Iowa Department of Transportation

**MINUTES**
**OF**
**IOWA DOT SPECIFICATION COMMITTEE MEETING**

**March 12, 2015**

| | | |
|---|---|---|
| **Members Present:** | Darwin Bishop | District 3 - Construction |
| | Donna Buchwald | Office of Local Systems |
| | Eric Johnsen, Secretary | Specifications Section |
| | Greg Mulder | Office of Construction & Materials |
| | Gary Novey | Office of Bridges & Structures |
| | Dan Redmond | District 4 - Materials |
| | Tom Reis, Chair | Specifications Section |
| | Willy Sorensen | Office of Traffic & Safety |
| **Members Not Present:** | Mark Brandl | District 6 - Davenport RCE |
| | Mitch Dillavou | Project Delivery Bureau |
| | Wes Musgrove | Office of Contracts |
| | Brian Smith | Office of Design |
| **Advisory Members Present:** | Lisa McDaniel | FHWA |
| **Others Present:** | Daniel Harness | Office of Design |
| | Ed Kasper | Office of Contracts |

Tom Reis, Specifications Engineer, opened the meeting. The following items were discussed in accordance with the agenda dated March 2, 2015:

**1. Article 2416.03, A, Construction (Rigid Pipe Culverts).**
**Article 2417.03, A, 1, Construction (Corrugated Culverts).**

The Specification Section requested to allow 15 inch entrance pipe culverts on non-Interstate and non-Primary projects.

**2. Article 4115.01, Description (Coarse Aggregate for Portland Cement Concrete).**

The Office of Construction and Materials requested to clarify that coarse aggregate for PCC is a washed product.

**3. Article 4127, Aggregate for Hot Mix Asphalt.**

The Office of Construction and Materials requested to clarify the requirements of fine aggregate for hot mix asphalt.

**4. Article 4136.03, Expansion Joint Fillers and Seals.**

The Office of Bridges and Structures requested to add specifications for new expansion joint material.

**5. Article 4187.01, C, 3, a, 2, Fasteners for Aluminum Alloy and Galvanized Steel Superstructures and Anchor Bolts.**

The Office of Bridges and Structures requested to correct an error in the specifications.

**6. DS-12012, Traffic Signalization (SUDAS).**

The Specifications Section requested approval of a new Developmental Specifications for Traffic Signalization (SUDAS).

**7. DS-12040, Doc Express (Electronic Document Storage).**

The Office of Construction and Materials requested revisions to the Developmental Specifications for Doc Express (Electronic Document Storage).

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Tom Reis / Eric Johnsen | **Office:** Specifications | **Item 1** |
| **Submittal Date:** 2015.02.23 | **Proposed Effective Date:** October 2015 | |
| **Article No.:** 2416.03, A<br>**Title:** Construction (Rigid Pipe Culverts)<br>**Article No.:** 2417.03, A, 1<br>**Title:** Construction (Corrugated Culverts) | **Other:** | |

**Specification Committee Action:** Approved as recommended.

| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 10/20/2015 |
|---|---|---|---|

**Specification Committee Approved Text:** See Specification Section Recommended Text.

**Comments:** The Office of Design has some concerns that designers may use the 15 inch bid items on interstate and primary projects. The Design Manual will address this issue. The Design Manual will recommend 24 inch culverts with 18 inch as the minimum.

The Office of Traffic and Safety asked if the table is even necessary, as it is something that the designer will use. The committee decided that the tables should stay as they will give the inspector information they can use to make sure the minimums are followed during construction.

**Specification Section Recommended Text:**

**2416.03, A.**

**Replace** Table 2416.03-1:

**Table 2416.03-1: Minimum and Maximum Allowable Pipe Sizes**

| Culvert Use | Minimum Pipe Size in. (mm) | Maximum Pipe Size in. (mm) |
|---|---|---|
| Roadway Culvert | 18 (450) | 108 (2700) |
| Entrance Culvert | 18 (450) * | 108 (2700) |

* 15 inch (375 mm) entrance pipes allowed on non-interstate and non-primary roadways.

**2417.03, A, 1.**

**Replace** Table 2417.03-1:

**Table 2417.03-1: Minimum Allowable Pipe Sizes**

| Culvert Use | Minimum Pipe Size in. (mm) |
|---|---|
| Roadway Culvert | 18 (450) |
| Entrance Culvert | 18 (450) * |

* 15 inch (375 mm) entrance pipes allowed on non-interstate and non-primary roadways.

**Comments:**

**Member's Requested Change:** **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

**Reason for Revision:** 15 inch entrance pipe sizes were eliminated in April 2013 as a result of a specification revision to comply with:

1) Iowa Administrative Code 761-Chapter 112.6(3)a.
2) Design Manual 4B-1 Determining Entrance and Safety Ramp Pipe Culverts Lengths
3) Guidelines for Preliminary Design of Culverts, April 2000, page 2, Size.

The Iowa Administrative Code section referenced does not apply to city and county roadways. Cities and counties have requested to use the 15 inch bid items that were previously obsoleted. This revision

| | | |
|---|---|---|
| clarifies that the 15 inch entrance pipes will only be allowed on non-primary and non-interstate roadways. | | |
| **New Bid Item Required (X one)** | **Yes X** | **No** |
| **Bid Item Modification Required (X one)** | **Yes** | **No** X |
| **Bid Item Obsoletion Required (X one)** | **Yes** | **No** X |
| **Comments:** 15 inch entrance culvert pipes will be reinstated. | | |
| **County or City Comments:** | | |
| **Industry Comments:** | | |

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Greg Mulder | **Office**: Construction and Materials | **Item 2** |
| **Submittal Date:** 2015.01.08 | **Proposed Effective Date:** October 2015 | |
| **Article No.:** 4115.01<br>**Title:** Description (Coarse Aggregate for Portland Cement Concrete) | **Other:** | |

**Specification Committee Action:** Approved as recommended.

| | | | |
|---|---|---|---|
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 10/20/2015 |

**Specification Committee Approved Text:** See Specification Section Recommended Text.

**Comments:** None.

**Specification Section Recommended Text:**

**4115.01, Description.**

**Add** the sentence to the end of the first paragraph:

Unless stated otherwise on the source approval, coarse aggregate for Portland Cement Concrete shall be washed with sufficient agitation to cause material coatings to be separated and removed.

**Comments:**

Action: Add new language.

**Section 4115. Coarse Aggregate for Portland Cement Concrete**

- **4115.01 DESCRIPTION.**

Gravel or crushed stone particles meeting one of the aggregate durability classes listed below. Acquire aggregates from an approved source meeting the requirements of Materials I.M. 409. Unless stated otherwise on the source approval, coarse aggregate for Portland cement concrete must be washed with sufficient agitation to cause material coatings to be separated and removed from the coarse aggregate.

**Reason for Revision:** It has always been implied aggregate for PCC was to be a washed product. We feel the language needs to be in the specifications and not simply in the source approvals.

| | | | | | |
|---|---|---|---|---|---|
| **County or City Input Needed (X one)** | | | **Yes** | **No** X | |
| **Comments:** | | | | | |
| **Industry Input Needed (X one)** | | | **Yes** X | **No** | |
| **Industry Notified:** | **Yes** X | **No** | **Industry Concurrence:** | **Yes** X | **No** |
| **Comments:** | | | | | |

| | | |
|---|---|---|
| **Submitted by:** Greg Mulder | **Office:** Construction and Materials | **Item 3** |
| **Submittal Date:** 2015.02.19 | **Proposed Effective Date:** October 2015 | |
| **Section No.:** 4127<br>**Title:** Aggregate for Hot Mix Asphalt | **Other:** | |

**Specification Committee Action:** Approved as recommended.

| | | | |
|---|---|---|---|
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 10/20/2015 |

**Specification Committee Approved Text:** See Specification Section Recommended Text.

**Comments:** None.

**Specification Section Recommended Text:**

**4127.01, Description.**

**Replace** the Article:

~~**A.**~~ Crushed stone, gravel, slag, sand, and filler from an approved source. Crushed gravel may be used to satisfy crushed particle and friction requirements for HMA mixtures. Produce crushed gravel as a separate operation by crushing the portion of a gravel aggregate retained on a screen at least 1/4 inch (6 mm) larger than the sieve size that 100% of the gravel will pass after crushing.

~~**B.** If a gravel aggregate has 100% passing the 3/8 inch (9.5 mm) sieve, the Engineer may replace the requirements of Table 4127.02-1 with the requirements of Article 4127.03~~.

**4127.03, A.**

**Replace** the second sentence:

A gradation for wearing course mixture of no more than 50% retained between two consecutive standard sieves below the No. 4 (4.75 mm) sieve or gravel aggregate with 100% passing the 3/8 inch (9.5 mm) sieve meeting these requirements.

**Comments:**

Action: Remove 4127.01 B and replace with 4107.03 C

**4127.01 DESCRIPTION.**

~~**B.** If a gravel aggregate has less than 5% retained on the No. 4 sieve (6 mm) 100% passing the 3/8 inch (9.5 mm) sieve, the Engineer may replace the requirements of Table 4127.02-1 with the requirements of Article 4127.03~~.

**4127.03 FINE AGGREGATE.**

**A.** Natural sand containing no more than 0.01% organic matter when tested using Iowa Test Method 215. A gradation for wearing course mixture of no more than 50% retained between two consecutive standard sieves below the No. 4 (4.75 mm) or gravel aggregate with 100% passing the 3/8 inch (9.5mm) sieve meeting these requirements.

**Reason for Revision:** The original intent was to allow a coarse sand without having to test the No. 4 x3/8 as a coarse aggregate. “the Engineer” phrase has the potential to cause confusion with the Producers when aggregate crosses Districts. The change to 4127.03 better reflects the intent to treat the material as fine aggregate.

| | | | | | |
|---|---|---|---|---|---|
| **County or City Input Needed (X one)** | | | **Yes** | **No** X | |
| **Comments:** | | | | | |
| **Industry Input Needed (X one)** | | | **Yes** X | **No** | |
| **Industry Notified:** | **Yes** X | **No** | **Industry Concurrence:** | **Yes** X | **No** |
| **Comments:** Fine aggregate may have up to 10% retained on the #4 sieve. This wording change is to clarify what is to be tested and a coarse and fine aggregate. | | | | | |

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Gary Novey | **Office:** Bridges and Structures | **Item 4** |
| **Submittal Date:** February 5, 2015 | **Proposed Effective Date:** October 2015 | |
| **Article No.:** 4136.03<br>**Title:** Expansion Joint fillers and seals | **Other:** | |

**Specification Committee Action:** Approved as recommended.

| | | | |
|---|---|---|---|
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 10/20/2015 |

**Specification Committee Approved Text:** See Specification Section Recommended Text.

**Comments:** The District 4 Office asked what is the criteria for becoming an approved source. The Materials I.M. gives the procedure, but the criteria for testing should be in the specifications. The Office of Bridges and Structures will review with the Office of Construction and Materials to see if more materials specifications are required and submit if necessary.

**Specification Section Recommended Text:**

**4136.03, Expansion Joint Fillers and Seals.**

**Add** the Article:

**E. Preformed, Pre-Compressed, Self-Expanding, Sealant System with Silicone Pre-Coated Surface**.

**1.** Furnish an expansion joint system comprised of the following three components:
- **a.** Cellular polyurethane foam impregnated with a hydrophobic polymer and factory coated with highway-grade, low modulus, fuel resistant silicone.
- **b.** Field-applied epoxy adhesive.
- **c.** Field-applied silicone sealant edging.

**2.** Use an impregnation agent having proven non-migratory characteristics. The highway grade, low modulus, fuel resistant silicone facing shall be factory applied to the impregnated foam when the foam is at a width greater than the maximum working joint opening and once cured and compressed will form a bellows. The self-expanding foam sealant system shall have a depth as recommended by the manufacturer.

**3.** Furnish material capable of movements of +/-50% (100% total) of nominal material size.

**4.** Approved sources of sealant systems are listed in Materials I.M. 436.07, Appendix A.

**Comments:**

**Member's Requested Change:** **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

**Add new paragraph to Article 4136.03**

**E. Preformed, Pre-Compressed, Self-Expanding, Sealant System with Silicone Pre-Coated Surface**.

Furnish an expansion joint system comprised of the following three components:
(a) Cellular polyurethane foam impregnated with a hydrophobic polymer and factory coated with highway-grade, low modulus, fuel resistant silicone.
(b) Field–applied epoxy adhesive.

(c) Field-applied silicone sealant edging.

Use an impregnation agent having proven non-migratory characteristics. The highway grade, low modulus, fuel resistant silicone facing shall be factory applied to the impregnated foam when the foam is at a width greater than the maximum working joint opening and once cured and compressed will form a bellows. The self-expanding foam sealant system shall have a depth as recommended by the manufacturer.

Furnish material capable of movements of +50 percent, -50 percent (100 percent total) of nominal material size.

Approved sources of sealant systems are listed in Materials IM. 436.07, Appendix A.

**Reason for Revision:** Provide specifications for a new type of expansion joint material which has performed well for Iowa.

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|---|---|---|
| **New Bid Item Required (X one)** | **Yes X** | **No** |
| **Bid Item Modification Required (X one)** | **Yes** | **No** X |
| **Bid Item Obsoletion Required (X one)** | **Yes** | **No** X |
| **Comments:** | | |
| **County or City Comments:** | | |
| **Industry Comments:** | | |

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Gary Novey | **Office:** Bridges & Structures | **Item 5** |
| **Submittal Date:** February 5, 2015 | **Proposed Effective Date:** October 2015 | |
| **Article No.:** 4187.01, C, 3, a, 2<br>**Title:** Fasteners for Aluminum Alloy and Galvanized Steel Superstructures and Anchor Bolts | **Other:** | |

**Specification Committee Action:** Approved with changes.

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|---|---|---|---|
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 10/20/2015 |

**Specification Committee Approved Text:**
**4187.01, C, 3, a, 2.**

**Replace** the Article:
Comply with either ASTM F 1554, ~~Grade 36,~~ Grade 55, S1; or Grade 105, S5 ~~as specified~~.

**Comments:** The Office of Bridges and Structures requested that "as specified" be deleted, as the contractor has the option of the two remaining grades.

**Specification Section Recommended Text:**
**4187.01, C, 3, a, 2.**

**Replace** the Article:
Comply with ASTM F 1554, ~~Grade 36,~~ Grade 55, S1 or Grade 105, S5 as specified.

**Comments:**

**Member's Requested Change:** **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

**3. Anchor Bolts, Nuts, and Washers.**
Meet the following requirements:

**a. Anchor Bolts.**

**1)** Use full-length galvanized bolts.
**2)** Comply with ASTM F 1554, ~~Grade 36~~, Grade 55, S1 or Grade 105, S5 as specified.
**3)** Threads are to comply with ANSI/ASME B1.1 for UNC thread series, Class 2A tolerance.
**4)** The end of each anchor bolt intended to project from the concrete is to be color coded to identify the grade.
**5)** Do not bend or weld anchor bolts.

**Reason for Revision:** With the rewrite of IM 453.08 some of the language for anchor bolts was moved into the Specifications. The Grade 36 was mistakenly added to this Article which specifically refers to anchor bolts for sign support structures. Sign support structures are designed for Grade 55 or 105 material. The Grade 36 anchor bolts are used for bridge bearings which are referenced in Article 2405.03H.

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| **New Bid Item Required (X one)** | **Yes** | **No** X |
| **Bid Item Modification Required (X one)** | **Yes** | **No** X |
| **Bid Item Obsoletion Required (X one)** | **Yes** | **No** X |

**Comments:**

**County or City Comments:**

**Industry Comments:**

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Tom Reis / Eric Johnsen | **Office:** Specifications Section | **Item 6** |
| **Submittal Date:** 2015.02.23 | **Proposed Effective Date:** May 2015 | |
| **Article No.:**<br>**Title:** | **Other:** DS-12013, Traffic Signalization (SUDAS) | |

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|---|---|---|---|
| **Specification Committee Action:** Approved as recommended. | | | |
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 5/19/2015 |
| **Specification Committee Approved Text:** See attached Developmental Specifications for Traffic Signalization (SUDAS). | | | |
| **Comments:** The Office of Bridges and Structures asked if a required grade of anchor bolt was necessary. SUDAS was informed of this question and will take appropriate action as deemed necessary. | | | |
| **Specification Section Recommended Text:** See attached Draft Developmental Specifications for Traffic Signalization (SUDAS). | | | |
| **Comments:** Changes from previous version are not shown as the SUDAS Standard Specifications have been significantly changed since DS-12013 was originally released as DS-01045 in July 2004. | | | |

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|---|---|---|
| **Member's Requested Change:** **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)** | | |
| **Reason for Revision:** To update to current 2015 edition for project in the May letting. | | |
| **New Bid Item Required (X one)** | **Yes** | **No** X |
| **Bid Item Modification Required (X one)** | **Yes** | **No** X |
| **Bid Item Obsoletion Required (X one)** | **Yes** | **No** X |
| **Comments:** | | |
| **County or City Comments:** | | |
| **Industry Comments:** | | |

**DS-12XXX**
**Replaces DS-12013)**

Iowa Department of Transportation

**DEVELOPMENTAL SPECIFICATIONS**
**FOR**
**TRAFFIC SIGNALS (SUDAS)**

**Effective Date**
**May 19, 2015**

**THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

## TABLE OF CONTENTS



The applicable sections of the SUDAS Standard Specifications, 2015 Edition, have been included and modified in this specification.

## DIVISION 1 - GENERAL PROVISIONS AND COVENANTS

### I. SECTION 1050 - CONTROL OF WORK

**1.01 - 1.04 INTENTIONALLY LEFT BLANK**

**1.05 SHOP DRAWINGS, CERTIFICATES, AND EQUIPMENT LISTS**

**A.** Intentionally left blank.

**B. Submission of Equipment Lists:**

**1.** Intentionally left blank.

**2.** Contractor shall submit applicable brochures, technical data, catalogs, cuts, diagrams, manufacturer's drawings and installation instructions, samples if required, and other descriptive data including the complete description, trade name, model number, type, size, and rating.

**C.** Intentionally left blank.

**1.06 - 1.14 INTENTIONALLY LEFT BLANK**

## DIVISION 8 - TRAFFIC SIGNALS

### II. SECTION 8010 - TRAFFIC SIGNALS

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

**A.** Underground

**B.** Detection

**C.** Communications

**D.** Cabinet and Controller

**E.** Poles, Heads, and Signs

**1.02 DESCRIPTION OF WORK**

This part of the specification includes furnishing of material and equipment necessary to complete, in place and operational, traffic control signal(s) as described in the project plans.

**1.03 SUBMITTALS**

Comply with Article 1050, 1.05, B of this specification, as well as the additional requirements listed below. All of the following shall be submitted within 30 calendar days after awarding of the contract. Verify the method of submittal with the Engineer.

**A. Schedule of Unit Prices:** Submit a completed schedule of unit prices. Estimates of the work performed on the project will be made by the Engineer and the unit costs will be used to prepare progress payments to the Contractor.

**B. Material and Equipment List:** Submit a completed list of materials and equipment to the Engineer for written approval before any equipment or materials are ordered.

**C. Contractor Certification:** Submit name(s) and contact information of the IMSA Level II Certified Traffic Signal Technician(s) working on the project and a copy of their IMSA certificate.

**D. Shop Drawings:** Submit shop drawings for traffic signal poles and structures to be furnished on the project. Submit catalog cuts and manufacturer's specifications for all items in the equipment list.

**1.04 - 1.06 INTENTIONALLY LEFT BLANK**

**1.07 SPECIAL REQUIREMENTS**

Comply with the MUTCD.

**1.08 MEASUREMENT AND PAYMENT**

**A. Traffic Signal:**

**1. Measurement:** Lump sum item; no measurement will be made.

**2. Payment:** Payment will be at the lump sum price for traffic signal installation.

**B. Temporary Traffic Signal:**

**1. Measurement:** Lump sum item; no measurement will be made.

**2. Payment:** Payment will be at the lump sum price for temporary traffic signal installation.

**PART 2 - PRODUCTS**

**2.01 UNDERGROUND**

**A. Handhole:**

**1. General:**
- **a. Cable Hooks:** Provide four galvanized steel cable hooks with a minimum diameter of 3/8 inch (9.5 mm) and a minimum length of 5 inches (125 mm).
- **b. Granular Base:** Comply with the following gradations; however, the Engineer may authorize a change in gradation, subject to materials available locally at the time of construction.

| Sieve | Percent Passing |
|---|---|
| 2" (50 mm) | 100 |
| 1 1/2" (37.5 mm) | 80 to 90 |
| 1" (25 mm) | 15 to 20 |
| 3/4" (19 mm) | 0 to 0.5 |

- **c. Cover:** Include "TRAFFIC SIGNAL" as a message on the cover. Alternate messages may be required as specified in the contract documents.

**2. Precast Concrete Handhole:**
- **a. Pipe:** Use Class 2000D (Class III) (100D). Four, 8 inch (200 mm) knockouts (conduit entrance points) equally spaced around the handhole.
- **b. Casting:** Gray cast iron and certified according to requirements of AASHTO M 306

for a 16,000 pound (7260 kg) proof-load (HS-20).

3. **Composite Handhole and Cover:** Composed of mortar consisting of sand, gravel, and polyester resin reinforced by a woven glass fiber mat or of resin mortar and fiberglass. Ensure the handhole and cover withstands a load of 20,000 pounds 9070 kg). Provide a skid resistant surface on the cover. Provide two 3/8-16 (M10 x 1.5) UNC stainless steel hex head bolts with washers.

**B. Conduit:**

1. **General:**
   - **a.** Furnish weatherproof fittings of identical or compatible material to the conduit. Use standard factory elbows, couplings, and other fittings.
   - **b.** Use a manufactured conduit sealing compound that is readily workable material at temperatures as low as 30°F (-1ºC) and will not melt or run at temperatures as high as 300°F (149ºC).

2. **Steel Conduit and Fittings:**
   - **a.** Comply with ANSI C80.1.
   - **b.** Use weatherproof expansion fittings with galvanized, malleable iron, fixed and expansion heads jointed by rigid steel conduit sleeves. As an option, the fixed head may be integral with the sleeve, forming a one piece body of galvanized malleable iron.
   - **c.** Provide steel bushings.

3. **Plastic Conduit and Fittings:**
   - **a. PVC:**
     - **1)** PVC Schedule 40 plastic conduit and fittings complying with NEMA TC-2 (pipe), NEMA TC-3 (fittings), and UL 651 for Schedule 40 heavy wall type.
     - **2)** Solvent welded, socket type fittings, except where otherwise specified in the contract documents.
     - **3)** Threaded adaptors for jointing plastic conduit to rigid metal ducts.
     - **4)** Provide bell end fittings or bushings.
   - **b. HDPE:**
     - **1)** Comply with ASTM F 2160 (conduit) and ASTM D 3350 (HDPE material), SDR 13.5.
     - **2)** Use orange colored conduit.
     - **3)** Continuous reel or straight pieces to minimize splicing.
     - **4)** For dissimilar conduit connections, provide an adhesive compatible with both materials.

**C. Wiring and Cable:** Provide wire that is plainly marked on the outside of the sheath with the manufacturer's name and identification of the type of the cable.

1. **Power Cable:** Comply with Article 4185.12 of the Standard Specifications.

2. **Signal Cable:** Comply with IMSA Specifications 19-1 (PVC jacket) or 20-1 (PE jacket) for PE insulated, 600 volt, solid, multi-conductor copper wire, No. 14 AWG.

3. **Tracer Wire:** Comply with No. 10 AWG, single conductor, stranded copper, Type thermoplastic high-heat nylon-coated (THHN), with UL approval, and an orange colored jacket.

4. **Communications Cable:** Comply with IMSA Specifications 39-2 or 40-2 for No. 19 AWG, solid copper conductor, twisted pairs. Use polyethylene insulated, aluminum shielded, complying with REA Specification PE-39 for paired communication cable with

electrical shielding.

5. **Category 5E (Cat5E) Cable:** Provide outdoor use rated cable.

6. **Fiber Optic Cable and Accessories:**
   - **a.** Furnish fiber optic cable of the mode type, size, and number of fibers specified in the contract documents, and all associated accessories.
   - **b.** Meet the latest applicable standard specifications by ANSI, Electronics Industries Association (EIA), and Telecommunications Industries Association (TIA).
   - **c.** Multimode Fiber:
     Core Diameter: 62.5 µm ± 1.0 µm
     Cladding Diameter: 125.0 µm ± 1.0 µm
     Core Concentricity: ± 1%
     Max. Attenuation: 3.50 dB/km @ 850 nm
   - **d.** Single-Mode Fiber:
     Typical Core Diameter: 8.3 µm ± 1.0 µm
     Cladding Diameter: 125.0 µm ± 1.0 µm
     Core Concentricity: ± 1%
     Attenuation Uniformity: No point discontinuity greater than 0.1 dB at either 1310 nm or 1550 nm
     Max. Attenuation: 0.25 dB/km @ 1550 nm, 0.35 dB/km @ 1310 nm
   - **e.** Dual layer UV cured acrylate coating applied by the fiber manufacturer, mechanically or chemically strip-able without damage to the fiber.
   - **f.** Glass reinforced plastic rod central member designed to prevent the buckling of the cable. Cable core interstices filled with water blocking tape to prevent water infiltration. Dielectric fillers may be included in the cable core where needed to lend symmetry to the cable cross-section.
   - **g.** Buffer tubes of dual layer construction with a polycarbonate inner layer and polyester outer layer. Each buffer tube filled with a water-swellable yarn or tape. Buffer tubes stranded around the central member using reverse oscillation or “SZ” stranding process. Gel-free cable and buffer tubes.
   - **h.** Buffer tubes and fibers meeting TIA/EIA-598A, “Color coding of fiber optic cables,” with 12 fibers per buffer tube.
   - **i.** Cable tensile strength provided by a high tensile strength aramid yarn and/or fiber glass.
   - **j.** All dielectric cables, without armoring, sheathed with medium density polyethylene (1.4 mm minimum nominal jacket thickness). Jacketing material applied directly over the tensile strength members and flooding compound. Jacket or sheath marked in a contrasting color with the manufacturer's name and the words “Optical Cable,” the year of manufacture, and sequential meter or feet marks. Additionally, provide a durable weather proof label on the cable jacket showing the actual attenuation of each fiber expressed in dB/km.
   - **k.** Cable fabricated to withstand a maximum pulling tension of 600 pounds (2670 N) during installation (short term) and 135 pounds (600 N) upon installation (long term).
   - **l.** Shipping, storing, and operating temperature range of the cable: -40°F (-40ºC) to 158ºF (70°C). Installation temperature range of cable: 14ºF (-10°C) to 140ºF (60°C).
   - **m.** Each fiber of all fiber optic cable tested by manufacturer at the 100% level for the following tests:
     - Proof tested at a minimum load of 50 kpsi (350 Mpa)
     - Attenuation
   - **n.** Meet the appropriate standard Fiber Optic Test Procedure for the following measurements:
     - Fluid Penetration
     - Compound Drip
     - Compressive Loading Resistance

- Cyclic Flexing
- Cyclic Impact
- Tensile Loading and Bending

**o.** Make cable ends available for testing. Seal cable ends to prevent moisture impregnation.

**p.** Fiber Distribution Panel: Provide a fiber distribution panel capable of terminating a minimum of 24 fibers, or as specified in the contract documents.

**q.** Fiber Optic Connectors:

**1)** ST type connectors of ceramic ferrule and physical contact end finish to terminate multi-mode fibers to equipment.

**2)** SC type connectors of ceramic ferrule and physical contact end finish to terminate single-mode fibers to equipment.

**3)** ST or mechanical connectors not allowed for cable splices.

**4)** Maximum attenuation per connector: 0.75 dB.

**r.** Fiber Optic Jumpers/Patch Cords: For connections in the cabinet, provide factory-assembled duplex pigtail jumpers with dielectric strength member, durable outer jacket and ST or SC compatible connectors. Provide adequate length for connections and 2 feet (0.6 m) minimum slack.

**s.** Fiber Optic Breakout Kits: Provide breakout kits for separation and protection of individual fibers, with buffering tube and jacketing materials suitable for termination of the fiber and fiber optic connector.

**t.** Splices/ Splice Enclosures: Fusion splice continuous fiber runs or branch circuit connections in splice enclosures as allowed or specified in the contract documents. Provide environmentally protected outside plant splice enclosures with adequate number of trays to splice all fibers. Maximum attenuation per splice: 0.3 dB.

**D. Footings:**

**1.** Use Class C structural concrete complying with Section 2403 of the Standard Specifications.

**2.** Use uncoated reinforcing steel complying with Section 4151 of the Standard Specifications.

**E. Bonding and Grounding:**

**1. Ground Rods:** Provide 5/8 inch (16 mm) by 8 foot (2.4 m) copper clad, steel ground rod at each pole and controller footing.

**2. Bonding Jumper or Connecting Wire:** Provide No. 6 AWG bare conductor, copper wire.

## 2.02 DETECTION

**A. Inductive Loop Vehicle Detector:** A detector consists of a conductor loop or series of loops installed in the roadway, lead-in (feeder) cable, and a sensor (amplifier) unit with power supply installed in a traffic signal controller cabinet.

**1. Cables:** All cables must be UL approved.

**a. Tube Loop Detector Cable:** Comply with IMSA Specifications 51-5.

**b. Preformed Loop Detector Cable:** As approved by the Engineer.

**c. Loop Detector Lead-in Cable:** Comply with IMSA Specifications 50-2.

**2. Detector Loop Sealant:**

**a.** Use a rapid cure, high viscosity, liquid epoxy sealant formulated for use in sealing inductive wire loops and leads embedded in pavement. Ensure the cured sealer is unaffected by oils, gasoline, grease, acids, and most alkalis.

**b.** Use a sealant complying with Materials I.M. 491.18.

**3. Sensor (Amplifier) Unit:**

**a.** Use a sensor unit that is solid state, digital, providing detection channel(s) with an inductance range of 0 to 2000 micro-henries. Output circuits of the sensor unit will be provided by relays. Vehicle presence will result in a continuous call indication.

**b.** Provide a sensor unit with the following qualities:

**1)** Sensitivity adjustment to allow as a minimum the selection of high, medium, or low sensitivity.

**2)** Be capable of providing reliable detection of all licensed motor vehicles.

**3)** Provide an indicator light for visual indication of each vehicle detection.

**4)** Will not require external equipment for tuning or adjustment.

**5)** Provide operation in the pulse mode or presence mode. Ensure mode switch is readily accessible.

**6)** Provide a self tuning system that is activated automatically with each application of power. Provide automatic and continuous fine tuning to correct for environmental drift of loop impedance.

**7)** Provide for fail-safe operation (continuous call) in the event of detector loop failure.

**8)** Ensure each detector channel will respond to a frequency shift in an increasing or decreasing value as occurs with temperature shifts in the pavement without requiring a locked call.

**9)** Use detector units with delay and extension timing. The delay feature is selected and adjusted externally on the sensor unit housing. Digitally derived timing is selectable in 1 second increments from 0 to 30 seconds. Ensure delay timing inhibits detector output until presence has been maintained for the time selected. Restart delay timer at each new detection.

**10)** Use a sensor unit capable of normal operation without interference and false calls between sensor units ("crosstalk") when installed in the physical environment of the controller cabinet and the electrical environment of the associated electronic equipment installed therein, including other detectors.

**B. Pedestrian Push Button Detectors:**

**1. Assembly:**

**a.** Ensure the entire assembly is weather tight, secure against electrical shock, withstands continuous hard usage.

**b.** Provide a removable contact assembly mounted in a die cast aluminum case.

**c.** Ensure contacts are normally open with no current flowing except at the moment of actuation.

**d.** Ensure the contacts are entirely insulated from the housing and operating button with terminals for making connections.

**e.** Provide housing with one outlet for 1/2 inch (12.5 mm) pipe.

**2. Accessible Pedestrian Signals (APS) Push Button Stations:**

**a. Housing:** Die cast aluminum, weather tight, secure against electrical shock and withstands continuous hard usage.

**b. Audible and Vibrotactile Features:** Audible walk indication tone, vibrotactile arrow, and locator tone complying with MUTCD.

**c. Voice Messages:** As specified in the contract documents and per MUTCD.

**d. Speaker:** Weatherproof with automatic volume adjustment to 5 dBA over ambient sound. Maximum volume 100 dB at 3 feet (0.9 m).

**e. Push Button:** Nonrusting metal alloy, ADA compliant, 2 inch (50 mm) diameter with tactile arrow and 3 pounds (13 N) maximum operational force.
**f. Switch:** Solid state rated at 20 million operations minimum.
**g. Program and Audio File Updates:** USB or Ethernet.
**h. Operating Temperature:** -30ºF (-34ºC) to 165$^0$F (74ºC).

**3. Solid State Pedestrian Push Buttons (non-APS):**
**a. Housing:** Die cast aluminum, weather tight, secure against electrical shock and withstands continuous hard usage.
**b. Push Button:** Nonrusting metal alloy, ADA compliant, 2 inch (50 mm) diameter with 3 pounds (13 N) maximum operational force.
**c. Switch:** Solid state rated at 20 million operations minimum.
**d. Operating Temperature:** -30ºF (-34ºC) to 165$^0$F (74ºC).

**4. Signs:** Furnish signs complying with MUTCD.

**C. Video Detection Camera System:** Detects vehicles by processing video images and providing detection outputs to the traffic signal controller.

**1. Video Detection System and Processors:**
**a.** Processor to be card rack mounted or located within camera. Compatible with NEMA TS-1, TS-2, and Type 170 controllers and cabinets.
**b.** Shall be capable of the following:
**1)** Shadow rejection without special hardware.
**2)** Non-impaired operation under light intensity changes.
**3)** Maintained operation during various weather conditions (e.g. rain, fog, snow).
**4)** Anti-vibration, 5% rejection based on image change.
**5)** Ability to select direction of flow parameters.
**6)** Ability to properly detect directionally.
**7)** Operate in presence mode with less than 4% error.
**c.** Provide user-defined detection zone programming via a graphical user interface (GUI) and any necessary equipment for future programming. Store detection zones in non-volatile memory.
**d.** Comply with NEMA TS-1 and TS-2environmental and physical standards with an operating temperature of -34°C (-30ºF) to 60°C (140ºF), and 0% to 95% relative humidity.
**e.** Ensure a factory certified representative from the supplier provides on-site VDS programming and testing.

**2. Video Cameras:**
**a.** Provide a charge-coupled device (CCD) image sensor with variable focus color or black and white lens providing a minimum of 4 to at least a 40 degree horizontal field of view.
**b.** Equipped with internal thermostatically controlled heater and external sunshield.
**c.** Meet NEMA-4 or NEMA-6P environmental standards.
**d.** Use camera cable(s) meeting the manufacturer's recommendations. Provide a continuous run, without splices, from the camera to the controller cabinet.

**D. Microwave Vehicle Detectors:** Detects all vehicles moving within the field of detection at speeds from 2 to 80 mph (3 to 129 kph).

**1.** Must be capable of the following:
**a.** Minimum detection range from 3 to 200 feet (0.9 to 61 m) for all vehicles.
**b.** Pattern spread of the detection field no more than 16 degrees.
**c.** Self-tuning and capable of continuous operation over a temperature range of -35°F (-37ºC) to 165°F (74ºC).

**d.** Side-fire mount or overhead mount.
**e.** Detecting directional traffic and the direction user selectable.

**2.** Microprocessor based using Doppler microwave at an operating frequency of 10.525 GHz.

**3.** FCC certification and tested to the applicable FCC specifications.

**4.** Enclosure constructed of aluminum or stainless steel and water resistant.

**5.** All user operated controls and adjustments must be clearly marked and easily accessible.

**6.** Relay detection output to the controller with a minimum 5 amp rating and designed to place a constant call to the controller in the event of any failure.

**7.** Easily accessible indicator showing activation of detection relay.

**8.** Required wiring as recommended by the manufacturer.

**9.** Provide mounting hardware for the type of mounting specified in the contract documents and power supply equipment as recommended by the manufacturer.

## 2.03 COMMUNICATIONS

**A. Traffic Monitoring System:** Provide as specified in the contract documents including, video camera in dome, dome mounting bracket and hardware, camera controller, cabling from camera to controller cabinet, and all accessories and hardware necessary for a complete and operational system.

**1.** Pan/tilt/zoom (PTZ) color camera with automatic conversion to monochrome during low light levels, auto focus, auto-iris control, electronic image stabilization, privacy masking and high resolution 1/4 inch (2.36 mm) CCD imager. Minimum optical zoom: 25X. Minimum digital zoom: 12X.

**2.** Camera system provided in a NEMA 4X or IP66 certified rugged weather-resistant package.

**3.** Provide all required lightning protection for electronics control, power, and coax video outputs.

**4.** Operating temperature range: -40ºF (-40ºC) to 122ºF (50ºC).

**5.** Maximum cable length as specified by camera manufacturer.

**6.** Provide full 360 degree endless pan and 220 degree tilt under PTZ control.

**7.** Dome electronics capable of programming a minimum of 64 preset views and nine preprogrammed pattern sequences of preset views. All views selectable by the central office computer or a remote control device.

**8.** Provide encoder and decoder devices as needed to transmit video over existing or proposed communication systems at 30 frames per second.

**9.** Provide all necessary rack support devices for video viewing and PTZ control.

**10.** Provide ability to control PTZ and view video remotely.

**B. Fiber Optic Hub Cabinet:** As specified in the contract documents.

**C. Wireless Interconnect Network:** Provides two-way data communication between the on-street master controller and local traffic signal controllers.

**1. Data Transceiver:**
- **a.** Utilize a license-free spread spectrum radio frequency (902-928 MHZ) with frequency hopping technology.
- **b.** Completely programmable by software. Furnish software to the Engineer.
- **c.** Built-in diagnostics capabilities.
- **d.** Configurable as master, slave, or repeater with store and forward capability.
- **e.** Maintains user selectable power output levels between 0.1 and 1 watt.
- **f.** Operates with input voltages between 6 VDC and 30 VDC.
- **g.** RS-232 interface with 115.2 kbps capability.
- **h.** Operating temperature of -40°F (-40ºC) to 167ºF (75°C).
- **i.** Receiver sensitivity of -108 to -110 dBm at $10^{-6}$ BER.
- **j.** Protected from power surges.
- **k.** Rack or shelf mounted in controller cabinet and connections for antenna, power, and controller.

**2. Antenna:**
- **a.** Capable of transmitting and receiving data between intersections.
- **b.** Mount near the top of the signal pole nearest the controller cabinet or as specified in the contract documents. Provide engineer-approved mounting hardware.
- **c.** Connect to transceiver via appropriate cable from pole to signal cabinet in same conduit as traffic signal cable. Conceal cable within a watertight connection at antenna.

## 2.04 CABINET AND CONTROLLER

**A. NEMA Controller, Cabinet, and Auxiliary Equipment:** Comply with the latest edition of NEMA TS1 or TS2 standards.

**1. Controller:**
- **a.** Solid state modular design with digital timing and capable of accommodating at least eight phases.
- **b.** Fully prompted, front panel keyboard with menu driven programmability.
- **c.** Local time base scheduler including automatic accommodation for daylight savings time.
- **d.** Local coordination control.
- **e.** Local preemption control with at least four programmable internal preemption sequences.
- **f.** Current software and documentation.
- **g.** Data retained in a memory medium that does not require battery backup.

**2. Cabinet:**
- **a.** Unpainted aluminum cabinet according to NEMA standards.
- **b.** Aluminum cabinet riser with same dimensions as cabinet and 12 to 18 inch (300 to 900 mm) height, as specified in the contract documents.
- **c.** Police door with auto/flash switch and on/off power switch for signal heads only. Controller to remain in full operation regardless of switch positions.
- **d.** Maintenance panel on inside of the main door containing the following test switches.
  - **1)** Controller power switch.
  - **2)** Detector test switches.
  - **3)** Stop time switch.
  - **4)** Signal flash switch.

**e.** Heavy-duty clear plastic envelope attached to inside wall of cabinet or cabinet door, for cabinet wiring diagrams, 12 inches (300 mm) by 18 inches (900 mm) minimum.
**f.** GFI electrical outlet and lamp in accessible location near the front of the cabinet. GFI outlet fused separately from main AC circuit breaker. Fluorescent or LED cabinet lamp connected and fused with GFI outlet.
**g.** Back panel positions to accommodate phasing and expansibility specified in the contract documents.
**h.** Power protection devices including AC power circuit breakers, radio interference suppressors, and lightning and surge protectors.
**1)** AC field service single pole, nonadjustable, magnetic breaker rated for 117 VAC operation, NEC approved.
**2)** Radio interference suppressors (RIS) as required to minimize interference in all broadcast transmission and aircraft frequency bands.
**3)** Lightning arrestor/surge protector capable of withstanding repeated (minimum of 25) 30,000 ampere surges.
**i.** Neatly train wiring throughout the cabinet and riser. Bundle and attach wiring to interior panels using nonconductive clamps or tie-wraps.

**3. Auxiliary Equipment:** Conflict monitor/malfunction management unit, flasher, load switches, terminals and facilities, and miscellaneous equipment and materials according to NEMA standards.

**B. Uninterruptible Power Supply Battery Backup System:** Monitors 120VAC input from the electric utility source and automatically switches to/from a system consisting of batteries and electronics.

**1.** Include a maintenance bypass switch to allow operation of the traffic signal system while repairs are made to the battery backup system.

**2.** Designed to provide a minimum of 4 hours of normal operation.

**3.** Use cabinet equipment that is plug connected and shelf mounted.

**4.** Designed to cover a temperature range from -30°F (-34ºC) to 165°F (74ºC) and include a surge suppressor.

**C. Emergency Vehicle Preemption System:** As specified in the contract documents.

## 2.05 POLES, HEADS, AND SIGNS

**A. Vehicle Traffic Signal Head Assembly:** Comply with current MUTCD and ITE standards.

**1. Housing:**
**a.** Individual signal sections made of a durable polycarbonate. Use color specified in the contract documents. Color to be an integral part of the materials composition.
**b.** Self-contained unit capable of separate mounting or inclusion in a signal face containing two or more signal sections rigidly and securely fastened together.
**c.** Equipped with openings and positive locking devices in the top and bottom so that it may be rotated between waterproof supporting brackets capable of being directed and secured at any angle in the horizontal plane.
**d.** Doors and lenses with suitable watertight gaskets and doors that are suitably hinged and held securely to the body of the housing by simple locking devices of non-corrosive material. Doors are to be easily removed and reinstalled without use of special tools.

2. **Optical System:** Designed to prevent any objectionable reflection of sun rays even at times of the day when the sun may shine directly into the lens.

3. **Lenses:** 12 inch (300 mm) diameter polycarbonate. Do not use glass lenses.

4. **Visors:**
   a. **Standard Installation:**
      **1)** Each signal lens is to have a visor with the bottom 25% open.
      **2)** Minimum 0.1 inch (2.5 mm) in thickness and black in color.
      **3)** Fits tightly against the housing door with no filtration of light between the visor and door.
      **4)** Minimum length of 9 1/2 inches (240 mm). Ensure the visor angle is slightly downward.
   b. **Optically Programmed Sections:** Make sure the optical unit and visor are designed as a whole to eliminate the return of outside rays entering the unit from above the horizontal.

5. **Terminal Block:**
   **a.** Three-section signal equipped with a six position terminal block.
   **b.** Four- and five-section signal equipped with an eight position terminal block.

6. **Backplate:**
   **a.** Manufactured one-piece, durable, black plastic capable of withstanding a 100 mph (160 kph) wind.
   **b.** Provides 5 inches (125 mm) of black field around the assembly.

7. **Mounting Hardware:**
   **a. Fixed:** 1 1/2 inch (37.5 mm) aluminum pipe and fittings, natural aluminum finish for galvanized poles or match the pole color. Secure to pole with a minimum 5/8 inch (16 mm) wide stainless steel banding material.
   **b. Universally Adjustable:** Rigid mounted, consisting of both top and bottom brackets and easily adjustable in both horizontal and vertical planes.

8. **LED Modules:** Comply with current ITE standards.

**B. Pedestrian Traffic Signal Head Assembly:** Comply with current MUTCD and ITE standards.

1. **Housing:**
   **a.** Made of a durable polycarbonate. Use color specified in the contract documents. Color to be an integral part of the materials composition.
   **b.** Self-contained unit capable of separate mounting or inclusion in a signal face containing one or more signal sections rigidly and securely fastened together.
   **c.** Equipped with openings and positive locking devices in the top and bottom so that it may be rotated between waterproof supporting brackets capable of being directed and secured at any angle in the horizontal plane.
   **d.** Doors and lenses with suitable watertight gaskets and doors that are suitably hinged and held securely to the body of the housing by simple locking devices of non-corrosive material. Doors are to be easily removed and reinstalled without use of special tools.

2. **Visor:**
   **a.** Tunnel type visor attached to the housing door by stainless steel screws.
   **b.** Fit tightly against the housing door to prevent any filtration of light between the door and the visor.
   **c.** Ensure the visor angle is slightly downward.

**3. LED Module:**

**a.** Provide a LED unit(s) for the filled upraised hand symbol, walking person symbol, and countdown timer.

**b.** Ensure immediate blank out of the countdown timer display upon recognizing a shortened “Walk” or a shortened "Flashing Don't Walk" interval.

**C. Traffic Signal Poles and Mast Arms:**

**1. General:**

**a.** Mast arm length and vertical pole height as specified in the contract documents.

**b.** Ensure the mast arms, poles, and supporting bases are galvanized inside and out according to ASTM A 123.

**c.** Continuous tapered, round, steel poles of the transformer base type. Fabricated from low carbon (maximum carbon 0.30%) steel of U.S. standard gauge.

**d.** When a transformer base is not specified, provide a 6 inch (150 mm) by 16 inch (400 mm) handhole in the pole shaft for cable access. Provide a cover for the handhole. Secure the cover to the base with simple tools. Hardware to be corrosion resistant.

**e.** Ensure minimum yield strength of 48,000 psi (331,000 kPa) after manufacture. Supply base and flange plates of structural steel complying with AASHTO M 183 (ASTM A 36) and cast steel complying with ASTM A 27, Grade 65-35 or better.

**f.** Where a combination street lighting/signal pole is specified in the contract documents, the luminaire arm is to be mounted in the same vertical plane as the signal arm unless otherwise specified. Use a single member tapered type arm for the luminaire arm type. Equip the pole with a minimum 4 inch (100 mm) by 6 inch (150 mm) handhole and cover located opposite the signal mast arm.

**g.** If allowed by the Engineer, poles and mast arms may be fabricated by welding two sections together, resulting in a smooth joint and factory welded as follows:

**1)** Ensure a minimum of 60% penetration for plates 3/8 inch (9.5 mm) and less in thickness for longitudinal butt welds, except within 1 foot (0.3 m) of a transverse butt-welded joint. Ensure a minimum of 80% penetration for plates over 3/8 inch (9.5 mm) in thickness.

**2)** Ensure 100% penetration for longitudinal butt welds on poles and arms within 1 foot (0.3 m) of a transverse butt-welded joint.

**3)** Ensure 100% penetration, achieved by back-up ring or bar, for transverse butt welds for connecting.

**4)** Examine 100% of transverse butt welds and 100% penetration longitudinal butt welds by ultrasonic inspection according to the requirements of AWS D1.1-80.AH.

**5)** Comply with Structural Welding Code AWS D1-180, as modified by AASHTO 1981 Standard Specifications for Welding of Structural Steel Highway Bridges and by Supplemental Specifications No. 969.

**h.** Provide non-shrink grout (complying with Materials I.M. 491.13) or a rodent guard (complying with Materials I.M. 443.01) for placement between the pole base and the foundation.

**2. Pole Design:**

**a.** Comply with AASHTO 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

**b.** Designed to support the loading necessary for all traffic control equipment. Capable of withstanding winds up to 80 mph (129 kph) with a 1.3 gust factor without failure.

**3. Hardware:**

**a.** Equipped with all necessary hardware and anchor bolts to provide for a complete installation without additional parts.

**b.** Anchor bolts complying with ASTM F 1554 Grade 105, hot dip galvanized and threaded a minimum of 6 inches (150 mm) at one end and have a 4 inch (100 mm)

long, 90 degree bend at the other end.

**c.** Washers complying with ASTM F 436.

**d.** Heavy hex nuts complying with ASTM A 563.

**e.** All hardware made of steel, hot dipped galvanized complying with ASTM F 2329, or ASTM B 695, Class 50, Type I, or electrodeposited coated of the same coating thickness and designed for this purpose.

**D. Traffic Signal Pedestal Poles:**

**1. Materials:**

**a. Pedestal:** The height from the bottom of the base to the top of the shaft as specified in the contract documents.

**b. Pedestal Shaft:** Schedule 80 with satin brush or spun finish aluminum tubing. Top of the shaft outer diameter to be 4 1/2 inches (115 mm) and provided with a pole cap. Supply base collar for poles with shaft lengths greater than 10 feet (3 m).

**c. Pedestal Base:** Cast aluminum, square in shape, with a handhole.

**1) Handhole:** Minimum of 6 inches (150 mm) by 6 inches (150 mm) and equipped with a cast aluminum cover that can be securely fastened to the base with the use of simple tools.

**2) Base:** Minimum weight of 20 pounds (9 kg) with a four bolt pattern uniformly spaced on a 12 1/2 inch (317.5 mm) diameter bolt circle. Meet or exceed AASHTO breakaway requirements.

**2. Anchor Bolts:** Four 3/4 inch (19 mm) by 15 inch (380 mm) steel, hot dip galvanized anchor bolts with right angle bend at the bottom end, complete with all hardware required for installation.

**E. Pedestrian Push Button Post:**

**1. Material:**

**a. Post:** Standard weight (Schedule 40) pipe complying with ASTM F 1083, galvanized inside and out; 2 1/2 inches (63 mm) in diameter.

**b. Cap:** Waterproof cap complying with ASTM F 626.

**c. Anchor Bolts:** Four 1/2 inch (12.5 mm) by 24 inch (610 mm) steel, hot dip galvanized anchor bolts complete with all hardware required for installation.

**d. Non-shrink Grout:** Comply with Materials I.M. 491.13 or a rodent guard (complying with Materials I.M. 443.01) for placement between the post base and the foundation.

**e. Base Plate:** Provide a 5 inch (125 mm) square, 1/2 inch (12.5 mm) thick galvanized steel base plate with a 4 1/2 inch (115 mm) bolt circle.

**F. Traffic Signs:**

**1.** Comply with Section 4186 of the Standard Specifications.

**2.** Use a universally adjustable mast arm mounted sign bracket.

**3.** Comply with MUTCD and the contract documents for the street name sign dimensions, letter height and font, and sheeting.

## PART 3 - EXECUTION

### 3.01 UNDERGROUND

**A. Handhole:**

1. **Locations:**
   - **a.** Do not construct in ditch bottoms, low areas where ponding of water may occur, or where they will be subject to normal vehicular traffic.
   - **b.** With Engineer approval, additional handholes may be placed, at no additional cost to the Contracting Authority, to facilitate the work.

2. **Excavation:** Excavate as necessary to accommodate the handhole and granular base.

3. **Granular Base:** Install 8 inch (200 mm) thick granular base extending a minimum of 6 inches (150 mm) beyond the outside walls of the handhole.

4. **Placement:**
   - **a.** In paved areas, install the handhole at an elevation so the casting is level and flush with the pavement. In unpaved areas, install the handhole approximately 1 inch (25 mm) above the final grade.
   - **b.** Verify ring placement. Invert rings when installed in paved areas.

5. **Conduit:**
   - **a.** Remove knockouts as necessary to facilitate conduit entrance.
   - **b.** Extend conduit into the handhole, through a knockout, approximately 2 inches (50 mm) beyond the inside wall. Conduit to slope down and away from the handhole.
   - **c.** Place non-shrink grout (complying with DOT Materials I.M. 491.13) in the opening of the knockout area after placement of conduit.

6. **Cable Hooks:** Install cable hooks centered between the knockouts and the top of the handhole.

7. **Backfill:** Place suitable backfill material according to Section 2552 of the Standard Specifications.

8. **Casting:** Place the casting on the handhole. Ensure the final elevation meets the handhole placement requirements.

**B. Conduit:**

1. **General:**
   - **a.** Place conduit to a minimum depth of 30 inches (760 mm) and a maximum depth of 60 inches (1500 mm) below the gutterline. When conduit is placed behind the curb, place to a minimum depth of 24 inches (600 mm) and a maximum depth of 48 inches (1200 mm) below top of curb.
   - **b.** Change direction at handholes or by bending, such that the conduit will not be damaged or its internal diameter changed. Ensure bends are uniform in curvature and the inside radius of curvature of any bend is no less than six times the internal diameter of the conduit.
   - **c.** On the exposed ends of conduit, place bell-end fittings on PVC or HDPE conduit and bushings on steel conduit prior to installing cable. Extend all conduits a minimum of 2 inches (50 mm) and a maximum of 4 inches (100 mm) above the finished surface of any footing or structural base.
   - **d.** When it is necessary to cut and thread steel conduit, do not allow exposed threads. Ensure conduits and fittings are free from burrs and rough places. Clean, swab, and ream conduit runs before cables are installed. Use nipples to eliminate cutting and threading where short lengths of conduit are required. Coat damaged galvanized finish on conduit with zinc rich paint. Use only galvanized steel fittings with steel conduit.
   - **e.** Pack conduit ends with a conduit sealing compound.

**2. Trenched Installation:**

**a.** Place backfill in layers not to exceed 12 inches (300 mm) in depth with each layer thoroughly compacted before the next layer is placed. Ensure backfill material is free of cinders, broken concrete, or other hard or abrasive materials.

**b.** Remove all surplus material from the public right-of-way as soon as possible.

**3. Trenchless Installation:**

**a.** When placing conduit under pavements, use the trenchless installation methods described in Section 2553 of the Standard Specifications.

**b.** If trenchless methods that compact soils in the bore path are used, provide sufficient cover to prevent heaving of overlying paved surfaces.

**c.** Do not allow pits for boring to be closer than 2 feet (0.6 m) to the back of curb, unless otherwise specified in the contract documents.

**C. Wiring and Cable:**

**1.** Where practical, follow color codes so that the red insulated conductor connects to the red indication terminal, yellow to yellow, and green to green. Ensure cables are properly labeled at the controller by durable labels, or other appropriate methods, attached to the cables. Label home runs for cables as follows: northwest corner is red, southeast corner is blue, northeast corner is green, and southwest corner is orange.

**2.** Install continuous runs of vehicle and pedestrian signal cables from the vehicle or pedestrian signal head to the handhole compartment of the signal pole base. Install continuous runs of vehicle and pedestrian signal cables from the handhole compartment of the signal pole base to the terminal compartment in the controller cabinet. Do not splice signal cables in underground handholes.

**3.** Install continuous runs for video detection and emergency vehicle preemption cables from the unit to the controller cabinet.

**4.** Install continuous runs of power lead-in cables from the service point to the meter socket and from the meter socket to the controller cabinet.

**5.** Install continuous detector cable from each detector loop to the first handhole adjacent to the loop. Ensure cables are properly labeled at the controller by durable labels, or other appropriate methods, attached to the cables. Install continuous homerun cable from the splice made in the first handhole to the terminal compartment in the controller cabinet. Attach the drain wire of the shielded cable to the ground in the controller cabinet.

**6.** Provide a minimum of 4 feet (1.2 m) of additional cable at each handhole and loosely coil the extra cable on the handhole cable hooks. Provide a minimum of 2 feet (0.6 m) of additional cable at each signal pole (measured from the handhole compartment in the pole to the end of the cable). Provide a minimum of 10 feet (3 m) of additional cable at each controller base.

**7.** Pull cables through conduit using a cable grip designed to provide a firm hold upon the exterior covering of the cable or cables, and minimize dragging on the ground or pavement.

**8.** Install a tracer wire in all conduits with the exception of conduits between detector loops and handholes. Use a silicon-filled wire nut to splice the tracer wire in each handhole and at the controller to form a continuous run.

9. **Fiber Optic Cable and Accessories:**
   - **a.** Use a suitable cable feeder guide between the cable reel and the face of the conduit to protect the cable and guide the cable directly into the conduit off the reel. During the installation, carefully inspect cable jacket for defects. If defects are found, notify the Engineer prior to any additional cable being installed. Take care when pulling the cable to ensure the cable does not become kinked, crushed, twisted, snapped, etc.
   - **b.** Attach a pulling eye to the cable and use to pull the cable through the conduit. Use a pulling swivel to preclude twisting of the cable. Lubricate cable prior to entering the conduit with a lubricant recommended by the manufacturer. Use dynamometer or break away pulling swing to ensure the pulling tension does not exceed the specified force of 600 pounds (2670 N) or the cable manufacturer's recommendations, whichever is less. Do not allow the cable to twist, stretch, become crushed, or forced around sharp turns that exceed the bend radius or scar or damage the jacket. Manually assist the pulling of the cable at each pull point.
   - **c.** Do not pull cable through any intermediate junction box, handhole, pull box, pole base, or any other opening in the conduit unless specified in the contract documents. Install cable by pulling from handhole or controller cabinet to the immediate next downstream handhole or cabinet. Carefully store the remaining length of cable to be installed in the next conduit run(s) in a manner that is not hazardous to pedestrian or vehicular traffic, yet ensures that no damage to the cable occurs. Storage methods are subject to Engineer approval.
   - **d.** At each handhole, visibly mark or tag cable, “CITY (or COUNTY) FIBER OPTIC”
   - **e.** Secure cables inside controller cabinet so that no load is applied to exposed fiber strands.
   - **f.** Ensure the radius of the bend for static storage is no less than 10 times the outside diameter of the cable, or as recommended by the manufacturer. Ensure the radius of the bend during installation is no less than 15 times the outside diameter of the cable, or as recommended by the manufacturer.
   - **g.** Provide cable slack in each handhole, junction box, and cabinet as specified in the contract documents. Where handholes or junction boxes lack sufficient area for cable storage or bend radius requirements, provide equivalent additional slack in adjacent facilities. Coil and bind slack cable at three points around the cable perimeter and support in its static storage position.
   - **h.** Install fiber optic accessories according to the manufacturer’s recommendations and as specified in the contract documents.

10. **Fiber Optic Cable Field Testing:** Provide for each fiber both on-reel testing prior to installation and final testing after installation using a high-resolution optical time domain reflectometer (OTDR). Conduct measurements for single-mode fibers at 1310 ± 30 nanometer wavelength. Conduct measurements for multimode fibers at 850 ±30 nanometer wavelength. Record the identification, location, length, and attenuation measurements of each fiber, and furnish test reports to the Engineer. Replace any cable that fails testing, at no additional cost to the Contracting Authority.
    - **a. On-reel Testing:** Perform testing for attenuation and continuity using OTDR and a pigtail splice. Complete testing in one direction only. Acceptable test results will be within ± 3% of factory-supplied attenuation measurements. Except for access to and test preparation of one end of the newly furnished cable, preserve the cable in its originally-shipped condition. Furnish test reports to the Engineer prior to installation.
    - **b. Cable Segment Testing:** Perform an end-to-end attenuation test of each terminated fiber of each fiber optic cable. Perform testing using hand-held optical test sets. Include test results in documentation package provided to the Engineer at the conclusion of the project. Acceptable test results will not exceed the cumulative specified losses of the components. For example, at 850 nanometers, a one kilometer multimode fiber link with two splices and a connector on each end will not exceed 5.6 dB:

| | |
|---|---|
| 1.0 km x 3.5 dB/km: | 3.5 dB |
| 0.3 dB per splice x 2: | 0.6 dB |
| 0.75 dB per connector x 2: | 1.5 dB |
| Maximum allowable loss: | 5.6 dB |

Repair or replace any cable segment that fails testing. Retest any repaired or replaced cable. Submit complete documentation of test results to the Engineer (hard copy or electronically).

**c. Final System Testing:** After complete fiber optic system is installed and terminated, but prior to capping unused fibers, perform OTDR readings on all cables to ensure that each section is in compliance with the specifications. Provide copies of OTDR trace signatures for all fibers for all cable sections to the Engineer. Also provide test results for attenuation test for the installed fibers using the insertion loss procedure and the transmitter/receiver power level test and the continuity test.

**D. Footings:**

**1. Excavation:** Excavate to the size, shape, and depth specified in the contract documents. Ensure the bottom of all foundations rest securely on firm undisturbed soil. Minimize over-excavation to ensure support and stability of the foundation.

**2. Footing:** Provide a means for holding all of the following elements rigidly in place while the concrete is being placed.

**a. Forms:**

**1)** Set the forms level or sloped to meet the adjacent paved areas.

**2)** When adjacent to paved areas, shape the top 11 inches (280 mm) of the footing to be square and flush with the surrounding paved area. Provide preformed expansion material between the footing and paved areas.

**3)** When installed in an unpaved area, set the top of the footing 2 inches (50 mm) above the surface of the ground.

**b. Reinforcing Steel:** Install reinforcing steel.

**c. Conduit:** Install conduit.

**d. Anchor Bolts:**

**1)** Set anchor bolts using a template constructed to accommodate the specified elevation, orientation, and spacing according to the pole and controller manufacturer's requirements.

**2)** Center the pole anchor bolts within the concrete footing.

**3)** Protect the anchor bolts until poles are erected.

**4)** Orient controller footing with the back of the cabinet toward the intersection such that the signal heads can be viewed while facing the controller, unless otherwise directed by the Engineer.

**e. Concrete:**

**1)** Place concrete to form a monolithic foundation. Consolidate concrete by vibration methods.

**2)** Finish the top of the base level and round the top edges with an edging tool having a radius of 1/2 inch (12.5 mm). Provide a rubbed surface finish on the exposed surface of the footing.

**3)** Allow the footings to cure a minimum of 4 days prior to erecting the poles and 7 days prior to installing the mast arms. Times may be shortened if supported by strength test results.

**3. Backfill:** Place suitable backfill material according to Section 2552 of the Standard Specifications.

**E. Bonding and Grounding:**

**1.** Ensure the traffic signal installation is grounded as required by the National Electric Safety Code.

**2.** Install a ground rod at each signal pole and controller footing.

**3.** Use PVC conduit within the footing to accommodate the connection between the top of the footing and the ground rod.

**4.** Bond poles to ground rods with copper wire. Connect ground wires to ground rods with approved mechanical connectors.

**5.** Bond rigid steel conduit ends in handholes with copper wire and approved fittings.

## 3.02 DETECTION

### A. Detector Loop Cable Installation:

**1.** Coordinate the location of the detector loop with the Engineer. Obtain the Engineer's approval prior to cutting the pavement.

**2.** Saw to ensure proper depth and alignment of the slot. Make a 2 inch (50 mm) deep clean, straight, well-defined 3/8 inch (9.5 mm) wide saw cut without damage to adjacent areas. Overlap the saw cuts where the detector loop changes direction to provide full depth at all corners. Do not use right angle or corners less than 90 degrees.

**3.** Before installing the detector loop cable, check the saw cuts for the presence of jagged edges or protrusions and remove if present. Clean and dry the saw cuts to remove cutting dust, grit, oil, moisture, or other contaminants. Clean by flushing with a stream of water under pressure. Use oil-free compressed air to dry the saw cuts.

**4.** Install detector loop cable without damage. Place three turns of the detector loop cable into the saw cut. Seal the ends of the tubing at the time of placement to prevent entrance of moisture.

**5.** Ensure the detector loop cables are in the bottom of the saw cut. Place detector loop sealant within the saw cut area. Comply with the manufacturer's instructions for mixing and using the detector loop sealant.

**6.** Install preformed loop detector according to the manufacturer's recommendations.

**7.** Identify each detector loop cable in the handhole by phase and location. Wind loops that are physically adjacent in an individual lane or adjacent lanes with opposite rotation (i.e. #1 clockwise, #2 counter-clockwise, #3 clockwise, etc.). Rotation reversal can be accomplished by reversing leads at the handhole.

**8.** Twist, with at least five turns per foot (0.3 m), all lengths of loop wires and tubing that are not embedded in the pavement.

**9.** Identify all detector loop lead-in cables with appropriate detector numbers.

**10.** Use a detector loop cable splice kit for the electrical splice between the detector loop cable and the detector loop lead-in cable to the controller.
- **a.** Ensure splice kit provides a watertight protective covering for the spliced wire, the shielding on the detector loop lead-in cable, and the end of the tubing containing the detector loop cable.
- **b.** Use a manufactured electrical splice kit approved by the Engineer.

**11.** Test all loops and document by using the following procedures:
- **a.** Determine the insulation resistance of the loop wire using a "megger" with 500V applied to either loop wire to earth ground. The resistance is to be greater than 100 megohms.
- **b.** Determine the inductance of the loop using a loop inductance meter.

**B. Pedestrian Push Button Detectors:**

**1.** Install according to the manufacturer's recommendations.

**2.** Seal the wire entrance into the pedestrian push button assembly.

**C. Video Detection Camera System:** Install according to the manufacturer's recommendations and as specified in the contract documents.

## 3.03 COMMUNICATIONS

**A. Traffic Monitoring System:** Install according to the manufacturer's recommendations and as specified in the contract documents, as well as the following:

**1.** Position camera dome on the pole as directed by the Engineer.

**2.** Test installed system under the supervision of the Engineer, and certify as fully-functional.

**B. Fiber Optic Hub Cabinet:** Install according to the manufacturer's recommendations and as specified in the contract documents.

## 3.04 CABINET AND CONTROLLER

**A. Controller, Cabinet, and Auxiliary Equipment:**

**1.** Install according to the manufacturer's recommendations and as specified in the contract documents.

**2.** Install on pre-placed caulking material on the concrete base. After the cabinet is installed in place, place caulking material around the base of the cabinet.

**B. Controller:** Install according to the manufacturer's recommendations and as specified in the contract documents.

**C. UPS Battery Backup System:** Install according to the manufacturer's recommendations and as specified in the contract documents.

**D. Emergency Vehicle Preemption System:** Install according to the manufacturer's recommendations and as specified in the contract documents.

## 3.05 POLES, HEADS, AND SIGNS

**A. Vehicle and Pedestrian Traffic Signal Heads:**

**1.** Inspect each signal head assembly while still on the ground for the following:
- **a.** Physical defects
- **b.** Visor type
- **c.** LED wattage
- **d.** Lens orientation

**e.** Wiring connections

**2.** Attach signal head mounting hardware according to the manufacturer's recommendations. Apply anti-seize compound to all mechanical fasteners.

**3.** Adjust each signal head both vertically and horizontally to approximate a uniform grade of all like signal heads.

**4.** During the course of construction and until the signals are placed in operation, cover signal faces or turn away from approaching traffic. When ready for operation, plumb and aim the heads.

**B. Traffic Signal and Pedestal Poles and Pedestrian Push Button Posts:**

**1.** Erect all poles and posts vertically under normal load.

**2.** Securely bolt the bases to the cast-in-place concrete foundations.
- **a.** Mast Arm Poles: Provide footing type (A through F) as specified in the contract documents. Level by using two nuts on each anchor bolt or according to the manufacturer's recommendations.
- **b.** Pedestal Poles: Level by using metal shims and one nut on each anchor bolt or according to the manufacturer's recommendations.
- **c.** Pedestrian Push Button Posts: Weld the post to the base plate using a minimum 3/16 inch (5 mm) weld. Level by using two nuts on each bolt.

**3.** After leveling the poles, use non-shrink grout or a rodent guard between the pole base and the foundation. When non-shrink grout is used, neatly finish exposed edges of grout to present a pleasing appearance, and place a weep hole in the grout.

**4.** Apply anti-seize compound to all mechanical fasteners on pole access doors.

**5.** Install pedestrian push button post caps with tamper-proof set screws per manufacturer's direction or by driving the cap a minimum of 1/2 inch (12.5 mm) onto the post.

**C. Traffic Signs:** Install signs using universally adjustable sign brackets banded to the pole. Apply anti-seize compound to all mechanical fasteners.

## 3.06 TEMPORARY TRAFFIC SIGNAL

Construct according to Article 2528.03, H of the Standard Specifications and to the configuration specified in the contract documents.

## 3.07 SURFACE RESTORATION

**A.** Replace or reconstruct features removed as a part of the work, such as sidewalks, driveways, curbs, roadway pavement, unpaved areas, or any other items.
**B.** Complete restoration according the applicable sections of the Standard Specifications.

## 3.08 TESTING

**A.** Notify the Engineer 48 hours in advance of the time and date the signal or signal system will be ready for turn on. Do not turn on the signal or signal system without authorization of the Engineer.

**B.** Ensure a representative from the manufacturer and/or supplier of signal controller or other authorized person is at the project site when the signal controllers are ready to be turned on

to provide technical assistance including, as a minimum, programming of all necessary input data.

**C.** All required signal timing data will be provided by the Engineer.

**D.** A test period of 30 calendar days will start upon confirmation from the Engineer that the signal or signal system is operating consistent with the project requirements. Any failure or malfunction of the equipment furnished by the Contractor, occurring during the test period will be corrected by the Contractor at no additional cost to the Contracting Authority. Upon confirmation by the Engineer that any failure or malfunction has been corrected, a new test period of 30 calendar days will start, exclusive of minor malfunctions such as lamp burnouts. Repeat this procedure until the signal equipment has operated satisfactorily for 30 consecutive calendar days.

**E.** After signal turn on and prior to completion of the 30 calendar day test period, respond, within 24 hours, to perform maintenance or repair of any failure or malfunction reported.

## 3.09 DOCUMENTATION

**A.** Provide file documentation packages with each signal system, consisting of the following:

**1.** Complete cabinet wiring diagram.

**2.** Complete physical description of the equipment.

**3.** Controller printout or equal documentation of initial controller settings installed in the field or in the office.

**4.** Product manuals for all cabinet equipment.

**5.** Standard industry warranties on equipment supplied.

**6.** Documentation of field cable labeling scheme.

**7.** Diagram of phasing and detector locations.

**8.** One set of as-built construction plans indicating changes from the original contract documents.

**B.** Supply two complete sets of documentation. One set to be placed in the controller cabinet and the other set (less construction plan) to be delivered to the Engineer.

**SPECIFICATION REVISION SUBMITTAL FORM**

| | | |
|---|---|---|
| **Submitted by:** Greg Mulder | **Office:** Construction and Materials | **Item 7** |
| **Submittal Date:** 2/26/2015 | **Proposed Effective Date:** May 19, 2015 | |
| **Article No.:**<br>**Title:** | **Other:** DS-12040 Developmental Specifications for Doc Express (Electronic Document Storage) | |

**Specification Committee Action:** Approved as recommended.

| | | | |
|---|---|---|---|
| **Deferred:** | **Not Approved:** | **Approved Date:** 3/12/2015 | **Effective Date:** 5/19/2015 |

**Specification Committee Approved Text:** See attached Developmental Specifications for Doc Express (Electronic Document Storage).

**Comments:** The Office of Contracts pointed out that the April letting is already processed and this would have to be effective in May.

The Office of Construction and Materials intends for this specification to go into the Standard Specifications in the next year or so. The Office of Local Systems indicated that it may be applied to all Local Systems projects at that time also.

**Specification Section Recommended Text:** See attached Draft Developmental Specifications for Doc Express (Electronic Document Storage).

**Comments:** Beginning with the May letting, Grundy and Montgomery Counties will be using the DS on some projects.

**Member's Requested Change:** **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

See attached DS for Doc Express.

**Reason for Revision:** The DS for Doc Express has been utilized for Contract Administration for 2 years with implementation on all primary road projects for the past year. The widespread use has provided opportunity for more user input into the positive and negative aspects of the program and the DS.

The changes to the DS address a Doc Express version update which rewrote the program to current programming language.

The DS has been modified for anticipated future placement in the Division 11 of the Standard Specifications which condensed the standard five sections into two general sections defining the Doc Express requirements.

Several sections of the DS have been removed to address input from DOT and Industry users. Major changes include:

- Removal of cover sheet requirement for any submittal made by the Contractor
- Elaborate on Contracting Authority Responsibilities
- Removal of language which defines items described elsewhere in the specifications and Materials IMs
- Define the need of summary statements for specific items to assist with authorizing progress payments.

| | | |
|---|---|---|
| **New Bid Item Required (X one)** | **Yes** | **No** X |
| **Bid Item Modification Required (X one)** | **Yes** | **No** X |
| **Bid Item Obsoletion Required (X one)** | **Yes** | **No** X |
| **Comments:** | | |

| |
|---|
| **County or City Comments:** |
| **Industry Comments:** |

**DS-12XXX**
**(Replaces DS-12040)**

Iowa Department of Transportation

**DEVELOPMENTAL SPECIFICATIONS**
**FOR**
**DOC EXPRESS (ELECTRONIC DOCUMENT STORAGE)**

**Effective Date**
**May 19, 2015**

**THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**12XXX.01 GENERAL.**

This specification contains requirements for collection and management of electronic documents through the use of Doc Express at ~~https://docs.infotechexpress.com~~ https://docexpress.com. Doc Express is a web based document management program which accepts electronic documents and ~~has~~ provides security ~~in~~ as appropriate for each submittal ~~which prevents modifications to the submitted electronic document~~.

The Contracting Authority will perform setup of Doc Express ~~based on the detail within this specification and~~ in accordance with project requirements. Doc Express is the complete and officially recognized ~~file storing material approval documentation, certified payrolls, and other~~ construction document management system for contract documents required by the Contracting Authority. ~~Full implementation of Doc Express is required.~~

~~Contractor responsibilities within this specification are designated as the prime contractor who may choose to delegate responsibilities to subcontractors and suppliers of the project.~~

**A. Doc Express Structure.**

~~This specification provides t~~The framework ~~for which Doc Express will be utilized~~ utilizes basic contract drawers to store project documents. ~~Three basic file cabinet drawers will be used to store documents:~~

Within each drawer are types used to group similar items together. A complete listing of the types in each drawer can be seen when submitting a document to that drawer in Doc Express.

~~**1.** Materials Certifications drawer which include the following types of folders:~~
- ~~**a.** Defined by Contract Item – Types of information included within each Contract Item include:~~
  - ~~**1)** Type A, Type C, Type D Certifications.~~
  - ~~**2)** Material Source.~~
  - ~~**3)** Approved Warehouse Stock.~~
  - ~~**4)** Approved Shop Drawing & Approved Catalog Cut.~~
  - ~~**5)** Fabrication Reports.~~
  - ~~**6)** Visual Approval by Project Engineer.~~
  - ~~**7)** Plant Reports.~~
  - ~~**8)** Profilometer Reports.~~

~~**9)** Smoothness Reports.~~
~~**b.** Material Test Results.~~
~~**c.** Rejected Items.~~

~~**2.** Contract Documents drawer which include the following types of folders:~~
~~**a.** Weekly Work Day Reports.~~
~~**b.** Daily Traffic Control Diaries.~~
~~**c.** Storm Water Inspection Reports.~~

~~**3. Certified Payrolls Drawer.**~~
~~Documents will be stored in the appropriate folder within each drawer of the file cabinet (Contract). The Contracting Authority will either receive the document which will acknowledge the document addresses an aspect of the project or reject the document if the document is in error.~~

~~**B. Doc Express User Guide.**~~
~~A Doc Express User's Guide is available at https://docs.infotechexpress.com/html/help.html to provide detail on how to navigate the program but a few key functionalities include:~~

~~**1.** The Doc Express program provides an opportunity to add comments each time a document is submitted, copied, received, or rejected.~~

~~**2.** A certification statement requiring an acknowledgement the information submitted is accurate. Enabling this certification statement and submitting the document places an electronic signature within Doc Express.~~

~~**3.** When a user performs a submittal, copies a submittal (Contracting Authority only has this option), adds a comment, receives a submittal, or rejects a submittal; those actions are tracked, logged, and are able to be viewed in an activity audit trail of the submitted document.~~

~~**C** **B. Doc Express Security.**~~
As requested, ~~E~~each user within an organization will be assigned an account within Doc Express by their own organization. Access to Doc Express will be tracked through the use of the user's unique email address and ~~a unique~~ password. ~~This unique user ID is utilized by the tracking feature described in Article DS-12040.01, B, 3.~~ User permissions will be defined within Doc Express for each specific contract.

1. ~~**Principal**~~ **Prime -** The Prime Contractor will be assigned ~~Principal~~ Prime permission ~~which will authorize any person associated with the Contractor~~ to submit documents and view all documents submitted into Doc Express - including those submitted by the Contracting Authority and users with an Associate level permission.

   The Prime can grant access to all associates to all drawers except the Payroll drawer to which only the Prime should have access.

2. **Associate -** Subcontractors and suppliers will be assigned Associate permission which will authorize any user associated with the respective subcontractor or supplier to submit documents but can view only those documents submitted by that respective entity. An Associate user is not able to view documents submitted by a ~~Principal~~ Prime, Contracting Authority, or other Associate users.

3. **Reviewer -** ~~A~~ Reviewer permission will allow the user to only view all documents and will typically be assigned to those that will oversee the specific contract but are not responsible for daily tasks.

4. **Contracting Authority** – A formal permission level is not assigned. Contracting Authority

staff has the ability to submit ~~documents~~, receive ~~submitted documents~~, audit, or reject a ~~submitted~~ document ~~which does not address a specific requirement of the contract~~.

Documents submitted into Doc Express are secure. Security of the program will not allow modifications to a submitted document by any user. The user, or another user within the organization, who submitted the document may delete the submittal from Doc Express as long as the document has not been received, rejected, or had a comment attached.

The Payroll drawer has a more restrictive security setting. Only the user who submits a payroll document or a Contracting Authority user specifically assigned to access payroll information for the specific contract can view the payroll document. Other ~~Principal~~ Prime users will not be able to view the submitted payroll document nor will other Contracting Authority users ~~have access to the Payroll drawer~~.

**~~D~~ C. Doc Express Document Types.**

Doc Express will accept all types of electronic documents including but not limited to Microsoft Excel files, Microsoft Word documents, Adobe Portable Document File (PDF), Tagged Image File (TIFF), and Joint Photographic Experts Group (JPEG). ~~Doc Express has a 2 GB size limitation on a document,~~ The maximum size limit of a file is 50 MB, but uploading and opening of the document will take longer as the file size increases. Preference should be given to smaller file sizes anytime they can be used.

**~~E. Doc Express Email Preferences.~~**

~~Doc Express will provide email notifications but is not designed to operate as a communication tool. Each individual user has the option of an email notification when a document has been rejected or when documents are submitted. When the rejected email notification option is enabled, an email will be sent to the user every time a submitted document is rejected. When the document submittal option is enabled, the user will be provided a summary of the number of documents submitted the previous day. These notifications will only occur for instances when document(s) can be accessed as per the defined permission level of the user.~~

**~~F. Doc Express Archive.~~**

~~Contracting Authority users only have the option to electronically archive all documents submitted and processed during the project and at project completion.~~

**~~12040.02 EQUIPMENT.~~**

~~Doc Express requires access to the internet. The preferred web browser is Internet Explorer 8 or newer. Other web browsers such as Mozilla Firefox and Google Chrome may be used but the functionality of Doc Express may be compromised. The use of air cards and laptop computers may be desired to allow field users access to documents.~~

**12XXX.0~~3~~2 ~~CONSTRUCTION~~ RESPONSIBILITIES.**

**A. Contracting Authority ~~Responsibilities~~.**

~~**1.** Engineer will create the drawers and document folders within a file cabinet (Contract) in Doc Express. The name of the file cabinet will include: project number, reference to administering office, brief description of work, and the Contractor.~~

~~**2.** Define document drawers within the contract file cabinet in Doc Express based on the requirements of the project. At a minimum, the Materials Certification and Contract Documents drawers will be included. The Payroll drawer will be included when Certified Payrolls are specified in the contract documents.~~

~~**3.** Assign Principal, Associate, and Reviewer Permissions for the contract file cabinet within Doc Express.~~

~~**4.** Assign folders under the document drawer within the contract file cabinet in Doc Express to categorize information to be submitted. The drawer/folder organization will include:~~

~~**a. Material Certifications.**~~

~~**1)** By Contract Item.~~

~~**2)** Items added by Contract Modification.~~

~~**3)** Material Test Reports.~~

~~**b. Contract Documents.**~~

~~**1)** Weekly Work Day Reports.~~

~~**2)** Daily Traffic Control Diaries.~~

~~**3)** Storm Water Inspection Reports.~~

~~**c. Certified Payrolls.**~~

~~**1)** Contractor.~~

~~**2)** Each subcontractor.~~

~~**5.** Review and receive submitted electronic documents in Material Certifications drawer.~~

~~**a.** Verify electronic material certification document for specific material corresponds to the material delivered to project site.~~

~~**b.** After field verification, receive the submitted electronic document in Doc Express prior to material being incorporated into the project or processing payment for work completed.~~

~~**c.** A list of electronic certification which the Contracting Authority is responsible for submitting to Doc Express as defined in Materials I.M. 204 includes:~~

~~**1)**Test reports – Includes job control tests, verification tests, and independent assurance tests.~~

~~**2)**Approved Warehouse Stock.~~

~~**3)**Material Approved by Visual Inspection.~~

~~**6.** Submit and receive Erosion Control Seeds Type A certification tags from the material bag.~~

~~**7.** Submit and receive on a weekly basis the Weekly Report of Working Days to the Weekly Work Day Reports folder in the Contract Documents drawer of Doc Express.~~

~~**8.** Review the electronic submittal and take action on the Contractor submitted Daily Traffic Control Diaries.~~

~~**9.** Submit and receive on a weekly basis the Storm Water Inspection Reports to the Storm Water Inspection Reports folder in the Contract Documents drawer of Doc Express.~~

~~**10.** Review and take action on Contractor submitted Certified Payrolls. Comments section will be utilized to note which payrolls have a detailed check performed.~~

**1.** Contract set-up including drawer and type creation within a contract with applicable Prime, Associate, and Reviewer permissions.

**2.** The Construction Project File will be maintained in Doc Express. The Contracting Authority will submit to the appropriate drawer and type, all construction related documents generated by the Contracting Authority.

**3.** Review and verify that the documentation submitted meets the applicable submittal requirements. The review of documents will be made promptly from when the documents were able to be verified. Contractor payment may be withheld for contract documents not submitted.

**B. Contractor ~~Responsibilities~~.**

~~**1.** Contractor shall ensure materials used in the project meet quality requirements of the contract. This responsibility includes providing the Engineer a certification document stating the material meets the requirements of the Contract Documents.~~

~~**2.** Submit electronic material certifications per contract item to Doc Express as defined in the Materials Acceptance Report and Materials I.M. 204.~~

- ~~**a.** Each electronic submittal may contain multiple pages and/or types of certification documentation but shall provide certification covering one contract item only. Electronic submittals which include certification for multiple contract items will not be accepted. For example, a project with the following six contract items: 24 inch Concrete Roadway Pipe, 30 inch Concrete Roadway Pipe, 36 inch Concrete Roadway Pipe, 24 inch Concrete Apron, 30 inch Concrete Apron, and 36 inch Concrete Apron, shall not have all six contract items grouped into one certification document. Six individual documents, one per contract item, is required so each document is submitted to the respective contract item and contains specific certification required for that specific contract item only.~~
- ~~**b.** Material certifications which are components of multiple contract items may be submitted and copied to multiple contract item folders, i.e. Liquid Curing Compound may be applicable for multiple contract items.~~

~~**3.** Include a cover sheet showing contract item specific information for all electronic material certifications submitted to Doc Express. Cover sheet shall include, but is not limited to the following information:~~

- ~~**a.** Project number.~~
- ~~**b.** Contract item number.~~
- ~~**c.** Date the material is delivered to project site.~~
- ~~**d.** Description of the material certified.~~
- ~~**e.** Itemized delivery quantity which this specific submitted certification covers.~~
- ~~**f.** Log of all material shipments with total certified project quantity delivered. When multiple shipments will be used, then the initial cover sheet is to be updated with subsequent shipments to show each delivery, quantity included, and total certified on one cover sheet.~~

~~**4.** Notify Contracting Authority if an item which requires submittal is not available within Doc Express. This notification will prompt the Contracting Authority to add the requested item.~~

~~**5.** A list of electronic certification which the Contractor is responsible as defined in Materials I.M. 204 includes:~~

- ~~**a.** Type A Certification – lab report with test results and a certification statement (e.g. Steel Mill Certifications).~~
- ~~**b.** Type C Certification – a document prepared by manufacturer or producer with certification statement with applicable specification number or Material IM number identified.~~
- ~~**c.** Type D Certification – a document prepared by an approved manufacturer with certification statement.~~
- ~~**d.** Approved Source – also referred to as Approved Brand, Approved Producer, Approved Supplier, and Approved Fabricator.~~
- ~~**e.** Fabrication Reports.~~

~~**6.** Contractor shall electronically submit Daily Traffic Control Diaries to the Traffic Control Diaries folder in the Contract Documents drawer of Doc Express. Diaries shall be grouped together per week and submitted within one week after the end of the week which work is performed.~~

~~**7.** Contractor shall electronically submit certified payrolls for each contractor/subcontractor working during the week to the Certified Payrolls drawer of Doc Express. This submittal is due within 2 weeks after the end of the week which work was performed on the project.~~

**1.** Verify subcontractors and suppliers involved with the project have access to contract in Doc Express. Add any subcontractor or supplier which was omitted from the set-up performed by the Contracting Authority.

**2.** Submit electronic documentation per type defined in Doc Express. Each electronic submittal may contain multiple pages of documentation but shall provide information required for the specified type only.

**3.** Provide daily or weekly statements that show an itemized summary of the quantity of certified non-proportioned material delivered to the project site. The statement is to include a total for the day or week provided and a running total for the amount delivered to the project to date.

**4.** Submit the invoice, certified bill of materials, or bill of lading for each shipment as documentation to allow the Contracting Authority to authorize progress payments for:

- Corrugated Metal Culvert Pipe – Materials I.M. 441.
- Precast Concrete – Materials I.M. 445.
- Plastic Pipe – Materials I.M. 446.

**C. Shared Contracting Authority and Contractor/Supplier Responsibilities.**
Doc Express will store final versions of documentation required for the contract. Some of the documents require involvement and coordination between the Contracting Authority and the Contractor to reach a final version. This shared responsibility will be coordinated to prevent incomplete or redundant data from being electronically stored.

~~**1. Non-Proportioned Aggregates.**~~

~~**a.** Aggregates are defined in Materials I.M. 204 Appendix A, B, C, and D. The Method of Acceptance is by Approved Source and will include tickets with each delivery to the project site.~~

~~**b.** Contracting Authority will collect delivery tickets as the material is delivered to the project site.~~

~~**c.** Contractor shall provide to the Contracting Authority a daily or weekly summary of loads delivered to the project for each material certified.~~

~~**d.** Contracting Authority will verify delivery tickets are accurately reflected on the summary. Contracting Authority will submit and receive the summary in Doc Express once accurate information is collected. A copy of one of the tickets per source showing Iowa DOT gradation number, project number, quantity, source name, and Materials I.M. T-203 A number will also be submitted and received in Doc Express.~~

~~**e.** Contractor shall submit to Doc Express Form 821278 for non-proportion aggregate processed from recycled products that are accepted by bulk volume.~~

~~**2. Proportioned Aggregates.**~~

~~**a.** Aggregates are defined in Materials I.M. 204 Appendix E and F. The Method of Acceptance is by Approved Source and will include tickets with each delivery to the HMA or PCC Plant.~~

~~**b.** Certified Plant Inspector shall collect delivery tickets and summarize the quantity of each aggregate in the plant book for review by the Contracting Authority Plant Monitor.~~

~~**c.** Certified Plant Inspector shall provide proportioned aggregate information with plant information described in Article DS-12040.03, C, 3 and Article DS-12040.03, C, 4.~~

~~**3. HMA Plant.**~~

~~**a.** Certified Plant Inspector shall perform plant inspection responsibilities as defined in Materials I.M. 511 including obtaining electronic certifications specified in Materials I.M. 204 Appendix F and submit the HMA Plant Book by email to the Contracting Authority.~~

~~**b.** Plant Book and Plant Reports shall be per contract item with required component material certifications itemized for each contract item.~~

~~**c.** Contracting Authority will review the electronic plant book received by email and add information as required. The Contracting Authority will submit and receive the plant report and plant book in Doc Express once accurate information is reflected in the plant book/report.~~

~~**d.** Electronic document certifications for individual HMA mix components shall be submitted~~

by the Certified Plant Inspector to the appropriate item in Doc Express when the contract item is completed. These components consist of:

**1)** Proportioned Aggregates – Detailed in Article DS-12040.03, C, 2.
**2)** Asphalt Binder.
**3)** Hydrated Lime.
**4)** Emulsions & Cutbacks.
**5)** Recycled Asphalt Material.

**4. PCC Plant.**

**a.** Certified Plant Inspector shall perform plant inspection responsibilities as defined in Materials I.M. 527 including obtaining electronic certifications specified in Materials I.M. 204 Appendix E and submit the PCC Plant Book by email to the Contracting Authority.

**b.** Plant Book and Plant Reports shall be per contract item with required component material certifications itemized for each contract item.

**c.** Contracting Authority will review the electronic plant book received by email and add information as required. Contracting Authority will submit and receive the plant report and plant book in Doc Express once accurate information is reflected in the plant book/report.

**d.** Electronic document certifications for individual PCC mix components shall be submitted by the Certified Plant Inspector to the appropriate item in Doc Express when the contract item is completed. These components consist of:

**1)**Proportioned Aggregates – Detailed in Article DS-12040.03, C, 2.
**2)**Portland Cement.
**3)**Fly Ash.
**4)**GGBFS (Ground Granulated Blast Furnace Slag).
**5)**Chemical Admixtures (Examples: Air Entrainment, Water Reducer, Retarder).

**5. Shop Drawings and Catalog Cuts.**

**a.** Contractor shall submit electronic documents of shop drawings and catalog cuts as per Article 1105.03 of the Standard Specifications.

**b.** The information shall be submitted per contract item.

**c.** Contracting Authority will review and if required return to the Contractor with comments until the submitted information is approved. Contracting Authority will submit and receive electronic approved shop drawings and catalog cuts per contract item to Doc Express.

**12XXX.043 METHOD OF MEASUREMENT.**

None.

**12XXX.054 BASIS OF PAYMENT.**

Costs associated with the use of Doc Express are incidental to Mobilization. Contract item progress payments will be withheld until documentation is provided as defined within this specification.