be AASHTO M 270 Grade 36 structural steel. They shall be in accordance with Section 509 of the Standard Specifications and the plan details. The handrails shall be galvanized by the hot dip process.

No foundation is to be poured until the Resident Engineer gives his/her approval as to the depth of the foundation.

Method of Measurement. The foundation will be measured for payment in feet in place. The length measured will be limited to that shown on the plans or authorized by the Engineer. Excavation in rock will be measured for payment according to Article 502.12.

Basis for Payment. This work will be paid for at the contract unit price per foot of depth of CONCRETE FOUNDATION (SPECIAL).

Excavation in rock will be paid for according to Article 502.13. Obstruction mitigation will be paid according to Article 109.04.

MODIFY EXISTING LIGHTING CONTROLLER

Description. This item shall consist of modifying an existing lighting controller in place to accommodate additional ITS circuits.

Materials. Material shall be in accordance with the following:

- A. Circuit Breaker. The cabinet shall be equipped with circuit breaker(s) for power as shown on the plans. Circuit Breakers shall be thermal magnetic bolt on type with a minimum interrupting capacity of 10,000 symmetrical amperes at 240 volts line to line service or 14,000 at 480 Volt rated at line to line service. They shall be lockable in the "off" position for compliance with OSHA lockout/tagout requirements. Handles shall be tripped free. Circuit Breakers shall be rated for 600 volts for use on 480-volt circuits, 240 volts for use on 240, 208 and 120, volt circuits. Circuit Breakers shall be suitable for mounting to the equipment panel of the cabinet. Rating of breakers shall be shown on the face of breaker or handle. Breaker function shall also be labeled.
- B. Wire and cable. Wire and cable shall be in accordance with Article 1066 of the Standard Specifications.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall prepare and submit a shop drawing detailing the complete lighting controller modification, including a wiring diagram and equipment layout. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer.

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.

Existing lighting controller schematics and wiring diagrams shall be updated to reflect the new circuit(s) installed under this work.

The Contractor shall schedule and perform work to ensure the existing lighting system will be operational every night from dusk to dawn.

Method of Measurement. This work will be measured for payment per each lighting controller modified as shown on the plans.

Basis of Payment. This work will be paid for at the Contract unit price each for MODIFY EXISTING LIGHTING CONTROLLER at the locations shown on the plans.

REMOVE EXISTING TRAFFIC SURVEILLANCE EQUIPMENT

Description. This work shall consist of removing and salvaging or disposing of various traffic surveillance equipment, as specified herein and as shown in the plans.

General Requirements. No removal work will be permitted without approval from the Engineer.

Traffic surveillance equipment shall be removed in accordance with the following requirements and/or Articles of the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction.

(a) Bluetooth Detection Site.

- (1) Bluetooth detector and solar panel (Salvage). The Bluetooth detector, solar panel, and associated cable shall be disconnected and removed from the ITS pole for salvage. Upon removal from the ITS pole, the Contractor shall access the Bluetooth detector cabinet and disconnect cables from the battery.
- (2) Detector Pole and Breakaway Base (Salvage). The detector pole shall be removed in accordance with Article 842.03(b).

Removal of Traffic Surveillance Equipment, Salvage. When indicated, traffic surveillance equipment and associated hardware and appurtenances shall remain the property of the Department and shall be delivered to a Department facility within District One, as directed by the Engineer.

Prior to any work being performed by the Contractor, the Contractor shall, in the presence of the Engineer and the EMC Engineer, conduct an inspection of the equipment to be salvaged, making note of any parts which are found broken, missing, defective, or malfunctioning. The EMC Engineer will test the equipment as deemed necessary by the Engineer. Any problems noted will be resolved as directed by the Engineer and the EMC Engineer.

The Contractor shall assume full responsibility for the equipment during removal, transportation, and shipping/transfer to the Department facility. Traffic surveillance equipment shall be removed, boxed in new containers, approved by the Engineer, and delivered to the Department facility. The contractor is responsible for all packaging, transportation, and delivery.

The Contractor shall handle the equipment in such a manner as to prevent damage. Any damage resulting from the removal and/or transportation/shipping of the traffic surveillance equipment to be salvaged shall be repaired or replaced in kind at the Contractor's expense. The Engineer will be the sole judge to determine the extent of damage and the suitability of repair and/or replacement.

Method of Measurement. This work will be measured on a lump sum basis.

Basis of Payment. This work will be paid for at the contract lump sum price for REMOVE EXISTING TRAFFIC SURVEILLANCE EQUIPMENT.

REMOVE FIBER OPTIC CABLE FROM CONDUIT

Description. This work shall consist of removing existing fiber optic cable from conduit and removing associated fiber optic cable marker posts along the existing fiber optic cable route.

General Requirements. Trunk and distribution fiber removal takes place between existing communication vault CMV-IE-WB-26D and the existing fiber interconnect cabinet at I-80 & I-355. No removal work will be permitted without approval from the Engineer. Removal will not be allowed to start until the Contractor demonstrates to the Engineer that they have completed all pre-installation requirements associated with the FIBER OPTIC CABLE, MICRO, SINGLE MODE special provision and have a sufficient quantity of FIBER OPTIC CABLE, MICRO, 288 FIBERS, SINGLE MODE on hand to replace the existing 96-count fiber that will be removed.

CONSTRUCTION REQUIREMENTS

The fiber optic cable shall be disconnected from any splice cases and/or the communications end equipment and fiber enclosures prior to removal. Fiber optic cable shall be removed from conduits, handholes and junction boxes as shown on the Plans, and as directed by the Engineer. Cables removed as part of this item shall become the property of the Contractor and shall be disposed of according to Article 202.03.

Sequencing. Removal sequencing shall be as follows to minimize downtime of existing ITS sites between Gougar Road and I-355:

1. Remove the existing 96-count trunk fiber cable. The existing 96-count distribution fiber cable shall remain in place.
2. Install new distribution cable (DCF-IE-005 and DCF-IE-006, FIBER OPTIC CABLE, MICRO, 288 FIBERS, SINGLE MODE) in the existing 1-1/4" innerduct previously assigned to the 96-count trunk fiber cable.
3. Cut over existing ITS sites between Gougar and I-355 from the existing 96-count distribution cable to the new distribution cables (DCF-IE-005 and DCF-IE-006) one at a time, confirming full reestablishment of communication to each ITS site switch with IDOT before attempting to cut over the next ITS site.

4. After all existing ITS sites have been successfully cut over with communication confirmed, remove the existing 96-count distribution cable.
5. Install new trunk cable (TCF-IE-005 and TCF-IE-006, FIBER OPTIC CABLE, MICRO, 288 FIBERS, SINGLE MODE) in the existing 1-1/4" innerduct previously assigned to the 96-count trunk distribution cable.

Method of Measurement. This work will be measured for payment in place in feet. If two or more cables in a conduit are to be removed, each cable will be measured for payment separately.

Basis of Payment. This work will be paid for at the contract unit price per foot for REMOVE FIBER OPTIC CABLE FROM CONDUIT.

COMMUNICATIONS VAULT

Description. This work shall consist of constructing a composite concrete handhole and 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 shall have an open bottom.

The composite concrete handhole and cover shall have a design/test loading of 22,500/33,750 pounds, respectively. The composite concrete handhole lid shall have two 1 1/2-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-Do-IT".

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.

The cable marker locate post shall be made of non-conductive high-density polymer. The locate post for IDOT communications vaults shall be white in color with an orange cap with black graphic and lettering on two sides. The locate post for Third Party communications vaults shall be orange in color with an orange cap with black graphic and lettering on two sides. Lettering on the IDOT and Third Party markers shall read: "IDOT 847-705-4612". 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. The Locate post will have a removeable top exposing seven (7) ½ inch stainless steel bolt lugs with locking washer and nut.

CONSTRUCTION REQUIREMENTS

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

Conduits shall enter the open bottom of the composite concrete handhole. The side walls of the handhole shall not be punched, drilled, or altered in any way for conduit entry.

The composite concrete handhole shall be placed on 18 inches of coarse aggregate, CA-5 or CA 7 Class A, as specified in Section 1004 of the Standard Specifications.

Incidental to the installation of each communications vault, a cable marker locate post shall be installed. One cable marker locate post shall be installed next to every communications vault. 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 wire from each micro-duct conduit entering the communications vault shall be connected to the top lug in the locate post.

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

Basis of Payment. This work will be paid for at the contract unit price per each for COMMUNICATIONS VAULT.

GATEWAY INTEGRATION

Description. This work shall consist of software modification to the Gateway Server Interface from the ATMS XML feed, and any modifications required to broadcast this information to the GATEWAY web page and media.

To distribute the detector data and sign legends to the media, traffic engineers and the GATEWAY web page, the ATMS data must be integrated into the GATEWAY. The integration software shall utilize the five-minute feeds from the ATMS and translate the data into a format compatible with the existing user interface and distribution processes. The data shall appear to all users in a format identical to existing stations. No operator intervention shall be required to incorporate the data into the GATEWAY.

CONSTRUCTION REQUIREMENTS

Gateway Provider Coordination: The Contractor shall contact and coordinate both the work required and timing of the integration with the Gateway Provider listed below:

John Dillenburg
University of Illinois at Chicago Department of Computer Science
(312) 996-5598
dillenbu@uic.edu

This work shall be performed by Gateway Provider.

All software developed for this process shall become the property of the Illinois Department of Transportation.

Basis of Payment. Any charges by the Gateway Provider to integrate the proposed ATMS XML feed into the existing Gateway system will be paid for according to Article 109.05 once final acceptance has been granted as determined by the Engineer.

STORM WATER POLLUTION PREVENTION PLAN



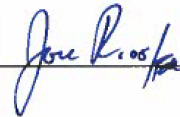
Storm Water Pollution Prevention Plan

Route	Marked Route	Section Number
Interstate 80	F.A.I. Route 80	FAI 80 21 VLS
Project Number	County	Contract Number
C-91-106-22	Various	62R19

This plan has been prepared to comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) Permit No. ILR10 (Permit ILR10), issued by the Illinois Environmental Protection Agency (IEPA) for storm water discharges from construction site activities.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Permittee Signature & Date

 4.21.2025

SWPPP Notes

Preparing BDE 2342 (Storm Water Pollution Prevention Plan)

Guidance on preparing each section of BDE 2342 (Storm Water Pollution Prevention Plan) is found in Chapter 41 of the IDOT Bureau of Design and Environment (BDE) Manual, please consult this chapter during SWPPP preparation. Please note that the Illinois Environmental Protection Agency (IEPA) has 30 days to review the Notice of Intent (NOI) prior to project approval and any deficiencies can result in construction delays.

The Notice of Intent contains the following documents:

- BDE 2342 (Storm Water Pollution Prevention Plan)
- BDE 2342 A (Contractor Certification Statement)
- Erosion and Sediment Control Plan (See Section 63-4.09 of the BDE Manual)

Non-applicable information

If any section of the SWPPP is not applicable put "N/A" in box rather than leaving blank.

National Pollutant Discharge Elimination System (NPDES) Compliance

Description of Work: This work shall consist of those efforts necessary for compliance with the requirements of the Clean Water Act, Section 402 (NPDES), and the Illinois Environment Protection Act. This provision also provides the background information needed to comply with ILR10 and ILR40 permits for this project.

NPDES COMPLIANCE REQUIREMENTS

Part I: Site Description

1. Describe the project location; include latitude and longitude, section, town, and range.

The I-80 ITS fiber installation takes place along the I-80 corridor. Approximate latitude/longitude is 41.512621 N/-88.076341 W. Township 35N, Range 10E, Sections 15 and 16. The design, installation, and maintenance of BMPs at these locations are within an area where annual erosivity (R value) is less than or equal to 160. Erosivity is less than 5 in all two-week periods between October 12 and April 15, which would qualify for a construction rainfall erosivity waiver under the US Construction General Permit requirements. At these locations, erosivity is highest in spring to autumn, April 16 - October 11.

2. Describe the nature of the construction activity or demolition work.

This contract generally includes installing ITS fiber optic cable in already constructed conduits and installing ITS devices on previously installed foundations along I-80 from Ridge Road to Wheeler Ave and from Gardner St to I-355. The section from Gardner St to Rowell Ave will also include construction of the conduits, handholes, and ITS foundations as shown on the Erosion Control Plans. A new Communication Hut will be constructed along the Frontage Road near the I-80 and I-55 interchange. No work will take place within Higgins Creek, which is mapped as WOVS.

3. Describe the intended sequence of major activities which disturb soils for major portions of the site (e.g. clearing, grubbing, excavation, grading, on-site or off-site stockpiling of soils, on-site or off-site storage of materials).

All work will take place in one construction stage with associated BMPs installed, maintained, and removed as shown on the Erosion Control Plans. Therefore there is no need for temporary erosion control ground stabilization, only permanent stabilization and landscaping. Permanent stabilization will be completed once the underground improvements (conduits, handholes and foundations) are complete and finished grade is met. There are no final landscape sheets included in the plans, instead final landscaping is shown on the ESC plans.

4. The total area of the construction site is estimated to be 4.84 acres.

5. The total area of the site estimated to be disturbed by excavation, grading or other activities is 4.84 acres.

6. Determine an estimate of the runoff coefficient of the site after construction activities are completed.

Runoff coefficient before and after construction activities is the same, as existing conditions will be restored following the ITS installation. The runoff coefficient before and after construction activities is 0.40.

7. Provide the existing information describing the potential erosivity of the soil at discharge locations at the project site.

The majority of soils found within the corridor are C-soils with erosivity values ranging from 0.28-0.37. See the full list of soils and K values in item 9 below.

8. Erosion and Sediment Control Plan (Graphic Plan) is included in the contract. ☒ Yes ☐ No

9. List all soils found within project boundaries; include map until name, slope information, and erosivity.

Soils found within the project corridor are the following. Romeo silt loam, 0-2% slopes, K = 0.32; Lorenzo loam, 0-2% slopes, K = 0.28; Lorenzo loam, 2-4% slopes, K = 0.32; Lorenzo loam, 4-6% slopes, eroded, K = 0.28; Orthents, loamy, 1-6% slopes, K = 0.37; Lawson silt loam, heavy till plain, 0-2% slopes, occasionally flooded, K = 0.37.

10. List of all MS4 permittees in the area of this project

Illinois Department of Transportation; City of Joliet; Will County

Note: For sites discharging to an MS4, a separate map identifying the location of the construction site and the location where the MS4 discharges to surface water must be included.

Part II: Waters of the US

1. List the nearest named receiving water(s) and ultimate receiving waters.

The project is tributary to Hickory Creek, which discharges to the Des Plaines River and the Illinois River.

2. Are wetlands present in the project area? ☒ Yes ☐ No

If yes, describe the areal extent of the wetland acreage at the site.

Wetlands are adjacent to the proposed construction activity, however no impacts will occur. Wetland exclusion fencing and "wetland no intrusion" signage along with BMPs such as perimeter erosion barrier will be installed around adjacent wetlands to ensure no impacts. The following wetlands/WOUS are adjacent to the proposed work:

Wetland 4A: 0.018 acres/ 0 acres of impact
Wetland 9A: 0.023 acres/ 0 acres of impact
Wetland 12A: 0.132 acres/ 0 acres of impact
Wetland 14A: 1.402 acres/ 0 acres of impact
Wetland 14C: 0.029 acres/ 0 acres of impact
Wetland 15A: 0.027 acres/ 0 acres of impact
Wetland 16A: 0.399 acres/ 0 acres of impact
Wetland 17A: 0.131 acres/ 0 acres of impact
Wetland 18A: 0.531 acres/ 0 acres of impact
Wetland 18C: 0.051 acres/ 0 acres of impact
Wetland 34B: 0.062 acres/ 0 acres of impact
Wetland 35A: 0.826 acres/ 0 acres of impact
Wetland 37A: 0.277 acres/ 0 acres of impact
Wetland 42A: 0.051 acres/ 0 acres of impact
Wetland 42C: 0.024 acres/ 0 acres of impact
Wetland 43A: 0.751 acres/ 0 acres of impact
Wetland 46A: 0.072 acres/ 0 acres of impact
Wetland 48A: 0.167 acres/ 0 acres of impact
Wetland 49A: 0.262 acres/ 0 acres of impact
Wetland 1 From I-80 Bridge WL Report: 0.04 acres/ 0 acres of impact
Wetland 2 From I-80 Bridge WL Report: 0.003 acres/ 0 acres of impact
Wetland 3 From I-80 Bridge WL Report: 0.04 acres/ 0 acres of impact
Wetland 59A: 0.141 acres/ 0 acres of impact
Wetland 62A: 0.002 acres/ 0 acres of impact
Wetland 64C: 0.028 acres/ 0 acres of impact
Wetland 65A: 0.00 acres/ 0 acres of impact
WOUS W4: 0.016 acres/ 0 acres of impact
WOUS W5: 0.059 acres/ 0 acres of impact
WOUS W6: 0.151 acres/ 0 acres of impact
WOUS W8: 0.018 acres/ 0 acres of impact
WOUS W9: 1.886 acres/ 0 acres of impact
WOUS W10: 0.210 acres/ 0 acres of impact
WOUS W11: 0.308 acres/ 0 acres of impact
WOUS W12: 0.019 acres/ 0 acres of impact
WOUS W13: 0.025 acres/ 0 acres of impact
WOUS W14: 0.281 acres/ 0 acres of impact
WOUS W15: 0.019 acres/ 0 acres of impact
WOUS W16: 0.031 acres/ 0 acres of impact
WOUS W1 From I-80 Bridge WL Report: 0.55 acres/ 0 acres of impact
WOUS W2 From I-80 Bridge WL Report: 0.47 acres/ 0 acres of impact
WOUS W3 From I-80 Bridge WL Report: 0.002 acres/ 0 acres of impact
WOUS W20: 0.011 acres/ 0 acres of impact
WOUS W21: 0.012 acres/ 0 acres of impact

3. Natural buffers:

For any storm water discharges from construction activities within 50 feet of a Waters of the United States, except for activities for water-dependent structures authorized by a Section 404 permit, the following shall apply:

(i) A 50-foot undisturbed natural buffer between the construction activity and the Waters of the United States has been provided

☐ Yes ☒ No; and/or

(ii) Additional erosion and sediment controls within that area has been provided

☒ Yes ☐ No; and Describe: N/A

Part III. Water Quality

1. Water Quality Standards

As determined by the Illinois Pollution Control Board, Illinois waters have defined numeric limits of pollutants under the umbrella term "Water Quality Standards." In the following table are commonly used chemicals/practices used on a construction site. These chemicals if spilled into a waterway, could potentially contribute to a violation of a Water Quality Standard. If other chemicals that could contribute a violation of a Water Quality Standard, add as needed.

☒ Fertilizer (check as appropriate)

☒ Nitrogen

☒ Phosphorus, and/or

☒ Potassium

☐ Herbicide

☒ Petroleum (gas, diesel, oil, kerosene, hydraulic oil / fluids)

☐ Waste water for concrete washout station

☐ Coal tar Pitch Emulsion

☐ Other (Specify) _____

☐ Other (Specify) _____

Table 1: Common chemicals/potential pollutants used during construction

If no boxes are checked in Table 1 above, check the following box:

☐ There are no chemicals on site that will exceed a Water Quality Standards if spilled.

If any boxes are checked in Table 1 above, check the following box:

There are chemicals on site that if spilled could potentially cause an exceedance of a Water Quality Standard. The Department shall implement Pollution Prevention/Good Housekeeping Practices as described in the Department's ILR40 Discharge for Small Municipal Separate Storm Sewer Systems (MS4) reiterated below and Part VIII. Unexpected Regulated Substances/Chemical Spill Procedures:

☒ Municipal Separate Storm Sewer Systems (MS4) reiterated below and Part VIII. Unexpected Regulated Substances/Chemical Spill Procedures:

Pollution Prevention:

The Department will design, and the contractor shall, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants from construction activities. At a minimum, such measures must be designed, installed, implemented and maintained to:

- (a) Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge.
- (b) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, chemical storage tanks, deicing material storage facilities and temporary stockpiles, detergents, sanitary waste, and other materials present on the site exposed to precipitation and to storm water.
- (c) Minimize the discharge of pollutants from spills, leaks and vehicle and equipment maintenance and repair activities and implement chemical spill and leak prevention and response procedures;
- (d) Minimize the exposure of fuel, oil, hydraulic fluids, other petroleum products, and other chemicals by storing in covered areas or containment areas. Any chemical container with a storage of 55 gallons or more must be stored a minimum of 50 feet from receiving waters, constructed or natural site drainage features, and storm drain inlets. If infeasible due to site constraints, store containers as far away as the site permits and document in your SWPPP the specific reasons why the 50-foot setback is infeasible and how the containers will be stored.
- (e) The contractor is to provide regular inspection of their construction activities and Best Management Practices (BMPs). Based on inspection findings, the contractor shall determine if repair, replacement, or maintenance measures are necessary in order to ensure the structural integrity, proper function, and treatment effectiveness of structural storm water BMPs. Necessary maintenance shall be completed as soon as conditions allow to prevent or reduce the discharge of pollutants to storm water or as ordered by the Engineer. The Engineer shall conduct inspections required in Section XI Inspections, and report to the contractor deficiencies noted. These Department conducted inspections do not relieve the contractor from their responsibility to inspect their operations and perform timely maintenance; and
- (f) In addition, all IDOT projects are screened for Regulated Substances as described in Section 27-3 of the BDE Manual and implemented via Section 669: Removal and Disposal of Regulated substances in the Standard Specifications for Road and Bridge Construction.

Approved alterations to the Department's provided SWPPP, including those necessary to protect Contractor Borrow, Use and Waste areas, shall be designed, installed, implemented and maintained by the Contractor in accordance with IDOT Standard Specifications Section 280.

2. 303(d) Impaired Waterways

Does the project area have any 303(d) impaired waterways with the following impairments?

- suspended solids
- turbidity, and or
- siltation

☒ Yes ☐ No

If yes, list the name(s) of the listed water body and the impairment(s)

303(d) waterbody	Impairments(s)
Hickory Creek	Total suspended solids

In addition, It is paramount that the project does not increase the level of the impairment(s) described above. Discuss which BMPs will be implemented to reduce the risk of impairment increase

Erosion and sediment control practices to be implemented include temporary ditch checks, inlet/outlet protection and permanent seeding with erosion control blanket or heavy duty erosion control blanket. Perimeter erosion barrier will be installed at the downslope end of proposed work. These elements will be utilized to prevent discharge of sediment from the construction area.

3. Total Maximum Daily Load (TMDL)

Does the project include any receiving waters with a TMDL for sediment, total suspended solids, turbidity or siltation? ☐ Yes ☒ No

If yes, List TMDL waterbodies below and describe associated TMDL

TMDL waterbody	TMDL
None	None

Provide a description of the erosion and sediment control strategy that will be incorporated into the site design that is consistent with the assumptions and requirements of the TMDL

N/A

If a specific numeric waste load allocation has been established that would apply to the project's discharges, provide a description of the necessary steps to meet that allocation

N/A

Part IV. Temporary Erosion and Sediment Controls

Stabilization efforts must be initiated within 1 working day of cessation of construction activity and completed within 14 days. Areas must be stabilized if they will not be disturbed for at least 14 calendar days. Exceptions to this time frame include:

- (i) Where the initiation of stabilization measures is precluded by snow cover, stabilization measures must be initiated as soon as practicable,
- (ii) On areas where construction activities have temporarily ceased and will resume after 14 days, a temporary stabilization method can be used (temporary stabilization techniques must be described), and
- (iii) Stabilization is not required for exit points at linear utility construction site that are used only episodically and for very short durations over the life of the project, provided other exit point controls are implemented to minimize sediment track-out.

Additionally, a record must be kept with the SWPPP throughout construction of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated.

At a minimum, controls must be coordinated, installed and maintained to:

1. Minimize the amount of soil exposed during construction activity.
2. Minimize the disturbance of steep slopes.
3. Maintain natural buffers around surface waters, direct storm water to vegetated areas to increase sediment removal and maximize storm water infiltration, unless infeasible.
4. Minimize soil compaction and, unless infeasible, preserve topsoil.

Note: For practices below, consult relevant design criteria in Chapter 41 of the BDE Manual and maintenance criteria in Erosion and Sediment Control Field Guide for Construction.

1. Erosion Control:

The following are erosion control practices which may be used on a project (place a check by each practice that will be utilized on the project, add additional practices as needed):

☒ Mulch ☒ Erosion Control Blanket ☐ Turf Reinforcement Mat ☐ Sodding ☐ Geotextile fabric	☐ Preservation of existing vegetation ☐ Temporary Turf Cover Mixture (Class 7) ☒ Permanent seeding (Class 1-6) ☒ Other (Specify) <u>Heavy duty erosion control blanket</u> ☐ Other (Specify) _____ ☐ Other (Specify) _____

2. Sediment Control:

The following sediment control devices will be implemented on this project:

☒ Ditch Checks	☒ Perimeter Erosion Barrier

☒ Inlet and Pipe protection	☐ Rolled Excelsior
☐ Hay or Straw bales	☐ Silt Filter Fence
☐ Above grade inlet filters (fitted)	☐ Urethane foam/geotextiles
☐ Above grade inlet filters (non-fitted)	☐ Other (Specify) _____
☐ Inlet filters	☐ Other (Specify) _____
	☐ Other (Specify) _____

3. Structural Practices:

Provide below is a description of structural practices that will be implemented:

☐ Aggregate Ditch	☐ Stabilized Construction Exits
☐ Articulated Block Revetment Mat	☐ Stabilized Trench Flow
☐ Barrier (Permanent)	☐ Sediment Basin
☐ Concrete Revetment Mats	☐ Retaining Walls
☒ Dewatering Filtering	☐ Riprap
☐ Gabions	☒ Storm Drain Inlet Protection
☐ In-Stream or Wetland Work	☐ Slope Walls
☐ Level Spreaders	☐ Sediment Trap
☐ Paved Ditch	☐ Other (Specify) _____
☐ Permanent Check Dams	☐ Other (Specify) _____
☐ Precast Block Revetment Mat	☐ Other (Specify) _____
☐ Rock Outlet Protection	☐ Other (Specify) _____

4. Polymer Flocculants

Design guidance for polymer flocculants is available in Chapter 41 of the BDE Manual. In addition, Polymer Flocculants may only be used by district Special Provision.

If polymer flocculants are used for this project, the following must be adhered to and described below:

- Identify the use of all polymer flocculants at the site.
- Dosage of treatment chemicals shall be identified along with any information from any Material Safety Data Sheet.
- Describe the location of all storage areas for chemicals.
- Include any information from the manufacturer's specifications.
- Treatment chemicals must be stored in areas where they will not be exposed to precipitation.
- The SWPPP must describe procedures for use of treatment chemicals and staff responsible for use/application of treatment chemicals must be trained on the established procedures.

N/A

Part V. Other Conditions

1. Dewatering

Will dewatering be required for this project? ☒ Yes ☐ No

If yes, the following applies:

- Dewatering discharges shall be routed through a sediment control (e.g., sediment trap or basin, pumped water filter bag) designed to minimize discharges with visual turbidity;
- The discharge shall not include visible floating solids or foam;
- The discharge must not cause the formation of a visible sheen on the water surface, or visible oily deposits on the bottom or shoreline of the receiving water. An oil-water separator or suitable filtration device shall be used to treat oil, grease, or other similar products if dewatering water is found to or expected to contain these materials;
- To the extent feasible, use well-vegetated (e.g., grassy or wooded), upland areas of the site to infiltrate dewatering water before discharge;
- You are prohibited from using receiving waters as part of the treatment area;
- To minimize dewatering-related erosion and related sediment discharges, use stable, erosion-resistant surfaces (e.g., well-vegetated grassy areas, clean filler stone, geotextile underlayment) to discharge from dewatering controls. Do not place dewatering controls, such as pumped water filter bags, on steep slopes (15% or greater in grade);
- Backwash water (water used to backwash/clean any filters used as part of storm water treatment) must be properly treated or hauled off-site for disposal;
- Dewatering treatment devices shall be properly maintained; and
- See Part XI (Inspections) for inspection requirement.

Part VI. Permanent (i.e., Post-Construction) Storm Water Management Controls

Provided below is a description of measures that may be installed during the construction process to control volume and therefore the amount pollutants in storm water runoff that can occur after construction operations have been completed.

Practices may include but are not limited to the following:

- Aggregate ditch checks;
- bioswales,
- detention pond(s),
- infiltration trench;
- retention pond(s),
- open vegetated swales and natural depressions,
- treatment train (sequential system which combine several practices).
- Velocity dissipation devices (See Structural Practices above)

Describe these practices below

None

Part VII. Additional Practices Incorporated From Local Ordinance(s)

In some instances, an additional practice from a local ordinance may be included in the project. If so, describe below (Note: the Department is not subject to local ordinances)

None

Part VIII. Unexpected Regulated Substances/Chemical Spill Procedures

When Unexpected Regulated Substances or chemical spills occur, Article 107.19 of the Standard Specifications for Road and Bridge Construction shall apply. In addition, it is the contractor's responsibility to notify the Engineer in the event of a chemical spill into a ditch or waterway, the Engineer will then notify appropriate IEPA and IEMA personnel for the appropriate cleanup procedures.

Part IX. Contractor Required Submittals

Prior to conducting any professional services at the site covered by this plan, the Contractor and each subcontractor responsible for compliance with the permit shall submit to the Resident Engineer a Contractor Certification Statement, BDE 2342A.

1. The Contractor shall provide a construction schedule containing an adequate level of detail to show major activities with implementation of pollution prevention BMPs, including the following items:

- Approximate duration of the project, including each stage of the project
- Rainy season, dry season, and winter shutdown dates
- Temporary stabilization measures to be employed by contract phases
- Mobilization time-frame
- Mass clearing and grubbing/roadside clearing dates
- Deployment of Erosion Control Practices
- Deployment of Sediment Control Practices (including stabilized construction entrances and exits to be used and how they will be maintained)
- Deployment of Construction Site Management Practices (including concrete washout facilities, chemical storage, refueling locations, etc.)
- Paving, saw-cutting, and any other pavement related operations
- Major planned stockpiling operation
- Time frame for other significant long-term operations or activities that may plan non-storm water discharges as dewatering, grinding, etc.
- Permanent stabilization activities for each area of the project

2. During the pre-construction meeting, the Contractor and each subcontractor shall provide, as an attachment to their signed Contractor Certification Statement, a discussion of how they will comply with the requirements of the permit in regard to the following items and provide a graphical representation showing location and type of BMPs to be used when applicable:

- Temporary Ditch Checks - Identify what type and the source of Temporary Ditch Checks that will be installed as part of the project. The installation details will then be included with the SWPPP.
- Vehicle Entrances and Exits - Identify type and location of stabilized construction entrances and exits to be used and how they will be maintained.
- Material Delivery, Storage and Use- Discuss where and how materials including chemicals, concrete curing compounds, petroleum products, etc. will be stored for this project. Specifically, any chemical stored in a 55 gallon drum provided by the contractor.
- Stockpile Management - Identify the location of both on-site and off-site stockpiles. Discuss what BMPs will be used to prevent pollution of storm water from stockpiles.
- Waste Disposal - Discuss methods of waste disposal that will be used for this project.
- Spill Prevention and Control - Discuss steps that will be taken in the event of a material spill.
- Concrete Residuals and Washout Wastes - Discuss the location and type of concrete washout facilities to be used on this project and how they will be signed and maintained.
- Litter Management - Discuss how litter will be maintained for this project (education of employees, number of dumpsters, frequency of dumpster pick-up, etc.).
- Vehicle and Equipment Fueling - Identify equipment fueling locations for this project and what BMPs will be used to ensure

containment and spill prevention.

- Vehicle and Equipment Cleaning and Maintenance - Identify where equipment cleaning and maintenance locations for this project and what BMPs will be used to ensure containment and spill prevention.
- Dewatering Activities - Identify the controls which will be used during dewatering operations to ensure sediments will not leave the construction site.

Additional measures indicated in the plan

None.

Part X. Maintenance

It will be the Contractor's responsibility to attain maintenance guidelines for any manufactured BMPs which are to be installed and maintained per manufacture's specifications. However, when requested by the Contractor, the Resident Engineer will provide general maintenance guides (e.g., IDOT Erosion and Sediment Control Field Guide) to the Contractor for the practices associated with this project. Any damage or undermining shall be repaired immediately.

For Inlet Protection: Where there is evidence of sediment accumulation adjacent to the inlet protection measure, the deposited sediment must be removed by the following business day.

Below, describe procedures to maintain in good and effective operating conditions

Mulch: Repair straw if blown or washed away. Place tackifier or an ECB if mulch does not control erosion.

Erosion Control Blanket: Repair damage due to water running beneath the blanket and restore blanket when displacement occurs. Reseeding may be necessary. Replace all displaced blanket and restaple.

Inlet Filters: Remove sediment from inlet filter baskets when basket is 25% full or 50% of the fabric pores are covered with silt. Remove ponded water on road surfaces immediately. Clean filter if standing water is present longer than one hour after a rain event. Clean sediment when sediment accumulates to one-third the height of the fabric. Remove trash accumulated around or on top of inlet filter. When filter is removed for cleaning, replace fabric if any tear is present.

Temporary Ditch Checks: Remove sediment from upstream side of ditch check when sediment has reached 50% of height of structure. Repair or replace ditch checks whenever tears, splits, unraveling or compressed excelsior is apparent. Replace torn fabric mat that may allow water to undermine the ditch check. Remove debris (garbage, corn stalks, etc.) when observed on check. Reestablish the flow over the center of the ditch check. Water or sediment going around the ditch check indicates incorrect installation. Device needs lengthening or the selected device is inappropriate for the site conditions. Remove ditch checks once all upslope areas are stabilized, seed or otherwise stabilize TDC area(s).

Storm Drain Inlet Protection: Remove sediment from inlet filter basket when basket is 25% full or 50% of the fabric pores are covered with silt. Remove ponded water on road surfaces immediately. Clean filter if standing water is present longer than one hour after a rain event. Clean sediment or replace silt fence and straw bale inlet protection when sediment accumulates to one-third the height of the fabric. Remove trash accumulated around or on top of practice. When filter is removed for cleaning, replace filter if any tear is present.

Perimeter Erosion Barrier: Repair tears, gaps or undermining. Restore leaning PEB and ensure taut. Repair or replace any missing or broken stakes immediately. Clean PEB if sediment reaches one-third height of barrier. Remove PEB once final stabilization establishes since PEB is no longer necessary and should be removed. Repair PEB if undermining occurs anywhere along its entire length.

Additional information can be found in the IDOT Erosion and Sediment Control Field Guide located at:
<https://idot.illinois.gov/content/dam/soi/en/web/idot/documents/transportation-system/manuals-guides-and-handbooks/highways/environment/erosion-and-sediment-control-field-guide-for-construction-inspection.pdf>

Part XI. Inspections

Qualified personnel shall inspect disturbed areas of the construction site that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm or by the end of the following business or workday that is 0.50 inches or greater or equivalent snowmelt (except as allowed for Frozen Conditions).

In addition, all areas where storm water typically flows within the site should be inspected periodically to check for evidence of pollutants entering the drainage system, as well as all locations where stabilization measures have been implemented to ensure they are operating correctly.

Inspections shall be documented on the form BC 2259 (Storm Water Pollution Prevention Plan Erosion Control Inspection Report).

The Erosion and Sediment Control Field Guide for Construction Inspection shall be consulted as needed.

Dewatering

For site(s) discharging dewatering water, an inspection during the discharge shall be done once per day on which the discharge occurs and record the following in a report within 24 hours of completing the inspection:

- The inspection date;
- Names and titles of personnel performing the inspection;
- Approximate times that the dewatering discharge began and ended on the day of inspection;
- Estimates of the rate (in gallons per day) of discharge on the day of inspection;
- Whether or not any of the following indications of pollutant discharge were observed at the point of discharge: a sediment plume, suspended solids, unusual color, presence of odor, decreased clarity, or presence of foam; and/or a visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water.

Frozen Conditions

Inspections may be reduced to once per month when all construction activities have ceased due to frozen conditions. Weekly inspections will recommence when construction activities resume, either temporarily or continuously, or if there is 0.5" or greater rain event, or a discharge due to snowmelt occurs.

Flooding or unsafe conditions

Areas that are inaccessible during required inspections due to flooding or other unsafe conditions must be inspected within 72 hours of becoming accessible.

Part XII. Incidence of Noncompliance (ION)

The Department shall notify the appropriate Agency Field Operations Section office by email as described on the IEPA ION form, within 24 hours of any incidence of noncompliance for any violation of the storm water pollution prevention plan observed during any inspection conducted, or for violations of any condition of this permit.

The Department shall complete and submit within 5 days an "Incidence of Noncompliance" (ION) report for any violation of the storm water pollution prevention plan observed during any inspection conducted, or for violations of any condition of this permit. Submission shall be on forms provided by the IEPA and include specific information on the cause of noncompliance, actions which were taken to prevent any further causes of noncompliance, and a statement detailing any environmental impact which may have resulted from the noncompliance. Corrective actions must be undertaken immediately to address the identified non-compliance issue(s).

Illinois EPA
2520 W. Iles Ave./P.O. Box 19276
Springfield, IL 62794-9276

Please note that if these are delivered via FedEx or UPS, these carriers cannot deliver to our P.O. Box and this number must be excluded from the mailing address.

Part XIII. Corrective Actions

Corrective actions must be taken when:

- A storm water control needs repair or replacement;
- A storm water control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly;
- Discharges are causing an exceedance of applicable water quality standards; or
- A prohibited discharge has occurred.

Corrective Actions must be completed as soon as possible and documented within 7 days in an Inspection Report or report of noncompliance. If it is infeasible to complete the installation or repair within 7 calendar days, it must be documented in the records why it is infeasible to complete the installation or repair within the 7 day time-frame and document the schedule for installing the storm water control(s) and making it operational as soon as feasible after the 7-day time-frame. In the event that maintenance is required for the same storm water control at the same location three or more times, the control must be repaired in a manner that prevents continued failure to the extent feasible, and it must be documented the condition and how it was repaired in the records. Alternatively, it must be documented why the specific re-occurrence of this same issue must continue to be addressed as a routine maintenance fix.

Part XIV. Retention of Records

The Department must retain copies of the SWPPP and all reports and notices required by this permit, records of all data used to complete the NOI to be covered by this permit, and the Agency Notice of Permit Coverage letter for at least three years from the date that the permit coverage expires or is terminated. The permittee must retain a copy of the SWPPP and any revisions to the SWPPP required by this permit at the construction site from the date of project initiation to the date of final stabilization. Any manuals or other documents referenced in the SWPPP must also be retained at the construction site.

Part XV. Failure to Comply

Failure to comply with any provisions of this Storm Water Pollution Prevention Plan will result in the implementation of a National Pollutant Discharge Elimination System/Erosion and Sediment Control Deficiency Deduction against the Contractor and/or penalties under the Permit ILR10 which could be passed on to the contractor (See Article 105.03 Conformity with Contract)

Part XVI. Keeping the SWPPP ("plan") Current

IDOT shall amend the plan whenever there is a change in design, construction, operation, or maintenance, which has a significant effect on the potential for the discharge of pollutants to Waters of the United States and which has not otherwise been addressed in the plan or if the plan proves to be ineffective in eliminating or significantly minimizing sediment and/or pollutants identified under paragraph Part II. Water Quality or in otherwise achieving the general objectives of controlling pollutants in storm water discharges associated with construction site activity.

In addition, the plan shall be amended to identify any new contractor and/or subcontractor that will implement a measure of the plan. Amendments to the plan may be reviewed by the IEPA the same manner as the SWPPP and Erosion and Sediment Control Plan (ESCP) submitted as part of the Notice of Intent (NOI). The SWPPP and site map must be modified within 7 days for any changes to construction plans, storm water controls or other activities at the site that are no longer accurately reflected in the SWPPP.

In addition, the NOI shall be modified using the CDX system for any substantial modifications to the project such as:

- address changes
- new contractors
- area coverage
- additional discharges to Waters of the United States, or
- other substantial modifications (e.g. addition of dewatering activities).

The notice of intent shall be modified within 30 days of the modification to the project.

Part XVII: Notifications

In addition to the NOI submitted to IEPA, all MS4 permittees identified in Part I. Site Description shall receive a copy of the NOI.

Part XVIII. Notice of Termination

Where a site has completed final stabilization and all storm water discharges from construction activities that are authorized by this permit are eliminated, the permittee must submit a completed Notice of Termination (NOT) that is signed in accordance with ILR10 permit.

Method of Measurement: NPDES Compliance shall not be measured for payment separately. Measurement for payment for Temporary Erosion and Sediment Control shall be in accordance with Section 280 or as otherwise provided in the contract. Permanent BMPs necessary to comply with this provision shall be measured for payment in accordance with their respective provisions in the contract.

Basis of Payment: NPDES Compliance shall not be paid for separately. Payment for Temporary Erosion and Sediment Control shall be in accordance with Section 280 or as otherwise provided in the contract. Permanent BMPs necessary to comply with this provision shall be paid for in accordance with their respective payment provisions in the contract.

PROTECTION OF THE PIPELINES AND EASEMENTS OF ONEOK

EXHIBIT D

PROTECTION OF THE PIPELINES AND EASEMENTS OF ONEOK

ONEOK North System L.L.C. as the owner and operator of pipelines (by and through its direct and indirect subsidiaries or Affiliates) (collectively "ONEOK")), is dedicated to protecting the environment, the public, contractors, and employees. The following requirements and guidelines for encroachment on the easements of ONEOK are established to comply with governmental regulations and to reduce the risk of damage to ONEOK's pipelines. Deviations from the following requirements may be requested, in writing and **must** be approved and permitted by ONEOK.

A party desiring to construct, install or otherwise place or permit any object, natural or artificial to be placed within the Easement Area is hereinafter referred to as the "Encroacher."

General Requirements:

1. A plan and profile with sufficient detail depicting the relationship between ONEOK's pipeline, existing grade, grade during construction, final grade, and all surface and underground encroachments (a "**Construction Plan**") must be provided to ONEOK's engineering department for evaluation and approval. If the encroachment is part of a development that will eventually result in the construction of a private dwelling, or any industrial building, or place of public assembly within fifty (50) feet of the pipeline, then the Encroacher must agree to provide the pipeline with a minimum depth of cover of 36" within the confines of the legal description for which the permit is written, and also to provide a registered plat at the Encroacher's expense of the centerline of the pipeline with respect to the Encroacher's planned improvements.
2. After acquiring approval of a Construction Plan, the Encroacher must give at least **forty-eight (48) hours** notice by calling the appropriate state One-Call telephone number before starting any individual excavation or other construction work in or near ONEOK's easement.
3. ONEOK's easement must be kept clear of such things as trees, shrubs, ponds, culverts, driveways, rock or brick fences, retaining walls, lateral lines, septic tanks, lagoons, dikes, bridges, canals, levees, burn piles, trash dumps, feeders, pole barns, hay barns, carports, garages, trailers, tanks, buildings, homes or any inhabitable structures, or other obstructions that are not specifically permitted.
4. ONEOK permits the encroachment only to the extent it may do so by law.
5. No utilities or roads shall run parallel to the ONEOK pipeline within the easement.
6. An authorized ONEOK representative must be present during excavation within twenty-five (25) feet of an ONEOK facility or pipeline and will be deemed to be present if proper notice was given under this Agreement and appointment set for ONEOK representative to be present.
7. Blasting within five hundred (500) feet of a ONEOK pipeline is subject to evaluation and prior approval by ONEOK.
8. ONEOK personnel shall review construction drawings for facilities planned near or crossing ONEOK's easement. All construction drawings shall have a note that reads as follows: "**WARNING-High Pressure Natural Gas Pipeline or Natural Gas Liquids Line, Contact the state's "One-Call" system and ONEOK at 800-562-5879 before digging.**"
9. Changes in grade that could cause loss of cover or erosion on the easement are forbidden. Provisions to prevent erosion shall be incorporated into the plans of the encroachment.
10. Markers and signs must not be obstructed, removed, or damaged; however, any signs damaged or removed during construction and or operations shall be replaced per ONEOK's specifications.
11. Transportation of construction equipment longitudinally over ONEOK's pipeline is not permitted. A perpendicular construction crossing that provides a minimum of thirty-six (36) inches of cover, and as further described below in the Surface Construction Requirements, below, must be used to gain access to job sites.

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12. Future repairs to ONEOK's easement or ONEOK's pipeline, which are required due to the activities of the Encroacher, are to be performed at the expense of the Encroacher.
13. Pipeline rerouting, lowering, encasing, etc., will be done by ONEOK, or ONEOK's contractor, and will be paid for by the Encroacher. The Encroacher must pay the estimated costs of such operations in advance.
14. Storage of equipment or materials on ONEOK's Pipeline Easements is prohibited.
15. Ground cover over the facility shall not be reduced and after completion of the encroachment, the ground cover shall be restored by the Permittee as nearly as reasonably possible to its condition prior to the construction.

Equipment Restrictions:

1. The use of scrapers or pan-type tractors for soil removal within ten (10) feet of ONEOK's pipeline is prohibited.
2. The use of vibratory rollers or sheepfoot rollers within five (5) feet of ONEOK's pipeline is prohibited. ONEOK will address the best available technique at a reasonable cost given the specific circumstances at the time.
3. If reasonable, teeth covers shall be used on excavating equipment to reduce the chance of damaging ONEOK's pipeline; however, the heavy equipment operator must dig no closer than one foot from the top, bottom, or sides of the pipeline, or greater if required by federal, state, or local regulation.
4. Track equipment shall not turn directly over ONEOK's pipeline.

Surface Construction Requirements:

1. Roads shall cross as close to ninety degrees (90°) to ONEOK's pipeline as possible. In the event Encroacher will place upon or cross the easement with a load exceeding 20,000 pounds per axle and over 8" nominal diameter pipe or larger, Encroacher shall install the approved facilities as required by ONEOK to ensure the continued safety and integrity of the pipeline. By way of example and not to be construed as a limitation, in the event Encroacher will place upon or cross the easement with a load exceeding 20,000 pounds per axle and on 8" nominal diameter pipe or larger, ONEOK may require the placement of wooden ties for temporary crossings and/or constructing a concrete cap. In addition, ONEOK agrees to install signage containing a "High Pressure Natural Gas Pipeline" warning adjacent to any roadway under which the pipeline is located. Crossings shall be constructed in accordance with the standard parameters established by ONEOK for all road crossings, unless otherwise specifically approved by ONEOK in writing.
2. At no time will (i) the removal of the existing earth cover from over the ONEOK pipeline(s) such that ONEOK would be in violation of any existing law, regulation or order be permitted (ii) the cover be allowed to be less than thirty-six inches (36"), except to the extent prior written approval is granted by ONEOK, or (iii) an increase in the existing earth cover cause the total to exceed ten (10) feet over the pipeline(s).
3. Temporary construction crossings for heavy equipment access to job sites shall cross as close to ninety degrees (90°) to ONEOK's pipeline as possible and provide a minimum of ten (10) feet of earth cover or temporary bridges to be approved by ONEOK. Provisions to prevent rutting and erosion shall be used.
4. Structures such as manholes and catch basins cannot be located within ONEOK's easement.
5. Overhead power lines or other such crossings must maintain a twenty-five (25) foot clearance above the entire breadth of ONEOK's easement, and cross as close to ninety degrees (90°) as possible.
6. In the event the permittee is a wind farm, the rotor blades must maintain a seventy-five foot (75') clearance above the entire breadth of ONEOK's easement.
7. Poles, guy wires, etc. cannot be located within the boundaries of ONEOK's easement.
8. Fence posts must be located a minimum of ten (10) feet horizontal distance from ONEOK's pipeline.

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Underground Construction Requirements:

1. Crossings shall be made as close to ninety degrees (90°) to ONEOK's pipeline as possible.
2. Crossings shall be made under the existing line with a clearance of one and one-half (1.5) times the diameter of the largest pipe, but with at least two (2) feet of separation from ONEOK's pipeline.
3. Except for portions of crossings installed by boring, a six (6) inch wide warning tape must be installed twelve (12) to eighteen (18) inches above non-metallic lines across the entire width of ONEOK's easement. For crossings installed by boring, markers will be installed at the boring ends and Encroacher will sign the crossing. No tape will be installed between boring markers.
4. Warning signs, where practical, identifying the owner, type of service, and emergency phone numbers shall be placed at each edge of the easement crossing.
5. Fiber optics cables shall be encased in non metallic conduit within ONEOK's easement.
6. Power lines must be installed in a non-metallic conduit; however, if a metallic conduit must be installed, cathodic protection will be required. Notwithstanding anything herein to the contrary, underground alternating current (AC) electrical cables with a metallic outer sheath or bare concentric neutral installed within a twenty foot corridor, ten feet on each side of the pipeline, should be placed in an insulating conduit or jacket such as reinforced fiberglass, polyethylene or polyvinyl chloride pipe. Cables energized to 600 volts or more should cross a minimum of 3 feet below the pipeline if practical, be incased in concrete if practical, and color coded red, across the entire right-of-way width. If it is practical to encase the cable in concrete, then six (6) inches of red concrete must protect the top of the conduit; however, in these instances concrete may be omitted if forty-eight (48) inches of clearance is maintained. The cable crossing should be clearly and permanently marked on each side of the right-of-way, if practical.
7. Metallic pipe crossings shall have corrosion test leads installed on both pipes at their intersection, if deemed necessary by Permittee and ONEOK engineers.
8. Bore pits must be ten (10) feet or more from ONEOK's pipeline(s). The crossing point must be exposed at least two (2) feet deeper than the bottom of the pipeline to verify sufficient clearance of the boring tool.
9. Open trench crossings must be made across only one pipeline at a time. The trench must meet OSHA requirements. Temporary piping supports may be required.
10. Backfilling shall be performed in such a manner that the pipeline is not subjected to impact damage or excessive stresses, and no large lumps of frozen soil, rocks, gravel, or like materials shall be backfilled directly onto the pipe. No foreign substances, such as welding rods, cans, ropes, skids, brush or trees, are to be placed in any excavation on ONEOK's easement.

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DRILLED SHAFTS

Effective: October 5, 2015

Revised: October 27, 2023

Revise Section 516 of the Standard Specifications to read:

“SECTION 516. DRILLED SHAFTS

516.01 Description. This work shall consist of constructing drilled shaft foundations.

516.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) Reinforcement Bars.....	1006.10
(c) Grout (Note 2).....	1024.01
(d) Permanent Steel Casing.....	1006.05(d)
(e) Slurry (Note 3)	

Note 1. When the soil contains sulfate contaminates, ASTM C 1580 testing will be performed to assess the severity of sulfate exposure to the concrete. If the sulfate contaminate is >0.10 to < 0.20 percent by mass, a Type II (MH) cement shall be used. If the sulfate contaminate is >0.20 to < 2.0 percent by mass, a Type V cement shall be used. If the sulfate contaminate is ≥ 2.0 percent by mass, refer to ACI 201.2R for guidance.

Note 2. The sand-cement grout mix shall be according to Section 1020 and shall be two to five parts sand and one part Type I or II cement. The maximum water cement ratio shall be sufficient to provide a flowable mixture with a typical slump of 10 in. (250 mm).

Note 3. Slurry shall be bentonite, emulsified polymer, or dry polymer, and shall be approved by the Engineer.

516.03 Equipment. Equipment shall be according to the following.

Item	Article/Section
(a) Concrete Equipment	1020.03
(b) Drilling Equipment (Note 1)	
(c) Hand Vibrator	1103.17(a)
(d) Underwater Concrete Placement Equipment	1103.18

Note 1. The drilling equipment shall have adequate capacity, including power, torque and down thrust, to create a shaft excavation of the maximum diameter specified to a depth of 20 percent beyond the depths shown on the plans.

516.04 Submittals. The following information shall be submitted on form BBS 133.

- (a) Qualifications. At the time of the preconstruction conference, the Contractor shall provide the following documentation.
 - (1) References. A list containing at least three projects completed within the three years prior to this project's bid date which the Contractor performing this work has installed drilled shafts of similar diameter, length, and site conditions to those shown in the plans. The list of projects shall contain names and phone numbers of owner's representatives who can verify the Contractor's participation on those projects.
 - (2) Experience. Name and experience record of the drilled shaft supervisor, responsible for all facets of the shaft installation, and the drill operator(s) who will be assigned to this project. The supervisor and operator(s) shall each have a minimum of three years experience in the construction of drilled shafts.
- (b) Installation Procedure. A detailed installation procedure shall be submitted to the Engineer for acceptance at least 28 days prior to drilled shaft construction and shall address each of the following items unless otherwise directed by the Engineer in writing.
 - (1) Equipment List. List of proposed equipment to be used including cranes, drill rigs, augers, belling tools, casing, vibratory hammers, core barrels, bailing buckets, final cleaning equipment, slurry equipment, tremies, or concrete pumps, etc.
 - (2) General Sequence. Details of the overall construction operation sequence, equipment access, and the sequence of individual shaft construction within each substructure bent or footing group. The submittal shall address the Contractor's proposed time delay and/or the minimum concrete strength necessary before initiating a shaft excavation adjacent to a recently installed drilled shaft.
 - (3) Shaft Excavation. A site specific step by step description of how the Contractor anticipates the shaft excavation to be advanced based on their evaluation of the subsurface data and conditions expected to be encountered. This sequence shall note the method of casing advancement, anticipated casing lengths, tip elevations and diameters, the excavation tools used and drilled diameters created. The Contractor shall indicate whether wet or dry drilling conditions are expected and if groundwater will be sealed from the excavation.

- (4) Slurry. When the use of slurry is proposed, details on the types of additives to be used and their manufacturers shall be provided. In addition, details covering the measurement and control of the hardness of the mixing water, agitation, circulation, de-sanding, sampling, testing, and chemical properties of the slurry shall be submitted.
- (5) Shaft Cleaning. Method(s) and sequence proposed for the shaft cleaning operation.
- (6) Reinforcement Cage and Permanent Casing. Details of reinforcement placement including rolling spacers to be used and method to maintain proper elevation and location of the reinforcement cage within the shaft excavation during concrete placement. The method(s) of adjusting the reinforcement cage length and permanent casing if rock is encountered at an elevation other than as shown on the plans. As an option, the Contractor may perform soil borings and rock cores at the drilled shaft locations to determine the required reinforcement cage and permanent casing lengths.
- (7) Concrete Placement. Details of concrete placement including proposed operational procedures for free fall, tremie or pumping methods. The sequence and method of casing removal shall also be stated along with the top of pour elevation, and method of forming through water above streambed.
- (8) Mix Design. The proposed concrete mix design(s).
- (9) Disposal Plan. Containment and disposal plan for slurry and displaced water. Containment and disposal plan for contaminated concrete pushed out of the top of the shaft by uncontaminated concrete during concrete placement.
- (10) Access and Site Protection Plan. Details of access to the drilled shafts and safety measures proposed. This shall include a list of casing, scaffolding, work platforms, temporary walkways, railings, and other items needed to provide safe access to the drilled shafts. Provisions to protect open excavations during non-working hours shall be included.

The Engineer will evaluate the drilled shaft installation procedure and notify the Contractor of acceptance, need for additional information, or concerns with the installation's effect on the existing or proposed structure(s).

CONSTRUCTION REQUIREMENTS

516.05 General. Excavation for drilled shaft(s) shall not proceed until written authorization is received from the Engineer. The Contractor shall be responsible for verification of the dimensions and alignment of each shaft excavation as directed by the Engineer.

Unless otherwise approved in the Contractor's installation procedure, no shaft excavation, casing installation, or casing removal with a vibratory hammer shall be made within four shaft diameters center to center of a shaft with concrete that has a compressive strength less than 1500 psi (10,300 kPa). The site-specific soil strengths and installation methods selected will determine the actual required minimum spacing, if any, to address vibration and blow out concerns.

Lost tools shall not remain in the shaft excavation without the approval of the

Engineer. Blasting shall not be used as a method of shaft excavation.

516.06 Shaft Excavation Protection Methods. The construction of drilled shafts may involve the use of one or more of the following methods to support the excavation during the various phases of shaft excavation, cleaning, and concrete placement dependent on the site conditions encountered. Surface water shall not flow uncontrolled into the shaft excavation, however water may be placed into the shaft excavation in order to meet head pressure requirements according to Articles 516.06(c) and 516.13.

The following are general descriptions indicating the conditions when these methods may be used.

- (a) **Dry Method.** The dry construction method shall only be used at sites where the groundwater and soil conditions are suitable to permit the drilling and dewatering of the excavation without causing subsidence of adjacent ground, boiling of the base soils, squeezing, or caving of the shaft side walls. The dry method shall consist of drilling the shaft excavation, removing accumulated water, cleaning the shaft base, and placing the reinforcement cage and concrete in a predominately dry excavation.
- (b) **Slurry Method.** The slurry construction method may be used at sites where dewatering the excavation would cause collapse of the shaft sidewalls or when the volume and head of water flowing into the shaft is likely to contaminate the concrete during placement resulting in a shaft defect. This method uses slurry, or in rare cases water, to maintain stability of the shaft sidewall while advancing the shaft excavation. After the shaft excavation is completed, the slurry level in the shaft shall be kept at an elevation to maintain stability of the shaft sidewall, maintain stability of the shaft base, and prevent additional groundwater from entering the shaft. The shaft base shall be cleaned, the reinforcement cage shall be set, and the concrete shall be discharged at the bottom of the shaft excavation, displacing the slurry upwards.

- (c) Temporary Casing Method. Temporary casing shall be used when either the dry or slurry methods provide inadequate support to prevent sidewall caving or excessive deformation of the shaft excavation. Temporary casing may be used with slurry or be used to reduce the flow of water into the excavation to allow dewatering and concrete placement in a dry shaft excavation. Temporary casing shall not be allowed to remain permanently without the approval of the Engineer.

During removal of the temporary casing, the level of concrete in the casing shall be maintained at a level such that the head pressure inside the casing is a minimum of 1.25 times the head pressure outside the casing, but in no case is less than 5 ft (1.5 m) above the bottom of the casing. Casing removal shall be at a slow, uniform rate with the pull in line with the shaft axis. Excessive rotation of the casing shall be avoided to limit deformation of the reinforcement cage. In addition, the slump requirements during casing removal shall be according to Article 516.12.

When called for on the plans, the Contractor shall install a permanent casing as specified. Permanent casing may be used as a shaft excavation support method or may be installed after shaft excavation is completed using one of the above methods. After construction, if voids are present between the permanent casing and the drilled excavation, the voids shall be filled with grout by means of tremie(s) or concrete pump which shall be lowered to the bottom of the excavation. The contractor's means and methods for grout placement shall fill the annular void(s) between the permanent casing and the surrounding earth material to restore and provide lateral earth resistance to the shaft. Grout yield checks shall be performed by the contractor for submittal to the Engineer. Permanent casing shall not remain in place beyond the limits shown on the plans without the specific approval of the Engineer.

When the shaft extends above the streambed through a body of water and permanent casing is not shown, the portion above the streambed shall be formed with removable casings, column forms, or other forming systems as approved by the Engineer. The forming system shall not scar or spall the finished concrete or leave in place any forms or casing within the removable form limits as shown on the plans unless approved as part of the installation procedure. The forming system shall not be removed until the concrete has attained a minimum compressive strength of 2500 psi (17,200 kPa) and cured for a minimum of 72 hours. For shafts extending through water, the concrete shall be protected from water action after placement for a minimum of seven days.

516.07 Slurry. When slurry is used, the Contractor shall provide a technical representative of the slurry additive manufacturer at the site prior to introduction of the slurry into the first shaft where slurry will be used, and during drilling and completion of a minimum of one shaft to adjust the slurry mix to the specific site conditions. During construction, the level of the slurry shall be maintained a minimum of 5 feet (1.5 m) above the height required to prevent caving of the shaft excavation. In the event of a sudden or significant loss of slurry in the shaft excavation, the construction of that foundation shall be stopped and the shaft excavation backfilled or supported by temporary casing, until a method to stop slurry loss, or an alternate construction procedure, has been approved by the Engineer.

- (a) General Properties. The material used to make the slurry shall not be detrimental to the concrete or surrounding ground. Mineral slurries shall have both a mineral grain size that remains in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. Polymer slurries shall have sufficient viscosity and gel characteristics to transport excavated material to suitable screening systems or settling tanks. The percentage and specific gravity of the material used to make the slurry shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement.

If approved by the Engineer, the Contractor may use water and excavated soils as drilling slurry. In this case, the range of acceptable values for density, viscosity and pH, as shown in the following table for bentonite slurry shall be met.

When water is used as the slurry to construct rock sockets in limestone, dolomite, sandstone or other formations that are not erodible, the requirements for slurry testing shall not apply if the entire fluid column is replaced with fresh water after drilling. To do so, fresh water shall be introduced at the top of the shaft excavation and existing water used during drilling shall be pumped out of the shaft excavation from the bottom of the shaft excavation until the entire volume of fluid has been replaced.

- (b) Preparation. Prior to introduction into the shaft excavation, the manufactured slurry admixture shall be pre-mixed thoroughly with clean, fresh water and for adequate time in accordance with the slurry admixture manufacturer's recommendations. Slurry tanks of adequate capacity shall be used for slurry mixing, circulation, storage and treatment. No excavated slurry pits will be allowed in lieu of slurry tanks without approval from the Engineer. Adequate desanding equipment shall be provided to control slurry properties during the drilled shaft excavation in accordance with the values provided in Table 1.

- (c) Quality Control. Quality control tests shall be performed on the slurry to determine density, viscosity, sand content and pH of freshly mixed slurry, recycled slurry and slurry in the shaft excavation. Tests of slurry samples from within two feet of the bottom and at mid-height of the shaft excavation shall be conducted in each shaft excavation during the excavation process to measure the consistency of the slurry. A minimum of four sets of tests shall be conducted during the first eight hours of slurry use on the project. When a series of four test results do not change more than 1% from the initial test, the testing frequency may be decreased to one set every four hours of slurry use. Reports of all tests, signed by an authorized representative of the Contractor, shall be furnished to the Engineer upon completion of each drilled shaft. The physical properties of the slurry shall be as shown in Table 1.

The slurry shall be sampled and tested less than 1 hour before concrete placement. Any heavily contaminated slurry that has accumulated at the bottom of the shaft shall be removed. The contractor shall perform final shaft bottom cleaning after suspended solids have settled from the slurry. Concrete shall not be placed if the slurry does not have the required physical properties.

Table 1 – SLURRY PROPERTIES				
	Bentonite	Emulsified Polymer	Dry Polymer	Test Method
Density, lb/cu ft (kg/cu m) (at introduction)	65.2 ± 1.6 ¹ (1043.5 ± 25.6)	63 (1009.0) max.	63 (1009.0) max.	ASTM D 4380
Density, lb/cu ft (kg/cu m) (prior to concrete placement)	67.0 ± 3.5 ¹ (1073.0 ± 56.0)	63 (1009.0) max.	63 (1009.0) max.	ASTM D 4380
Viscosity ² , sec/qt (sec/L)	46 ± 14 (48 ± 14)	38 ± 5 (40 ± 5)	65 ± 15 (69 ± 16)	ASTM D 6910
pH	9.0 ± 1.0	9.5 ± 1.5	9.0 ± 2.0	ASTM D 4972
Sand Content, percent by volume (at introduction)	4 max.	1 max.	1 max.	ASTM D 4381
Sand Content, percent by volume (prior to concrete placement)	10 max.	1 max.	1 max.	ASTM D 4381
Contact Time ^{3,4} hours	4 max.	72 max.	72 max.	

Note 1. When the slurry consists of only water and excavated soils, the density shall not exceed 70 lb/cu ft (1121 kg/cu m).

Note 2. Higher viscosities may be required in loose or gravelly sand deposits. Note 3. Contact time is the time without agitation and sidewall cleaning.

516.08 Obstructions. An obstruction is an unknown isolated object that causes the shaft excavation method to experience a significant decrease in the actual production rate and requires the Contractor to core, break up, push aside, or use other means to mitigate the obstruction. Subsurface conditions such as boulders, cobbles, or logs and buried infrastructure such as footings, piling, or abandoned utilities, when shown on the plans, shall not constitute an obstruction. When an obstruction is encountered, the Contractor shall notify the Engineer immediately and upon concurrence of the Engineer, the Contractor shall mitigate the obstruction with an approved method.

516.09 Top of Rock. The top of rock will be considered as the point where rock, defined as bedded deposits and conglomerate deposits exhibiting the physical characteristics and difficulty of rock removal as determined by the Engineer, is encountered which cannot be drilled with augers and/or underreaming tools configured to be effective in the soils indicated in the contract documents.

516.10 Design Modifications. If the top of rock elevation differs from that shown on the plans by more than 10 percent of the length of the drilled shaft above the rock, the Engineer shall be contacted to determine if any drilled shaft design changes may be required. In addition, if the type of soil or rock encountered is not similar to that shown in the subsurface exploration data, the Contractor may be required to extend the drilled shaft length(s) beyond those specified in the plans. In either case, the Engineer will determine if revisions are necessary and the extent of the modifications required.

516.11 Excavation Cleaning and Inspection. Materials removed or generated from the shaft excavations shall be disposed of according to Article 202.03.

After excavation, each shaft shall be cleaned. For a drilled shaft terminating in soil, the depth of sediment or debris shall be a maximum of 1 1/2 in. (38 mm). For a drilled shaft terminating in rock, the depth of sediment or debris shall be a maximum of 1/2 in. (13 mm).

A shaft excavation shall be overreamed when, in the opinion of the Engineer, the sidewall has softened, swelled, or has a buildup of slurry cake. Overreaming may also be required to correct a shaft excavation which has been drilled out of tolerance. Overreaming may be accomplished with a grooving tool, overreaming bucket, or other approved equipment. Overreaming thickness shall be a minimum of 1/2 in. (13 mm) and a maximum of 3 in. (75 mm).

516.12 Reinforcement. This work shall be according to Section 508 and the following.

The shaft excavation shall be cleaned and inspected prior to placing the reinforcement cage. The reinforcement cage shall be completely assembled prior to drilling and be ready for adjustment in length as required by the conditions encountered. The reinforcement cage shall be lifted using multiple point sling straps or other approved methods to avoid reinforcement cage distortion or stress. Cross frame stiffeners may be required for lifting or to keep the reinforcement cage in proper position during lifting and concrete placement.

The Contractor shall attach rolling spacers to keep the reinforcement cage centered within the shaft excavation during concrete placement and to ensure that at no point will the finished shaft have less than the minimum concrete cover(s) shown on the plans. The rolling spacers or other approved non-corrosive spacing devices shall be installed within 2 ft (0.6 m) of both the top and bottom of the drilled shaft and at intervals not exceeding 10 ft (3 m) throughout the length of the shaft to ensure proper reinforcement cage alignment and clearance for the entire shaft. The number of rolling spacers at each level shall be one for each 1.0 ft (300 mm) of shaft diameter, with a minimum of four rolling spacers at each level. For shafts with different shaft diameters throughout the length of the excavation, different sized rolling spacers shall be provided to ensure the reinforcement cage is properly positioned throughout the entire length of the shaft.

When a specific concrete cover between the base of the drilled shaft and the reinforcement cage is shown on the plans, the bottom of the reinforcement cage shall be supported so that the proper concrete cover is maintained.

If the conditions differ such that the length of the shaft is increased, additional longitudinal bars shall be either mechanically spliced or lap spliced to the lower end of the reinforcement cage and confined with either hoop ties or spirals. The Contractor shall have additional reinforcement available or fabricate the reinforcement cages with additional length as necessary to make the required adjustments in a timely manner as dictated by the encountered conditions. The additional reinforcement may be non-epoxy coated.

516.13 Concrete Placement. Concrete work shall be performed according to the following.

Throughout concrete placement the head pressure inside the drilled shaft shall be at least
1.1 times the head pressure outside the drilled shaft.

Concrete placement shall begin within 1 hour of shaft cleaning and inspection. The pour shall be made in a continuous manner from the bottom to the top elevation of the shaft as shown on the contract plan or as approved in the Contractor's installation procedure. Concrete placement shall continue after the shaft excavation is full and until 18 in. (450 mm) of good quality, uncontaminated concrete is expelled at the top of shaft. Vibration of the concrete will not be allowed when the concrete is displacing slurry or water. In dry excavations, the concrete in the top 10 ft (3 m) of the shaft shall be vibrated.

When using temporary casing or placing concrete under water or slurry, a minimum of seven days prior to concrete placement, a 4 cu yd (3 cu m) trial batch of the concrete mixture shall be performed to evaluate slump retention. Temporary casing shall be withdrawn before the slump of the concrete drops below 6 in. (150 mm). For concrete placed using the slurry method of construction, the slump of all concrete placed shall be a minimum of 6 in. (150 mm) at the end of concrete placement.

Devices used to place concrete shall have no aluminum parts in contact with concrete.

When the top of the shaft is at the finished elevation and no further concrete placement above the finished elevation is specified, the top of the shaft shall be level and finished according to Article 503.15(a).

Concrete shall be placed by free fall, tremie, or concrete pump subject to the following conditions.

- (a) Free Fall Placement. Concrete shall only be placed by free fall when the rate of water infiltration into the shaft excavation is less than 12 in. (300 mm) per hour and the depth of water in the shaft excavation is less than 3 in. (75 mm) at the time of concrete placement.

Concrete placed by free fall shall fall directly to the base without contacting the reinforcement cage, cross frame stiffeners, or shaft sidewall. Drop chutes may be used to direct concrete to the base during free fall placement.

Drop chutes used to direct placement of free fall concrete shall consist of a smooth tube. Concrete may be placed through either a hopper at the top of the tube or side openings as the drop chute is retrieved during concrete placement. The drop chute shall be supported so that free fall does not exceed 60 ft (18.3 m) for conventional concrete or 30 ft (9.1 m) for self-consolidating concrete. If placement cannot be satisfactorily accomplished by free fall in the opinion of the Engineer, either a tremie or pump shall be used to accomplish the pour.

- (b) Tremie and Concrete Pump Placement. Concrete placement shall be according to Article 503.08, except the discharge end of the steel pipe shall remain embedded in the concrete a minimum of 10 ft (3.0 m) throughout concrete placement when displacing slurry or water.

516.14 Construction Tolerances. The following construction tolerances shall apply to all drilled shafts.

- (a) Center of Shaft. The center of the drilled shaft shall be within 3 in. (75 mm) of the plan station and offset at the top of the shaft.
- (b) Center of Reinforcement Cage. The center of the reinforcement cage shall be within 1 1/2 in. (40 mm) of plan station and offset at the top of the shaft.
- (c) Vertical Plumbness of Shaft. The out of vertical plumbness of the shaft shall not exceed 1.5 percent.
- (d) Vertical Plumbness of Reinforcement Cage. The out of vertical plumbness of the shaft reinforcement cage shall not exceed 0.83 percent.
- (e) Top of Shaft. The top of the shaft shall be no more than 1 in. (25 mm) above and no more than 3 in. (75 mm) below the plan elevation.
- (f) Top of Reinforcement Cage. The top of the reinforcement cage shall be no more than 1 in. (25 mm) above and no more than 3 in. (75 mm) below the plan elevation.
- (g) Bottom of shaft. Excavation equipment and methods used to complete the shaft excavation shall have a nearly planar bottom. The cutting edges of excavation equipment used to create the bottom of shafts in rock shall be normal to the vertical axis of the shaft within a tolerance of 6.25 percent.

516.15 Method of Measurement. This work will be measured for payment in place and the volume computed in cubic yards (cubic meters). The volume will be computed using the plan diameter of the shaft multiplied by the measured length of the shaft. The length of shaft in soil will be computed as the difference in elevation between the top of the drilled shaft shown on the plans, or as installed as part of the Contractor's installation procedure, and the bottom of the shaft or the top of rock (when present) whichever is higher. The length of shaft in rock will be computed as the difference in elevation between the measured top of rock and the bottom of the shaft.

When permanent casing is specified, it will be measured for payment in place, in feet (meters). Permanent casing installed at the Contractor's option will not be measured for payment.

Reinforcement furnished and installed will be measured for payment according to Article 508.07.

516.16 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for DRILLED SHAFT IN SOIL, and/or DRILLED SHAFT IN ROCK.

Permanent casing will be paid for at the contract unit price per foot (meter) for PERMANENT CASING.

Reinforcement furnished and installed will be paid for according to Article 508.08.

Obstruction mitigation will be paid for according to Article 109.04."

CEMENT, FINELY DIVIDED MINERALS, ADMIXTURES, CONCRETE, AND MORTAR (BDE)
Effective: January 1, 2025 Revised: January 1, 2026

Revise the first paragraph of Article 285.05 of the Standard Specifications to read:

"285.05 Fabric Formed Concrete Revetment Mat. The grout shall consist of a mixture of cement, fine aggregate, and water so proportioned and mixed as to provide a pumpable slurry. Fly ash or ground granulated blast furnace (GGBF) slag, and concrete admixtures may be used at the option of the Contractor. The grout shall have an air content of not less than 6.0 percent nor more than 9.0 percent of the volume of the grout. The mix shall obtain a compressive strength of 2500 psi (17,000 kPa) at 28 days according to Article 1020.09."

Revise Article 302.02 of the Standard Specifications to read:

"302.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Hydrated Lime	1012.01
(d) By-Product, Hydrated Lime	1012.02
(e) By-Product, Non-Hydrated Lime	1012.03
(f) Lime Slurry	1012.04
(g) Fly Ash	1010
(h) Soil for Soil Modification (Note 1)	1009.01
(i) Bituminous Materials (Note 2)	1032

Note 1. This soil requirement only applies when modifying with lime (slurry or dry).

Note 2. The bituminous materials used for curing shall be emulsified asphalt RS-2, CRS-2, HFE 90, or HFE 150; rapid curing liquid asphalt RC-70; or medium curing liquid asphalt MC-70 or MC-250.”

Revise Article 312.07(c) of the Standard Specifications to read:

“(c) Cement 1001”

Add Article 312.07(i) of the Standard Specifications to read:

“(i) Ground Granulated Blast Furnace (GGBF) Slag 1010”

Revise the first paragraph of Article 312.09 of the Standard Specifications to read:

“312.09 Proportioning and Mix Design. At least 60 days prior to start of placing CAM II, the Contractor shall submit samples of materials to be used in the work for proportioning and testing. The mixture shall contain a minimum of 200 lb (120 kg) of cement per cubic yard (cubic meter). Cement may be replaced with fly ash or ground granulated blast furnace (GGBF) slag according to Article 1020.05(c)(1) or 1020.05(c)(2), respectively, however the minimum cement content in the mixture shall be 170 lbs/cu yd (101 kg/cu m). Blends of coarse and fine aggregates will be permitted, provided the volume of fine aggregate does not exceed the volume of coarse aggregate. The Engineer will determine the proportions of materials for the mixture according to the “Portland Cement Concrete Level III Technician Course” manual. However, the Contractor may substitute their own mix design. Article 1020.05(a) shall apply, and a Level III PCC Technician shall develop the mix design.”

Revise Article 352.02 of the Standard Specifications to read:

“352.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cement (Note 1)	1001
(b) Soil for Soil-Cement Base Course	1009.03
(c) Water	1002
(d) Bituminous Materials (Note 2)	1032

Note 1. Bulk cement may be used for the traveling mixing plant method if the equipment for handling, weighing, and spreading the cement is approved by the Engineer.

Note 2. The bituminous materials used for curing shall be emulsified asphalt RS-2, CRS-2, HFE 90, or HFE 150; rapid curing liquid asphalt RC-70; or medium curing liquid asphalt MC-70 or MC-250.”

Revise Article 404.02 of the Standard Specifications to read:

“404.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Fine Aggregate	1003.08
(d) Bituminous Material (Tack Coat)	1032.06
(e) Emulsified Asphalts (Note 1) (Note 2)	1032.06
(f) Fiber Modified Joint Sealer	1050.05
(g) Additives (Note 3)	

Note 1. When used for slurry seal, the emulsified asphalt shall be CQS-1h according to Article 1032.06(b).

Note 2. When used for micro-surfacing, the emulsified asphalt shall be CQS-1hP according to Article 1032.06(e).

Note 3. Additives may be added to the emulsion mix or any of the component materials to provide the control of the quick-traffic properties. They shall be included as part of the mix design and be compatible with the other components of the mix.

Revise the last sentence of the fourth paragraph of Article 404.08 of the Standard Specifications to read:

“When approved by the Engineer, the sealant may be dusted with fine sand, cement, or mineral filler to prevent tracking.”

Revise Note 2 of Article 516.02 of the Standard Specifications to read:

“Note 2. The sand-cement grout mix shall be according to Section 1020 and shall be a 1:1 blend of sand and cement comprised of a Type I, IL, or II cement at 185 lb/cu yd (110 kg/cu m). The maximum water cement ratio shall be sufficient to provide a flowable mixture with a typical slump of 10 in. (250 mm).”

Revise Note 2 of Article 543.02 of the Standard Specifications to read:

“Note 2. The grout mixture shall be 6.50 hundredweight/cu yd (385 kg/cu m) of cement plus fine aggregate and water. Fly ash or ground granulated blast furnace (GGBF) slag may replace a maximum of 5.25 hundredweight/cu yd (310 kg/cu m) of the cement. The water/cement ratio, according to Article 1020.06, shall not exceed 0.60. An air-entraining admixture shall be used to produce an air content, according to Article 1020.08, of not less than 6.0 percent nor more than 9.0 percent of the volume of the grout. The Contractor shall have the option to use a water-reducing or high range water-reducing admixture.”

Revise Article 583.01 of the Standard Specifications to read:

“583.01 Description. This work shall consist of placing cement mortar along precast, prestressed concrete bridge deck beams as required for fairing out any unevenness between adjacent deck beams prior to placing of waterproofing membrane and surfacing.”

Revise Article 583.02(a) of the Standard Specifications to read:

“(a) Cement 1001”

Revise the first paragraph of Article 583.03 of the Standard Specifications to read:

“ 583.03 General. This work shall only be performed when the air temperature is 45 °F (7 °C) and rising. The mixture for cement mortar shall consist of three parts sand to one part cement by volume. The amount of water shall be no more than that necessary to produce a workable, plastic mortar.”

Revise Article 606.02(h) of the Standard Specifications to read:

“(h) Fibers (Note 1) 1014”

Revise Note 1. in Article 606.02(h) of the Standard Specifications to read:

“Note 1. Fibers, when required, shall only be used in the concrete mixture may be required for slipform applications.”

Revise the third paragraph in Article 606.10 of the Standard Specifications to read:

“Welded wire fabric shall be 6 x 6 in. (150 x 150 mm) mesh, #4 gauge (5.74 mm), 58 lb (26 kg) per 100 sq ft (9 sq m).”

Revise Article 1001.01(d) of the Standard Specifications to read:

“(d) Rapid Hardening Cement. Rapid hardening cement shall be according to the Bureau of Materials Policy Memorandum “Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants”, and ASTM C 1600, Type URH, Type VRH, or Type RH-CAC. It shall be used according to Article 1020.04 or when approved by the Engineer. The Contractor shall submit a report from the manufacturer or an independent lab that contains results for testing according to ASTM C 1600 which shows the cement meets the requirements of either Type URH, Type VRH, or Type RH-CAC. Test data shall be less than 1 year old from the date of submittal.

Revise Article 1001.01(e) of the Standard Specifications to read:

- “(e) Other Cements. Other cements shall be according to the Bureau of Materials Policy Memorandum “Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants”, and ASTM C 1157 or ASTM C 1600, as applicable. Other cements shall be used according to Article 1020.04 or when approved by the Engineer. For cements according to ASTM C 1157, the Contractor shall submit a report from the manufacturer or an independent lab that contains results of tests which shows the cement meets the requirements Type GU, HE, MS, MH, or LH. For cements according to ASTM C 1600, the Contractor shall submit a report from the manufacturer or an independent lab that contains results of tests which shows the cement meets the requirements Type MRH or GRH. Test data shall be less than 1 year old from the date of submittal.”

Revise Article 1002.02 of the Standard Specifications to read:

“**1002.02 Quality.** Water used with cement in concrete or mortar and water used for curing concrete shall be clean, clear, and free from sugar. In addition, water shall be tested and evaluated for acceptance according to one of the following options.

OPTION 1.

- (a) Acceptable limits for acidity and alkalinity when tested according to ITP T 26.

- (1) Acidity -- 0.1 Normal NaOH 2 ml max.*
(2) Alkalinity -- 0.1 Normal HCl..... 10 ml max.*

*To neutralize 200 ml sample.

- (b) Acceptable limits for solids when tested according to the following.

- (1) Organic (ITP T 26).....0.02% max.
(2) Inorganic (ITP T 26).....0.30% max.
(3) Sulfate (SO₄) (ASTM D 516-82) 0.05% max.
(4) Chloride (ASTM D 512) 0.06% max.

- (c) The following tests shall be performed on the water sample and on deionized water. The same cement and sand shall be used for both tests.

- (1) Unsoundness (ASTM C 151).
(2) Initial and Final Set Time (ASTM C 266).
(3) Strength (ASTM C 109).

The test results for the water sample shall not deviate from the test results for the deionized water, except as allowed by the precision in the test method.

OPTION 2. Water shall meet the requirements ASTM C 1602 Tables 1 and 2 as outlined in Sections 5.1, 5.2, and 5.4.”

Revise Note 2/ in Article 1003.01(b) of the Standard Specifications to read:

“2/ Applies only to sand. Sand exceeding the colorimetric test standard of 11 (Illinois Modified AASHTO T 21) will be checked for mortar making properties according to Illinois Modified ASTM C 87 and shall develop a compressive strength at the age of 14 days when using Type I, IL, or II cement of not less than 95 percent of the comparable standard.

Revise the second sentence of Article 1003.02(e)(1) of the Standard Specifications to read:

“The test will be performed with Type I, IL, or II portland cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.90 percent or greater.”

Revise the first sentence of the second paragraph of Article 1003.02(e)(3) of the Standard Specifications to read:

“The ASTM C 1293 test shall be performed with Type I, IL, or II portland cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.80 percent or greater.”

Revise the second sentence of Article 1004.02(g)(1) of the Standard Specifications to read:

“The test will be performed with Type I, IL, or II portland cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.90 percent or greater.”

Add the following Section to the Standard Specifications.

“SECTION 1014. FIBERS FOR CONCRETE

1014.01 General. Fibers used in concrete shall be Type II or Type III (polyolefin or carbon) according to ASTM C 1116. The testing required for Type II fibers or Type III polyolefin fibers shall be performed by an independent lab a minimum of once every five years, and the test results provided to the Department. Manufacturers of Type III carbon fibers shall provide materials certification documentation not more than 6 years old a minimum of once every 5 years to the Department. The Department will maintain a qualified product list. The method of inclusion of fibers into concrete mixtures shall be according to the manufacturer’s specifications.

At the discretion of the Engineer, the concrete mixture shall be evaluated in a field demonstration for fiber clumping, ease of placement, and ease of finishing. The field demonstration shall consist of a minimum 2 cu yd (1.5 cu m) trial batch placed in a 12 ft. x 12 ft. (3.6 m x 3.6 m) slab.

1014.02 Concrete Gutter, Curb, Median and Paved Ditch. Fibers shall be Type III. Fibers shall have a minimum length of 1/2 in. (13 mm) and a maximum length of 0.75 in. (19 mm). The maximum dosage rate in the concrete mixture shall not exceed 1.5 lb/cu yd (0.9 kg/cu m). The minimum dosage rate shall be per the manufacturer’s recommendation.

1014.03 Concrete Inlay or Overlay. Fibers shall be Type III. Fibers shall have a minimum length of 1.0 in. (25 mm), a maximum length of 2 1/2 in. (63 mm), and a maximum aspect ratio (length divided by the equivalent diameter of the fiber) of 150. The maximum dosage rate shall not exceed 5.0 lb/cu yd (3.0 kg/cu m). The minimum dosage rate shall be per the manufacturer's recommendation.

1014.04 Bridge Deck Fly Ash, Ground Granulated Blast Furnace (GGBF) Slag, High Reactivity Metakaolin, or Microsilica (Silica Fume) Concrete Overlay. Fibers shall be Type III. The dosage rate shall be a minimum of 3.0 lb/cu yd (1.8 kg/cu m), unless a field demonstration according to Article 1014.01 indicates that a lower dosage rate is necessary. Based on the results of the field demonstration, the Department has the option to reduce the dosage rate of fibers, but the dosage will not be reduced to less than 2.0 lb / cu yd (1.2 kg/cu m).

1014.05 Bridge Deck Latex Concrete Overlay. Fibers shall be Type II or III. Fibers shall have a minimum length of 0.75 in. (19 mm), a maximum length of 1.75 in. (45 mm), and an aspect ratio (length divided by the equivalent diameter of the fiber) of between 70 and 100. The dosage rate shall be a minimum of 3.0 lb/cu yd (1.8 kg/cu m), unless a field demonstration according to Article 1014.01 indicates that a lower dosage rate is necessary. Based on the results of the field demonstration, the Department has the option to reduce the dosage rate of fibers, but the dosage will not be reduced to less than 2.0 lb/cu yd (1.2 kg/cu m)."

Add the following Section to the Standard Specifications:

"SECTION 1015. HIGH PERFORMANCE SHOTCRETE

1015.01 Packaged Shotcrete With Aggregate. The packaged shotcrete with aggregate shall be a pre-blended dry combination of materials for the wet-mix shotcrete method according to ASTM C 1480, Type FA or CA, Grade FR, Class I. The fibers shall be Type III according to Article 1014.01. The cement and finely divided minerals in the mixture shall be a minimum 6.65 cwt/cu yd (395 kg/cu m), and the portland cement shall not be below 4.70 cwt/cu yd (279 kg/cu m). Microsilica is required in the mixture and shall be a minimum of 5 percent by weight (mass) of cementitious material, and a maximum of 10 percent. Strength requirements shall be according to ASTM C 1480 except that the strength at 28 days shall be at least 4000 psi (27,500 kPa). Strength testing shall be according to ASTM C 1140. The air content as shot shall be 4.0 – 8.0 percent when tested according to AASHTO T 152, and the coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm).

The packaged shotcrete shall have a water soluble chloride ion content of less than 0.15% by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260.

The testing according to ASTM C 1480, ASTM C 1140, AASHTO 152, and ASTM C 1218 or AASHTO T 260 shall be performed by an independent lab a minimum of once every 5 years, and the test results shall be provided to the Department. The Department will maintain a qualified product list. Batching and mixing shall be per the manufacturer's recommendations.

1015.02 Packaged Shotcrete Without Aggregate. The packaged shotcrete that does not include pre-blended aggregate shall be according to Article 1015.01, except the added aggregate shall be according to Articles 1003.02 and 1004.02. The aggregate gradation shall be according to the manufacturer. The Department will maintain a qualified product list. Batching and mixing shall be per the manufacturer's recommendations."

Revise Article Section 1017.01 of the Standard Specifications to read:

"SECTION 1017. PACKAGED, DRY, COMBINED MATERIALS FOR MORTAR AND CONCRETE

"1017.01 Mortar.Requirements. The mortar shall be high-strength according to ASTM C 387 and shall have a minimum 80.0 percent relative dynamic modulus of elasticity when tested by the Department according to Illinois Modified AASHTO T 161 or AASHTO T 161 when tested by an independent lab. For prestressed concrete applications, tThe high-strength mortar shall have a water-soluble chloride ion content of less than 0.40 lb/cu yd (0.24 kg/cu m) 0.06 percent by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260; and for non-prestressed concrete applications, the water soluble chloride content shall be less than 0.15 percent by weight of cementitious material.. The test shall be performed according to ASTM C 1218, and the high-strength mortar shall have an age of 28 to 42 days at the time of test. The testing according to ASTM C 387, AASHTO T 161, and either ASTM C 1218 or AASHTO T 260 test shall be performed by an independent lab a minimum of once every five years, and the test results shall be provided to the Department. The Department will maintain a qualified product list. Mixing of the high-strength mortar shall be according to the manufacturer's specifications. The Department will maintain a qualified product list.

1017.02 Concrete. The materials, testing, and preparation of aggregate for the "high slump" packaged concrete mixture shall be according to ASTM C 387. The mixture shall be air entrained, the slump shall be 5-10 in. (125-250 mm), and the coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). Strength requirements shall be according to ASTM C 387 except that the strength at 28 days shall be at least 4000 psi (27,500 kPa). The "high slump" packaged concrete mixture shall have a water soluble chloride ion content of less than 0.15% by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260. The testing according to ASTM C 387, and either ASTM C 1218 or AASHTO T 260 shall be performed by an independent lab a minimum of once every 5 years, and the test results shall be provided to the Department. The Department will maintain a qualified product list. Mixing shall be per the manufacturer's recommendations.

1017.02 Self-Consolidating Concrete. The materials, testing, and preparation of aggregate for the “self-consolidating concrete” packaged concrete mixture shall be according to ASTM C 387. The mixture shall be air entrained, it should be uniformly graded, and the coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). Strength requirements shall be according to ASTM C 387 except that the strength at 28 days shall be at least 4000 psi (27,500 Pa). Slump flow range shall be 22 in. (550 mm) minimum to 28 in. (700 mm) maximum when tested according to AASHTO T 347. The visual stability index shall be a maximum of 1 when tested according to AASHTO T 351. At the option of the manufacturer, either the J-Ring value shall be a maximum of 2 in. (50 mm) when tested according to AASHTO T 347 or the L-Box blocking ratio shall be a minimum of 80 percent when tested according to AASHTO T 419. The hardened visual stability index shall be a maximum of 1 when tested according to AASHTO R 81.

The “self -consolidating concrete” packaged concrete mixture shall have a water soluble chloride ion content of less than 0.15 percent by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260.

The testing according to ASTM C 387, AASHTO T 347, AASHTO T 351, AASHTO T 419, AASHTO R 81, ASTM C 1218 and AASHTO T 260 shall be performed by an independent lab a minimum of once every 5 years, and the test results shall be provided to the Department. The Department will maintain a qualified product list. Mixing shall be per the manufacturer's recommendations.”

Revise the fourth sentence of Article 1018.01 of the Standard Specifications to read:

“1018.01 Requirements. The rapid hardening mortar or concrete shall be according to ASTM C 928 and shall have successfully completed and remain current with the AASHTO Product Eval and Audit Rapid Hardening Concrete Patching Materials (RHCP) testing program. R1, R2, or R3 concrete shall be air entrained, the slump shall be 5-10 in. (125-250 mm), and the coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). For prestressed concrete applications, the mortar or concrete shall have a water-soluble chloride ion content of less than 0.06 percent by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260; and for non-prestressed concrete applications, the water soluble chloride content shall be less than 0.15 percent by weight of cementitious material. The Department will maintain a qualified product list. Mixing of the mortar or concrete shall be according to the manufacturer's specifications. The ASTM C 1218 test shall be performed by an independent lab a minimum of once every five years, and the test results shall be provided to the Department.”

Revise Article 1019.02 of the Standard Specifications to read:

“1019.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Fine Aggregate for Controlled Low-Strength Material (CLSM)	1003.06
(d) Fly Ash	1010
(e) Ground Granulated Blast Furnace (GGBF) Slag.....	1010
(f) Admixtures (Note 1)	

Note 1. The air-entraining admixture may be in powder or liquid form. Prior to approval, a CLSM air-entraining admixture will be evaluated by the Department. The admixture shall be able to meet the air content requirements of Mix 2. The air content produced by the admixture shall be 15-25 percent when incorporated into Mix 2 or an equivalent mixture as determined by the Department and tested according to AASHTO T 121 or AASHTO T 152. The testing according to AASHTO T 121 or AASHTO T 152 shall be performed by an independent lab a minimum of once every five years, and the test results shall be provided to the Department. The Department will maintain a qualified product list.”

Revise the third paragraph of Article 1019.04 of the Standard Specifications to read:

“The Engineer will instruct the Contractor to adjust the proportions of the mix design in the field as needed to meet the design criteria, provide adequate flowability, maintain proper solid suspension, or other criteria established by the Engineer.”

Revise Article 1019.05 of the Standard Specifications to read:

“1019.05 Department Mix Design. The Department mix design shall be Mix 1, 2, or 3 and shall be proportioned to yield approximately one cubic yard (cubic meter).

Mix 1	
Cement	50 lb (30 kg)
Fly Ash – Class C or F, and/or GGBF Slag	125 lb (74 kg)
Fine Aggregate – Saturated Surface Dry	2900 lb (1720 kg)
Water	50-65 gal (248-322 L)
Air Content	No air is entrained

Mix 2	
Cement	125 lb (74 kg)
Fine Aggregate – Saturated Surface Dry	2500 lb (1483 kg)
Water	35-50 gal (173-248 L)
Air Content	15-25 %

Mix 3	
Cement	40 lb (24 kg)
Fly Ash – Class C or F, and/or GGBF Slag	125 lb (74 kg)
Fine Aggregate – Saturated Surface Dry	2500 lb (1483 kg)
Water	35-50 gal (179-248 L)
Air Content	15-25 %

Revise Article 1020.04, Table 1, Note (8) of the Standard Specifications to read:

“(8) In addition to the Type III portland cement, 100 lb/cu yd of ground granulated blast-furnace slag and 50 lb/cu yd of microsilica (silica fume) shall be used. For an air temperature greater than 85 °F, the Type III portland cement may be replaced with Type I, IL, or II portland cement.”

Revise Article 1020.04, Table 1 (Metric), Note (8) of the Standard Specifications to read:

“(8) In addition to the Type III portland cement, 60 kg/cu m of ground granulated blast-furnace slag and 30 kg/cu m of microsilica (silica fume) shall be used. For an air temperature greater than 30 °C, the Type III portland cement may be replaced with Type I, IL, or II portland cement.”

Revise Note 9 of Table 1 of Article 1020.04 of the Standard Specifications to read:

“(9) The cement shall be a rapid hardening according to Article 1001.01(d). Minimum or maximum cement factor may be adjusted when approved by the Engineer.”

Revise the second paragraph of Article 1020.05(a) of the Standard Specifications to read:

“For a mix design using a portland-pozzolan cement, portland blast-furnace slag cement, portland-limestone cement, or replacing portland cement with finely divided minerals per Articles 1020.05(c) and 1020.05(d), the Contractor may submit a mix design with a minimum portland cement content less than 400 lbs/cu yd (237 kg/cu m), but not less than 375 lbs/cu yd (222 kg/cu m), if the mix design is shown to have a minimum relative dynamic modulus of elasticity of 80 percent determined according to AASHTO T 161. Testing shall be performed by an independent laboratory accredited by AASHTO re:source for Portland Cement Concrete.”

Revise the first sentence of the first paragraph of Article 1020.05(b) of the Standard Specifications to read:

“Corrosion inhibitors and concrete admixtures shall be according to the qualified product lists.”

Delete the fourth and fifth sentences of the second paragraph of Article 1020.05(b) of the Standard Specifications.

Revise the third sentence of the second paragraph of Article 1020.05(b)(5) of the Standard Specifications to read:

“The qualified product lists of concrete admixtures shall not apply.”

Revise Article 1020.05(b)(5) of the Standard Specifications to read:

“(5) For Class PP-4 concrete, a high range water-reducing admixture, retarder, and/or hydration stabilizer may be used in addition to the air-entraining admixture. The Contractor also has the option to use a water-reducing admixture with the high range water-reducing admixture. An accelerator shall not be used. A mobile portland cement concrete plant shall be used to produce the patching mixture.

For PP-5 concrete, a non-chloride accelerator, high range water-reducing admixture, retarder, hydration stabilizer, and/or air-entraining admixture may be used. The accelerator, high range water-reducing admixture, retarder, hydration stabilizer, and/or air-entraining admixture shall be per the Contractor’s recommendation and dosage. The qualified product list of concrete admixtures shall not apply. A mobile portland cement concrete plant shall be used to produce the patching mixture.”

Revise second paragraph of Article 1020.05(b)(10) of the Standard Specifications to read:

“When calcium nitrite is used, it shall be added at the rate of 4 gal/cu yd (20 L/cu m) and shall be added to the mix immediately after all compatible admixtures have been introduced to the batch. Other corrosion inhibitors shall be added per the manufacturer’s specifications.”

Delete the third paragraph of Article 1020.05(b)(10) of the Standard Specifications.

Revise Article 1020.15(b)(1)c. of the Standard Specifications to read:

“c. The minimum portland cement content in the mixture shall be 375 lbs/cu yd (222 kg/cu m). When the total of organic processing additions, inorganic processing additions, and limestone addition exceed 5.0 percent in the cement, the minimum portland cement content in the mixture shall be 400 lbs/cu yd (237 kg/cu m). For a drilled shaft, foundation, footing, or substructure, the minimum portland cement may be reduced to as low as 330 lbs/cu yd (196 kg/cu m) if the concrete has adequate freeze/thaw durability. The Contractor shall provide freeze/thaw test results according to AASHTO T 161, and the relative dynamic modulus of elasticity of the mix design shall be a minimum of 80 percent. Testing shall be performed by an independent laboratory accredited by AASHTO re:source for Portland Cement Concrete. Freeze/thaw testing will not be required for concrete that will not be exposed to freezing and thawing conditions as determined by the Engineer.”

Revise Article 1021.01 of the Standard Specifications to read:

“1021.01 General. Admixtures shall be furnished in liquid or powder form ready for use. The admixtures shall be delivered in the manufacturer's original containers, bulk tank trucks or such containers or tanks as are acceptable to the Engineer. Delivery shall be accompanied by a ticket which clearly identifies the manufacturer, the date of manufacture, and trade name of the material. Containers shall be readily identifiable as to manufacturer, the date of manufacture, and trade name of the material they contain.

Concrete admixtures shall be on one of the Department's qualified product lists. Unless otherwise noted, admixtures shall have successfully completed and remain current with the AASHTO Product Eval and Audit Concrete Admixture (CADD) testing program. For admixture submittals to the Department; the product brand name, manufacturer name, admixture type or types, an electronic link to the product's technical data sheet, and the NTPEP testing number which contains an electronic link to all test data shall be provided. In addition, a letter shall be submitted certifying that no changes have been made in the formulation of the material since the most current round of tests conducted by AASHTO Product Eval and Audit. After 28 days of testing by AASHTO Product Eval and Audit, air-entraining admixtures may be provisionally approved and used on Departmental projects. For all other admixtures, unless otherwise noted, the time period after which provisionally approved status may be earned is 6 months.

The manufacturer shall include the following in the submittal to the AASHTO Product Eval and Audit CADD testing program: the manufacturing range for specific gravity, the midpoint and manufacturing range for residue by oven drying, and manufacturing range of pH. The submittal shall also include an infrared spectrophotometer trace no more than five years old.

For air-entraining admixtures according to Article 1021.02, the specific gravity allowable manufacturing range established by the manufacturer shall be according to AASHTO M 194. For residue by oven drying and pH, the allowable manufacturing range and test methods shall be according to AASHTO M 194.

For admixtures according to Articles 1021.03, 1021.04, 1021.05, 1021.06, 1021.07, and 1021.08, the pH allowable manufacturing range established by the manufacturer shall be according to ASTM E 70. For specific gravity and residue by oven drying, the allowable manufacturing range and test methods shall be according to AASHTO M 194.

All admixtures, except chloride-based accelerators, shall contain a maximum of 0.3 percent chloride by weight (mass) as determined by an appropriate test method. To verify the test result, the Department will use Illinois Modified AASHTO T 260, Procedure A, Method 1.

Prior to final approval of an admixture, the Engineer reserves the right to request a sample for testing. The test and reference concrete mixtures tested by the Engineer will contain a cement content of 5.65 cwt/cu yd (335 kg/cu m). For freeze-thaw testing, the Department will perform the test according to Illinois Modified AASHTO T 161. The flexural strength test will be performed according to AASHTO T 177. If the Engineer decides to test the admixture, the manufacturer shall submit AASHTO T 197 water content and set time test results on the standard cement used by the Department. The manufacturer may select their lab or an independent lab to perform this testing. The laboratory is not required to be accredited by AASHTO.

Random field samples may be taken by the Department to verify an admixture meets specification. A split sample will be provided to the manufacturer if requested. Admixtures that do not meet specification requirements or an allowable manufacturing range established by the manufacturer shall be replaced with new material.”

Revise Article 1021.03 of the Standard Specifications to read:

“1021.03 Retarding and Water-Reducing Admixtures. The admixture shall be according to the following.

- (a) Retarding admixtures shall be according to AASHTO M 194, Type B (retarding) or Type D (water-reducing and retarding).
- (b) Water-reducing admixtures shall be according to AASHTO M 194, Type A.
- (c) High range water-reducing admixtures shall be according to AASHTO M 194, Type F (high range water-reducing) or Type G (high range water-reducing and retarding).”

Revise Article 1021.05 of the Standard Specifications to read:

“1021.05 Self-Consolidating Admixtures. Self-consolidating admixture systems shall consist of either a high range water-reducing admixture only or a high range water-reducing admixture combined with a separate viscosity modifying admixture. The one or two component admixture system shall be capable of producing a concrete that can flow around reinforcement and consolidate under its own weight without additional effort and without segregation.

High range water-reducing admixtures shall be according to AASHTO M 194, Type F.

Viscosity modifying admixtures shall be according to AASHTO M 194, Type S (specific performance).”

Revise Article 1021.06 of the Standard Specifications to read:

“1021.06 Rheology-Controlling Admixture. Rheology-controlling admixtures shall be capable of producing a concrete mixture with a lower yield stress that will consolidate easier for slipform applications used by the Contractor. Rheology-controlling admixtures shall be according to AASHTO M 194, Type S (specific performance).”

Revise Article 1021.07 of the Standard Specifications to read:

“1021.07 Corrosion Inhibitor. The corrosion inhibitor shall be according to one of the following.

- (a) Calcium Nitrite. Corrosion inhibitors shall contain a minimum 30 percent calcium nitrite by weight (mass) of solution and shall comply with either the requirements of AASHTO M 194, Type C (accelerating) or the requirements of ASTM C 1582. The corrosion inhibiting performance requirements of ASTM C 1582 shall not apply.

(b) Other Materials. The corrosion inhibitor shall be according to ASTM C 1582.

For submittals requiring testing according to ASTM M 194, Type C (accelerating), the admixture shall meet the requirements of the AASHTO Product Eval and Audit CADD testing program according to Article 1021.01.

For submittals requiring testing according to ASTM C 1582, a report prepared by an independent laboratory accredited by AASHTO re:source for portland cement concrete shall be provided. The report shall show the results of physical tests conducted no more than five years prior to the time of submittal, according to applicable specifications. However, ASTM G 109 test information specified in ASTM C 1582 is not required to be from an independent accredited lab. All other information in ASTM C 1582 shall be from an independent accredited lab. Test data and other information required to be submitted to AASHTO Product Eval and Audit according to Article 1021.01, shall instead be submitted directly to the Department.”

Add Article 1021.08 of the Standard Specifications as follows:

“1021.08 Other Specific Performance Admixtures. Other specific performance admixtures 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 characteristics.

Initial testing according to AASHTO M 194 may be conducted under the AASHTO Product Eval and Audit CADD testing program according to Article 1021.01, or by an independent laboratory accredited by AASHTO re:source for Portland Cement Concrete. In either case, test data and other information required to be submitted to AASHTO Product Eval and Audit according to Article 1021.01, shall also be submitted directly 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, according to applicable specifications.”

Add Article 1021.09 of the Standard Specifications as follows:

“1021.09 Latex Admixtures. The latex admixture shall be a uniform, homogeneous, non-toxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture. The latex admixture shall not contain any chlorides and shall contain 46-49 percent solids.

In lieu of meeting the requirements of Article 1021.01, the Contractor shall submit a manufacturer's certification that the latex emulsion meets the requirements of FHWA Research Report RD-78-35, Chapter VI. The certificate shall include the date of manufacture of the latex admixture, batch or lot number, quantity represented, manufacturer's name, and the location of the manufacturing plant. The latex emulsion shall be sampled and tested in accordance with RD-78-35, Chapter VII, Certification Program.

The latex admixture shall be packaged and stored in containers and storage facilities which will protect the material from freezing and from temperatures above 85°F (30°C). Additionally, the material shall not be stored in direct sunlight and shall be shaded when stored outside of buildings during moderate temperatures.”

Revise Article 1024.01 of the Standard Specifications to read:

“1024.01 Requirements for Grout. The grout shall be proportioned by dry volume, thoroughly mixed, and shall have a minimum temperature of 50 °F (10 °C). Water shall not exceed the minimum needed for placement and finishing.

Materials for the grout shall be according to the following.

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Fine Aggregate	1003.02
(d) Fly Ash	1010
(e) Ground Granulated Blast Furnace (GGBF) Slag.....	1010
(f) Concrete Admixtures	1021”

Revise Note 1 of Article 1024.02 of the Standard Specifications to read:

“Note 1. Nonshrink grout shall be according to Illinois Modified ASTM C 1107.

For prestressed concrete applications, Tthe nonshrink grout shall have a water soluble chloride ion content of less than 0.06 percent by weight of cementitious material when tested according to ASTM C 1218 or AASHTO T 260; and for non-prestressed concrete applications, the water soluble chloride ion content shall be less than 0.15 percent by weight of cementitious material. The testing according to ASTM 1107, and either ASTM C 1218 or AASHTO T 260 shall be performed by an independent lab a minimum of once every five years, and the test results shall be provided to the Department. 0.40 lb/cu yd (0.24 kg/cu m). The test shall be performed according to ASTM C 1218, and the grout shall have an age of 28 to 42 days at the time of test. The ASTM C 1218 test shall be performed by an independent lab a minimum of once every five years, and the test results shall be provided to the Department. Mixing of the nonshrink grout shall be according to the manufacturer’s specifications. The Department will maintain a qualified product list. Mixing of the nonshrink grout shall be according to the manufacturer’s specifications.”

Revise Article 1029.02 of the Standard Specifications to read:

“ **1029.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Cement.....	1001
(b) Fly Ash	1010
(c) Ground Granulated Blast Furnace (GGBF) Slag	1010
(d) Water.....	1002
(e) Fine Aggregate.....	1003
(f) Concrete Admixtures	1021
(g) Foaming Agent (Note 1)	

Note 1. The manufacturer shall submit infrared spectrophotometer trace and test results indicating the foaming agent meets the requirements of ASTM C 869 in order to be on the Department's qualified product list. Submitted data/results shall not be more than five years old.”

Revise the second paragraph of Article 1103.03(a)(4) the Standard Specifications to read:

“The dispenser system shall provide a visual indication that the liquid admixture is actually entering the batch, such as via a transparent or translucent section of tubing or by independent check with an integrated secondary metering device. If approved by the Engineer, an alternate indicator may be used for admixtures dosed at rates of 25 oz/cwt (1630 mL/100 kg) or greater, such as accelerating admixtures, corrosion inhibitors, and viscosity modifying admixtures.”

Revise Article 1103.04 of the Standard Specifications to read:

“ **1103.04 Mobile Portland Cement Concrete Plants.** The mobile concrete plant shall be according to AASHTO M 241 and the Bureau of Materials Policy Memorandum “Approval of Volumetric Mobile Mixers for Concrete”. The mixer shall be capable of carrying sufficient unmixed materials to produce not less than 6 cu yd (4.6 cu m) of concrete.”

Revise the first two sections of Check Sheet #11 “Subsealing of Concrete Pavements” of the Supplemental Specifications and Recurring Special Provisions to read:

“Description. This work shall consist of filling voids beneath rigid and composite pavements with cement grout.

Materials. Materials shall be according to the following Articles/Sections of Division 1000 - Materials of the Standard Specifications:

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Fly Ash	1010
(d) Ground Granulated Blast Furnace (GGBF) Slag.....	1010
(e) Admixtures	1021
(f) Packaged Rapid Hardening Mortar or Concrete	1018"

Revise the Materials section of Check Sheet #28 "Portland Cement Concrete Inlay or Overlay" of the Recurring Special Provisions to read:

"Materials. Materials shall be according to the following Articles/Sections of the Standard Specifications.

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) Fibers for Concrete.....	1014
(c) Protective Coat.....	1023.01

Note 1. Class PV concrete shall be used, except the cement factor for central mixed concrete shall be 6.05 cwt/cu yd (360 kg/cu m). A cement factor reduction according to Article 1020.05(b)(8) of the Standard Specifications will be permitted. CA 5 shall not be used and CA 7 may only be used for overlays that are a minimum of 4.5 in. (113 mm) thick. The Class PV concrete shall have a minimum flexural strength of 550 psi (3800 kPa) or a minimum compressive strength of 3000 psi (20,700 kPa) at 14 days."

COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017

Revised: April 1, 2019

Revise Article 107.40(b) of the Standard Specifications to read:

"(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows.

- (1) Minor Delay. A minor delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.
- (2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.
- (3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days."

Revise Article 107.40(c) of the Standard Specifications to read:

"(c) Payment. Payment for Minor, Major, and Reduced Rate of Production Delays will be made as follows.

- (1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

- (2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to two weeks plus the cost of move-out to either the Contractor's yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

- (3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13."

Revise Article 108.04(b) of the Standard Specifications to read:

“(b) No working day will be charged under the following conditions.

- (1) When adverse weather prevents work on the controlling item.
- (2) When job conditions due to recent weather prevent work on the controlling item.
- (3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.
- (4) When delays caused by utility or railroad adjustments prevent work on the controlling item.
- (5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.
- (6) When any condition over which the Contractor has no control prevents work on the controlling item.”

Revise Article 109.09(f) of the Standard Specifications to read:

“(f) Basis of Payment. After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited.”

Add the following to Section 109 of the Standard Specifications.

“109.13 Payment for Contract Delay. Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

- (a) Escalated Material and/or Labor Costs. When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.
- (b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.
 - (1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to \$5,000,000	One Project Superintendent
Over \$ 5,000,000 - up to \$25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over \$25,000,000 - up to \$50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over \$50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

- (c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid for according to Article 109.04. For working day contracts the payment will be made according to Article 109.04. For completion date contracts, an adjustment will be determined as follows.

Extended Traffic Control occurs between April 1 and November 30:

$$\text{ETCP Adjustment (\$)} = \text{TE} \times (\% / 100 \times \text{CUP} / \text{OCT})$$

Extended Traffic Control occurs between December 1 and March 31:

$$\text{ETCP Adjustment (\$)} = \text{TE} \times 1.5 (\% / 100 \times \text{CUP} / \text{OCT})$$

Where: TE = Duration of approved time extension in calendar days.

% = Percent maintenance for the traffic control, % (see table below).

CUP = Contract unit price for the traffic control pay item in place during the delay.

OCT = Original contract time in calendar days.

Original Contract Amount	Percent Maintenance
Up to \$2,000,000	65%
\$2,000,000 to \$10,000,000	75%
\$10,000,000 to \$20,000,000	85%
Over \$20,000,000	90%

When an ETCP extended traffic control adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay under this provision, the Contractor shall assign subrogation rights to the Department for the Department's efforts of recovery from any other party for monies paid by the Department as a result of any claim under this provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this provision."

CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)

Effective: June 1, 2010
2014January 1, 2025

Revised: November 1,

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term “equipment” refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown according to the table below. Equipment that is of a model year older than the year given for that equipment’s respective horsepower range shall be retrofitted:

Horsepower Range	Model Year and Older
50-99	20034
100-299	20023
300-599	20001
600-749	20012
750 and up	20056

- 1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.
- 2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/cleandiesel/verification/verified-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>); or
- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

Diesel Retrofit Deficiency Deduction

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

EROSION CONTROL BLANKET (BDE)

Effective: August 1, 2025

Revise Article 251.02 of the Standard Specifications to read:

“251.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Compost	1081.05(b)
(b) Mulch	1081.06(a)
(c) Chemical Mulch Binder	1081.06(a)(3)
(d) Chemical Compost Binder	1081.06(a)(4)
(e) Erosion Control Blanket	1081.10(a)
(f) Wildlife Friendly Erosion Control Blanket	1081.10(b)
(g) Wire Staples	1081.10(c)
(h) Wood Stakes	1081.10(d)
(i) Turf Reinforcement Mat	1081.10(e)”

Revise the first and second sentences of Article 251.04 of the Standard Specifications to read:

“251.04 Erosion Control Blanket. All erosion control blanket materials shall be placed on the areas specified within 24 hours of seed placement.”

Revise the second paragraph of Article 251.04 of the Standard Specifications to read:

“After the area has been properly shaped, fertilized (when applicable), and seeded, the blanket shall be laid out flat, evenly, and smoothly, without stretching the material. The erosion control blanket shall be placed according to the manufacture’s recommendations.”

Revise the second sentence of Article 251.06(b) of the Standard Specifications to read:

“Erosion control blanket, wildlife friendly erosion control blanket, and turf reinforcement mat will be measured for payment in square yards (square meters).”

Revise Article 251.07 of the Standard Specifications to read:

“251.07 Basis of Payment. This work will be paid for at the contract unit price per acre (hectare) for MULCH, of the method specified; and at the contract unit price per square yard (square meter) for EROSION CONTROL BLANKET, WILDLIFE FRIENDLY EROSION CONTROL BLANKET, or TURF REINFORCEMENT MAT.”

Revise first sentence of Article 280.04(h) of the Standard Specifications to read:

“This system consists of temporarily installing erosion control blanket or wildlife friendly erosion control blanket over areas that are to be reworked during a later construction phase.”

Revise Article 280.08(g) of the Standard Specifications to read:

- “(g) Temporary Erosion Control Blanket. Temporary erosion control blanket will be paid for at the contract unit price per square yard (square meter) for TEMPORARY EROSION CONTROL BLANKET or TEMPORARY WILDLIFE FRIENDLY EROSION CONTROL BLANKET.

The work of removing, storing, and reinstalling the blanket over areas to be reworked more than once will not be paid for separately but shall be included in the cost of the temporary erosion control blanket or temporary wildlife friendly erosion control blanket.”

Revise Article 1081.10 of the Standard Specifications to read:

“**1081.10 Erosion Control Blankets.** The manufacturer shall furnish a certificate with each shipment stating the amount of product furnished and that the material complies with these requirements.

- (a) Erosion Control Blanket. Erosion control blanket shall be covered on top and bottom, also known as double net, with a 100 percent biodegradable woven, natural fiber or jute net meeting the following.

Material	Minimum Value
Excelsior	80%
Straw	100%
Coconut or Coir	100% Coconut or Coir
Straw/Coconut or Coir	70% Straw / 30% Coconut or Coir

- (b) Wildlife Friendly Erosion Control Blanket. Wildlife friendly erosion control blanket shall be according to Article 1081.10(a) except the netting shall be loose weave, also known as leno weave or gauze weave, with a moveable joint.
- (c) Wire Staples. Staples shall be made from No. 11 gauge or heavier uncoated black carbon steel wire, a minimum of 1 in. (25 mm) wide at the top and a minimum overall length of 8 in. (200 mm).
- (d) Wood Stakes. Hardwood blanket anchors shall be nominally 7 in. (180 mm) long from neck of hook to tip of anchor. The anchor shall have a minimum 1/2 in. (13 mm) curving hook to hold the blanket in place.
- (e) Turf Reinforcement Mat (TRM). The TRM shall be comprised of non-degradable, ultraviolet stabilized synthetic fibers, filaments, netting, and/or wire mesh processed into a three-dimensional reinforced mat. The mats may include degradable material to assist with vegetation establishment. Soil filled mats will not be allowed.

The TRM shall meet the following physical and performance properties:

Property	Value	Test Method
Tensile Strength, lb/ft (kN/m)	150 (2.19) min.	ASTM D 6818
UV Stability, (% Tensile Retained)	80 min.	ASTM D 4355 (1000 Hour Exposure)
Resiliency, (% Thickness Retained)	80 min.	ASTM D 6524
Allowable Shear Stress, lb/sq ft (Pa) ^{1/}	8 (384)	ECTC approved test method and independent laboratory

1/ Minimum shear stress the TRM (fully vegetated) can sustain without physical damage or excess erosion (> 1/2 in. (13 mm) soil loss) during a 30 minute flow event in large scale testing.

For TRMs containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone.”

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (BDE)

Effective: January 1, 2024

Revised: April 1, 2024

Revise the first paragraph of Article 669.04 of the Standard Specifications to read:

“669.04 Regulated Substances Monitoring. Regulated substances monitoring includes environmental observation and field screening during regulated substances management activities. The excavated soil and groundwater within the work areas shall be managed as either uncontaminated soil, hazardous waste, special waste, or non-special waste.

As part of the regulated substances monitoring, the monitoring personnel shall perform and document the applicable duties listed on form BDE 2732 “Regulated Substances Monitoring Daily Record (RSMDR)”.

Revise the first two sentences of the nineteenth paragraph of Article 669.05 of the Standard Specifications to read:

“The Contractor shall coordinate waste disposal approvals with the disposal facility and provide the specific analytical testing requirements of that facility. The Contractor shall make all arrangements for collection, transportation, and analysis of landfill acceptance testing.”

Revise the last paragraph of Article 669.05 of the Standard Specifications to read:

“The Contractor shall select a permitted landfill facility or CCDD/USFO facility meeting the requirements of 35 Ill. Admin. Code Parts 810-814 or Part 1100, respectively. The Department will review and approve or reject the facility proposed by the Contractor based upon information provided in BDE 2730. The Contractor shall verify whether the selected facility is compliant with those applicable standards as mandated by their permit and whether the facility is presently, has previously been, or has never been, on the United States Environmental Protection Agency (U.S. EPA) National Priorities List or the Resource Conservation and Recovery Act (RCRA) List of Violating Facilities. The use of a Contractor selected facility shall in no manner delay the construction schedule or alter the Contractor's responsibilities as set forth.”

Revise the first paragraph of Article 669.07 of the Standard Specifications to read:

“**669.07 Temporary Staging.** Soil classified according to Articles 669.05(a)(2), (b)(1), or (c) may be temporarily staged at the Contractor's option. All other soil classified according to Articles 669.05(a)(1), (a)(3), (a)(4), (a)(5), (a)(6), or (b)(2) shall be managed and disposed of without temporary staging to the greatest extent practicable. If circumstances beyond the Contractor's control require temporary staging of these latter materials, the Contractor shall request approval from the Engineer in writing.

Topsoil for re-use as final cover which has been field screened and found not to exhibit PID readings over daily background readings as documented on the BDE 2732, visual staining or odors, and is classified according to Articles 669.05(a)(2), (a)(3), (a)(4), (b)(1), or (c) may be temporarily staged at the Contractor's option.

”

Add the following paragraph after the sixth paragraph of Article 669.11 of the Standard Specifications.

“The sampling and testing of effluent water derived from dewatering discharges for priority pollutants volatile organic compounds (VOCs), priority pollutants semi-volatile organic compounds (SVOCs), or priority pollutants metals, will be paid for at the contract unit price per each for VOCS GROUNDWATER ANALYSIS using EPA Method 8260B, SVOCs GROUNDWATER ANALYSIS using EPA Method 8270C, or RCRA METALS GROUNDWATER ANALYSIS using EPA Methods 6010B and 7471A. This price shall include transporting the sample from the job site to the laboratory.”

Revise the first sentence of the eight paragraph of Article 669.11 of the Standard Specifications to read:

“Payment for temporary staging of soil classified according to Articles 669.05(a)(1), (a)(3), (a)(4), (a)(5), (a)(6), or (b)(2) to be managed and disposed of, if required and approved by the Engineer, will be paid according to Article 109.04.”

SEEDING (BDE)

Effective: November 1, 2022

Revise Article 250.07 of the Standard Specifications to read:

“250.07 Seeding Mixtures. The classes of seeding mixtures and combinations of mixtures will be designated in the plans.

When an area is to be seeded with two or more seeding classes, those mixtures shall be applied separately on the designated area within a seven day period. Seeding shall occur prior to placement of mulch cover. A Class 7 mixture can be applied at any time prior to applying any seeding class or added to them and applied at the same time.

TABLE 1 - SEEDING MIXTURES			
Class - Type	Seeds	lb/acre (kg/hectare)	
1 Lawn Mixture 1/	Kentucky Bluegrass	100	(110)
	Perennial Ryegrass	60	(70)
	<i>Festuca rubra</i> ssp. <i>rubra</i> (Creeping Red Fescue)	40	(50)
1A Salt Tolerant Lawn Mixture 1/	Kentucky Bluegrass	60	(70)
	Perennial Ryegrass	20	(20)
	<i>Festuca rubra</i> ssp. <i>rubra</i> (Creeping Red Fescue)	20	(20)
	<i>Festuca brevipila</i> (Hard Fescue)	20	(20)
	<i>Puccinellia distans</i> (Fults Saltgrass or Salty Alkaligrass)	60	(70)
1B Low Maintenance Lawn Mixture 1/	Turf-Type Fine Fescue 3/	150	(170)
	Perennial Ryegrass	20	(20)
	Red Top	10	(10)
	<i>Festuca rubra</i> ssp. <i>rubra</i> (Creeping Red Fescue)	20	(20)
2 Roadside Mixture 1/	<i>Lolium arundinaceum</i> (Tall Fescue)	100	(110)
	Perennial Ryegrass	50	(55)
	<i>Festuca rubra</i> ssp. <i>rubra</i> (Creeping Red Fescue)	40	(50)
	Red Top	10	(10)
2A Salt Tolerant Roadside Mixture 1/	<i>Lolium arundinaceum</i> (Tall Fescue)	60	(70)
	Perennial Ryegrass	20	(20)
	<i>Festuca rubra</i> ssp. <i>rubra</i> (Creeping Red Fescue)	30	(20)
	<i>Festuca brevipila</i> (Hard Fescue)	30	(20)
	<i>Puccinellia distans</i> (Fults Saltgrass or Salty Alkaligrass)	60	(70)
3 Northern Illinois Slope Mixture 1/	<i>Elymus canadensis</i> (Canada Wild Rye) 5/	5	(5)
	Perennial Ryegrass	20	(20)
	Alsike Clover 4/	5	(5)
	<i>Desmanthus illinoensis</i> (Illinois Bundleflower) 4/ 5/	2	(2)
	<i>Schizachyrium scoparium</i> (Little Bluestem) 5/	12	(12)
	<i>Bouteloua curtipendula</i> (Side-Oats Grama) 5/	10	(10)
	<i>Puccinellia distans</i> (Fults Saltgrass or Salty Alkaligrass)	30	(35)
	Oats, Spring	50	(55)
	Slender Wheat Grass 5/	15	(15)
	Buffalo Grass 5/ 7/	5	(5)
3A Southern Illinois Slope Mixture 1/	Perennial Ryegrass	20	(20)
	<i>Elymus canadensis</i> (Canada Wild Rye) 5/	20	(20)
	<i>Panicum virgatum</i> (Switchgrass) 5/	10	(10)
	<i>Schizachyrium scoparium</i> (Little Blue Stem) 5/	12	(12)
	<i>Bouteloua curtipendula</i> (Side-Oats Grama) 5/	10	(10)
	<i>Dalea candida</i> (White Prairie Clover) 4/ 5/	5	(5)
	<i>Rudbeckia hirta</i> (Black-Eyed Susan) 5/	5	(5)
	Oats, Spring	50	(55)

Class – Type	Seeds	lb/acre (kg/hectare)
4 Native Grass 2/ 6/	<i>Andropogon gerardi</i> (Big Blue Stem) 5/	4 (4)
	<i>Schizachyrium scoparium</i> (Little Blue Stem) 5/	5 (5)
	<i>Bouteloua curtipendula</i> (Side-Oats Grama) 5/	5 (5)
	<i>Elymus canadensis</i> (Canada Wild Rye) 5/	1 (1)
	<i>Panicum virgatum</i> (Switch Grass) 5/	1 (1)
	<i>Sorghastrum nutans</i> (Indian Grass) 5/	2 (2)
	Annual Ryegrass	25 (25)
	Oats, Spring	25 (25)
	Perennial Ryegrass	15 (15)
4A Low Profile Native Grass 2/ 6/	<i>Schizachyrium scoparium</i> (Little Blue Stem) 5/	5 (5)
	<i>Bouteloua curtipendula</i> (Side-Oats Grama) 5/	5 (5)
	<i>Elymus canadensis</i> (Canada Wild Rye) 5/	1 (1)
	<i>Sporobolus heterolepis</i> (Prairie Dropseed) 5/	0.5 (0.5)
	Annual Ryegrass	25 (25)
	Oats, Spring	25 (25)
	Perennial Ryegrass	15 (15)
4B Wetland Grass and Sedge Mixture 2/ 6/	Annual Ryegrass	25 (25)
	Oats, Spring	25 (25)
	Wetland Grasses (species below) 5/	6 (6)
	<u>Species:</u>	<u>% By Weight</u>
	<i>Calamagrostis canadensis</i> (Blue Joint Grass)	12
	<i>Carex lacustris</i> (Lake-Bank Sedge)	6
	<i>Carex slipata</i> (Awl-Fruited Sedge)	6
	<i>Carex stricta</i> (Tussock Sedge)	6
	<i>Carex vulpinoidea</i> (Fox Sedge)	6
	<i>Eleocharis acicularis</i> (Needle Spike Rush)	3
	<i>Eleocharis obtusa</i> (Blunt Spike Rush)	3
	<i>Glyceria striata</i> (Fowl Manna Grass)	14
	<i>Juncus effusus</i> (Common Rush)	6
	<i>Juncus tenuis</i> (Slender Rush)	6
	<i>Juncus torreyi</i> (Torrey's Rush)	6
	<i>Leersia oryzoides</i> (Rice Cut Grass)	10
	<i>Scirpus acutus</i> (Hard-Stemmed Bulrush)	3
	<i>Scirpus atrovirens</i> (Dark Green Rush)	3
	<i>Bolboschoenus fluviatilis</i> (River Bulrush)	3
	<i>Schoenoplectus tabernaemontani</i> (Softstem Bulrush)	3
	<i>Spartina pectinata</i> (Cord Grass)	4

Class – Type	Seeds	lb/acre (kg/hectare)
5	Forb with Annuals Mixture (Below) Annuals Mixture 2/ 5/ 6/ Forb Mixture (Below) Annuals Mixture - Mixture not exceeding 25 % by weight of any one species, of the following: <i>Coreopsis lanceolata</i> (Sand Coreopsis) <i>Leucanthemum maximum</i> (Shasta Daisy) <i>Gaillardia pulchella</i> (Blanket Flower) <i>Ratibida columnifera</i> (Prairie Coneflower) <i>Rudbeckia hirta</i> (Black-Eyed Susan) Forb Mixture - Mixture not exceeding 5 % by weight PLS of any one species, of the following: <i>Amorpha canescens</i> (Lead Plant) 4/ <i>Anemone cylindrica</i> (Thimble Weed) <i>Asclepias tuberosa</i> (Butterfly Weed) <i>Aster azureus</i> (Sky Blue Aster) <i>Symphotrichum leave</i> (Smooth Aster) <i>Aster novae-angliae</i> (New England Aster) <i>Baptisia leucantha</i> (White Wild Indigo) 4/ <i>Coreopsis palmata</i> (Prairie Coreopsis) <i>Echinacea pallida</i> (Pale Purple Coneflower) <i>Eryngium yuccifolium</i> (Rattlesnake Master) <i>Helianthus mollis</i> (Downy Sunflower) <i>Heliopsis helianthoides</i> (Ox-Eye) <i>Liatris aspera</i> (Rough Blazing Star) <i>Liatris pycnostachya</i> (Prairie Blazing Star) <i>Monarda fistulosa</i> (Prairie Bergamot) <i>Parthenium integrifolium</i> (Wild Quinine) <i>Dalea candida</i> (White Prairie Clover) 4/ <i>Dalea purpurea</i> (Purple Prairie Clover) 4/ <i>Physostegia virginiana</i> (False Dragonhead) <i>Potentilla arguta</i> (Prairie Cinquefoil) <i>Ratibida pinnata</i> (Yellow Coneflower) <i>Rudbeckia subtomentosa</i> (Fragrant Coneflower) <i>Silphium laciniatum</i> (Compass Plant) <i>Silphium terebinthinaceum</i> (Prairie Dock) <i>Oligoneuron rigidum</i> (Rigid Goldenrod) <i>Tradescantia ohiensis</i> (Spiderwort) <i>Veronicastrum virginicum</i> (Culver's Root)	1 (1) 10 (10)

Class – Type	Seeds	lb/acre (kg/hectare)
5A Large Flower Native Forb Mixture 2/ 5/ 6/	Forb Mixture (see below)	5 (5)
<u>Species:</u> <i>Aster novae-angliae</i> (New England Aster) <i>Echinacea pallida</i> (Pale Purple Coneflower) <i>Helianthus mollis</i> (Downy Sunflower) <i>Heliopsis helianthoides</i> (Ox-Eye) <i>Liatris pycnostachya</i> (Prairie Blazing Star) <i>Ratibida pinnata</i> (Yellow Coneflower) <i>Rudbeckia hirta</i> (Black-Eyed Susan) <i>Silphium laciniatum</i> (Compass Plant) <i>Silphium terebinthinaceum</i> (Prairie Dock) <i>Oligoneuron rigidum</i> (Rigid Goldenrod)		<u>% By Weight</u> 5 10 10 10 10 5 10 10 20 10
5B Wetland Forb 2/ 5/ 6/	Forb Mixture (see below)	2 (2)
<u>Species:</u> <i>Acorus calamus</i> (Sweet Flag) <i>Angelica atropurpurea</i> (Angelica) <i>Asclepias incarnata</i> (Swamp Milkweed) <i>Aster puniceus</i> (Purple Stemmed Aster) <i>Bidens cernua</i> (Beggarticks) <i>Eutrochium maculatum</i> (Spotted Joe Pye Weed) <i>Eupatorium perfoliatum</i> (Boneset) <i>Helenium autumnale</i> (Autumn Sneeze Weed) <i>Iris virginica shrevei</i> (Blue Flag Iris) <i>Lobelia cardinalis</i> (Cardinal Flower) <i>Lobelia siphilitica</i> (Great Blue Lobelia) <i>Lythrum alatum</i> (Winged Loosestrife) <i>Physostegia virginiana</i> (False Dragonhead) <i>Persicaria pensylvanica</i> (Pennsylvania Smartweed) <i>Persicaria lapathifolia</i> (Curlytop Knotweed) <i>Pychanthemum virginianum</i> (Mountain Mint) <i>Rudbeckia laciniata</i> (Cut-leaf Coneflower) <i>Oligoneuron riddellii</i> (Riddell Goldenrod) <i>Sparganium eurycarpum</i> (Giant Burreed)		<u>% By Weight</u> 3 6 2 10 7 7 7 2 2 5 5 2 5 10 10 5 5 2 5
6 Conservation Mixture 2/ 6/	<i>Schizachyrium scoparium</i> (Little Blue Stem) 5/ <i>Elymus canadensis</i> (Canada Wild Rye) 5/ Buffalo Grass 5/ 7/ Vernal Alfalfa 4/ Oats, Spring	5 (5) 2 (2) 5 (5) 15 (15) 48 (55)
6A Salt Tolerant Conservation Mixture 2/ 6/	<i>Schizachyrium scoparium</i> (Little Blue Stem) 5/ <i>Elymus canadensis</i> (Canada Wild Rye) 5/ Buffalo Grass 5/ 7/ Vernal Alfalfa 4/ Oats, Spring <i>Puccinellia distans</i> (Fulfs Saltgrass or Salty Alkaligrass)	5 (5) 2 (2) 5 (5) 15 (15) 48 (55) 20 (20)
7 Temporary Turf Cover Mixture	Perennial Ryegrass Oats, Spring	50 (55) 64 (70)

Notes:

- 1/ Seeding shall be performed when the ambient temperature has been between 45 °F (7 °C) and 80 °F (27 °C) for a minimum of seven (7) consecutive days and is forecasted to be the same for the next five (5) days according to the National Weather Service.
- 2/ Seeding shall be performed in late fall through spring beginning when the ambient temperature has been below 45 °F (7 °C) for a minimum of seven (7) consecutive days and ending when the ambient temperature exceeds 80 °F (27 °C) according to the National Weather Service.
- 3/ Specific variety as shown in the plans or approved by the Engineer.
- 4/ Inoculation required.
- 5/ Pure Live Seed (PLS) shall be used.
- 6/ Fertilizer shall not be used.
- 7/ Seed shall be primed with KNO₃ to break dormancy and dyed to indicate such.

Seeding will be inspected after a period of establishment. The period of establishment shall be six (6) months minimum, but not to exceed nine (9) months. After the period of establishment, areas not exhibiting 75 percent uniform growth shall be interseeded or reseeded, as determined by the Engineer, at no additional cost to the Department.”

SHORT TERM AND TEMPORARY PAVEMENT MARKINGS (BDE)

Effective: April 1, 2024

Revised: April 2, 2024

Revise Article 701.02(d) of the Standard Specifications to read:

“(d) Pavement Marking Tapes (Note 3) 1095.06”

Add the following Note to the end of Article 701.02 of the Standard Specifications:

“Note 3. White or yellow pavement marking tape that is to remain in place longer than 14 days shall be Type IV tape.”

Revise Article 703.02(c) of the Standard Specifications to read:

“(c) Pavement Marking Tapes (Note 1) 1095.06”

Add the following Note to the end of Article 703.02 of the Standard Specifications:

“Note 1. White or yellow pavement marking tape that is to remain in place longer than 14 days shall be Type IV tape.”

Revise Article 1095.06 of the Standard Specifications to read:

“1095.06 Pavement Marking Tapes. Type I white or yellow marking tape shall consist of glass spheres embedded into a binder on a foil backing that is precoated with a pressure sensitive adhesive. The spheres shall be of uniform gradation and distributed evenly over the surface of the tape.

Type IV tape shall consist of white or yellow tape with wet reflective media incorporated to provide immediate and continuing retroreflection in wet and dry conditions. The wet retroreflective media shall be bonded to a durable polyurethane surface. The patterned surface shall have approximately 40 ± 10 percent of the surface area raised and presenting a near vertical face to traffic from any direction. The channels between the raised areas shall be substantially free of exposed reflective elements or particles.

Blackout marking tape shall consist of a matte black, non-reflective, patterned surface that is precoated with a pressure sensitive adhesive. The surface of the blackout pavement marking tape shall provide a minimum skid resistance value of 45 BPN when tested according to ASTM E 303.

- (a) Color. The material white and yellow markings shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degrees circumferential/zero degree geometry, illuminant D65, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

Color	Daylight Reflectance %Y
White	65 min.
Yellow *	36 - 59

*Shall match Aerospace Material Specification Standard 595 33538 (Orange Yellow) and the chromaticity limits as follows.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

- (b) Retroreflectivity. The white and yellow markings shall be retroreflective. Reflective values measured in accordance with the photometric testing procedure of ASTM D 4061 shall not be less than those listed in the table below. The coefficient of retroreflected luminance, R_L , shall be expressed as average millicandelas/footcandle/sq ft (millicandelas/lux/sq m), measured on a 3.0 x 0.5 ft (900 mm x 150 mm) panel at 86 degree entrance angle.

Coefficient of Retroreflected Luminance, R_L , Dry					
Type I			Type IV		
Observation Angle	White	Yellow	Observation Angle	White	Yellow
0.2°	2700	2400	0.2°	1300	1200
0.5°	2250	2000	0.5°	1100	1000

Wet retroreflectance shall be measured for Type IV under wet conditions according to ASTM E 2177 and meet the following.

Wet Retroreflectance, Initial R_L	
Color	R_L 1.05/88.76
White	300
Yellow	200

- (c) Skid Resistance. The surface of Type IV and blackout markings shall provide an average minimum skid resistance of 50 45 BPN when tested according to ASTM E 303.
- (d) Application. The pavement marking tape shall have a precoated pressure sensitive adhesive and shall require no activation procedures. Test pieces of the tape shall be applied according to the manufacturer's instructions and tested according to ASTM D 1000, Method A, except that a stiff, short bristle roller brush and heavy hand pressure will be substituted for the weighted rubber roller in applying the test pieces to the metal test panel. Material tested as directed above shall show a minimum adhesion value of 750 g/in. (30 g/mm) width at the temperatures specified in ASTM D 1000. The adhesive shall be resistant to oils, acids, solvents, and water, and shall not leave objectionable stains or residue after removal. The material shall be flexible and conformable to the texture of the pavement.
- (e) Durability. Type IV pavement marking and blackout tape shall be capable of performing for the duration of a normal construction season and shall then be capable of being removed intact or in large sections at pavement temperatures above 40 °F (4 °C) either manually or with a roll-up device without the use of sandblasting, solvents, or grinding. The Contractor shall provide the Engineer a manufacturer's certification, from the manufacturer of the tape, that the material to be furnished meets the requirements for being removed after the following minimum traffic exposure based on transverse test decks with rolling traffic.
- (1) Time in place - 400 days
 - (2) ADT per lane - 9,000 (28 percent trucks)
 - (3) Axle hits - 10,000,000 minimum

Samples of the material, applied to standard specimen plates will be measured for thickness, and tested for durability in accordance with Federal Test Method Standard No. 141A, Method 6192ASTM D 4060, using a CS-17 wheel and 1000-gram load, and shall meet the following criteria for minimum initial thickness and for durability, showing no significant change in color after being tested for the number of cycles indicated.

Test	Type I	Type IV	Blackout
Minimum Initial Thickness, mils (mm)	20 (0.51)	65 (1.65) ^{1/} 20 (0.51) ^{2/}	65 (1.65) ^{1/} 120 (0.5125) ^{2/}
Durability (cycles)	5,000	1,500	1,500

1/ Measured at the thickest point of the patterned surface.

2/ Measured at the thinnest point of the patterned surface.

The pavement marking tape, when applied according to the manufacturer's recommended procedures, shall be weather resistant and shall show no appreciable fading, lifting, or shrinkage during the useful life of the marking. The tape, as applied, shall be of good appearance, free of cracks, and edges shall be true, straight, and unbroken.

(f) Sampling and Inspection.

- (1) Sample. Prior to approval and use of Type IV pavement marking tape, the manufacturer shall submit a notarized certification from an independent laboratory, together with the results of all tests, stating that the material meets the requirements as set forth herein. The independent laboratory test report shall state the lot tested, the manufacturer's name, and the date of manufacture.

After initial approval by the Department, samples and certification by the manufacturer shall be submitted for each subsequent batch of Type IV tape used. The manufacturer shall submit a certification stating that the material meets the requirements as set forth herein and is essentially identical to the material sent for qualification. The certification shall state the lot tested, the manufacturer's name, and the date of manufacture.

- (2) Inspection. The Contractor shall provide a manufacturer's certification to the Engineer stating the material meets all requirements of this specification. All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and shall be submitted to the Engineer of Materials, 126 East Ash Street, Springfield, Illinois 62704-4766 at least 30 days in advance of the pavement marking operations."

SOURCE OF SUPPLY AND QUALITY REQUIREMENTS (BDE)

Effective: January 2, 2023

Revised: January 1, 2026

Add Revise the following to third through ninth paragraphs of Article 106.01 of the Standard Specifications to read:

“Articles, materials, and supplies shall be classified into only one of the following categories.

- (a) Iron and Steel. All iron and steel products, which are to be incorporated into the work, shall be domestically manufactured or produced and fabricated, unless an exception is expressly permitted under Federal and/or State law and written permission is given by the Department. The Contractor shall obtain from the iron or steel producer and/or fabricator, in addition to the mill analysis, a certification that all iron or steel materials meet these domestic source requirements.

The applications of all coatings, epoxy, galvanizing, painting, etc. to iron and steel products shall be domestically applied.

- (b) Manufactured Products. Manufactured products shall include articles, materials or supplies that have been processed into a specific form or shape; or have been combined with other articles, materials, or supplies to create a product with different properties than the individual articles, materials, or supplies. Manufactured products incorporated into the work shall have the final assembly for the manufacturing process occur domestically.

A manufactured product may include components that are construction materials, iron or steel products, or exempt materials.

Precast concrete products and intelligent transportation systems (ITS) or other electronic hardware systems shall comply with the requirements of Article 106.01(a) in addition to the requirements of manufactured products.

- (c) Construction Materials. The finalAll manufacturing processes for construction materials and the immediately preceding manufacturing stage for construction materials shall occur within the United States. Construction materials shall include an article, material, or supply that is or consists of only oneprimarily of the following.

- (1a) Non-ferrous metals;

- (2b) Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);

- (3c) Glass (including optic glass);

- (4) Fiber optic cable (including drop cable);

- (5) Optical fiber;
- (6d) Lumber;
- (7e) Drywall;
- (8) Engineered wood.

Minor additions of articles, materials, supplies, or binding agents to a construction material do not change the categorization of the construction material.

- (d) Exempt Materials. Materials exempt from domestic production requirements are cement or cementitious materials, aggregates, aggregate binding agents or additives, or items not permanently incorporated into the work. Exempt materials may be combined with other materials into a final form to produce a manufactured product. Items consisting of two or more of the listed construction materials that have been combined through a manufacturing process, and items including at least one of the listed materials combined with a material that is not listed through a manufacturing process shall be exempt.”

SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)

Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

“109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.
The Contractor shall report all payments made to the following parties:

- (a) first tier subcontractors;
- (b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;
- (c) material suppliers or trucking firms that are part of the Contractor’s submitted DBE utilization plan.

The report shall be made through the Department’s on-line subcontractor payment reporting system within 21 days of making the payment.”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: November 2, 2017

Revised: April 1, 2019

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

“This mobilization payment shall be made at least 14seven days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than \$10,000	25%
\$10,000 to less than \$20,000	20%
\$20,000 to less than \$40,000	18%
\$40,000 to less than \$60,000	16%
\$60,000 to less than \$80,000	14%
\$80,000 to less than \$100,000	12%
\$100,000 to less than \$250,000	10%
\$250,000 to less than \$500,000	9%
\$500,000 to \$750,000	8%
Over \$750,000	7%”

SUBMISSION OF BIDDERS LIST INFORMATION (BDE)

Effective: January 2, 2025

Revised: March 2, 2025

In accordance with 49 CFR 26.11(c) all bidders for federally assisted contracts shall submit bidders list information with their bid or initial response to a procurement solicitation. Submission of the bidders list information is a material bidding requirement, and failure to comply with this requirement may render the bid non-responsive.

The bidders list information shall be provided for all DBE and non-DBEs who bid as prime contractors and subcontractors shall provide bidders list information, each firm from whom the bidder receives any bid as a subcontractor. This requirement is not limited to DBE subcontractor bids but applies toincluding all DBE and non-DBE firms from whom the bidder has received a quote or bid to work as a subcontractor, whether or not the bidder has relied upon that bid in placing its bid as the prime contractor. The bidders list information shall contain the following.

- (a) Firm name;
- (b) Firm address including ZIP code;
- (c) Firm's status as a DBE or non-DBE;
- (d) Race and gender information for the firm's majority owner;
- (e) NAICS code applicable to each scope of work the firm sought to perform in its bid;
- (f) Age of the firm; and
- (g) The annual gross receipts of the firm (this may be provided by indicating whether the firm's annual gross receipts are less than \$1 million; \$1-3 million; \$3-6 million; \$6-10 million; etc.).

The bidders list information shall be submitted with the bid using the link provided within the "Integrated Contractor Exchange (iCX)" application of the Department's "EBids System".

SUBMISSION OF PAYROLL RECORDS (BDE)

Effective: April 1, 2021
2022November 2, 2023

Revised: November 1,

FEDERAL AID CONTRACTS. Revise the following section of Check Sheet #1 of the Recurring Special Provisions to read:

"STATEMENTS AND PAYROLLS

The payroll records shall include the worker's name, social security number, the worker's last known address, the worker's telephone number when available, email address, the worker's social security number, the worker's classification or classification(s) of work actually performed, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof), the worker's gross and net wages paid in each pay period, the worker's daily and weekly number of hours actually worked each day in total, deductions made, and actual wages paid the worker's starting and ending times of work each day. However, any Contractor or subcontractor who remits contributions to a fringe benefit fund that is not jointly maintained and jointly governed by one or more employers and one or more labor organization must additionally submit the worker's hourly wage rate, the worker's hourly overtime wage rate, the worker's hourly fringe benefit rates, the name and address of each fringe benefit fund, the plan sponsor of each fringe benefit, if applicable, and the plan administrator of each fringe benefit, if applicable.

The Contractor and each subcontractor shall certify and submit certified payroll records to the Department each week from the start to the completion of their respective work, except that full social security numbers, last known addresses, telephone numbers, and email addresses shall not be included on weekly submittals. Instead, the payrolls shall need only include an identification number for each employee (e.g., the last four digits of the employee's social security number). In addition, starting and ending times of work each day may be omitted from the payroll records submitted. The submittals shall be made using LCPtracker Pro software. The software is web-based and can be accessed at <https://lcptracker.com/>. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate option ("No Work", "Suspended", or "Complete") selected."

STATE CONTRACTS. Revise Item 3 of Section IV of Check Sheet #5 of the Recurring Special Provisions to read:

- "3. Submission of Payroll Records. The Contractor and each subcontractor shall, no later than the 15th day of each calendar month, file a certified payroll for the immediately preceding month to the Illinois Department of Labor (IDOL) through the Illinois Prevailing Wage Portal in compliance with the State Prevailing Wage Act (820 ILCS 130). The portal can be found on the IDOL website at <https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx>. Payrolls shall be submitted in the format prescribed by the IDOL.

In addition to filing certified payroll(s) with the IDOL, the Contractor and each subcontractor shall certify and submit payroll records to the Department each week from the start to the completion of their respective work, except that full social security numbers shall not be included on weekly submittals. Instead, the payrolls shall include an identification number for each employee (e.g., the last four digits of the employee's social security number). In addition, starting and ending times of work each day may be omitted from the payroll records submitted. The submittals shall be made using LCPtracker Pro software. The software is web-based and can be accessed at <https://lcptracker.com/>. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate option ("No Work", "Suspended", or "Complete") selected."

SURVEYING SERVICES (BDE)

Effective: April 1, 2025

Delete the fourth paragraph of Article 667.04 of the Standard Specifications.

Delete Section 668 of the Standard Specifications.

TRAINING SPECIAL PROVISIONS (BDE)

Effective: October 15, 1975

Revised: June 2, 2021 September 2, 2021

This Training Special Provision supersedes Section 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities," and is in implementation of 23 U.S.C. 140(a).

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under this contract will be 5. In the event the Contractor subcontracts a portion of the contract work, it shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also ensure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within the reasonable area of recruitment. Prior to commencing construction, the Contractor shall submit to the Illinois Department of Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee it employs on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority trainees and women (e.g. by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps it has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he or she has successfully completed a training course leading to journeyman status or in which he or she has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Illinois Department of Transportation and the Federal Highway Administration. The Illinois Department of Transportation and the Federal Highway Administration shall approve a program, if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved by not necessarily sponsored by the U.S. Department of Labor Employment Training Administration shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Illinois Department of Transportation and the Federal Highway Administration. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirement of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program.

It is not required that all trainees be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program he will follow in providing the training. The Contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The Contractor shall provide for the maintenance of records and furnish periodic reports documenting its performance under this Training Special Provision.

For contracts with an estimated total project cost awarded contract value of \$500,000 or more, the Contractor is required to comply with the Illinois Works Apprenticeship Initiative (30 ILCS 559/20-20 to 20-25) and all applicable administrative rules to the extent permitted by Section 20-20(g). For federally funded projects, the number of trainees to be trained under this contract, as stated in the Training Special Provisions, will be the established goal for the Illinois Works Apprenticeship Initiative 30 ILCS 559/20-20(g). The Contractor shall make a good faith effort to meet this goal. For federally funded projects, the Illinois Works Apprenticeship Initiative will be implemented using the FHWA approved OJT procedures. The Contractor must comply with the recordkeeping and reporting obligations of the Illinois Works Apprenticeship Initiative for the life of the project, including the certification as to whether the trainee/apprentice labor hour goals were met.

Method of Measurement. The unit of measurement is in hours.

Basis of Payment. This work will be paid for at the contract unit price of 80 cents per hour for TRAINEES. The estimated total number of hours, unit price, and total price have been included in the schedule of prices.

IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION

Effective: August 1, 2012

Revised: February 2, 2017

In addition to the Contractor's equal employment opportunity (EEO) affirmative action efforts undertaken as required by this Contract, the Contractor is encouraged to participate in the incentive program described below to provide additional on-the-job training to certified graduates of the IDOT pre-apprenticeship training program, as outlined in this Special Provision.

IDOT funds, and various Illinois community colleges operate, pre-apprenticeship training programs throughout the State to provide training and skill-improvement opportunities to promote the increased employment of minority groups, disadvantaged persons and women in all aspects of the highway construction industry. The intent of this IDOT Pre-Apprenticeship Training Program Graduate (TPG) special provision (Special Provision) is to place these certified program graduates on the project site for this Contract in order to provide the graduates with meaningful on-the-job training. Pursuant to this Special Provision, the Contractor must make every reasonable effort to recruit and employ certified TPG trainees to the extent such individuals are available within a practicable distance of the project site.

Specifically, participation of the Contractor or its subcontractor in the Program entitles the participant to reimbursement for graduates' hourly wages at \$15.00 per hour per utilized TPG trainee, subject to the terms of this Special Provision. Reimbursement payment will be made even though the Contractor or subcontractor may also receive additional training program funds from other non-IDOT sources for other non-TPG trainees on the Contract, provided such other source does not specifically prohibit the Contractor or subcontractor from receiving reimbursement from another entity through another program, such as IDOT through the TPG program. With regard to any IDOT funded construction training program other than TPG, however, additional reimbursement for other IDOT programs will not be made beyond the TPG Program described in this Special Provision when the TPG Program is utilized.

No payment will be made to the Contractor if the Contractor or subcontractor fails to provide the required on-site training to TPG trainees, as solely determined by IDOT. A TPG trainee must begin training on the project as soon as the start of work that utilizes the relevant trade skill and the TPG trainee must remain on the project site through completion of the Contract, so long as training opportunities continue to exist in the relevant work classification. Should a TPG trainee's employment end in advance of the completion of the Contract, the Contractor must promptly notify the IDOT District EEO Officer for the Contract that the TPG's involvement in the Contract has ended. The Contractor must supply a written report for the reason the TPG trainee involvement terminated, the hours completed by the TPG trainee on the Contract, and the number of hours for which the incentive payment provided under this Special Provision will be, or has been claimed for the separated TPG trainee.

Finally, the Contractor must maintain all records it creates as a result of participation in the Program on the Contract, and furnish periodic written reports to the IDOT District EEO Officer that document its contractual performance under and compliance with this Special Provision. Finally, through participation in the Program and reimbursement of wages, the Contractor is not relieved of, and IDOT has not waived, the requirements of any federal or state labor or employment law applicable to TPG workers, including compliance with the Illinois Prevailing Wage Act.

Method of Measurement: The unit of measurement is in hours.

Basis of Payment: This work will be paid for at the contract unit price of \$15.00 per hour for each utilized certified TPG Program trainee (TRAINEES TRAINING PROGRAM GRADUATE). The estimated total number of hours, unit price, and total price must be included in the schedule of prices for the Contract submitted by Contractor prior to beginning work. The initial number of TPG trainees for which the incentive is available for this contract is 5.

The Department has contracted with several educational institutions to provide screening, tutoring and pre-training to individuals interested in working as a TPG trainee in various areas of common construction trade work. Only individuals who have successfully completed a Pre-Apprenticeship Training Program at these IDOT approved institutions are eligible to be TPG trainees. To obtain a list of institutions that can connect the Contractor with eligible TPG trainees, the Contractor may contact: HCCTP TPG Program Coordinator, Office of Business and Workforce Diversity (IDOT OBWD), Room 319, Illinois Department of Transportation, 2300 S. Dirksen Parkway, Springfield, Illinois 62764. Prior to commencing construction with the utilization of a TPG trainee, the Contractor must submit documentation to the IDOT District EEO Officer for the Contract that provides the names and contact information of the TPG trainee(s) to be trained in each selected work classification, proof that the TPG trainee(s) has successfully completed a Pre-Apprenticeship Training Program, proof that the TPG is in an Apprenticeship Training Program approved by the U.S. Department of Labor Bureau of Apprenticeship Training, and the start date for training in each of the applicable work classifications.

To receive payment, the Contractor must provide training opportunities aimed at developing a full journeyworker in the type of trade or job classification involved. During the course of performance of the Contract, the Contractor may seek approval from the IDOT District EEO Officer to employ additional eligible TPG trainees. In the event the Contractor subcontracts a portion of the contracted work, it must determine how many, if any, of the TPGs will be trained by the subcontractor. Though a subcontractor may conduct training, the Contractor retains the responsibility for meeting all requirements imposed by this Special Provision. The Contractor must also include this Special Provision in any subcontract where payment for contracted work performed by a TPG trainee will be passed on to a subcontractor.

Training through the Program is intended to move TPGs toward journeyman status, which is the primary objective of this Special Provision. Accordingly, the Contractor must make every effort to enroll TPG trainees by recruitment through the Program participant educational institutions to the extent eligible TPGs are available within a reasonable geographic area of the project. The Contractor is responsible for demonstrating, through documentation, the recruitment efforts it has undertaken prior to the determination by IDOT whether the Contractor is in compliance with this Special Provision, and therefore, entitled to the Training Program Graduate reimbursement of \$15.00 per hour.

Notwithstanding the on-the-job training requirement of this TPG Special Provision, some minimal off-site training is permissible as long as the offsite training is an integral part of the work of the contract, and does not compromise or conflict with the required on-site training that is central to the purpose of the Program. No individual may be employed as a TPG trainee in any work classification in which he/she has previously successfully completed a training program leading to journeyman status in any trade, or in which he/she has worked at a journeyman level or higher.

VEHICLE AND EQUIPMENT WARNING LIGHTS (BDE)

Effective: November 1, 2021

Revised: November 1, 2022

Add the following paragraph after the first paragraph of Article 701.08 of the Standard Specifications:

“The Contractor shall equip all vehicles and equipment with high-intensity oscillating, rotating, or flashing, amber or amber-and-white, warning lights which are visible from all directions. In accordance with 625 ILCS 5/12-215, The lights shall only be in operation while the vehicle or equipment is engaged in construction operations.”

WORK ZONE TRAFFIC CONTROL DEVICES (BDE)

Effective: March 2, 2020
2025 January 1, 2026

Revised: January 1,

Add the following to Article 701.03 of the Standard Specifications:

“(q) Temporary Sign Supports 1106.02”

Revise Article 701.03(p) of the Standard Specifications to read:

“(p) Detectable Pedestrian Channelizing Barricades 1106.02(m)”

Revise the third paragraph of Article 701.14 of the Standard Specifications to read:

“For temporary sign supports, the Contractor shall provide a FHWA eligibility letter for each device used on the contract. The letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device. The signs shall be supported within 20 degrees of vertical. Weights used to stabilize signs shall be attached to the sign support per the manufacturer’s specifications.”

Revise the first paragraph of Article 701.15 of the Standard Specifications to read:

“ **701.15 Traffic Control Devices.** For devices that must meet crashworthiness standards, the Contractor shall provide a manufacturer’s self-certification or a FHWA eligibility letter for each Category 1 device and a FHWA eligibility letter for each Category 2 and Category 3 device used on the contract. The self-certification or letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device.”

Revise the first six paragraphs of Article 1106.02 of the Standard Specifications to read:

“ **1106.02 Devices.** Work zone traffic control devices and combinations of devices shall meet crashworthiness standards for their respective categories. The categories are as follows.

Category 1 includes small, lightweight, channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These include cones, tubular markers, plastic drums, and delineators, with no attachments (e.g. lights). Category 1 devices shall be MASH compliant.

Category 2 includes devices that are not expected to produce significant vehicular velocity change but may otherwise be hazardous. These include vertical panels with lights, barricades, temporary sign supports, and Category 1 devices with attachments (e.g. drums with lights). Category 2 devices shall be MASH compliant.

Category 3 includes devices that are expected to cause significant velocity changes or other potentially harmful reactions to impacting vehicles. These include crash cushions (impact attenuators), truck mounted attenuators, and other devices not meeting the definitions of Category 1 or 2. Category 3 devices manufactured after December 31, 2019 shall be MASH compliant. Category 3 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350, may be used on contracts let before December 31, 2029. Category 3 devices shall be crash tested for Test Level 3 or the test level specified.

Category 4 includes portable or trailer-mounted devices such as sign supports, speed feedback displays, arrow boards, changeable message signs, temporary traffic signals, and area lighting supports. It is preferable for Category 4 devices manufactured after December 31, 2019 to be MASH-16 compliant; however, there are currently no crash tested devices in this category, so it remains exempt from the NCHRP 350 or MASH compliance requirement.

For each type of device, when no more than one MASH compliant is available, an NCHRP 350 compliant device may be used, even if manufactured after December 31, 2019.”

Revise the first paragraph of Section 1106.02(a) of the Standard Specifications to read:

“(a) Lights. Lights shall meet the requirements of Chapter 13 of the “Equipment and Materials Standards of the Institute of Transportation Engineers,” 1998, Institute of Transportation Engineers, and shall be visible on a clear night from a distance of 3000 ft (900 m). Lights are classified as follows.”

Revise Articles 1106.02(g), 1106.02(k), and 1106.02(l), and 1106.02(m) of the Standard Specifications to read:

“(g) Truck Mounted/Trailer Mounted Attenuators. The attenuator shall be approved for use at Test Level 3. Test Level 2 may be used for normal posted speeds less than or equal to 45 mph.

(k) Temporary Water Filled Barrier. The water filled barrier shall be a lightweight plastic shell designed to accept water ballast and be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings.

(l) Movable Traffic Barrier. The movable traffic barrier shall be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings. The barrier shall be capable of being moved on and off the roadway on a daily basis.

(m) Detectable Pedestrian Channelizing Barricades. The top panel or handrail shall be continuous and there should be at least a 2 in. (50 mm) gap between the hand trailing edge and its support. When visible to vehicular traffic, the top rail shall have alternating white and orange retroreflective stripes sloping at 45 degrees. The bottom panel shall be continuous and have alternating white and orange retroreflective stripes sloping at 45 degrees. Barricade stripes shall be 6 in. (150 mm) in width. The predominant color for other barricade components shall be white, orange, or silver.”

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Non-segregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
- XI. Certification Regarding Use of Contract Funds for Lobbying
- XII. Use of United States-Flag Vessels:

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work

performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (see 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide

sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants /

Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials

and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (1) Withholding monthly progress payments;
- (2) Assessing sanctions;
- (3) Liquidated damages; and/or
- (4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than \$10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway

Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA- 1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act ([29 CFR part 3](#))), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act ([40 U.S.C. 3141\(2\)\(B\)](#)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in [29 CFR part 1](#), a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division

under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

- (1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;
- (2) A contracting agency for its procurement costs;
- (3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;
- (4) A contractor's assignee(s);
- (5) A contractor's successor(s); or
- (6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901](#)–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting

agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (e.g., the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at <https://www.dol.gov/sites/dolgov/files/WHHD/legacy/files/wh347.pdf> or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in [29 CFR part 3](#); and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH-347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature*. The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification*. The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under [18 U.S.C. 1001](#) and [31 U.S.C. 3729](#).

(7) *Length of certified payroll retention*. The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents*. The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access (1) Required record disclosures and access to workers*. The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements*. If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under [29 CFR part 6](#) any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures*. Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address

of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices (1) Rate of pay*. Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits*. Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio*. The allowable ratio of apprentices to journeymen on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates*. Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity*. The use of apprentices and journeymen under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and [29 CFR part 30](#).

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, [18 U.S.C. 1001](#).

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#);

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#);

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#); or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#).

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* \$31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

- (1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;
- (2) A contracting agency for its procurement costs;
- (3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;
- (4) A contractor's assignee(s);
- (5) A contractor's successor(s); or
- (6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901](#)–3907.

4. **Subcontracts.** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the

event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. **Anti-retaliation.** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

- (1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
- (2) the prime contractor remains responsible for the quality of the work of the leased employees;

- (3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
- (4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and

health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of \$150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov>). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which

this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov>), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily

excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or

cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS
PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY
SYSTEM OR APPALACHIAN LOCAL ACCESS**

ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B)

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.