MINUTES
OF
IOWA DOT SPECIFICATION COMMITTEE MEETING

May 9, 2024

Members Present:	Darwin Bishop	District 3 – DCE
	Daniel Harness	Design Bureau
	Eric Johnsen, Chair	Contracts & Specifications Bureau
	Wes Musgrove	Construction & Materials Bureau
	Scott Nixon	District 1 - DCE
	Dillon Feldmann	Local Systems Bureau
	Bob Welper	District 2 - DME
Members Not Present:	Mark Dunn	Contracts & Specifications Bureau
	Mike Nop	Bridges & Structures Bureau
	Willy Sorenson	Traffic & Safety Bureau
	Charlie Purcell	Project Delivery Division
Advisory Members Present:	Jeff Devries	Construction & Materials Bureau
	Brian Worrell	Construction & Materials Bureau
	Elijah Gansen	Construction & Materials Bureau
	Scott Sommers	Construction & Materials Bureau
	Curtis Carter	Construction & Materials Bureau
	Ashley Buss	Construction & Materials Bureau
	Lili Yang	Bridges & Structures Bureau
	Dan Sprengeler	Design Bureau
	Ben Hucker	Maintenance Bureau
	Josh Stott	FHWA
	Ryan Weideman	Hamilton County
	Andy Case	Dallas County
	Cole Budach	Dickinson County
	Dwayne Heintz	Jefferson County
	Bryan Horesowsky	Muscatine County
	David Carney	SUDAS

The Specification Committee met on Thursday, May 9, 2024, at 9:00 a.m. Eric Johnsen, Specifications Engineer, opened the meeting. The items were discussed in accordance with the agenda dated May 3, 2024.

The minutes are as follows:

1. Article 1107.08, Public Convenience and Safety.

The Construction and Materials Bureau requested to prohibit storing of construction equipment, flammable products, or combustible materials below overhead bridges or other highway structures.

2. **Article 2301.02, B, 3, a, Water, Consistency, and Batch Yield (Portland Cement Concrete Pavement).**

The Construction and Materials Bureau requested to allow a higher slump with use of water reducing admixtures.

3. **Article 2301, U, 1, Time for Opening Pavement for Use (Portland Cement Concrete Pavement).**

The Construction and Materials Bureau requested to require a lower flexural strength for opening 9 inch pavement when maturity method is used.

4. **Article 2303.05, A, 3, a, Laboratory Voids (Flexible Pavement).**

The Construction and Materials Bureau requested to disallow the PWL price adjustment schedules when key volumetric parameters are changed via plan note or SP.

5. **Article 2403.03, F, 5, Placing and Protection in Cold Weather (Structural Concrete).**
Article 2403.05, A, 4, Basis of Payment (Structural Concrete).

The Construction and Materials Bureau requested to update cold weather protection payment for structural concrete.

6. **Article 2412.03, D, 4, a, 8, Surface Finish (Concrete Bridge Decks).**
Article 2532.03, D, 1, b, Limitations (Pavement Surface Repair (Diamond Grinding)).

The Construction and Materials Bureau requested to restrict disposal of diamond grinding residue.

7. **Article 2528.03, J, Flaggers.**
Article 2528.04, J, Flaggers.
Article 2528.05, J, Flaggers.
Section 4188, Traffic Control Devices

The Design Bureau requested to add automated flagger assistance devices to the Standard Specifications as a contractor option.

8. **Article 2528.03, Construction.**
Article 2528.04, Method of Measurement.
Article 2528.05, Basis of Payment.
Section 4188, Traffic Control Devices

The Design Bureau requested to add Truck-Mounted or Trailer-Mounted Attenuators to the Standard Specifications.

9. **Section 2556, Dowel Bar Retrofit.**

The Construction and Materials Bureau requested to require smaller diameter dowels for pavements less than 10 inches.

10. **Article 4138.01, A, General Requirements (Cutback and Liquid Asphalts).**

The Construction and Materials Bureau requested to update an incorrect AASHTO reference.

11. **Article 4145.04, Design (Concrete Culvert Pipe).**

The District 2 Materials Office requested to eliminate some confusion for concrete culvert pipe thickness.

12. DS-23034, High Performance Concrete for Structures.

The Construction and Materials Bureau requested approval of revisions to the Developmental Specifications for High Performance Concrete for Structures.

13. DS-23040, Intelligent Transportation Systems.

The Traffic Operations Bureau and Specifications Section requested approval of revisions to the Developmental Specifications for Intelligent Transportation Systems.

14. DS-23053, PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems.

The Construction and Materials Bureau requested approval of revisions to the Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems.

15. DS-23055, Diamond Ground Rumble Strips.

The Construction and Materials Bureau requested approval of revisions to the Developmental Specifications for Diamond Ground Rumble Strips.

16. DS-23XXX, Fiber Reinforcement for Structural Concrete.

The Construction and Materials Bureau requested approval of Developmental Specifications for Fiber Reinforcement for Structural Concrete.

17. DS-XXXXX, Preformed Thermoplastic Pavement Markings.

The Construction and Materials Bureau requested approval of Developmental Specifications for Preformed Thermoplastic Pavement Markings.

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Curtis Carter	**Bureau/Office:** Construction & Materials	**Item 1**
Submittal Date: April 4, 2024	**Proposed Effective Date:** October 2024	
Article No.: 1107.08 **Title:** Public Convenience and Safety	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text:
1107.08, Public Convenience and Safety.

Add the Article and **renumber** subsequent Articles:

J. No storage of flammable products or combustible materials shall be permitted below overhead portions of bridges or other highway structures. When not in use, products and materials which present risk of fire hazard must be stored at least 15 feet from the footprint of overhead structural elements.

~~**J**~~ **K.**
~~**K**~~ **L.**
~~**L**~~ **M.**
~~**M**~~ **N.**

Comments: Due to objections from the AGC of Iowa, construction equipment was removed from this specification revision.

Specification Section Recommended Text:
1107.08, Public Convenience and Safety.

Add the Article and **renumber** subsequent Articles:

J. No storage of construction equipment, flammable products or combustible materials shall be permitted below overhead portions of bridges or other highway structures. When not in use, equipment and materials which present risk of fire hazard must be stored at least 15 feet from the footprint of overhead structural elements.

~~**J**~~ **K.**
~~**K**~~ **L.**
~~**L**~~ **M.**
~~**M**~~ **N.**

Comments:

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

Add new item "J" and adjust naming of subsequent items.

1107.08 PUBLIC CONVENIENCE AND SAFETY.

A. The schedule for removal of existing guardrail and traffic control devices requires Engineer's approval. The Contractor may be required to place temporary warning devices at locations where replacement features are not installed the same day as removal takes place.

B. The Contractor shall conduct the work to assure the least possible obstruction to access by the residents along the project. The Contractor shall schedule and conduct the work in such a way as to provide for their safety and convenience. The Contractor shall submit a construction staging plan to the Engineer for local access required to remain open. Relocated accesses shall be completed prior to removal of existing accesses. If a permanent access cannot be completed prior to removal of an existing access, the Contractor shall provide and maintain an alternate access. Work and materials required by the Engineer for public convenience and safety in excess of that provided for in the contract documents will be paid for per Article 1109.03, B.

C. Whenever it is practical to do so, the Contracting Authority will close the portion of the road under construction, provide a detour, and cause suitable detour signs to be erected to mark such detour.

D. When it is not practical for the Contracting Authority to close the road for construction, the Contractor will be expected to perform the work under traffic. The contract documents will provide instructions for handling traffic through the work area. Unless otherwise stated in the contract documents, all work shall be performed by the Contractor between the hours of 30 minutes after sunrise to 30 minutes before sunset.

E. Except when the contract documents indicate the road is to be closed, traffic will be permitted to use the roads involved at all times and shall not be delayed unnecessarily. Construction equipment and materials may be stored within the right-of-way, at least 15 feet from the edge of the traveled way, and the roadbed shall be free of Contractor's equipment during non-working hours. The work shall be planned and conducted to cause a minimum delay or interference with traffic.

F. When work on a traveled way necessitates diverting traffic from a work lane to another lane, material, personnel, equipment, and vehicles shall occupy the work lane to the minimum extent and for the minimum time necessary, and non-mobile equipment shall be removed from the work lane promptly after its operation is completed in that lane.

G. On two-lane roadways, a work area shall be established only on one side of the roadway and there shall be no parking of vehicles or equipment on the opposite shoulder within 500 feet of the work area. The location for storage of materials and equipment by the Contractor during nonworking hours shall be at least 15 feet from the edge of the traveled way and approved by the Engineer prior to use.

H. On divided highways, parking of unattended equipment within the median or storage of equipment within 50 feet of the edge of the traveled way will not be allowed.

I. Materials stored within the highway right-of-way shall be placed to cause a minimum obstruction to traffic. Sidewalks, gutters, sewer inlets, and portions of highway adjoining the roadway under construction shall not be obstructed more than is necessary.

J. No storage of construction equipment, flammable products or combustible materials shall be permitted below overhead portions of bridges or other highway structures. When not in use, equipment and materials which present risk of fire hazard must be stored at least 15 feet from the footprint of overhead structural elements.

~~J~~K. When the shoulder work is a part of the contract for work on a project open to public traffic during construction, the Contractor shall coordinate the operations so that the length and degree of pavement edge drop-off caused or partly caused by the operations are minimized.

~~K~~L. Shoulder construction in conjunction with PCC overlay or HMA resurfacing shall meet the following:

1. Paved Shoulders (Partial or Full Width).
Construction shall be staged so no drop-offs exist at the pavement or shoulder edge when the adjacent lane is to be opened to traffic. The pavement edge drop-off requirement shall be satisfied with an HMA shoulder fillet. This fillet shall extend into the shoulder area a minimum of six times the

thickness of the drop-off and shall be placed prior to the adjacent lane being opened to traffic. Compaction of the HMA fillet shall be a minimum of one coverage with a pneumatic tired roller per 1 inch of thickness. The fillet shall be removed prior to start of shoulder paving. The shoulder edge drop-off requirement shall be satisfied with a granular fillet, meeting the requirements of the following paragraph.

2. **Granular Shoulders.**
Construction shall be staged so no drop-offs exist at the pavement edge when the adjacent lane is to be opened to traffic. The drop-off requirements shall be satisfied with a shoulder fillet or full shoulder width of granular material according to Article 2121.03. The fillet shall extend into the shoulder area a minimum of six times the thickness of the drop-off and shall be placed prior to the adjacent lane being opened to traffic. Compaction of the fillet shall be a minimum of one coverage with a pneumatic tired roller per 1 inch of thickness.

~~L~~M. Paved shoulder construction adjacent to existing travel lanes shall meet the following:

1. **HMA Shoulder.**
   - Drop-offs greater than 2 inches will not be allowed when the adjacent lane is open to traffic,
   - Place the final lift of HMA shoulder material within 48 hours of the previous lift.

2. **PCC Shoulder.**
Do not open adjacent lane until PCC shoulder is cured enough to support traffic control devices.

~~M~~N. When the Contractor works on a bridge spanning a roadway or passageway, the Contractor shall take all necessary steps to protect the public using the facility below the bridge from falling debris, material, or construction equipment. The Contractor shall submit a safety procedure written plan to the Engineer prior to starting work. The plan shall include the following:
- Design of the means and methods used to provide protection.
- All assumptions used in the design.

Evaluation of the plan and design may require its preparation by a Professional Engineer licensed in the State of Iowa. If so, the costs will be paid for in accordance with Article 1109.03, B.

Reason for Revision: Following a few serious incidents nationwide, attention has been called to risk factors associated with storing flammable/combustible materials below bridges. Fire damage can reduce the integrity of concrete and/or metal structural elements, potentially impacting public mobility and/or safety.

This proposed specification revision introduces new language prohibiting the storage of flammable/combustible materials and equipment below overhead portions of bridges or other highway structures. Intent is for flammable/combustible materials to be relocated a reasonable distance away from the underside of structures, when not in active use.

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:		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Todd Hanon	**Office:** Construction & Materials	**Item 2**
Submittal Date: April 2, 2024	**Proposed Effective Date:** October 2024	
Article No.: 2301.02, B, 3, a **Title:** Water, Consistency, and Batch Yield (Portland Cement Concrete Pavement)	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text:

2301.02, B, 3, a.

Add as the third sentence:

When a water reducing admixture is used the maximum allowable slump will be 5 inches.

Comments: The Specifications Section asked whether the proposed language left it open to the Engineer on whether to accept a slump up to 5 inches. Language was revised to reflect that this is an required change to the maximum slump and not an option.

Specification Section Recommended Text:

2301.02, B, 3, a.

Add as the third sentence:

When a water reducing admixture is used the maximum slump may be increased to 5 inches.

Comments:

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

2301.02_B_3

3. Water, Consistency, and Batch Yield.

a. Use an amount of mixing water that will produce workable concrete of uniform consistency. Unless specifically modified by the Engineer, ensure slump, measured according to Materials I.M. 317, is no less than 1/2 inch or no more than 4 inches. When a water reducing admixture is used the maximum slump may be increased to 5 inches. Slump requirements will not apply to slip form paving.

Reason for Revision: With the max w/c for C-WR mixes to 0.45, concrete producers will likely need to use a mid range water reducer. With the mid range water reducer, slump may increase above 4 inches on occasion. This spec change will allow an increase in slump when a water reducer is used. This will also be consistent with structural specifications (2403 & 2412) to avoid confusion in the field.

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: Request from industry		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Todd Hanson	**Office:** Construction & Materials	**Item 3**
Submittal Date: April 2, 2024	**Proposed Effective Date:** October 2024	
Article No.: 2301, U, 1 **Title:** Time for Opening Pavement for Use (Portland Cement Concrete Pavement)	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2301.03, U, 1.

Replace Table 2301.03-3:

Table 2301.03- 3: Minimum Flexural Strength

Strength Class of Concrete	Thickness	Minimum Age	psi
A	<8” ≥8”	~~14~~ 10 calendar days~~(a)~~ 8 calendar days	500 500
C	<9” ≥9”	7 calendar days~~(b)~~ 5 calendar days	500 500(a)
M		48 hours~~(c b)~~	500

(a) ~~10 calendar days for concrete 8 inches thick or more.~~ 350 psi when maturity is used.
(b) ~~5 calendar days for concrete 9 inches thick or more.~~
~~(c)~~ Pavement may be opened for use prior to 48 hours when minimum flexural strength requirements are met.

Comments:

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

2301.03 U - Replace Table 2301.03-3 with the following:

U. Time for Opening Pavement for Use.

1. The time for opening pavement for use will be based on the restrictions listed in Table 2301.03-3, with flexural strength determined from beam specimens made during the progress of the work.

Table 2301.03- 3: Minimum Flexural Strength

Strength Class of Concrete	Thickness	Minimum Age Calendar Days	psi
A	<8” ≥8”	10 8	500 500
C	<9” ≥9”	7 5	500 500(a)

M		48 hours[(b)]	500
	(a) 350 psi when maturity is used. (b) Pavement may be opened for use prior to 48 hours when minimum flexural strength requirements are met.		

Reason for Revision: Based on TRB 950222 paper Flexural Strength Criteria for Opening Concrete Roadways to Traffic, the required opening strength for pavements 9” or thicker is 300 psi. This update to the table will add opening for pavements 9 inches or greater to 350 psi, when maturity used. Used 350 psi to be a bit more conservative and to be consistent with Section 2310.Update Table to include thickness so notes below can be cleaned up. Also updated minimum calendar days for the A mix. Modern cement hydrate more rapidly than when this table was included in the 1948 specifications.

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: Item came from CQI-IDOT meeting.		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Ashley Buss	**Office:** Construction & Materials	**Item 4**
Submittal Date: 4/11/2024	**Proposed Effective Date:** October 2024	
Article No.: 2303.05, A, 3, a. **Title:** Laboratory Voids (Flexible Pavement)	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2303.05, A, 3, a, Laboratory Voids.

Add the Article and **renumber** subsequent Articles:

2) When PWL applies, the minimum pay factor for lab voids shall be 1.0 when the following changes are made via plan note or special provision:

a) Decreasing the target lab voids from the limits published in Materials I.M. 510.

b) Increasing the minimum asphalt film thickness from the limits published in Materials I.M. 510.

~~**2**~~ **3)**

~~**3**~~ **4)**

Comments:

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

2303.05, A, 3, a.

3. Payment will be adjusted by the following Pay Factor for field voids, laboratory voids, and film thickness determined for the lot.

Multiply the unit price for the HMA bid item by the Pay Factor rounded to three decimal places.

a. Laboratory Voids.

1) Payment when PWL is used for acceptance:

PWL	Pay Factor
100.00	1.060
90.1 – 99.9	0.006000*PWL + 0.4600
90.0	1.000
50.0 – 89.9	0.00625*PWL + 0.4375
Less than 50.0	0.750 maximum

When PWL is less than 50.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

2) When PWL applies, the minimum pay factor for lab voids shall be 1.0 when the following changes are made via plan note or special provision:

a. Decreasing the target lab voids from the limits published in Materials I.M. 510.
b. Increasing the minimum asphalt film thickness from the limits published in Materials I.M. 510.

~~2)~~**3)** Payment when PWL lots are incomplete:

AAD from Target Air Void	Pay Factor
0.0 to 1.0	1.000
1.1 to 1.5	0.900
1.6 to 2.0	0.750
Over 2.0	0.500 maximum

When the AAD is more than 2.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

~~3)~~ **4)** Use the following payment schedule when a test strip is constructed:

AAD from Target Air Void	Pay Factor
0.0 to 1.5	1.000
1.6 to 2.0	2.5 - AAD
Over 2.0	0.500 maximum

Reason for Revision: The PWL schedules are calibrated for DOT specifications and verified to yield appropriate risk levels within FHWA guidance. There are situations where key volumetric parameters-asphalt film thickness and laboratory voids, are changed via plan note or special provision and the risk substantially changes. In these cases, the Iowa DOT PWL price adjustment schedules should not be used without conducting a new risk assessment to verify contractor and agency risk are maintained to appropriate levels. The need for this change was discussed with industry at the Strategic Asphalt Committee Meeting September 6, 2023. The change was discussed at the DME meeting on November 15, 2023.

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:		

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Curtis Carter	**Bureau/Office:** Construction & Materials	**Item 5**
Submittal Date: May, 2024	**Proposed Effective Date:** October, 2024	
Article No.: 2403.03, F, 5 **Title:** Structural Concrete – Placing and Protection in Cold Weather **Article No.:** 2403.05, A, 4 **Title:** Structural Concrete – Basis of Payment	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2403.03, F, 5.

Replace Articles c through e:

c. When insulation is used, apply an adequate amount of approved insulating material to formwork and exposed concrete surfaces to maintain concrete temperature in compliance with the requirements ~~of Article 2403.03, F, 5, d~~. Install and secure insulation in a manner which provides uniform and consistent protection across the entirety of each insulated face of the concrete element. Individually insulate metal which protrudes or projects from the formwork or finished concrete surface (e.g., metal formwork bracing, reinforcing steel projections), as needed to manage heat loss. Do not allow water or wind to compromise the effectiveness of the insulation. When blanket insulation is used, ensure edges and seams are overlapped, sealed and secured from disturbance. After placement, leave insulation undisturbed until the concrete attains a minimum age of 96 hours.

d. The duration of required cold weather protection shall be the first 96 hours after placing, subject to the following temperature controls. Maintain the concrete temperature at no less than 50°F for the first 48 hours after placing. After the first 48 hours, the concrete temperature may be allowed to gradually reduce for the next 48 hours at a rate not exceeding 25°F in 24 hours.

e. Monitor concrete temperatures for the ~~first 96 hours after placement~~ full duration of required cold weather protection. Furnish and install approved commercial temperature monitoring equipment configured to automatically record a minimum of one reading per hour for the ~~96 hour~~ full duration of temperature monitoring. The temperature monitoring equipment must be accurate within +/-2°F in the temperature range of 0°F to 180°F. The quantity and location of temperature sensors will be approved by the Engineer prior to concrete placement. Up to eight sensors per placement shall be situated to provide representative monitoring of concrete surface temperatures throughout the placement, with one sensor located in the area of minimum expected concrete temperature. Position the sensors with 2 inches clear cover to the surface of the concrete. Furnish temperature readings to the Engineer prior to discontinuation of cold weather protection.

2403.05, A, 4.

Replace the second sentence:

The additional payment for cold weather protection will ~~be $17.00~~ include base payment of $9.00 per cubic yard, plus payment of $2.00 per cubic yard per day of required cold weather protection.

Comments:

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

Edit 2403.03, F, 5, as follows:

5. Before concrete is placed at ambient air temperatures below 40°F or when these temperatures might occur within the first 96 hours after placement, provide cold weather protection and concrete temperature monitoring as follows:

a. Cold weather protection shall consist of heated housing, insulation, or combination thereof. Provide each formed or exposed concrete face with complete and uniform cold weather protection for the entirety of that face, unless otherwise approved by the Engineer.

b. When heated housing is used, use heating equipment that complies with the requirements of Article 2403.03, B, 4. Firmly secure combustible material to prevent contact with any source of heat and take adequate precautions to prevent fires. Construct the housing enclosure with sufficient weather resistance to maintain heat at the concrete surface as needed to comply with the temperature requirements of Article 2403.03, F, 5, d. Apply heat uniformly within the housing enclosure. Do not allow the ambient temperature in the enclosure to exceed the heat of the concrete surface by more than 35°F. Unless approved otherwise by the Engineer, suspend application of heat if the temperature of any portion of the concrete element exceeds 150°F. Do not allow the heating system to cause drying of exposed concrete surfaces or compromise the effectiveness of the curing protection required by Article 2403.03, E.

c. When insulation is used, apply an adequate amount of approved insulating material to formwork and exposed concrete surfaces to maintain concrete temperature in compliance with the requirements ~~of Article 2403.03, F, 5, d~~. Install and secure insulation in a manner which provides uniform and consistent protection across the entirety of each insulated face of the concrete element. Individually insulate metal which protrudes or projects from the formwork or finished concrete surface (e.g., metal formwork bracing, reinforcing steel projections), as needed to manage heat loss. Do not allow water or wind to compromise the effectiveness of the insulation. When blanket insulation is used, ensure edges and seams are overlapped, sealed and secured from disturbance. After placement, leave insulation undisturbed until the concrete attains a minimum age of 96 hours.

d. The duration of required cold weather protection shall be the first 96 hours after placing, subject to the following temperature controls. Maintain the concrete temperature at no less than 50°F for the first 48 hours after placing. After the first 48 hours, the concrete temperature may be allowed to gradually reduce for the next 48 hours at a rate not exceeding 25°F in 24 hours.

e. Monitor concrete temperatures for the full duration of required cold weather protection.~~first 96 hours after placement.~~ Furnish and install approved commercial temperature monitoring equipment configured to automatically record a minimum of one reading per hour for the full~~96 hour~~ duration of temperature monitoring. The temperature monitoring equipment must be accurate within +/-2°F in the temperature range of 0°F to 180°F. The quantity and location of temperature sensors will be approved by the Engineer prior to concrete placement. Up to eight sensors per placement shall be situated to provide representative monitoring of concrete surface temperatures throughout the placement, with one sensor located in the area of minimum expected concrete temperature. Position the sensors with 2 inches clear cover to the surface of the concrete. Furnish temperature readings to the Engineer prior to discontinuation of cold weather protection.

f. If all concrete for a given placement is at least 1 foot below ground water level, it may be placed at a temperature no less than 40°F and flooded to a minimum depth of 1 foot in lieu of other

methods of protection and curing provided the water temperature is 50°F or greater. Ensure that concrete cured in this manner remains completely submerged for the first 96 hours after placement and is not subjected to freezing temperatures for the first 10 calendar days after placement.

Edit 2403.05, A, as follows:

2403.05 BASIS OF PAYMENT.
Payment will be as follows:

A. Net volume of Structural Concrete as specified above:

1. Contract unit price per cubic yard.

2. For concrete placed within the contract period, additional payment will be made for heating of concrete mix ingredients, cold weather protection of placed concrete, or both.

3. Payment for heating of mix ingredients will be made when materials which are proportioned and mixed at the site are heated to meet requirements of Article 2403.03, F, or when heating is charged by the supplier of ready mixed concrete. For concrete proportioned and mixed at the site, the additional payment for heating will be $8.00 per cubic yard. For ready mixed concrete, the additional payment for heating will be the customary amount charged for heating, and separately identified on the invoice, with a maximum of $8.00 per cubic yard.

4. Payment for cold weather protection will be made when heated housing or insulation is used to meet requirements of Article 2403.03, F. The additional payment for cold weather protection will ~~be $17.00~~ include base payment of $9.00 per cubic yard, plus payment of $2.00 per cubic yard per day of required cold weather protection. If a concrete placement is protected by flooding with water in accordance with Article 2403.03, F, 5, f, no payment will be made. Payment for cold weather protection includes all costs of heated housing, insulation, concrete temperature sensors, concrete temperature monitoring and reporting.

Reason for Revision: Historically, the required duration of cold weather protection for structural concrete has been 4 days in most cases. The fixed-price payment for cold weather protection, per cubic yard of structural concrete, is based on this typical 4-day duration. However, use of the Developmental Specifications for High Performance Concrete (DS-23034) has become more common, and this Developmental Specification requires up to 7-day duration for cold weather protection. The current version of the Developmental Specification is silent on whether/how cold weather protection is to be paid for High Performance Concrete.

This package of proposed specification revisions (2403.03, F, 5; 2403.05, A; DS-23034) is intended to provide clarity on how cold weather protection for High Performance Concrete is to be paid.

This specific proposal includes bookkeeping edits intended to make this passage easier to reference and interpret with respect to scope of work and basis of payment for Structural Concrete and High Performance Concrete.

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:		

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Curtis Carter / Elijah Gansen	**Bureau/Office:** Construction & Materials	**Item 6**
Submittal Date: May, 2024	**Proposed Effective Date:** October, 2024	
Article No.: 2412.03, D, 4, a, 8 **Title:** Surface Finish (Concrete Bridge Decks) **Article No.:** 2532.03, D, 1, b **Title:** Limitations (Pavement Surface Repair (Diamond Grinding))	**Other:**	

Specification Committee Action: Approved as recommended.			
Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024
Specification Committee Approved Text: See Specification Section Recommended Text.			
Comments: None.			

Specification Section Recommended Text:

2412.03, D, 4, a, 8.

Replace the Article:

Continuously remove slurry or residue resulting from grooving operations. Do not deposit on deck or approach pavement. Leave deck and approach pavements in a clean condition. Ensure residue from grooving operations does not flow across lanes occupied by public traffic ~~or into gutters or other drainage facilities~~. This residue may be spread on foreslope or removed according to Article 1104.08. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or waterbodies.

2532.03, D, 1, b.

Replace the Article:

Continuously remove all slurry or residue resulting from the grinding operations. Do not deposit on the slab or shoulder. Leave pavement and paved shoulders in a clean condition. Ensure residue from grinding operations does not flow across lanes occupied by public traffic ~~or into gutters or other drainage facilities~~. This residue may be spread on the foreslope or removed according to Article 1104.08. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or waterbodies.

Comments:

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

Add to 2412.03, d, 4, a, 8), as follows:

8) Continuously remove slurry or residue resulting from grooving operations. Do not deposit on deck or approach pavement. Leave deck and approach pavements in a clean condition. Ensure residue from grooving operations does not flow across lanes occupied by public traffic ~~or into gutters or other drainage facilities~~. This residue may be spread on foreslope or removed according to Article 1104.08. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or waterbodies.

2532.03, D. 1. B.

b. Continuously remove all slurry or residue resulting from the grinding operations. Do not deposit on the slab or shoulder. Leave pavement and paved shoulders in a clean condition. Ensure residue from grinding operations does not flow across lanes occupied by public traffic. ~~or into gutters or other drainage facilities.~~ This residue may be spread on the foreslope or removed according to Article 1104.08. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or waterbodies.

Reason for Revision: On past projects the residue from diamond grinding has been distributed in a manner that causes issues with guard rail repairs and vegetation. The added language provides additional restrictions on how the material is to be distributed to ensure compliance with water quality regulations.

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:		

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Dan Sprengeler	**Bureau/Office:** Design	**Item 7**
Submittal Date: 4/22/2024	**Proposed Effective Date:** October 2024	
Article No.: 2528.03, J **Title:** Flaggers **Article No.:** 2528.04, J **Title:** Flaggers **Article No.:** 2528.05, J **Title:** Flaggers **Section No.:** 4188 **Title:** Traffic Control Devices	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: A county engineer asked about side road flagging. Although AFADs could be used, the safety factor is not as big an issue at side roads, where stop conditions already exist. Side roads would typically still be manned by flaggers only.

Specification Section Recommended Text:

2528.03, J, Flaggers.

Rename Article **a**nd **Add** the Article:

J. Flaggers and Automated Flagger Assistance Devices.

7. Automated Flagger Assistance Devices.

a. Contractor may choose to use Automated Flagger Assistance Devices (AFADs) for flagging operations. Ensure all AFADs meet the current requirements of the MUTCD Section 6E.04 and 6E.06.

b. AFADs shall be operated by trained flaggers who have been instructed in the operation of AFADs used on the project. Trained flaggers shall be available to step in as manual flaggers in case of an AFAD malfunction.

c. Place AFADs where flagger stations are shown on the project plans. AFADs shall be clearly visible to approaching traffic, and if used at night, illuminated as flagger stations.

d. A flagger operating an AFAD shall have direct line of sight to the AFAD location and an unobstructed view of approaching traffic. The use of a camera to monitor the AFAD and/or the approaching traffic is not permitted in lieu of a manual flagger.

e. Flaggers shall not perform other duties while operating AFADs. Flaggers shall not leave AFADs unattended at any time while they are in use. AFADs shall not be operated by a pilot car driver.

f. A single flagger is permitted to operate two AFADs if the following requirements are met:

1) The flagger has unobstructed view of both AFADs,

2) The flagger has unobstructed view of both directions of approaching traffic,

3) The distance between AFAD locations is not greater than 1000 feet.

g. Immediately replace AFADs with manual flaggers in the event of malfunction. The Contractor shall have an equal number of trained flaggers present on-site available to operate the number of AFADs in use.

h. Remove AFADs from the roadway when not in use.

2528.04, J, Flaggers.

Rename Article **a**nd **Add** the Article:

J. Flaggers and Automated Flagger Assistance Devices.

3. AFADs will not be measured for payment separately, but they may be used as a supplement or an alternate to flaggers. Flaggers will include AFADs, if AFADs are used as described in this specification. Flaggers will be measured as a single unit for the combination of manual flagger and AFAD at each flagger station location. If more than one AFAD is controlled by a single manual flagger, Flagger will be measured for payment by the flagger station locations (AFAD locations).

2528.05, J, Flaggers.

Rename Article **a**nd **Add** the Articles:

J. Flaggers and Automated Flagger Assistance Devices.

3. No direct payment for AFADs will be made for installation, operation, relocation, maintenance, or removal of the devices.

4. Additional flagging related signs and devices necessary to comply with requirements related to the use of AFADs will not be paid for directly but shall be incidental to Traffic Control.

4188, Traffic Control Devices.

Add the Article:

4188.12 AUTOMATED FLAGGER ASSISTANCE DEVICES.

A. Ensure all AFADs meet the current requirements of the MUTCD Section 6E.04 and 6E.06.

B. Use RED/YELLOW Lens type AFADs as per MUTCD Section 6E.06.

C. AFADs shall meet crashworthiness requirements of Article 4188.01, B.

D. When using AFADs for work zones on Primary roadways, remote communication capabilities meeting requirements of Article 4188.11 are required.

Comments:

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

2528.03.O (Eventually this could be combined with 2528.03.J Flaggers. Not sure where to put it in the interim.)

O. Automated Flagger Assistance Devices.
Contractor may choose to use Automated Flagger Assistance Devices (AFADs) for flagging operations. Ensure all AFADs meet the current requirements of the MUTCD Section 6E.04 and 6E.06.

1. **Definition.**
AFADs enable flaggers to be positioned out of the lane of traffic and are used to control road users through temporary traffic control zones. They are designed to be remotely operated by separate flaggers near the devices or by a single flagger in specific cases as defined in this article.

2. **Equipment.**
   - **5.** When using AFADs for work zones on Primary roadways, remote communication capabilities meeting requirements of Article 4188.11 are required.
   - **6.** AFADs shall meet crashworthiness requirements of Article 4188.01, B
   - **7.** Use RED/YELLOW Lens type AFADs as per MUTCD Section 6E.06.
   - **8.** AFADs will not be measured for payment separately, they may be used as a supplement or an alternate to flaggers. “Flaggers” will include AFADs, if AFADs are used as described in this specification.
   - **9.** “Flaggers” will be measured as a single unit for the combination of manual flagger and AFAD at each flagger station location. If more than one AFAD is controlled by a single manual flagger, “Flagger” will be measured for payment by the flagger station locations (AFAD locations).
   - **10.** No direct payment for AFADs will be made for installation, operation, relocation, maintenance, or removal of the devices.
   - **11.** Additional flagging related signs and devices necessary to comply with requirements related to the use of AFADs will not be paid for directly but shall be incidental to Traffic Control, Lump Sum.

3. **Operation.**
   - **a.** AFADs shall be operated by trained flaggers who have been instructed in the operation of AFADs used on the project. Trained flaggers shall be available to step in as manual flaggers in case of an AFAD malfunction.
   - **b.** Place AFADs where flagger stations are shown on the project plans. AFADs shall be clearly visible to approaching traffic, and if used at night, illuminated as flagger stations.
   - **c.** A flagger operating an AFAD shall have direct line of sight to the AFAD location and an unobstructed view of approaching traffic. The use of a camera to monitor the AFAD and/or the approaching traffic is not permitted in lieu of a manual flagger.
   - **d.** Flaggers shall not perform other duties while operating AFADs. Flaggers shall not leave AFADs unattended at any time while they are in use. AFADs shall not be operated by a pilot car driver.
   - **e.** A single flagger is permitted to operate two AFADs if the following requirements are met:
     - **4)** The flagger has unobstructed view of both AFADs,
     - **5)** The flagger has unobstructed view of both directions of approaching traffic,
     - **6)** The distance between AFAD locations is not greater than 1000 feet.
   - **f.** Immediately replace AFADs with manual flaggers in the event of malfunction. The Contractor shall have an equal number of trained flaggers present on-site available to operate the number of AFADs in use.
   - **g.** Remove AFADs from the roadway when not in use.

Reason for Revision: Allow contractors to use the AFADs for their flagging operations to get flaggers off of the roadway. This specification allows contractors to use AFADs and also prescribes how they should be operated in a safe manner. Some manufacturers propose using AFADs in a manner that FHWA and Iowa DOT do not allow (e.g. operating from a pilot car with no direct line-of-sight to the AFAD. Eventually, Iowa DOT plans to require AFADs for most flagging operations and the specification also tells contractors what communication protocols will be required when that

requirement becomes official. Iowa DOT will begin to test AFADs and develop an approved list of devices in MAPLE.		
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:		

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Dan Sprengeler	**Bureau/Office:** Design	**Item 8**
Submittal Date: 4/22/2024	**Proposed Effective Date:** October 2024	
Article No.: 2528.03, O **Title:** Truck Mounted or Trailer Mounted Attenuator **Article No.:** 2528.04, M **Title:** Truck Mounted or Trailer Mounted Attenuator **Article No.:** 2528.05, M **Title:** Truck Mounted or Trailer Mounted Attenuator **Article No.:** 4188 **Title:** Traffic Control Devices	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments:

Specification Section Recommended Text:

2528.03, Construction.

Add the Article and renumber existing Article O:

O. Truck-Mounted or Trailer-Mounted Attenuator.

1. When specified in the contract documents, furnish, operate, and maintain a Truck-mounted or Trailer-mounted Attenuator (TMA) that meets Test Level 3 (TL-3) requirements of NCHRP 350 or MASH-16.

2. Operate and maintain the TMA according to the manufacturer's recommendations, the contract documents, and/or as directed by the Engineer. Place the TMA as detailed in the appropriate Standard Road Plans or other contract documents.

~~O~~ **P.Limitations.**

2528.04, Method of Measurement.

Add the Article:

M. Truck-Mounted or Trailer-Mounted Attenuator.
The Engineer will count the number days that a TMA is required by the contract documents.

2528.05, Basis of Payment.

Add the Article:

M. Truck-Mounted or Trailer-Mounted Attenuator.
Payment will be at the contract unit price per calendar day for each TMA provided. Payment is full compensation for furnishing, placing, operating, and maintaining the TMA.

4188, Traffic Control Devices.

Add the Article:

4188.13 TRUCK-MOUNTED OR TRAILER-MOUNTED ATTENUATOR.
Use a TMA that meets or exceeds the requirements of Article 4188.01 for Category 3 devices. The face of the TMA visible to approaching traffic shall have retro reflectorized alternating red and yellow stripes, sloping downwards in both directions from the center of the TMA. Retroreflective sheeting shall meet ASTM D 4956, Type VIII or Type XI requirements.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**
2528, Traffic Control

Truck-mounted or Trailer-mounted Attenuators
When specified in the contract documents, furnish, operate, and maintain a Truck-mounted or Trailer-mounted Attenuator (TMA) that meets Test Level 3 (TL-3) requirements of NCHRP 350 or MASH-16.

Materials and Design
Use a TMA that meets or exceeds the requirements of Article 4188.01 for Category 3 devices. The face of the TMA visible to approaching traffic shall have retro reflectorized alternating red and yellow stripes, sloping downwards in both directions from the center of the TMA. Retroreflective sheeting shall meet ASTM D 4956, Type VIII or Type XI requirements.

Operation
Operate and maintain the TMA according to the manufacturer's recommendations, the contract documents, and/or as directed by the Engineer. Place the TMA as detailed in the appropriate Standard Road Plans or other contract documents.

Method of Measurement
The Engineer will count the number days that a TMA is required by the contract documents.

Basis of Payment.
Payment will be at the contract unit price per calendar day for each TMA measured as provided in Article xxx. Payment is full compensation for furnishing, placing, operating, and maintaining the TMA.

Reason for Revision: We want to be able to compensate the contractors when the devices are used. Also, in the future we may encourage them to use TMAs where they are now optional. TMA use promotes positive protection for workers and motorists. Several other Midwest states already are or are planning to do what we are proposing.

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:		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Todd Hanson	**Office:** Construction & Materials	**Item 9**
Submittal Date: Apr 3, 2024	**Proposed Effective Date:** October 2024	
Section No.: 2556 **Title:** Dowel Bar Retrofit	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2556.02, A, 1.

Replace the Article:

Ensure epoxy coated dowel bars, 1.25 inches by 15 inches for pavement less than 10 inches and 1.5 inches by 15 inches for pavement 10 inches or greater, conform to requirements of Section 4151. Uniformly coat dowel bars with approved bond breaker according to Article 4151.02, B.

2556.03, B, 1.

Add as the third sentence:

Cut slots to required width to prevent chairs from moving during placement of grout or the chair width plus 1/8 inch.

Comments: “Simultaneously” has already been fixed.

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

2556.02 MATERIALS.

A. Epoxy Coated Dowel Bars.

1. Ensure epoxy coated dowel bars, 1.5 inches by 15 inches for pavement 10 inches or greater and 1.25 inches by 15 inches for pavement less than 10 inches.~~, c~~Conform to requirements of Section 4151. Uniformly coat dowel bars with approved bond breaker according to Article 4151.02, B.

2556.03 CONSTRUCTION.

B. Preparing Slots for Dowel Bars.

1. Cut slots in pavement with gang saw capable of cutting at least three slots in each wheel path simultaneously ~~si~~multaneously. Cut slots to required depth to place center of dowels at mid-depth of

concrete slab. Cut slots to required width to prevent chairs from moving during placement of grout or the chair width plus 1/8 inch. Multiple saw cuts parallel to centerline may be required to remove material from slot.		
Reason for Revision: Specification update to require smaller diameter dowels for pavements less than 10 inches. SUDAS specifications already includes in standard drawing 7040.106. With narrower dowels, slot width may need to be adjusted as well. Fix misspelled word “simultaneously”.		
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: Item came from CQI-IDOT meeting.		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Ashley Buss	**Office:** Construction and Materials	**Item 10**
Submittal Date: 4/11/2024	**Proposed Effective Date:** October 2024	
Article No.: 4138.01, A **Title:** General Requirements (Cutback and Liquid Asphalts)	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

4138.01, A.

Replace the third bullet:

Slow Curing (SC) ~~AASHTO M 140~~ ASTM D 2026

Comments:

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

4138.01 GENERAL REQUIREMENTS.

A. Use the grade specified. Meet the following requirements:

- Rapid Curing (RC) AASHTO M 81
- Medium Curing (MC) AASHTO M 82
- Slow Curing (SC) ~~AASHTO M 140~~ ASTM D2026

Reason for Revision: AASHTO M140 only applies to emulsified asphalts and does not apply to slow curing cutback asphalts. At this time, there is not an "AASHTO" method specific to slow curing cutbacks so the ASTM method will be used.

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:

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Bob Welper	**Bureau/Office:** District 2 Materials	**Item 11**
Submittal Date: April 9, 2024	**Proposed Effective Date:** October 2024	
Article No.: 4145.04 **Title:** Design (Concrete Culvert Pipe)	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

4154.04, E.

Add as the second bullet:

- Computed wall thickness is defined as 1 inch per foot of pipe diameter or equivalent diameter, plus 1 inch.

4145.04, F.

Delete the Article:

~~**F.** Compute wall thickness based on the following: No more than 1 inch per foot of pipe diameter or equivalent diameter, plus 1 inch~~.

Comments:

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

4145.04 DESIGN.

A. For circular pipe, comply with the following for details of the shell, design, and distribution of reinforcement:
Diameter less than 12 inches: AASHTO M 86.
Diameter 12 inches or larger: AASHTO M 170.

B. Apply ASTM C 990/990M or ASTM C 443 when circular pipe with gaskets is specified.

C. Apply AASHTO M 206 when reinforced concrete arch pipe is specified.
D. Apply AASHTO M 207 when reinforced concrete elliptical pipe is specified.

E. If furnishing AASHTO design pipe, ensure it complies with the following:

- Minimum thickness of any part of the joint no less than 30% of the computed wall thickness
- Length of any part of the joint no less than shown in Table 4145.04-1.

Table 4145.04-1: Minimum Joint Length

Computed Wall Thickness	Minimum Length of Joint

3" or Less	87% of computed wall thickness
3" to 6"	75% of computed wall thickness but not less than 2 3/4"
6" to 9"	61% of computed wall thickness but not less than 4 1/2"

~~**F.** Compute wall thickness based on the following: No more than 1 inch per foot of pipe diameter or equivalent diameter, plus 1 inch~~.

- For joint thickness and length dimensioning purposes, computed wall thickness is defined as 1 inch per foot of pipe diameter or equivalent diameter, plus 1 inch.

Reason for Revision: Past specification updates reworded and renumbered a joint dimension requirement such that it now appears to set a maximum pipe wall thickness. As currently written, that maximum thickness allowed by spec conflicts with (is less than) the minimum pipe wall thicknesses required for some designs as established by AASHTO M 86, M 170, and M 207. For example, an M 207-compliant 48 inch equivalent diameter elliptical pipe shall have a 5.5-inch minimum pipe wall thickness. As written, Spec 4125.04F appears to set a 5-inch maximum pipe wall thickness for that unit.

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:		

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Curtis Carter	**Bureau/Office:** Construction & Materials	**Item 12**
Submittal Date: May, 2024	**Proposed Effective Date:** October, 2024	
Article No.: **Title:**	**Other:** DS-23034, High Performance Concrete for Structures	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See attached Developmental Specifications for High Performance Concrete for Structures.

Comments: None.

Specification Section Recommended Text: See attached Draft Developmental Specifications for High Performance Concrete for Structures.

Comments:

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

Edit 23034.02 Materials as follows:

23034.02 MATERIALS.
Contractor may use other mixes than those described below provided they meet the requirements of this specification and are approved by the District Materials Engineer.

A. Substructure:

1. Apply the following conditions for substructure HPC mixes:
- Coarse aggregate meeting Class 3i durability.
- Basic water to cementitious material (w/c) ratio in accordance with Materials I.M. 529~~of 0.42, with a maximum w/c ratio of 0.45~~.

2. HPC mix for substructure may be a HPC-S or CV-HPC-S. Apply the following conditions:
a. Use one of the following cement combinations:
- Type IS, IP or IT.
- Type I, II or IL with a minimum of 30% weight substitution with GGBFS.

b. Fly ash substitution not to exceed 20% by weight of the cement.
c. Maximum total substitution of 50%
d. A high range water reducer may be used with a maximum allowable slump of 8 inches and target air content of 7.5% ± 2.0%.

B. Deck.

1. Apply the following conditions for deck HPC mixes:
a. Use coarse aggregate meeting Class 3i durability.
b. Basic w/c ratio in accordance with Materials I.M. 529~~of 0.40, with a maximum w/c ratio of 0.42~~.

2. The HPC mix for the deck may be a HPC-D or a CV-HPC-D. Apply the following conditions:

a. Use one of the following cement combinations:

- Type IS, IP or IT.
- Type I, II or IL with a minimum of 30% weight substitution with GGBFS.

b. Fly ash substitution not to exceed 20% by weight of the cement.

c. Maximum total substitution of 50%.

d. Combined aggregate gradation optimized in Zone II according to Materials I.M. 532.

C. Contractor Designed HPC.

Other mixes meeting the above requirements may be approved by the District Materials Engineer.

Edit DS-23034.03, D, and DS-23034.05, as follows:

D. Cold Weather Protection.

1. Apply Article 2403.03, F. ~~Monitor surface temperature of concrete continuously during curing period using electronic recording type thermometers capable of recording a minimum of one reading per hour. Furnish results to Engineer in electronic format as required.~~

2. Replace the provisions of Article 2403.03, F, 5, d, with the following: ~~If supplemental housing and heating is used, locate temperature monitors in the concrete at the furthest and closest point from heat source. Verify maximum temperature at monitor point closest to heat source does not exceed 150ºF.~~

~~**3.** After required curing period, gradually reduce temperature of air surrounding concrete to outside air temperature according to Article 2403.03, I, of the Standard Specifications.~~

a. Substructure.

The duration of required cold weather protection shall be the first 120 hours after placing. Ensure concrete and its surface temperature are maintained at a temperature of no less than 50ºF for the first 120 hours after placing. Curing time will not be counted if concrete temperature falls below 50ºF. Following completion of the cold weather protection period, regulate the rate of concrete cooling to prevent thermal shock, until the concrete temperature falls within 35ºF of ambient air temperature.

b. Deck.

The duration of required cold weather protection shall be the first 168 hours after placing. Ensure concrete and its surface temperature are maintained at a temperature of no less than 50ºF for the first 168 hours after placing. Curing time will not be counted if the concrete temperature falls below 50ºF. Following completion of the cold weather protection period, regulate the rate of concrete cooling to prevent thermal shock, until the concrete temperature falls within 35ºF of ambient air temperature.

~~**1)** Covering with plastic will not be allowed as a substitute for continuous wet sprinkling system curing.~~

~~**2)** Ensure concrete and its surface temperature are maintained at a temperature of no less than 50ºF for 168 hours of continuous wet sprinkling system curing. Curing time will not be counted if the concrete temperature falls below 50ºF.~~

23034.04 METHOD OF MEASUREMENT.

Measurement for High Performance Concrete will be the cubic yards shown in the contract documents.

23034.05 BASIS OF PAYMENT.

Payment for High Performance Concrete will be at the contract unit price per cubic yard. Payment includes cost for testing production concrete.

For High Performance Concrete placed within the contract period, additional payment will be made for heating of concrete mix ingredients, cold weather protection of placed concrete, or both. Payment for heating of mix ingredients and cold weather protection will be in accordance with Article 2403.05, A, 3 and 2403.05, A, 4, respectively. The duration of cold weather protection eligible for payment shall be as specified in DS-23034, D, 2 [**update DS number if/when re-issued*].

Reason for Revision: Recent changes were made to relax the maximum w/c ratio for HPC-D mix in IM 529. The edits to this DS are proposed to reference the w/c requirements of IM 529, instead of specifying and maintaining separate limits within the DS.

Historically, the required duration of cold weather protection for structural concrete has been 4 days in most cases. The fixed-price payment for cold weather protection, per cubic yard of structural concrete, is based on this typical 4-day duration. However, use of the Developmental Specifications for High Performance Concrete (DS-23034) has become more common, and this Developmental Specification requires up to 7-day duration for cold weather protection. The current version of the Developmental Specification is silent on whether/how cold weather protection is to be paid for High Performance Concrete.

This package of proposed specification revisions (2403.03, F, 5; 2403.05, A; DS-23034) is intended to provide clarity on how cold weather protection for High Performance Concrete is to be paid.

This specific proposal includes bookkeeping edits intended to make this passage easier to reference and interpret with respect to scope of work and basis of payment for Structural Concrete and High Performance Concrete.

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- 23062
(Replaces DS-23034)

DEVELOPMENTAL SPECIFICATIONS
FOR
HIGH PERFORMANCE CONCRETE FOR STRUCTURES

Effective Date
October 15, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23062.01 DESCRIPTION.

A. Develop and provide high performance concrete (HPC) for bridge substructures and decks when called for in the contract documents. HPC is defined as a concrete mix providing the following:
- Desired workability.
- Maximum 28 day permeability of 2000 coulombs for the substructure (or greater than 20 K ohm-cm surface resistivity by Wenner probe) and 1500 coulombs for the deck (or greater than 30 K ohm-cm surface resistivity by Wenner probe), as a target.

B. Apply Sections 2403, 2412, and Division 41 of the Standard Specifications with the following modifications.

23062.02 MATERIALS.

Contractor may use other mixes than those described below provided they meet the requirements of this specification and are approved by the District Materials Engineer.

A. Substructure.

1. Apply the following conditions for substructure HPC mixes:
- Coarse aggregate meeting Class 3i durability.
- Basic water to cementitious material (w/c) ratio ~~of 0.42, with a maximum w/c ratio of 0.45~~ in accordance with Materials I.M. 529.

2. HPC mix for substructure may be a HPC-S or CV-HPC-S. Apply the following conditions:
e. Use one of the following cement combinations:
- Type IS, IP or IT.
- Type I, II or IL with a minimum of 30% weight substitution with GGBFS.

f. Fly ash substitution not to exceed 20% by weight of the cement.
g. Maximum total substitution of 50%
h. A high range water reducer may be used with a maximum allowable slump of 8 inches and target air content of 7.5% ± 2.0%.

B. Deck.

1. Apply the following conditions for deck HPC mixes:
   c. Use coarse aggregate meeting Class 3i durability.
   d. Basic w/c ratio ~~of 0.40, with a maximum w/c ratio of 0.42~~ in accordance with Materials I.M. 529.

2. The HPC mix for the deck may be a HPC-D or a CV-HPC-D. Apply the following conditions:
   e. Use one of the following cement combinations:
   - Type IS, IP or IT.
   - Type I, II or IL with a minimum of 30% weight substitution with GGBFS.

   f. Fly ash substitution not to exceed 20% by weight of the cement.
   g. Maximum total substitution of 50%.
   h. Combined aggregate gradation optimized in Zone II according to Materials I.M. 532.

C. Contractor Designed HPC.
Other mixes meeting the above requirements may be approved by the District Materials Engineer.

23062.03 CONSTRUCTION.

A. Production Concrete.

1. Notify the Engineer at least 48 hours prior to placement of production concrete. Use only approved HPC mixes for production concrete. If a mix other than mix described in Article DS-23062.02, A or B is to be used, ensure it has same materials, proportions, and properties (including slump, air content, and w/c ratio) as approved by the District Materials Engineer.

2. District Materials Engineer will obtain random verification strength samples on a minimum of one deck placement. Strength samples will be tested at District Materials Laboratory according to AASHTO T 22. A set of four cylinders will be cast, cured, and handled according to Materials I.M. 315. Three cylinders will be tested for strength at 28 days. One cylinder will be tested for permeability on a random basis by Central Materials Laboratory or Wenner probe resistivity testing by the District Materials Engineer. Permeability testing will not be evaluated on footings or drilled shafts.

B. Placing Concrete.
For the deck, placing of concrete floors shall not begin if the theoretical rate of evaporation exceeds 0.1 pounds per square foot per hour. Monitor theoretical evaporation rate at a maximum interval of every three hours during placement at a location as near the deck as possible. If the rate exceeds 0.15 pounds per square foot per hour cease placement at next location acceptable to Engineer.

C. Curing.

1. **Substructure.**
   a. Leave forms in place for 96 hours of curing.
   b. Apply curing protection to exposed surfaces of concrete in accordance with Article 2403.03, E, 4, b. Leave curing protection in place for 96 hours.

2. **Deck.**
   a. Leave forms in place for 168 hours of curing.
   b. Apply water to the burlap covering for 168 hours of continuous wet sprinkling system curing.
   c. Do not place curing compound on floor.
   d. Use burlap that is prewetted by fully saturating, stockpiling to drain, and covering with plastic to maintain wetness prior to placement. Place two layers of prewetted burlap on floor immediately after artificial turf drag or broom finish with a maximum time limit of 10 minutes after final finishing. Apply water to burlap covering for entire curing period by

means of a continuous wet sprinkling system that is effective in keeping burlap wet during moist curing period.

e. Use evaporation retardant only in situations where equipment and/or labor delays, or environmental conditions, prevent adequate protection of concrete until prewetted burlap is in place. Have an evaporation retardant, including Confilm, Conspec Acquafilm, Evapre, or Sure Film, readily available during placement for application as directed by the Engineer. Do not work evaporation retardant into concrete surface or use as a finishing aid.

D. Cold Weather Protection.

1. ~~Monitor surface temperature of concrete continuously during curing period using electronic recording type thermometers capable of recording a minimum of one reading per hour. Furnish results to Engineer in electronic format as required.~~ Apply Article 2403.03, F of the Standard Specifications.

2. ~~If supplemental housing and heating is used, locate temperature monitors in the concrete at the furthest and closest point from heat source. Verify maximum temperature at monitor point closest to heat source does not exceed 150ºF.~~ Replace the provisions of Article 2403.03, F, 5, d, of the Standard Specifications with the following:

~~**3.** After required curing period, gradually reduce temperature of air surrounding concrete to outside air temperature according to Article 2403.03, I, of the Standard Specifications.~~

a. Substructure.

The duration of required cold weather protection shall be the first 120 hours after placing. Ensure concrete and its surface temperature are maintained at a temperature of no less than 50ºF for the first 120 hours after placing. Curing time will not be counted if concrete temperature falls below 50ºF. Following completion of the cold weather protection period, regulate the rate of concrete cooling to prevent thermal shock, until the concrete temperature falls within 35ºF of ambient air temperature.

b. Deck.

~~**1)** Covering with plastic will not be allowed as a substitute for continuous wet sprinkling system curing.~~

~~**2)**~~ The duration of required cold weather protection shall be the first 168 hours after placing. Ensure concrete and its surface temperature are maintained at a temperature of no less than 50ºF for the first 168 hours ~~of continuous wet sprinkling system curing~~ after placing. Curing time will not be counted if the concrete temperature falls below 50ºF. Following completion of the cold weather protection period, regulate the rate of concrete cooling to prevent thermal shock, until the concrete temperature falls within 35ºF of ambient air temperature.

23062.04 METHOD OF MEASUREMENT.

Measurement for High Performance Concrete will be the cubic yards shown in the contract documents.

23062.05 BASIS OF PAYMENT.

A. Payment for High Performance Concrete will be at the contract unit price per cubic yard. Payment includes cost for testing production concrete.

B. For High Performance Concrete placed within the contract period, additional payment will be made for heating of concrete mix ingredients, cold weather protection of placed concrete, or both. Payment for heating of mix ingredients and cold weather protection will be in accordance with Articles 2403.05, A, 3 and 4, of the Standard Specifications. The duration of cold weather protection eligible for payment shall be as specified in DS-23062, D, 2.

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Mark Van Dyke / Eric Johnsen	**Bureau/Office:** Traffic Operations / Specifications	**Item 13**
Submittal Date: 4/22/2024	**Proposed Effective Date:** July 16, 2024	
Article No.: **Title:**	**Other:** DS-23040, Intelligent Transportation Systems	

Specification Committee Action: Approved as recommended.			
Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:**
Specification Committee Approved Text: See attached Developmental Specifications for Intelligent Transportation Systems.			
Comments: None.			
Specification Section Recommended Text: See attached Draft Developmental Specifications for Intelligent Transportation Systems.			
Comments:			

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

Reason for Revision: Update the DS

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:		

DS- 23058
(Replaces DS-23040)

DEVELOPMENTAL SPECIFICATIONS
FOR
INTELLIGENT TRANSPORTATION SYSTEMS

Effective Date
July 16, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23058.01 DESCRIPTION.

A. This section includes furnishing all work, apparatus, and materials to construct, install, and place in operation, to the Engineer's satisfaction, a complete ITS as shown in the contract documents.

B. Definition of Abbreviations.

AC – Alternating Current
AMP - Ampere
AWG – American Wire Gauge
CSR – Combined Stress Ratio
EMT – Electric Metallic Tube
GFCI – Ground Fault Circuit Interrupter
IP – Internet Protocol
ITU-T - International Telecommunications Union – Telecommunications Standardization Sector
LED – Light Emitting Diode
MVDS - Microwave Vehicle Detection System
NOC – Network Operations Center
OSP – Outside Plant
PDF – Portable Document File
RJ – Registered Jack
RMS – Root Mean Square
SC – Subscriber Connector
SCTE - Society of Cable Telecommunications Engineers
~~SM – Single Mode~~
TMC – Traffic Management Center
UPC - Ultra-Physical Contact
UV – Ultraviolet
VAC - Volts Alternating Current
XHHW - Cross-linked Polyethylene, High Heat and Water Resistant

C. Special Requirements.

1. Comply with NEC, latest edition adopted by the State of Iowa.

2. Comply with TIA latest editions.

3. EIA latest editions.

4. IEEE Standards and Practices.

5. ANSI Standards and Practices.

6. NEMA Standards.

7. UL Standards.

D. Submittals.

1. **Material List.**
   Complete and submit one electronic PDF file of the materials list to the project Engineer within 14 calendar days after award of the project contract. Include the name of the materials, supplier and catalog number of each item listed.

2. **Construction Schedule.**
   a. Fourteen calendar days before the preconstruction conference, submit to the Engineer one electronic PDF file of the detailed construction schedule including dates of commencement for each major work item, duration of each major work item and completion of each major work item on each segment of the proposed construction.
   b. Major items of work to be included on the schedule shall include, but are not limited to the following:
      - Duration of material procurement,
      - Installation of conduit, handholes, building entrances, and fiber optic cable,
      - Bridge attachments,
      - Installation of device cabinets, foundations, and poles,
      - Installation and energizing of power,
      - Splicing and termination of fiber optic cables, and
      - Duration of fiber testing and submission of test reports.
   c. The construction schedule shall comply with Section 1108 of the Standard Specifications. In addition to limitations of operations in Article 1108.03 of the Standard Specifications, work shall not be performed that may result in an unplanned network disruption during an ICN moratorium date. ~~Request moratorium dates from the ICN NOC at ICNServicedesk@iowa.gov, 1-800-572-3940, or 515-725-4400.~~
   d. Coordinate with the ~~ICN NOC~~ Engineer to schedule all splicing work.
   e. Upon acceptance of the schedule, the Contractor will be expected to adhere to these dates as proposed unless modified with the approval of the Engineer.
   f. Submittal and approval of the proposed construction schedule by the Engineer is required before the Contractor can commence construction activities.
   g. The cost of preparing and revising the construction schedule shall be included in the bid item for Mobilization.

3. **Shop Drawings.**
   a. Before any items are ordered or installation is started, submit the following list of shop drawings for approval according to Article 1105.03 of the Standard Specifications:
      - Power Installed Foundation.
      - Pole.
      - Breakaway Transformer Base.

- Pole Mount Cabinet Mounting Assemblies.
- Cabinet Foundation.
- Cabinet.
- HDPE Conduit.
- Schedule 80 HDPE Conduit.
- Conduit Splice Kit.
- Rigid Steel Conduit and Fittings.
- Duct Plugs.
- Duct Seal.
- Handholes.
- Test Stations.
- Fiber Markers.
- Ground Rods.
- Exothermic Welding Kit.
- Copper Cable (Power).
- Copper Cable (Ground).
- Tracer Wire.
- Tracer Wire Splice Kit.
- Fiber Optic Cable.
- NEMA 3R 240/120 1.0 kVA Transformer.
- Meter Pedestal.
- Circuit Breaker.
- OTDR Meter with Calibration Certificate from Manufacturer within last year.
- Fusion Splicer with Calibration Certificate from Manufacturer within last year.
- Fiber Optic Splice Closure.
- Fiber Optic Splice Tray.
- Module Connector Housing Splice Cassettes.
- Connector Adaptor Panel.
- Single Panel Housing.
- Fiber Connector and Pigtails.
- One Rack Unit Connector Housing.
- Four Rack Unit Connector Housing.
- ~~Cameras.~~
- ~~Sensors.~~
- Additional drawings may be required on a project specific basis in accordance with the contract documents.

b. Submittal for power installed foundation shall include all structural calculations and be accompanied by a shop drawing that at a minimum illustrates a schematic of the foundation with a summary of the design criteria, material data, foundation data and orientation details. Design calculations and shop drawing for power installed foundation shall be sealed by a Professional Engineer licensed in the State of Iowa.

c. Submittal for poles shall include all structural calculations and be accompanied by a shop drawing that at a minimum illustrates a schematic of the proposed pole and transformer base with a summary of the design criteria, material data, pole data and details of handholes, pole top, pole base and pole orientation. Design calculations for poles and transformer bases shall be sealed by a Professional Engineer licensed in the State of Iowa.

d. The Engineer will review the shop drawings/catalog cuts for the purpose of assuring general conformance with the project design concept and contract documents.

e. The Engineer will provide approval or rejection of shop drawings within 14 calendar days of the Contractor’s submission. Re-submit the shop drawings for approval within 7 calendar days of the Engineer’s rejection.

f. Provide written notice of any deviations from the requirements of the contract documents or Special Provisions.

g. Engineer's approval of shop drawings/catalog cuts does not relieve the Contractor of responsibility for providing satisfactory materials complying with the contract documents. Errors not detected during review do not authorize the Contractor to proceed in error.

h. Order all materials requiring production lead time greater than 4 weeks within 7 calendar days of receiving the approved shop drawing(s).
i. Submit to the Engineer proof of material purchase order in electronic PDF format.

4. Warranty.
a. Transfer all required standard materials warranties on the date of final acceptance to the Contracting Authority.
b. Warranty periods shall not commence prior to final acceptance of the work and shall remain in effect until at least 1 year after the final acceptance for all cables and equipment furnished and installed for the project.

E. As-Built Documentation.

1. General.
a. Maintain written records of daily construction progress, areas worked, and quantities installed to aid in the completeness of as-constructed documentation.
b. Provide as-built documentation package with the following:
1) Documentation of fiber cable sequentials at building entrances, cabinets, and in/out of handholes.
2) Master record set of plans (maintained throughout construction) documenting any deviations from the design shown in the original contract documents.
3) Confirmation that splicing was completed as planned or redline corrections on how it was spliced.

2. GPS Data Recording Staking Assistance.
a. Unless otherwise specified in the contract documents, ~~T~~the Engineer will be responsible for collecting GPS data of all installations including, but not limited to, conduit and/or cable routing and installation depth and handhole~~s~~ locations.
b. Coordinate and assist the Engineer in this effort by staking, flagging or otherwise locating all installed features until such time that the GPS data can be collected. Mark the conduit alignment at least every 50 feet.
c. ~~Mark the conduit alignment at least every 50 feet to allow GPS data to be collected.~~ For any segments that are bored, ~~make note on the flag or stake of~~ provide bore logs to the Engineer that include the bore depth ~~at the~~ and location ~~that is being marked~~ if the boring equipment is capable of producing these records.
d. The cost of GPS data recording staking assistance shall be included in the bid item for Mobilization.

F. Aerial photography shown on the plans is for reference only and may not match existing conditions.

23058.02 MATERIALS.

A. General.

1. Provide any items, equipment, or materials not specifically addressed in the contract documents but required to provide a complete and functional installation. The level of quality shall be consistent with other specified items. All miscellaneous electrical equipment and materials shall be listed for its specific application.

2. Material requirements apply to new construction, relocation, and maintenance of the Intelligent Transportation System.

B. ITS Construction Survey.

1. General.
ITS construction survey includes equipment and supplies required for fiber optic conduit path

and ITS construction surveying and staking necessary for construction of the project as shown in the contract documents.

2. **Lath.**
Provide wood lath that is approximately 3/8 inch thick by 1 1/2 inches wide by 48 inches long.

3. **Survey Equipment.**
Utilize survey equipment with a level of accuracy that will result in less than 6 inches of error horizontally.

C. Power Installed Foundation.

1. **General.**
   - **a.** This specification is for a power installed foundation compatible for use with, and support of, 45 foot steel breakaway poles.
   - **b.** Foundations and baseplate should be of steel construction.
   - **c.** Ensure the foundation and baseplate are hot dip galvanized inside and out according to ASTM A153.
   - **d.** After galvanizing, the manufacturer identification and fabrication date shall be permanently stamped to the baseplate in minimum 1/2 inch letters.
   - **e.** The manufacturer shall utilize industry recognized written quality control for materials and manufacturing processes.

2. **Fabrication Specifications.**
   - **a.** All foundations shall be designed in accordance with the AASHTO ~~"Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 2013~~ LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition.~~"~~
   - **b.** Mill certifications shall be supplied as proof of compliance with the specifications. The Fabricator shall be certified under Category I, "Conventional Steel Structures" as set forth by the AISC Quality Certification Program. All welding shall be in accordance with Article 2408.03, B of the Standard Specifications. Tackers and welders shall be qualified in accordance with the code. Tube longitudinal seam welds shall be free of cracks and excessive undercut, performed with automatic processes, and be visually inspected. Longitudinal welds suspected to contain defects shall be magnetic particle inspected. All circumferential butt-welded pole and arm splices shall be ultrasonically or radiographically inspected.
   - **c.** The baseplate shall be perpendicular to the shaft axis (± 1 degree) and hole and concentric (± 0.188 inches) to shaft axis.
   - **d.** Pilot point and shaft axis to be concentric (± 0.125 FIM) and in line (± 2 degrees)
   - **e.** Preheat, tumbleblast, handgrind, and clean baseplate on all welded areas prior to galvanizing.
   - **f.** All material is to be new, unused and mill traceable meeting the following specifications:

     Baseplate: ASTM A36 (Latest Revision) Structural Steel (Conform to AASHTO Tech. Bul. No. 270)

     Shaft: ASTM 252 (Latest Revision) Grade 2, steel pipe piles.
     Alternate material: ASTM A53 (Latest Revision) Type E or S, Grade B, steel

pipe
OR
ASTM A500 (Latest Revision), Grade B, structural steel tubing

Helix: ASTM A635 (Latest Revision) 1/2 inch thick hot rolled steel plate or coil.

Pilot Point: ASTM A575 (Latest Revision) 1 1/4 inch diameter hot rolled steel bar.

g. Two slots with minimum dimensions of 2.5 inches in width and 12 inches in length shall be cut into the shaft of the foundation, perpendicular to the base plate to allow for conduit entry during installation. The top of these conduit entryway openings shall be 12 inches from the bottom of the base plate.
h. The baseplate shall be permanently marked to indicate the conduit entryway openings in the shaft.
i. An 8 inch diameter hole shall be constructed in the baseplate to allow access between the shaft and pole foundation.
j. The bolt circle of the foundation shall be variable such that it will be compatible with the bolt circle of the pole design.
k. At a minimum, the foundation base plate thickness shall match the base plate thickness of the pole in the contract documents.

3. Design Calculations.

a. The design reference for foundations shall be AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition, Section 13, Foundation Design. The device loadings specified in this document shall be used in all AASHTO design calculations. Calculations and detailed drawings shall be submitted demonstrating compliance with the AASHTO specification.
b. Assume a soil profile of uniform cohesive soil (sand) with an angle of internal friction of 30 degrees and a unit weight of 100 pounds per cubic foot. Also, assume the water table is at a depth that will not affect lateral capacity.
c. Using the determined loads and assumed soil profile, the size of the foundation (shaft diameter, shaft length, base plate thickness, etc.) needed for adequate service shall be calculated using Broms Method for Lateral Pile Support.
d. A minimum factor of safety of 2.5 shall be used when recommending an adequate foundation.

D. Poles.

1. General

a. All poles shall be tapered steel poles, 45 feet in length (excluding the transformer base).
b. Poles shall satisfy the requirements of Article 1107.06 of the Standard Specifications.
c. The poles shall be designed to satisfy deflection requirements.
d. The poles shall be provided with two handholes with removable covers. The handhole openings shall be reinforced with a minimum 0.432 inch wide hot rolled steel rim. The first handhole shall be located 1.5 feet above the base plate (measured from bottom lip of handhole) and have minimum outside dimensions of 6 inches by 10 inches. The second handhole shall be oriented directly above the first handhole but located 40 feet above the baseplate (measured from bottom lip of handhole) and have minimum outside dimensions of 3 inches by 5 inches.
e. Ensure each pole has an approved grounding provision for use during installation and that it is accessible and will function as intended after the galvanization process. Ensure the grounding lug is readily accessible through the handhole and from the bottom of the pole shaft.
f. Poles shall include a removable end cap at the top of the pole with a J-hook cable support above the upper handhole.

g. Ensure the poles and base plates are hot dip galvanized inside and out according to ASTM A123.

h. Unless otherwise noted in this specification, materials shall meet the applicable minimum requirements of Section 4185 of the Standard Specifications.

2. Pole Design Calculations and Fabrication Specifications

a. All poles shall be designed in accordance with the AASHTO ~~"Standard~~ LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, ~~2013"~~ First Edition.

b. The device loadings specified in this document shall be used in all AASHTO design calculations and pole deflection evaluations and the poles shall be capable of withstanding winds up to 90 mph with a 1.14 gust factor without failure. Calculations and detailed drawings shall be submitted demonstrating compliance with the AASHTO specification.

c. Mill certifications shall be supplied as proof of compliance with the specifications. The Fabricator shall be certified under Category I, "Conventional Steel Structures" as set forth by the American Institute of Steel Construction Quality Certification Program. Proof of this certification will be required to ensure that the fabricator has the personnel, organization, experience, procedures, knowledge, equipment, capability and commitment to fabricate quality pole structures. All welding shall be in accordance with Article 2408.03, B, of the Standard Specifications. Tackers and welders shall be qualified in accordance with the code. Tube longitudinal seam welds shall be free of cracks and excessive undercut, performed with automatic processes, and be visually inspected. Longitudinal welds suspected to contain defects shall be magnetic particle inspected. All circumferential butt-welded pole and arm splices shall be ultrasonically or radiographically inspected.

d. All poles shall be designed to support the specified camera, sensor and device cabinet and shall be stiffened or otherwise manufactured to meet allowable deflection criteria contained herein. Pole design shall assume the following loadings. All mounting heights are measured from the base of foundation to bottom of equipment.

Radio Communication Equipment and Mounting Bracket
Weight: 10 pounds
Surface Area: ~~3~~ 2 square feet
Mounting Height: ~~44~~ 45 feet

Camera and Mounting Bracket
Weight: ~~12~~ 9 pounds
Surface Area: 1~~.5~~ square feet
Mounting Height: 40 feet

Roadway Sensor
Weight: ~~4.2~~ 6 pounds
Surface Area: 1~~.5~~ square feet
Mounting Height: 17 to 25 feet

Device Cabinet
Weight: ~~600~~ 95 pounds
Surface Area: 6 square feet
Mounting Height: ~~5~~ maximum 6 feet

e. The pole top deflection shall not exceed 1 inch in a 30 mph (non-gust) wind. Close consideration must be given to the effective projected area of the equipment along with the weight when designing the pole to meet the specified deflection performance criteria. The calculations shall include a pole, base plate, and anchor bolt analysis. The pole calculations shall be analyzed at the pole base, at 5 foot pole intervals/segments and at any other critical pole section. At each of these locations, the following information shall be given:

- The pole's diameter, thickness, section modulus, moment of inertia, and cross sectional area.
- The centroid, weight, projected area, drag coefficient, velocity pressure, and wind force of each pole segment.
- The axial force, shear force, primary moment, total moment, axial stress, bending stress, allowable axial stress, allowable bending stress, and combined stress ratio (CSR).
- The pole's angular and linear deflection.

f. All pole shafts shall have a minimum yield strength of 55 ksi and conform to ASTM A595 Grade A or ASTM A572 Grade 55. The shaft shall have a constant linear taper and contain only one longitudinal seam weld. Circumferential welded tube butt splices and laminated tubes are not permitted. Longitudinal seam welds within 6 inches of base plate welds shall be complete penetration welds.

g. Base plates shall conform to ASTM A36. Plates shall be integrally welded to the tubes with a telescopic welded joint or a full penetration butt weld with backup bar.

h. Anchor bolts shall conform to the requirements in Article 4185.02, B, 2 of the Standard Specifications.

3. Breakaway Transformer Base.

a. Transformer base shall be designed for installation with each ITS pole as specified above and is subsidiary to the pole.

b. Transformer base shall conform to breakaway criteria of AASHTO LRFD Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals, First Edition and in accordance with the guidelines of NCHRP Report 350.

c. The aluminum transformer base material shall conform to ASTM Designation B108 Alloy 356.0 T6.

d. Connecting hardware shall be finished to ASTM: B695 Class 50. All structural fasteners shall be galvanized high strength carbon steel. All non-structural fasteners shall be galvanized or zinc-plated carbon steel or stainless steel.

e. Height of transformer base shall be 17 inches.

f. Top plate bolt circle shall be 12.75 inch in diameter (+/- 0.75 inch) and accommodate bolts a maximum of one inch diameter. Top plate shall be 13.12 inch by 13.12 inch by 0.750 inch.

g. Bottom plate bolt circle shall be 14.5 inch in diameter (+/- 0.5 inch) and accommodate bolts a maximum of 1.25 inch diameter. Bottom plate shall be 14.5 inch by 14.5 inch by 0.625 inch.

h. Transformer base shall include one aluminum access door of 11 inches by 8.56 inches (at top) by 8.94 inches (at bottom).

E. Cabinet Foundations.

1. All concrete shall meet the requirements of ~~Section~~ Article 2403.02 of the Standard Specifications.

2. Use Class C concrete with 28 day compressive strength of 4000 PSI for cabinet foundations and all other non-paving concrete construction.

3. All reinforcement shall be epoxy coated and meet the requirements of Article 4151.03 of the Standard Specifications. All reinforcing steel shall be Grade 60.

F. Device Cabinets.

1. General.

a. Cabinets shall be dimensioned as identified in the contract documents.

b. Cabinets shall be corrosion resistant, NEMA Type 3R compliant, constructed of welded sheet aluminum with a minimum nominal thickness of 1/8 inch.

c. Cabinets shall be complete with all required internal components, fully wired back panel, side mount DIN rails, terminal strips, and stainless steel hardware.
d. Cabinets shall meet the requirements of ASTM B-209 for 5052 H-32 aluminum sheet. The aluminum shall be smooth and the exterior shall be left in its unpainted natural color.
e. The cabinet shall be effectively sealed to prevent the entry of rain, dust, and dirt.
f. All exterior seams for cabinet and doors shall be continuously welded.
g. Edges, seams, fittings, and hardware shall be finished free from burrs and sharp edges.
h. Use Type 316 stainless steel for all mounting hardware.
i. Use 3/4 inch wide and 0.03 inch thick banding for pole mounted cabinets.

2. Cabinet Doors.
a. The cabinet door shall be sturdy, torsionally rigid, and attached by a continuous heavy duty stainless steel butt hinge. The door shall substantially cover the full area of the front of the cabinet and have a stainless steel, pad-lockable handle.
b. The cabinet door shall be provided with a door stop catch mechanism to hold the door open at three positions; 90 degrees, 120 degrees and 180 degrees. Both the door and door stop mechanism shall be of sufficient strength to withstand a wind load of 5 pounds per square foot of door area applied to both inside and outside surfaces.
c. A closed-cell neoprene gasket shall be provided to act as a permanent and weather resistant seal at the cabinet door facing. The gasket material shall be of a non-absorbent material and shall maintain its resiliency after long-term exposure to the outdoor environment. The gasket shall have a minimum thickness of 1/3 inch. The gasket shall be located in a channel provided for this purpose either on the cabinet or on the door. An “L” bracket is acceptable in lieu of this channel if the gasket is fitted snugly against the bracket to insure a uniformly dust and weather resistant seal around the entire door facing.
d. LED cabinet light shall be provided and operated by door switch.
e. Each cabinet door shall be provided with a high quality, heavy duty tumbler-type lock. Two, No. 2 keys for each tumbler lock shall be provided for each cabinet. All locks for the project shall be keyed identically to key pattern 9R46142 or as otherwise identified by the Engineer. Keys shall be given to the Engineer. Do not attach keys to the exterior of the cabinet at any time during storage or installation.
f. A heavy-duty clear plastic envelope shall be provided, securely attached to the inside wall of the cabinet or cabinet door, for stowing cabinet wiring diagrams and equipment manuals. Minimum dimensions shall be 9 inches wide by 12 inches deep.

3. Electrical Components, Connecting Cables and Wiring.
a. Provide cabinets equipped and configured with internal power components as shown in the contract documents.
b. One four position service entrance terminal block with tin plated aluminum connectors, nickel plated steel screws, and a current rating up to 70 Amps.
c. One 20 Amp single pole breaker (Main).
d. One 15 Amp single pole breaker (Equipment).
e. One 15 Amp single pole breaker (Auxiliary).
f. One 120/240 VAC surge protector with surge current at minimum of 100 KA, nanosecond response time, and an operating temperature of -40°F to +185°F.
g. One auxiliary four-terminal electrical block rated for a maximum 250 VAC RMS maximum voltage and 20 Amps current.
h. One 15 Amp GFCI receptacle in Ivory color.
i. One 15 Amp Duplex receptacle in Ivory color.
j. One ten outlet, remotely resettable, Power Distribution Unit with eight individually switched circuits and two unswitched (always on) outlets. Built in surge suppressor, lithium-ion battery, resettable circuit breaker, minimum cord length of 6 feet, and a 10/100 autosensing, Static IP, RJ-45 Ethernet Interface.
k. One seven ~~TAP~~ tapped Ground Bar.
l. One seven ~~TAP~~ tapped Neutral Bar.
m. All miscellaneous wiring, harnesses connectors and attachment hardware.

n. All conductors used on the cabinet wiring shall be No. 14 AWG or larger with a minimum of 19 strands. Conductors shall conform to NEC.

4. Ventilation.

a. Vents.

1) Furnish cabinets containing a suitably designed rain tight vent or vents that:

a) Are equipped with suitable screens or dust filters, and

b) Allow the release of excessive heat and/or any explosive gases which may enter the cabinet.

2) Ensure when filters are utilized, positive retainment is provided on all sides to prevent warpage and entry of foreign matter around the edges.

3) The filters shall be dry type, easily removed and replaced, and standard dimensions commercially available.

b. Vent Fan.

1) A thermostatically controlled vent fan is furnished to provide air circulation within the cabinet.

2) The thermostat controlling the fan is manually adjustable to turn on between 90°F and 150°F with a differential of not more than 10°F between automatic turn on and turn off.

3) The fan is located with respect to the vent holes to direct the bulk of the air flow over the internal components within the cabinet.

4) Ventilation fan shall be fused separately and wired after the main AC+ circuit breaker.

5. Grounding.

a. The cabinet internal ground shall consist of one or more ground bus-bars permanently affixed to the cabinet and connected to the grounding electrode.

b. Use bare stranded No. 6 AWG copper wire between bus-bars and between the bus-bar and grounding electrode.

c. Each copper ground bus-bar shall have a minimum of 20 connector points. Each connector point shall be capable of securing at least one No. 6 AWG conductor.

d. AC neutral and equipment ground wiring shall return to bus-bars.

6. Pedestal.

a. Clean-cut in design and appearance to match cabinet.

b. Dimensioned as identified in the contract documents.

c. Corrosion resistant, NEMA Type 3R compliant, constructed of welded sheet aluminum with a minimum nominal thickness of 1/8 inch.

d. Complete with all stainless steel hardware.

e. Meet the requirements of ASTM B-209 for 5052 H-32 aluminum sheet. The aluminum shall be smooth and the exterior shall be left in its unpainted natural color.

f. Effectively sealed to prevent the entry of rain, dust, and dirt.

g. All exterior seams shall be continuously welded.

h. Edges, seams, fittings, and hardware shall be finished free from burrs and sharp edges.

G. Conduit.

1. High Density Polyethylene Conduit.

a. HDPE conduit shall be smooth wall and orange in color for communications.

b. HDPE conduit shall be smooth wall and orange, red, or black with red stripe in color for power. Verify conduit color requirements with local electrical utilities.

c. Comply with ASTM F 2160 (conduit) and ASTM D 3350 (HDPE material), minimum SDR 13.5 or 11 as specified in the contract documents.

d. Sequential foot markings printed on HDPE.

e. Continuous reel or straight pieces to minimize splicing.

f. For dissimilar conduit connections provide an adhesive compatible with both materials.

2. Rigid Steel Conduit

Comply with Article 4185.09 of the Standard Specifications.

3. **Electric Metallic Tube Conduit**
   - **a.** Listed and labeled in accordance with NEC.
   - **b.** EMT conduit shall be steel.
   - **c.** Comply with UL 797 and UL Category Control Number FJMX.
   - **d.** Zinc alternate corrosion-resistant coating exterior.
   - **e.** Zinc with organic top coating interior coating.
   - **f.** EMT fittings shall comply with UL 514B and UL Category Control Number FKAV.
   - **g.** EMT fittings shall be steel die cast.
   - **h.** Coupling shall use compression coupling or raintight compression coupling with distinctive color gland nut setscrew coupling. Setscrew couplings with only a single screw per conduit is unacceptable.

H. Handholes.

1. **General.**
   - **a.** Constructed of epoxy or polyester resin mortar with woven glass fiber reinforcement.
   - **b.** Handhole materials shall not support combustion when tested in accordance with ASTM D 635.
   - **c.** Water absorption shall not exceed 2% of the original weight of material under test conditions per ASTM D 570.
   - **d.** Functional without failure throughout a temperature range of -50°F to +170°F.
   - **e.** Walls shall not deflect more than 0.24 inches per foot of length of box when installed and subject to an ASTM C 857 TIER 22 load.
   - **f.** Meet or exceed ANSI/SCTE 77 requirements.
   - **g.** Lid strength shall be tested to 33,750 pounds (Tier 22).
   - **h.** Lid shall have skid resistant surface.
   - **i.** Label all handhole lids. ITS 36x24x36 and ITS 48x30x36 handhole shall be labeled as 'FIBER OPTIC'. ITS 30x17x24 handhole lids shall be labeled 'ELECTRICAL'.
   - **j.** ITS handholes shall not include cable hooks.

2. **Test Station.**
   - **a.** Triangular post station with anchor flaps on each side for securing the post into the ground.
   - ~~**a**~~ **c.** Test station shall be 78 inch ~~triangular flexible orange plastic marker with~~ made of polyester resin with reinforcing fibers, be UV stable, and remain flexible from -40°F to +140°F.
   - **d.** The station shall include five ~~separate access~~ internal stainless steel terminals on an eleven-hole terminal board, an isolation lever, and a set screw to hold terminal concealment cap on.
   - **b.** Orange in color with a removable black cap.
   - ~~**c**~~ **e.** Provide and place Engineer approved custom warning decals on all sides.
   - ~~**d**~~ **f.** Use bare stranded No. 6 AWG copper wire between terminal board and the ground rod.
   - ~~**e**~~ **g.** An Isolation Ground Switch is an alternative when above ground test stations cannot be used. Supply isolation ground switches to mount on the interior of handholes. This alternative shall only be used at locations specified in the contract documents.

3. **Ground Rod.**
   - **a.** Use copper bonded steel ground rod.
   - **b.** Ground rod shall be 5/8 inch by 8 feet.

4. **Fiber Marker.**
   - **a.** ~~Supply t~~Triangular post markers with anchor flaps on each side for securing the post into the ground.
   - **b.** ~~o~~Orange in color with an orange cap.
   - **c.** Markers shall be 78 inch, made of polyester resin with reinforcing fibers, be UV stable, and remain flexible from -40°F to +140°F.

d. Provide and place Engineer approved custom warning decals on all sides.

I. Wire and Cable.

1. Power Wire.

Comply with Article 4185.11 of the Standard Specifications.

2. Tracer Wire.

a. ~~Single conductor copper clad steel, No. 10 AWG with orange colored HDPE jacket.~~ Comply with Article 4189.01, C, 3 of the Standard Specifications.

b. Use a direct bury, self-stripping, locking connector system used for making connections to underground tracer wire systems on all mainline and lateral connections.

c. Use locking tracer wire connectors compatible with No. 10 AWG copper clad steel wire.

d. Use one-piece connectors that utilize mechanical compression.

e. Use a sealed wire connection system for use in damp, wet, raintight, watertight, submersible, and direct bury locations.

f. Tracer Wire Tags.

1) Self-laminating polyester material.

2) 1.5 inch by 0.75 inch.

3) Black text with a white background.

4) Specific for wire and cable applications.

3. XHHW Wire.

a. Use annealed stranded bare copper conductors per ASTM B3 and B8.

b. Use Class B stranding per ASTM B8.

c. Use flame retardant cross-linked polyethylene insulation.

d. Use UL listed wire.

e. Wire shall be rated for 194°F (90°C) wet/ dry and -40°F (-40°C) operating temperatures.

4. Grounding/Bonding.

Comply with Article 4189.01 of the Standard Specifications.

5. Fiber Optic Cable.

a. General.

1) The cable shall meet the latest applicable standard specifications by ANSI, EIA and TIA for the single-mode fiber cable of the size specified per the contract documents.

2) Provide all fiber optic cable for installation.

3) Provide the Engineer the manufacturer's production test provided with the spool.

4) Provide the Engineer with documentation of wasted cable.

5) The buffer tubes shall be compatible with standard hardware and shall have 12 fibers per tube, the fibers shall not adhere to the inside of the buffer tube, each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B "Optical Fiber Cable Color Coding" and be colored with ultraviolet (UV) curable ink.

6) The cable core shall be water blocked with dry water blocking materials to improve access and handling of individual tubes.

7) The cables shall be designed for point-to-point applications as well as mid-span access and provide a high-level of protection for fiber installed in the outside plant environment.

8) The optical fiber shall be fully capable of handling existing and legacy single-mode applications which traditionally operate in the 1310 nm and 1550 nm regions and shall also be designed to operate the full-spectrum from 1260 nm to 1625 nm for optical transmission.

9) The optical fiber shall be designed to provide optimum performance from 1260 nm to 1625 nm intended for 16 channel Course Wavelength Division Multiplexing applications.

10) The optical fiber glass shall ~~be manufactured by one of the U.S. based manufacturing companies~~ comply with Article 1107.06 of the Standard Specifications.
11) The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.
12) The jacket or sheath shall be free of holes, splits, and blisters.
13) Mark cable jackets with the manufacturer's name, month, and year of manufacturer, sequential foot markings, the symbol for communication cable as required by Section 350G of the NESC, fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more coextruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.
14) The maximum pulling tension shall be 600 pounds during installation (short term) and 200 pounds installed (long term).
15) The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C (-40°F to 158°F). The installation temperature range of the cable shall be -30°C to +70°C (-22°F to 158°F).

b. Single-Mode, Fiber Optic OSP Cable – Dielectric Loose Tube.

1) Fiber optic, single-mode, graded loose tube dielectric cable constructed with industry standard 2.5 mm buffer tubes stranded around a central strength member.
2) Single-mode, dispersion-unshifted fiber meeting International Telecommunications Union – Telecommunications Standardization Sector (ITU-T) G.652D/G.657.A1 requirements.
3) Cables shall be sheathed with MDPE. The minimum nominal jacket thickness shall be 1.3 mm. Jacketing material shall be applied directly over cable core and water swellable tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.
4) The cable jacket shall contain no metal elements and shall be of a consistent thickness.

c. Single-Mode, Fiber Optic OSP Cable – Single Armored Loose Tube.

1) Fiber optic, single-mode, graded loose tube armored cable constructed with industry standard 2.5 mm buffer tubes stranded around a central strength member.
2) Single-mode, dispersion-unshifted fiber meeting ITU-T G.652D/G.657.A1 requirements.
3) Armored cables shall have an armor layer applied directly over the water swellable tape and cable core. The armor shall be a corrugated steel tape, plastic-coated on both sides for corrosion resistance, and shall be applied around the outside of the water swellable tape and cable core with an overlapping seam with the corrugation in register. The outer jacket shall be applied over the corrugated steel tape armor. The outer jacket shall be sheathed with MDPE. The minimum nominal jacket thickness shall be 1.3 mm. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

d. Cable Identification Tags.

1) Use self-laminating rigid vinyl material rated for indoor/outdoor use. No adhesives.
2) Use tags with yellow background and black legend colors.
3) Pre-printed with "CAUTION/ FIBER OPTIC CABLE/ TYPE____/ COUNT____."
4) Rated for use up to 176°F.
5) 2 inch by 3.5 inch by 16 mil.
6) Use indelible ink, etching, or a label maker which does not fade in sunlight, or in buried or underground applications. No handwriting.

~~6. Microwave Vehicle Detection System (MVDS) Cable.~~

~~Supply all necessary materials and incidental items required to install the MVDS cable furnished by the Contracting Authority.~~

J. Meter Pedestals.

1. Verify requirements with local electrical utilities.

2. ~~100 amp, 120/240 volt circuit breaker.~~ Utility metering equipment shall meet the following at a minimum:
   - **a.** Aluminum enclosure with powder coated finish.
   - **b.** Direct bury pedestal mounted.
   - **c.** Include lever bypass.
   - **d.** Include 100 amp 240/120 volt main breaker.
   - **e.** Include up to six branch breakers.
   - **f.** UL tested and approved.
   - **g.** Rated NEMA 3R construction for outdoor use.

3. Six phase.

4. Meter pedestals and power connections shall comply with the requirements of the NEC, contract documents, electrical utility, and all generally accepted standards and requirements for the electrical components and power terminations in the individual power source.

K. Circuit Breakers.

1. Be of the size identified in the contract documents.
2. Be from the same manufacturer as the panel equipment, unless otherwise approved by the Engineer.

3. UL tested and approved.

~~K~~ L.Transformers.

1. NEMA 3R enclosure.

2. Single phase 1.0kVA; 60 Hz.

3. 240V primary, 240/120V secondary.

~~L~~ M.Fiber Optic Accessories and Hardware.

1. **Fiber Optic Splice Closures.**
   - **h.** Supply an outside plant case that provides environmental protection of cable and splices from water and dirt and that is designed to be submersed in water and installed underground for splicing fiber optic cables in handholes.
   - **i.** The splice closure shall be compatible with all sizes of fiber cables listed in the contract documents and large enough to accommodate the number of splices plus an additional 10% at locations where splices are shown in the contract documents.
   - **j.** The closures shall be a single-ended dome type splice closure manufactured from impact resistant polymer material with the following properties:
     - **1)** Cable entry shall be manufactured of similar material to the dome body and shall seal the closure with re-usable compressed gel-sealing technology instead of heat shrink, that accommodate a wide range of cable sizes.
     - **2)** Closures shall be re-enterable and re-sealable without the need for specialized tools or equipment or any additional parts.
     - **3)** No encapsulated materials shall be allowed.
     - **4)** Be provisioned for a minimum of six cable entries.
     - **5)** Hinging splicing trays that provide controlled access to splices and slack storage.
     - **6)** Splice and storage compartments accessible via a removable dome-clamp system.
     - **7)** The closure shall allow for the storage of at least eight unopened buffer tubes.
     - **8)** The closure shall be 11.5 inch diameter by 23 inch length, unless otherwise specified in the contract documents.

9) No factory installed trays.
10) Slack basket size shall be compatible with splice closure.
11) No ground-feed through lugs.
12) The closure shall include the standard valve for flash testing.

k. The splice closure shall contain all splice trays, storage baskets, splice sleeves, organizing materials, and any other incidental materials required to complete the splices at the locations shown in the contract documents.
l. After splicing is complete, flash test the fiber optic cable and closure for leaks.
m. Splice sleeves shall be from the same manufacturer as the splice closure and be compatible with all common fiber coatings. The sleeve shall consist of a clear outer heat shrink material, have a low temperature hot melt adhesive to encapsulate the splice, and include a stainless steel rod to ensure proper alignment and rigidity.
n. To seal tracer wire entering splice closure, use quick install gel sealing plugs, for a three cable seal.

2. Fiber Optic Splice Trays.
Splice trays shall be from the same manufacturer as the splice closure. The size of the splice tray shall be compatible with the splice closure and have capacity for 12, 24, or 72 splices as noted in the contract documents.

3. One Rack Unit Connector Housing.
a. Termination/splice housings shall provide for termination capabilities, splice protection, and associated fiber/pigtail storage.
b. Meets ANSI, TIA, and EIA-568A and 606 standards.
c. The housing shall be powder-coated metal with a polycarbonate tray.
d. Includes a durable polycarbonate-tinted front door for viewing jumpers and removable translucent top covers,
e. Accepts panels, modules, and cassettes. Connector position panel fitting standard 19 inch EIA racks or cabinets, with standard mounting, and hinged to allow complete access to the interior of the termination panel.
f. Supply appropriate cables and adapters to satisfy intended operation and use. The termination unit shall be lightweight and designed to operate fully from -40°C to 70°C (-40°F to 158°F).
g. Rack mountable closet connector housing shall hold two six-duplex connector adapter panels.

4. Four Rack Unit Connector Housing.
a. Termination/splice housings shall provide for termination capabilities, splice protection, and associated fiber/pigtail storage.
b. Meets ANSI, TIA, and EIA-568A and 606 standards.
c. The housing shall be powder-coated metal with a polycarbonate tray.
d. Includes a durable polycarbonate-tinted front door for viewing jumpers and removable translucent top covers,
e. Accepts panels, modules, and cassettes. Connector position panel fitting standard 19 inch EIA racks or cabinets, with standard mounting, and hinged to allow complete access to the interior of the termination panel.
f. Supply appropriate cables and adapters to satisfy intended operation and use. The termination unit shall be lightweight and designed to operate fully from -40°C to 70°C (-40°F to 158°F).
g. Rack mountable closet connector housing shall hold twelve six-duplex connector adapter panels.

5. Module Connector Housing Splice Cassettes
a. Use closet connector housing splice cassette modules for splice protection of connector pigtails.
b. Includes splice organizer.

c. Closet connector housing splice cassette modules shall be from the same manufacturer as the connector housing.

6. Floor Mount Equipment Rack

~~Use 19 inch wide floor mountable EIA rack.~~

a. Floor mountable high-strength, lightweight aluminum EIA rack with black finish.
b. Size rack to hold equipment identified in the Contract Documents.
c. Rack shall include easy positioning of equipment with marked and numbered rack-mount spaces and cable lacing points for cable installation, routing, and management.
d. Include appropriate floor installation kit to secure the rack to the floor.

7. Wall Mount Equipment Rack

~~Use 19 inch wide wall mountable EIA rack.~~

a. Wall mountable high-strength, lightweight aluminum EIA rack with black finish.
b. Size rack to hold equipment identified in the Contract Documents.
c. Rack shall include easy positioning of equipment with marked and numbered rack-mount spaces and cable lacing points for cable installation, routing, and management.
d. Include assembly hardware and mounting bolts.

8. Single Panel Housing.

a. Surface mounted termination/splice housings shall provide for termination capabilities, splice protection, associated fiber/pigtail storage, and stackable for growth capacity.
b. Surface mount housing shall be intended for splicing and management, and cross-connect or both for up to 12 fibers.
c. Top and bottom cable entry grommets for incoming fiber, fiber jumper.
d. Manufactured of metal and black in color.
e. 160 mm by 140 mm by 50 mm (6.3 inch by 5.5 by 2 inch).
f. Hinged front door, universal mounting brackets, jumper bend limiters, labels for identifying fiber terminations.
g. Wall mountable single panel housing shall hold one six-duplex SC connector adapter panel and splice organizer.

9. Connector Adaptor Panel

a. Use six-duplex SC connector adaptor panel with splice organizer.
b. Connector adaptor panel shall be from the same manufacturer as the single panel housing.

10. Six Duplex Connector Adapter Panel.

a. Termination adapter panels shall be duplex SC.
b. 6 adapters per panel.
c. Accommodate a fiber count of 12 strands, single-mode.
d. UPC polish type.
e. Adapter panels shall be from the same manufacturer as the housing.
f. Housing material shall be composite and blue in color.

11. UPC/SC Factory Terminated Fiber Connector and Pigtails.

a. All fiber connectors used on this project, including in shelves, cabinets, or panels, shall be factory installed connectors.
b. No field terminated connectors will be allowed.
c. Connectors shall be SC/UPC having a typical insertion loss (single-mode) of 0.15 dB or less, a maximum loss of 0.35 dB or less, with typical reflectance of -55 dB, and temperature stability from -40 °C to 75 °C (-40°F to 167°F).
d. Fiber used for pigtails must be of the same manufacturer as the main fiber cable.
e. Pigtails shall be rated for the environment they are installed in.
f. Pigtails shall be spliced in accordance with the splicing specifications and in fiber shelves or panels using manufacturer splice organizers.
g. Include splice and connector sleeves.

23058.03 CONSTRUCTION.

A. General Responsibilities.

1. Stake all handholes and proposed conduit alignment per ~~coordinates provided~~ location shown in the contract documents a minimum of 5 working days prior to construction and for approval by the Engineer. The Engineer will authorize any changes in location in writing before performing the installation. No additional compensation will be provided for additional work associated with or resulting from unauthorized changes to the contract documents.

2. The Contracting Authority will stake all ITS device pole and cabinet foundation locations. Do not adjust pole locations without approval by the Engineer. The Engineer will authorize any changes in location in writing before installation by the Contractor.

3. Figured dimensions on the plans shall be taken as correct but shall be checked before starting construction. Bring any errors, omissions, or discrepancies to the attention of the Engineer and the Engineer's decision thereon will be final. Correction of errors or omissions on the drawings or specifications may be made by the Engineer when such correction is necessary for the proper execution of the work.

4. Assign a responsible staff member that will work with the Engineer on decisions regarding order of work and coordination as needed throughout the duration of this project.

5. Provide the Engineer any requests to perform work during the dates of special events a minimum of 5 calendar days prior to the event. The decision of the Engineer regarding the request will be final.

6. During and after completion, employ appropriate measures for erosion control, where applicable. Seed and fertilize work areas upon completion of work in accordance with the Contract Documents.

7. Upon completion of the work at each work area, thoroughly clean the site and restore it to a condition at least equal to that existing prior to construction. The work area is defined as the approximate area disturbed during a normal week of work.

8. All existing infrastructure such as sidewalks, driveways, curbs, gutters, roadway pavement, roadway asphalt, unpaved areas, drainage ditches, culverts, drain tiles, embankments or any other items disturbed or damaged by the Contractor shall be restored to pre-construction conditions (or better) as directed by the Engineer at no additional cost to the Contracting Authority.

~~**6**~~ **9.** Comply with any special provisions and limitations identified in the contract documents.

~~**B. Material and Equipment Storage and Construction Site Access.**~~

~~**1.** Secure a designated material storage area for this project. Any request to store material in the ROW in order to complete the current work activity shall be approved by the Engineer.~~

~~**2.** Construction equipment may be stored within the ROW during non-working hours if it is outside of the roadway clear zone, as far from the traveled way as practical and as approved by the Engineer. Do not store equipment at the toe of any roadway slope.~~

~~**3.** No worker vehicles will be allowed to park in the ROW or access a job site directly from an Interstate or Freeway facility. Access to the job site for both workers and materials shall only~~

~~be via interchanges or intersecting roadways unless otherwise approved by the Engineer. Park worker vehicles off-site or at a location acceptable to the Engineer.~~

~~4. Do not leave open holes or mounds of dirt unprotected during non-working hours.~~

~~C~~ B.ITS Construction Survey

1. The Contracting Authority will stake permanent ROW corners per Section 2526 of the Standard Specifications.

2. **Documentation.**
   Format the survey work documentation in a manner acceptable to the Engineer. Ensure documentation is sufficient to prove means and methods used to transfer design intent to construction stakes. Check tie-ins with existing roadways, structures, and utilities prior to staking; notify the Engineer if discrepancies are found.

3. **Qualifications.**
   Perform ITS construction survey directly by or under responsible charge of a Professional Land Surveyor licensed in the State of Iowa.

4. Place ~~stakes~~ lath at the following locations and label with item being staked:
   - Handholes.
   - Conduit and/or cable alignment direction changes.
   - Critical conduit locations where contract documents specify depth greater than standard and bored installation methods as described in Section 2553 of the Standard Specifications.
   - Transitions from plow to bore or bore to plow.
   - At locations requiring specific depths to avoid existing or future facilities.
   - A minimum of 100 feet apart along plowed conduit.
   - A minimum of 25 feet apart along bored conduit.
   - At other locations as noted within the contract documents.

5. Label ~~stakes~~ lath marking bore locations with required minimum conduit depth ~~below existing grade~~ shown in the contract documents. Survey to field verify current ground elevation and adjust minimum conduit depth if field conditions differ from plan existing grade.

~~D~~ C.Disruption to Existing Fiber Networks and ITS Devices.

1. **Planned Work Near Existing Fiber Networks.**
   a. Ensure continuous operation of the existing fiber networks and systems during construction of the project.
   b. Do not work on splicing, disconnecting and/or in any way disrupting normal operation of the existing fiber networks or systems without approval from all affected parties. Affected parties will be noted in the contract documents and may include the Iowa DOT, the ICN, and local agencies. Provide a written request to the respective parties for approval at least 10 calendar days before work is done near an existing fiber network or equipment. Submit a copy of the written request to the Engineer in all cases. In addition to the written request, submit the work plan and schedule for approval by the Engineer. The work plan shall include all fiber strands and the parties possibly affected.
   c. Restore the disrupted system upon completion of the work within the allowable working hours as noted in the contract documents. Remain on site until the affected parties give notification that the disrupted systems are fully operational. Failure to restore disrupted systems and equipment within the allowable working hours will constitute an unplanned disruption.

2. Planned Work Near Existing ITS Devices.

a. Ensure continuous operation of all existing Iowa DOT ITS devices during the construction of the project.

b. Maintain and protect all existing power and communications cables connected to the ITS devices unless otherwise directed by the Engineer.

~~2~~ 3. Unplanned Disruption.

a. Apply Article 1107.15 of the Standard Specifications and the following:

b. In the event of an unplanned disruption, simultaneously notify the Engineer and any other affected party's representative(s). The notice shall include the type of facility damaged and the extent of the damage. Immediately stop all work in progress and expend all its efforts to restore the disrupted system(s) and/or correct the problem causing the disruption.

c. Remain on site until the affected parties give notification that the disrupted systems are fully operational. Unplanned disruptions shall result in the assessment of a price adjustment.

d. No extension of time for delays caused by repairing disrupted systems will be granted.

e. Correct any unplanned disruptions determined by the Engineer to be caused by the Contractor at no additional cost to the Contracting Authority. If repairs are not made in a timely manner, any costs incurred by the Contracting Authority to restore the disruption will be charged to the Contractor.

~~3~~ 4. Price Adjustment.

A price adjustment will be assessed at the rate of $250.00 per 15 minutes, for each 15 minute period that the proper operation of an existing fiber optic network element is not restored following an unplanned disruption.

~~E. Finishing Activities.~~

~~Upon completion of the work at each project area, thoroughly clean the site and restore it to a condition at least equal to that existing prior to construction. Project area is defined as the approximate area disturbed during a normal week of work. During and after completion, employ appropriate measures for erosion control, where applicable. Seed and fertilize work areas upon completion of work in accordance with the contract documents.~~

D. Grounding/Bonding.

1. Ground all installations as indicated in the contract documents.

2. Installation of grounds is incidental to the cost of the connected items of work.

3. Ground all installations in accordance with the requirements of NEC. Supply and install additional grounding rods and equipment as necessary to satisfy such requirements at no additional cost to the Contracting Authority.

~~F~~ E. Power Installed Foundation.

1. General.

a. If the power installed foundation is provided by the Iowa DOT, coordinate with the Iowa DOT regarding the time and location for the Contractor to accept the power installed foundation and deliver the power installed foundation to the field for installation or to the Contractor's construction yard for storage.

b. Install the power installed foundations in accordance with the contract documents and the manufacturer's recommendations.

c. Contact the Engineer a minimum of 7 calendar days in advance to arrange a field review prior to placing the power installed foundation.

d. Notify the Engineer immediately if an obstruction conflicts with a proposed power installed foundation location. The Engineer will relocate or determine another effective means of

supporting the structure to eliminate the conflict. Payment will not be made for re-work or extra work as the result of an unauthorized relocation of a power installed foundation.

2. **Installation Details.**
   - **a.** Install all power installed foundations as staked by the Engineer and set level and to the proper elevation.
   - **b.** After power installed foundation is in place, hand dig with shovel in order to install conduits into the provided conduit entrances. Seal all conduit openings using duct plugs or as directed by the Engineer.
   - **c.** Install a sufficient number of conduits sized as indicated in the contract documents. Locate all conduits as indicated in the contract documents.

3. **Improper Installation.**
   Remove and reinstall, at no additional cost to the Contracting Authority, all power installed foundations improperly installed or with improperly installed anchor bolts, conduit, or any other foundations components as determined by the Engineer.

~~G~~ F.Poles.

1. **General.**
   - **a.** If the poles are provided by the Iowa DOT, coordinate with the Iowa DOT regarding the time and location for the Contractor to accept the poles and deliver the poles to the field for installation or to the Contractor's construction yard for storage.
   - **b.** Install the pole in accordance with the contract documents and the manufacturer's recommendations.
   - **c.** Refer to Articles 2522.03, H, 2, b through h of the Standard Specifications for nut tightening procedure and requirements.
   - **d.** If pole has structural damage do not erect and notify the Engineer.
   - **e.** Repair any surface damage to galvanized components using a zinc-rich paint acceptable to the Engineer.
   - **f.** After drilling holes, apply a zinc-rich paint acceptable to the Engineer to the bare metal.

2. **Pole Erection.**
   - **a.** Erect poles (including camera mounting system and poles) and securely bolt to the ~~power installed~~ foundation base plate such that the pole is vertical to the centerline of the nearest adjacent major roadway.
   - **b.** Use leveling nuts on each anchor bolt installed below the pole flange. Adjust the pole's vertical position by adjusting both the upper and lower nuts.

3. **Breakaway Transformer Base.**
   - **a.** If the transformer base is provided by the Iowa DOT, coordinate with the Iowa DOT regarding the time and location to accept the transformer bases and deliver the transformer bases to the field for installation or to the Contractor's construction yard for storage.
   - **b.** Install breakaway transformer base in accordance with the contract documents for each ITS pole not mounted on a roadway bridge per the manufacturer's recommendations.
   - **c.** Level transformer base with shims only. Do not use leveling nuts.
   - **d.** To approach optimum static loads, use the largest possible bolt circles and hardware supplied with the transformer base.

~~3~~ 4. Grounding
   - **a.** Use a minimum of three copper bonded steel ground rods per steel pole. Ground rod shall be ~~5/8 inch by 8 feet~~ installed 12 inches below ground level.
   - **b.** The maximum grounding resistance shall be 20 ohms or less.
   - **c.** All ground connections shall be exothermic weld.

4 ~~5~~. Pole Removal.

a. Coordinate with the Iowa DOT for removal of ITS devices mounted on ITS poles prior to removal.

~~a~~ b. Remove ITS poles, including foundation to a minimum depth of 2 feet below established grade.

~~b~~ c. Furnish, place, and compact backfill according to Section 2552 of the Standard Specifications.

~~c~~ d. Deliver salvaged materials to the location specified in the contract documents.

~~H~~ G.Cabinet Foundations.

1. General.

a. Install cabinet foundations in accordance with the contract documents and the manufacturer's recommendations.

~~**b.** All cabinet foundations shall include a concrete maintenance pad area that is cast and reinforced as a single unit with the cabinet foundation dimensioned as shown in the contract documents.~~

~~**c.** Prepare and submit for Engineer approval, design plans and details for all cabinet foundations at no additional cost to the Contracting Authority.~~

~~d~~ b. Contact the Engineer a minimum of 7 calendar days in advance to arrange a field review prior to placing the cabinet foundation.

~~e~~ c. Notify the Engineer immediately if an obstruction conflicts with a foundation. The Engineer will relocate or determine another effective means of supporting the structure to eliminate the conflict. Payment will not be made for re-work or extra work as the result of an unauthorized relocation of a foundation.

2. Installation Details.

a. Install all foundations as located by the Engineer. Securely rest all foundations on firm ground and set level to the proper elevation. Foundation shall be finished level to ensure the cabinet is plumb after installation.

b. ~~Form the upper portion of all concrete foundations and for all instances where the excavation is irregular in shape to provide the proper dimensions. Forming materials shall be level and braced to avoid displacement, warping, or deflection from the specified pattern during construction and curing.~~ Excavate to the elevation and dimensions as shown in the Contract Documents. Excavation for the foundation shall be in accordance with Section 2402 of the Standard Specifications. Excavation is subsidiary to the cabinet foundation.

c. Install reinforcement in accordance with Article 2404.03 of the Standard Specifications.

d. Place all concrete in accordance with Article 2403.03 of the Standard Specifications. Surface finish shall be Class 1.

~~c~~ e. Install and secure ~~anchor bolts,~~ conduits, ground rod, and reinforcement before concrete placement. ~~Use a rigid template to position anchor bolts in accordance with the appropriate pattern. The center of the template and the center of the concrete base shall coincide unless otherwise directed by the Engineer.~~

f. Anchor cabinet to foundation as specified by cabinet manufacturer.

g. The minimum distance from the edge of concrete foundation to centerline of any anchor shall be 6 inches. Increase foundation size as needed to maintain this minimum.

~~d~~ h. Install ~~a sufficient~~ number and size of conduits ~~sized~~ and orient conduits as indicated in the contract documents. ~~Locate all conduits as indicated in the contract documents.~~ Place conduit within the foundation such that a minimum of 1 1/2 inch clearance is maintained between adjacent conduits. Mark the locations of all conduits entering the footing and ~~S~~seal all conduit openings using duct plugs ~~or as directed by the Engineer~~ prior to backfilling.

~~e~~ i. ~~Place all concrete within 90 minutes of batching and consolidate using a high-frequency vibrator during construction.~~ Provide 3/4 inch chamfer at all exposed edges of concrete.

~~f~~ j. Modification of a foundation after construction is not allowed.

~~**g.** Cover all anchor bolts to protect them against damage and to protect the public from possible injury until erecting.~~

~~**h.** Allow a minimum of 7 calendar days curing of concrete foundations before setting cabinets.~~

3. Grounding

a. Use a minimum of one copper bonded steel ground rod. Ground rod shall be installed twelve inches below ground level.

b. The maximum grounding resistance shall be 20 ohms or less.

c. All ground connections shall be exothermic weld.

~~3~~ 4. Improper Installation.

Remove and reinstall, at no additional cost to the Contracting Authority, all foundations improperly installed or with improperly installed anchor bolts, conduit, or any other foundation components as determined by the Engineer.

~~I~~ H. Device Cabinets.

1. General.

a. If the device cabinets are provided by the Iowa DOT, coordinate with the Iowa DOT regarding the time and location for the Contractor to accept the device cabinets and deliver the device cabinets to the field for installation or to the Contractor's construction yard for storage.

b. Install cabinets and hardware in accordance with the contract documents and the manufacturer's recommendations.

c. Do not penetrate the top of any cabinets without prior authorization by the Engineer.

d. Do not allow screws used for mounting shelves or other mounting purposes to protrude beyond the outside wall of the cabinet.

e. All exterior connections shall be watertight.

f. Contact the Engineer a minimum of 7 calendar days in advance to arrange a field review prior to placing the cabinets.

2. Mounting.

a. Orient cabinets as shown in the contract documents unless otherwise directed by the Engineer. If cabinet direction is not specified, position such that the maintenance staff will be facing oncoming traffic while working.

b. Ensure sufficient clamps, nuts, hardware, etc., as required for the specified mounting type, are furnished with each cabinet.

c. Seal all conduit openings in the device cabinet using duct plugs or as directed by the Engineer.

d. Mounting heights shall be as indicated or at minimum requirement allowed under current applicable electrical codes, whichever is greater.

3. Cabinet Removal.

a. Remove ITS cabinets, including mounting brackets, if applicable.

b. Disconnect power at power source. Cap and seal cable per NEC requirements.

c. Disconnect communications from the panel and reestablish communications per contract documents.

d. Protect and salvage any equipment inside ITS cabinets being removed.

e. Deliver salvaged materials to the location specified in the contract documents.

~~J~~ I. Conduit.

1. High Density Polyethylene Conduit.

a. General.

1) Install conduit in accordance with the contract documents and the manufacturer's recommendations.

2) Follow all general guidelines covering the construction of buried conduit.

3) Install conduit by plowing, boring, or other approved methods within the public ROW and in a manner that minimizes atypical damage from construction operations.

4) The minimum bending radius of HDPE conduit shall be the larger of 20 times the outside diameter or the HDPE manufacturer's recommendations for minimum bending radius.

5) Open trench installation is only permitted within 25 feet of any handhole, structure, or other similar improvements, and any other requested locations approved by the Engineer.

6) At the discretion of the Engineer, verify the integrity of the conduit structure in a manner acceptable to the Engineer.

7) Tunneling under the pavement or water jetting shall not be permitted.

8) No excavations are permitted to cross any roadways or any other paved or other similarly improved areas. At these locations, install conduits by boring method unless otherwise directed or approved in writing by the Engineer.

9) No direct-buried cable is allowed.

10) Seal all conduit openings using duct plugs or as directed by the Engineer, at all conduit openings at the handholes, foundations, and building entrances.

~~**11)** Thread and cap all rigid steel conduit ends with standard conduit caps until wiring is installed. Before wiring is installed, replace caps with threaded insulating bushing in accordance with Article 2523.03, N of the Standard Specifications.~~

~~**12**~~ **11)** Expose and protect at all times any existing conduit at locations identified in the contract documents.

12) For accessing existing cabinets on foundations, drill foundation for new conduit entrance. Foundation drill will be subsidiary to the conduit installation. Bond new conduit to the ground rod after installation of conduit. Place grout seal around conduit and return foundation to normal appearance. Avoid damaging existing conduit, conductors, and anchor bolts. Damages shall be repaired at no extra cost.

b. Installation Clearances.

1) Depth of all conduit installation shall be a minimum of 48 inches unless otherwise specified in the contract documents.

2) Depth of all conduit installation under natural flowing water shall be a minimum of 10 feet below the flow line unless otherwise specified in the contract documents.

~~**2**~~ **3)** Maintain the typical offsets from referenced locations as shown in the contract documents.

~~**3**~~ **4)** Maintain the minimum depth throughout the length of all conduit installations.

~~**4**~~ **5)** Maintain a minimum of 2 feet of separation when underground conduits parallel an existing facility.

~~**5**~~ **6)** Maintain a minimum of 2 feet vertical separation when crossing existing utilities.

~~**6**~~ **7)** Maintain a minimum of 15 feet vertical separation from top of rail when crossing existing railroad, unless otherwise specified in the contract documents.

~~**7**~~ **8)** Maintain a minimum of 5 feet vertical separation from bottom of culvert when crossing existing culverts, unless otherwise specified in the contract documents.

c. Conduit Splicing.

1) Install conduit with minimal splices between handholes and structures as shown on contract documents.

2) All mechanically joined conduit splices shall use compression couplings designed for underground placement and blown-in fiber installation.

3) Butt fusion welding and solvent welding of conduits will not be allowed.

4) All conduit splices shall be designed to be watertight to 200 psi.

5) Conduit splicing is incidental to the connected items of work.

d. Facilities Protection.

1) The Contractor is responsible for entering new conduit installations into the Iowa One-Call system and providing all utility locates when requested through One-Call ticketing services or by the Engineer. Perform any locating services within 48 hours of receiving notice that location services are needed.

2) The Contractor is responsible for protecting, locating, and maintaining the conduit throughout construction and until final acceptance.

3) Prior to final acceptance and transition of ownership in the Iowa One-Call system, meet with the Engineer to demonstrate the locate system is working properly throughout the entire locate system.
4) If more than 48 hours lag is expected behind a segment installation, install additional protective measures acceptable to the Engineer.

e. Backfilling.

1) Apply Section 2552 of the Standard Specifications and the following.
2) Backfill trenches and other excavations in lifts of 6 inches or less in compacted depth. Compact each layer thoroughly before placing subsequent layers.
3) Remove all cinders, broken concrete, or other hard or abrasive materials in the backfill material before commencing backfilling operations.
4) Remove and dispose of surplus and unsuitable materials upon completion of the backfilling operations in the area.
5) Place and carefully hand tamp backfill under and around the structures in lifts not to exceed 4 inches in loose thickness. Use a suitably sized mechanical tamper for all areas inaccessible to rollers.
6) Perform operations in a manner that minimizes soil erosion and employs appropriate storm water pollution prevention measures during all construction operations.
7) Maintain work areas in a neat, clean, and orderly condition at all times.
8) Upon completion of conduit/cable placing operations and any other work in an area, remove all debris, materials, tools, and equipment from the area and restore the disturbed area(s) to original or better condition within 24 hours or as soon as practicable as determined by the Engineer. Backfill all excavations and grade all disturbed areas during the restoration process.
9) Remove and dispose of rock and debris excavated and remaining after backfilling as directed by the Engineer.

~~**f. Surface Restoration.**~~

~~1) Replace or reinstall features removed as a part of the work, such as sidewalks, driveways, curbs, roadway pavement, unpaved areas, or any other items.~~
~~2) Immediately repair or replace any unauthorized disturbance or damage. Replace improved landscaping, lawns, scrubs, and hedge removed or damaged during construction in a manner acceptable to the Engineer. Re-sod damaged lawns using like grasses.~~
~~3) Complete restoration according to the applicable sections of the Standard Specifications.~~

~~g~~ **f. Multiple Duct Installation.**

Install multiple ducts, in continuity, at locations indicated in the contract documents unless authorized in writing by the Engineer.

~~h~~ **g.Plowed Conduit Installation.**

1) Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.
2) Furnish competent supervision at all times at the site of plowing operations to assure compliance with the contract documents.
3) The equipment shall be capable of extending the plow in order to maintain the required minimum depths under all terrain conditions.
4) The reel carrier shall be of adequate size and be configured so that the reel sizes being used can be safely handled.
5) Avoid damaging any paved surfaces, ditches, or other similar surface features. Immediately repair any damage to such features to the satisfaction of the Engineer.
6) Perform plowing in accordance with standard industry practices using a prime mover with hydrostatic type steering and a vibratory plow. The design of the plowshare shall be such that the buried conduit passing through the plow shall not bind and shall not be bent in a radius less than 20 times the outside diameter of the conduit and maintains the structural integrity of the conduit. The feed chute shall have a removable gate for the purpose of inspection and to allow the conduit to be removed from or inserted into the feed chute at any intermediate point between splice locations. The conduit path

inside the feed chute shall have low friction surfaces and be free of burrs and sharp edges to prevent damage to the conduit as it passes through. Smooth any welds before use. Internal guide rollers shall not be used. Exercise care during the plowing operation to avoid conduit damage. Feed the conduit into the ground through the plow loose and at no tension.

7) Excavate as needed start and finish pits and pits at points of intersection in advance of plowing. Expose ends of casings and crossings of foreign utilities before the start of plowing operations for a conduit segment. Exercise care in the use of trenching and excavating tools and equipment to avoid damaging installed and intersecting conduits or other facilities.

8) Restore plow furrowed areas to conform to the surrounding terrain using a rubber-tired tractor or heavy truck or a vibratory roller having a weight of 3 tons and a drum width between 4 and 6 feet or by other suitable means approved by the Engineer.

9) Boring may be used in lieu of plowing at the Contractor's expense.

~~i~~ h. Conduit in Trench.

1) Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.

2) Excavate open trench straight as practicable. Shape the trench to be smooth, free from any sharp edges, and clear of debris and loose rock. Excavate only gradual grade changes.

3) Do not leave trenches unattended at any time or open during non-working hours unless approved in writing by the Engineer. Install barriers or other protective measures to prevent livestock or persons from falling into an open trench when appropriate.

4) Notify the Engineer immediately if solid rock is encountered at any location. Excavate rock trenches using a rock saw or other suitable equipment. The excavation, backfill, and road crossings in solid rock areas shall conform to the requirements stated above unless specifically exempted in this section.

5) Rock excavation will be considered extra work and will be paid according to Article 1109.03, B of the Standard Specifications. Obtain approval from the Engineer before commencing any rock excavation.

~~j~~ i. Bored Conduit Installation.

1) Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.

2) Bore all crossings beneath roadways, streets, other paved surfaces, railroads, or other structure in accordance with requirements and regulations of the authority having jurisdiction and as directed in the contract documents.

3) Limit bore hole sizes to the outside diameter of the conduit being placed.

4) Locate bore pits ~~a minimum of 2 feet from the edge of pavement or shoulder~~ per the contract documents unless otherwise directed by the Engineer.

5) Rock excavation will be considered extra work and will be paid according to Article 1109.03, B of the Standard Specifications. Obtain approval from the Engineer before commencing any rock excavation.

~~k~~ j. Lower Conduit in Place.

1) Expose existing conduit in an open trench. Excavate to the depth specified in the contract documents.

2) If necessary, cut the conduit on either end of excavation to lower the conduit to the depth specified in the contract documents. Install split conduit with locking ridges and adhere a split coupling to each end of the split conduit.

3) The Contractor is responsible for protecting the existing cable inside the conduit.

4) Move cable slack needed to lower conduit as specified in the contract documents.

5) Ensure the bottom of the conduit rests securely on firm undisturbed soil.

6) Item includes the transition of conduit from existing depth to new depth specified in the contract documents.

7) Backfill open trench according to Section 2552 of the Standard Specifications and the additional requirements for conduit backfilling listed above.

2. **Rigid Steel Conduit.**
   a. Comply with Article 2523.03 of the Standard Specifications.
   b. Above ground risers shall be rigid steel conduit to a minimum depth of 18 inches below surface.
   c. Thread and cap all rigid steel conduit ends with standard conduit caps until wiring is installed. Before wiring is installed, replace caps with threaded insulating bushing in accordance with Article 2523.03, N of the Standard Specifications.

3. **Electric Metallic Tube Conduit.**
   Comply with ~~National Electric Code (~~NEC~~)~~.

~~K~~ J.Handholes.

1. **Handhole Installation.**
   a. Install handholes in accordance with the contract documents and the manufacturer's recommendations.
   b. Install the type and size of handholes at the locations indicated in the contract documents.
   c. Set top of all handholes level and flush with the pavement or soil grade.
   d. Install aggregate bedding a minimum of 12 inches below and 6 inches beyond the outside edges of the handhole as identified in the contract documents. Aggregate material shall meet Gradation No. 3 or 5 of the Aggregate Gradation Table in Article 4109.02 of the Standard Specifications.
   e. Conduit shall enter the handhole from the bottom and extend conduit ends between 4 and 6 inches above the aggregate bedding.
   f. Side penetrations of the handholes are not permitted.
   g. Terminate each tracer wire run in test stations in accordance with the contract documents.
   h. Install ground rods as indicated in the contract documents.
   i. Ground test station to ground rod with exothermic weld.
   j. Seal all conduit openings using duct plugs, or as directed by the Engineer, at all conduit openings at the handholes after cable installation.
   k. Rodent proof all handholes per the contract documents.
   l. Place suitable backfill material according to Section 2552 of the Standard Specifications. Backfill is incidental to each handhole being installed and will not be paid for separately.
   m. Do not install lid bolts.
   n. Do not install cable hooks.

2. **Test Station**
   a. Secure test station by placing over steel U- or T-post.
   b. Set test station at or near right-of-way, if possible.

3. **Handhole Removal.**
   a. Remove and dispose of handholes unless otherwise specified in the contract documents.
   b. Restore disturbed surfaces to match adjacent areas.
   c. Place suitable backfill material according to Section 2552 of the Standard Specifications. Backfill is incidental to each handhole being removed and will not be paid for separately.
   d. Apply seed and fertilizer to the disturbed areas in accordance with the contract documents.

~~L~~ K.Wire and Cable.

1. **General.**
   a. Install wire and cable in accordance with the contract documents and the manufacturer's recommendations.
   b. Before wire or cable is installed inside existing conduit, clear the conduit of deleterious material. The cost of clearing the existing conduit will be subsidiary to wire or cable installation.

~~b~~ **c.** All installations and connections shall comply with the contract documents and all generally accepted codes and standards.

~~c~~ **d.** The Engineer will resolve all conflicts.

2. Tracer Wire.

a. Install tracer wire inside conduit as indicated on the contract documents.

b. Where new tracer wire is installed:

- Splice tracer wire only in handholes to form a continuous network using splice kits listed for wet locations.
- Leave 50 foot coil of tracer wire in all ITS handholes when being terminated at the test station.
- Install one tracer wire per armored fiber optic cable between the splice closure and test station.
- Test all tracer wire for continuity, with approval by the Engineer prior to final acceptance.

c. Labeling Requirement: Place tags on all tracer wire identifying the direction of the tracer wire at every test station.

3. XHHW Wire.

a. Install XHHW wire inside conduit as indicated on the contract documents.

b. Comply with Article 2523.03 of the Standard Specifications.

~~**4. Grounding/Bonding.**~~

~~**a.** Ground all installations as indicated in the contract documents.~~

~~**b.** Installation of grounds is incidental to the cost of the connected items of work.~~

~~**c.** Ground all installations in accordance with the requirements of NEC. Supply and install additional grounding rods and equipment as necessary to satisfy such requirements at no additional cost to the Contracting Authority.~~

~~5~~ **4. Fiber Optic Cable.**

a. General.

1) If the fiber optic cable is provided by the Iowa DOT, coordinate with the Iowa DOT regarding the time and location for the Contractor to accept the fiber optic cable and deliver the fiber optic cable to the field for installation or to the Contractor's construction yard for storage.

2) Remove fiber optic cable from the reel in accordance with the manufacturer's recommendations.

3) Do not twist or bend the fiber optic cable in excess of the limits recommended by the manufacturer.

4) As the cable is fed into the duct and conduit system use a manufacturer approved water-based cable lubricant for all fiber optic cable installations.

5) Protect at all times all proposed cables, cable ends, and any exposed portions of fiber optic cable from damage including water intrusion.

6) Replace in kind any existing pull tape or tracer wire that is used as a pull rope for fiber optic cable installation. The cost of any tracer wire or pull tape replacement will be subsidiary to the fiber optic cable installation.

7) Expose and protect at all times any existing buried fiber optic cable at locations identified in the contract documents for splicing.

b. Fiber Optic Cable Testing.

1) Visually inspect fiber optic cable prior to installation. Report any defects to the Engineer.

2) Pre-acceptance of Contracting Authority provided fiber (on-reel), test all strands of fiber (uni-directional) with an OTDR at 1310 nm and 1550 nm to verify attenuation, continuity and length of the cable. Measured length by the OTDR shall match manufacturer cable foot markings plus manufacturer provided helicity. Provide the Engineer with a PDF

copy of the OTDR traces. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.

3) Test all strands of fiber per the contract documents with an OTDR at 1310 nm and 1550 nm to verify attenuation, continuity, and length of the cable. Measured length by the OTDR shall match manufacturer cable foot markings plus manufacturer provided helicity. Measured post installation length shall match pre-installation (on-reel) length +/- 50 feet for each strand. Provide the Engineer with a PDF copy of the OTDR traces. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.

4) The fiber optic cable is to have a maximum attenuation of 0.4 dB/km at 1310 nm and 0.3 dB/km at 1550 nm when measured with an OTDR. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.

5) Replace, as directed by the Engineer, any defect discovered during final acceptance at no additional cost to the Contracting Authority. Consider a defect to be any cable with an OTDR measured length that differs from the actual cable footage, excluding manufacturer's helicity.

6) All test equipment shall be factory certified within the last year. Provide copies of the certification 10 calendar days prior to testing.

7) Test results will be recorded on a form supplied by the Contractor, with data compiled in PDF format through the meter manufacturer's software. No additional alteration using software from the Contractor beyond the meter manufacturer's software will be allowed. Submit test results in a format approved by the Engineer. Hand completed test forms on each fiber over to the Engineer. Provide native test (electronic version) with no alterations and meter software for viewing of fiber traces. At a minimum, show the following:

- Cable and fiber identification (as approved by the Engineer).
- Operator Name.
- Date and Time.
- Setup and test parameters including wavelength, pulse width, range, scale and ambient temperature.
- Test results for OTDR test in both directions for total fiber trace, splice loss/gain (dB), connector loss (dB), all events greater than 0.05 dB, measured length from cable markings and total length from OTDR.
- Test results for attenuation test including measured cable length (cable marking), total length (from OTDR test), number of splices (from as-built) and total link end-to-end attenuation in each direction and the bidirectional average.

8) OTDR testing shall use a launch and receiving cable. Each cable shall be a minimum 1000 meters (3290 feet), or greater than the dead zone for the OTDR used for this test, whichever is larger.

c. Fiber Optic Cable Installation.

1) Utilize a suitable cable feeding method between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct.

2) Utilize dynamometers and breakaway pulling swings to ensure that the pulling line tension does not exceed 600 pounds.

3) The mechanical stress placed on a cable during installation shall not be such that the cable is twisted or stretched. To prevent the cable from twisting, attach a pulling eye and swivel to the cable. Use the pulling eye and swivel to pull the cable through the conduit.

4) Do not force cables around sharp corners and take precautions during installation to prevent the cable from being kinked, gouged, or crushed.

5) Minimum bending radius during installation shall not be less than 20 times the outside diameter of the cable or as recommended by the manufacturer, whichever is greater.

6) Pulling of the cable shall be hand assisted.

7) Approved installation methods include pulling, high air speed blowing, air- assist, push/pull installation, and air blown cable. Installation shall comply with all

manufacturers' recommendations for cable installation including pulling tensions, bending radii, and methods, including use of rollers.

8) Carefully inspect the cable for jacket defects. If defects are noticed, immediately stop the pulling operation and notify the Engineer. The Engineer will make a determination of acceptability or will reject the cable.

9) Install the fiber cable in continuous runs as marked in the contract documents. End of reel splices or butt splices not shown in the contract documents shall be pre-approved by the Engineer and are incidental to the cost of the installation of the cable. If approved, perform the end of reel or butt splices in existing splice vaults as shown in the contract documents. The cost associated with the end of reel or butt splices including splice closures, storage baskets, splice trays, protective sleeves, and all accessories shall be included in their respective items and shall not result in additional cost to the Contracting Authority.

10) No splices will be allowed unless indicated in the contract documents or approved by the Engineer.

11) Seal all conduit openings using duct plugs or as directed by the Engineer, at all conduit openings at the handholes after cable installation.

d. Fiber Optic Cable Removal.

1) Remove and dispose of fiber optic cable unless otherwise specified in the contract documents.

2) If the contract documents indicate that fiber optic cable is to be retained by DOT, place fiber optic cable onto a reel in accordance with the manufacturer's recommendations. Test all strands of fiber (uni-directional) with an OTDR at 1310 nm and 1550 nm to verify attenuation, continuity, and length of the cable. Measured length by the OTDR shall match manufacturer cable foot markings plus manufacturer provided helicity. Provide the Engineer with a PDF copy of the OTDR traces. Deliver salvaged materials to the location specified in the contract documents.

e. Facilities Protection.

1) In the event it is suspected that cable damage has occurred prior to final acceptance, test the cable with an OTDR within 72 hours after notification and submit a copy of the OTDR test to the Engineer upon completion.

2) Replace or repair, as directed by the Engineer, any damage occurring before final acceptance at no additional cost to the Contracting Authority. Perform any repairs or replacements as soon as reasonably possible unless otherwise approved by the Engineer.

3) Replace or repair any defect in the installed cable at no additional cost to the Contracting Authority. Consider a defect to be any condition resulting in a negative or adverse effect on current or future operations of the completed fiber optic communication system as determined by the Engineer.

4) Replace or repair any existing wiring that is damaged during fiber optic cable installation, as directed by the Engineer, at no additional cost to the Contracting Authority.

f. Slack Coils.

1) Leave sufficient slack at each end of the cable to allow proper cable splicing and termination. The minimum slack amount shall be as follows or as indicated in the contract documents:

- Intermediate pulling handhole – 100 feet
- Splice point handhole – 150 feet

2) Foot marker and cable size text shall be legible on the cable jacket coiled in the handhole.

3) Neatly coil slack cable in handholes. Bind the slack coils at a minimum of 3 points around the coil perimeter.

4) Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames and terminals.

5) For storage purposes, the minimum bending radius shall not be less than 10 times the outside diameter of the cable or as recommended by the manufacturer, whichever is greater.

g. Cable Identification.

1) Place tags on all fiber optic cable identifying the owner and direction of the cable.
2) Use tags to label fiber optic cable in every cabinet, handhole, and building termination.
3) Tags shall clearly identify where each individual cable run originated and where it ends (handhole to handhole, handhole to cabinet, handhole to building, etc.). Include mileposts for handholes.
4) Engineer will approve tag content before installation.
5) For joint fiber installations with the Contracting Authority, where the fiber will be owned by the other agency (or entity), install typical identifiers and/or markings for that fiber.

h. Lower Fiber Optic Cable in Place.

1) Expose existing direct buried fiber optic cable in an open trench. Excavate to the depth specified in the contract documents.
2) The Contractor is responsible for protecting the existing fiber optic cable.
3) Ensure the bottom of the fiber optic cable rests securely on firm undisturbed soil.
4) Item includes the transition of fiber optic cable from existing depth to new depth specified in the contract documents.
5) Backfill open trench according to Section 2552 of the Standard Specifications and the additional requirements for conduit backfilling listed above.

~~**6. Microwave/Radar Vehicle Detection System Cable.**~~

~~**a.** Apply Article 2523.03, Q of the Standard Specifications and the following:~~

~~**b.** Install MVDS and Radar cable in continuous runs from the unit to the controller as splicing shall not be permitted.~~

~~**c.** Install additional slack at the locations shown in the contract documents.~~

~~M~~ L.Meter Pedestals.

1. Apply Article 2523.03, C of the Standard Specifications and the following:

2. Install meter pedestals and power connections in accordance with the contract documents, the manufacturer's recommendations, NEC, and all requirements of local electrical utility. Approval from the Engineer and local electrical utility is required prior to revising any power locations.

3. Coordinate installations in advance as noted on the contract documents.

4. Provide all conduit, breaker enclosures, circuit breakers, wiring and accessories, neutral bars and accessories, ground bars and accessories, terminations and grounding in the power source.

5. Coordinate and schedule all locally required inspections of electrical work prior to putting a location into service.

6. Coordinate with the Engineer and power provider to request that electrical service at a device location be initiated. Complete and submit all new service applications to the local electrical utilities.

M. Circuit Breakers.

Install circuit breakers in accordance with the contract documents, the manufacturer's recommendations, NEC, and all requirements of local electrical jurisdiction.

N. Transformers.

1. Install transformer in accordance with the contract documents, the manufacturer's recommendations, NEC, and the manufacturer's recommendations.

2. Do not penetrate the top of any cabinets without prior authorization by the Engineer.

3. All exterior connections shall be watertight.

4. Ensure sufficient clamps, nuts, hardware, etc., as required for the specified mounting type, are furnished with each cabinet.

5. Provide all conduit, breaker enclosures, circuit breakers, wiring and accessories, neutral bars and accessories, ground bars and accessories, terminations, and grounding in the power source.

O. Fiber Optic Splicing.

1. **Fusion Splices.**
   - **a.** Use fusion splices to splice all continuous fiber runs in splice closures and factory terminated connector pigtails.
   - **b.** Splices shall be allowed only in the splice closures as located in the contract documents.
   - **c.** Maximum attenuation per splice as estimated by the fusion splicer shall not exceed 0.02 dB. Any splice exceeding 0.02 dB at the time of splicing shall be re-spliced.
   - **d.** Splice shall provide three axis core alignment using light injection and loss measurement techniques.
   - **e.** No mechanical splices of fiber cable will be allowed.
   - **f.** All fusion splice equipment shall be factory serviced within the last year. Provide copies of factory service 10 calendar days prior to splicing.
   - **g.** Maintain on site at all times all materials necessary to immediately install temporary and/or permanent repairs to active fiber damaged during the course of work, including availability of additional splicing equipment.

2. **Existing Fiber Optic Splice Closure Work.**
   - **a.** Provide a responsible supervisor at all times to monitor work being done at all splice locations having active fibers present.
   - **b.** The Engineer will notify the Contractor of any known active fiber optic cables in the work area.
   - **c.** Coordinate and supervise all work to avoid unplanned service interruptions of active facilities while performing the work.
   - **d.** The Engineer will approve any planned network interruptions by the Contractor before initiating the interruption.
   - **e.** Notify the Engineer at least 5 working days before commencing any work near active or potentially active fiber optic cables.
   - **f.** Notify the Engineer immediately if any active fibers are damaged.
   - **g.** Maintain on site at all times all materials necessary to immediately install temporary and/or permanent repairs to active fiber damaged during the course of work, including availability of additional splicing equipment.
   - **h.** Do not commence any work until repair measures are on site.
   - **i.** The Contractor is responsible for any direct or indirect costs related to the damage of the active fibers.

3. **Splicing Requirements.**
   - **a.** The Engineer will be responsible for requesting moratorium dates from the ICN NOC, completing a method of procedures (MOP) form, ~~O~~obtaining approval from the ICN NOC, and notifying the Iowa DOT TMC prior to any splicing work.
     - **1)** The notice to the Iowa DOT TMC shall include a listing of devices that will be inactive and the duration of the outage.

2) All MOPs require a minimum notice of 14 calendar days to the ICN NOC. Approval of ICN service affecting splicing windows is at the discretion of the ICN NOC. This may impact the scheduling of splicing work.

b. Maintenance windows for splicing are restricted to Monday night through Thursday night.

c. ~~Complete cable cuts (insertion splice locations)~~ All splicing and splice case work require a minimum notice of ~~14~~ 21 calendar days to the ~~ICN NOC~~ Engineer. ~~Splicing work at insertion splice locations shall be separated by a minimum of 10 working days.~~ Provide the Engineer with the Contractor's on-site splicing representative's contact information and proposed splicing date.

~~**d.** Multiple maintenance windows per week may be scheduled for splicing that does not impact ICN traffic depending on NOC approval.~~

~~e~~ d. ~~Only one splicing crew is allowed per night.~~ Multiple locations may be scheduled and spliced in the same night. ~~Notify ICN NOC prior to splicing work and upon completion of splicing before moving to the next location.~~ Complete work at one location and call the ICN NOC at 1-800-572-3940, or 515-725-4400 prior to starting work at the next location.

~~f~~ e. ~~Prior to splicing,~~ Immediately before beginning and immediately following the completion of splicing work, it will be the responsibility of the Contractor to notify the ~~following project~~ ICN NOC, Iowa DOT TMC, and any other contacts ~~unless~~ specified ~~elsewhere~~ in the contract documents~~:~~.

- ~~ICN NOC,~~
- ~~Engineer,~~
- ~~Iowa DOT TMC, and~~
- ~~Iowa DOT Statewide ITS Maintenance Contractor.~~

4. Fiber Optic Cable Acceptance Testing.

a. Test splicing termination to termination per the contract documents with an OTDR at 1310 nm and 1550 nm to verify attenuation and continuity of strands for the entire length of cable. Provide the Engineer with up to two copies of any software required for viewing electronic files of the OTDR traces.

b. Each splice is to have an averaged loss value of 0.07 dB or less when measured bi-directionally with an OTDR at 1310 nm and 1550 nm. Splice test results submitted to the Engineer that exceed the 0.07 dB or less specification will be identified as Out of Specification.

c. Each connector is to have an averaged loss value of 0.25 dB or less when measured bi-directionally with an OTDR at 1310 nm and 1550 nm. Connector test results submitted to the Engineer that exceed the max loss of 0.25 dB specification will be identified as Out of Specification.

d. All test equipment shall be factory certified within the last year. Provide copies of the certification 10 calendar days prior to testing.

e. Test results will be recorded on a form supplied by the Contractor, with data compiled in PDF format through the meter manufacturer's software. No additional alteration using software from the Contractor beyond the meter manufacturer's software will be allowed. Submit test results in a format approved by the Engineer. Hand completed test forms on each fiber over to the Engineer. Provide native test (electronic version) with no alterations and meter software for viewing of fiber traces. At a minimum, show the following:

- Cable and fiber identification (as approved by the Engineer).
- Operator Name.
- Date and Time.
- Setup and test parameters including wavelength, pulse width, range, scale and ambient temperature.
- Test results for OTDR test in both directions for total fiber trace, splice loss/gain (dB), connector loss (dB), all events greater than 0.05 dB, measured length from cable markings and total length from OTDR.

- Test results for attenuation test including measured cable length (cable marking), total length (from OTDR test), number of splices (from as-built) and total link end-to-end attenuation in each direction and the bidirectional average.

f. OTDR testing shall use a launch and receiving cable. Each cable shall be a minimum 1000 meters (3290 feet), or greater than the dead zone for the OTDR used for this test, whichever is larger.

23058.04 METHOD OF MEASUREMENT.

A. ITS Construction Survey.
Lump sum item; no measurement will be made.

B. ITS Power Installed Foundation.
By count.

C. ITS Steel Pole.
By count.

D. ITS Steel Pole, Remove and Reinstall.
By count.

E. ITS Steel Pole, Remove.
By count.

F. ITS Cabinet Foundation.
By count.

G. ITS Device Cabinet.
By count.

H. ITS Device Cabinet, Remove.
By count.

~~**H**~~ **I. ITS Device Cabinet, Remove and Reinstall.**
By count.

~~**I**~~ **J. ITS Conduit, of the type and install method specified.**
Linear feet shown in the contract documents.

~~**J**~~ **K.ITS Conduit, lower in place.**
Linear feet shown in the contract documents.

~~**K**~~ **L.Expose Existing Conduit.**
Linear feet shown in the contract documents.

~~**L**~~ **M.ITS Handhole, of the type specified.**
By count.

~~**M**~~ **N.ITS Handhole, Remove.**
By count.

~~**N**~~ **O.ITS Fiber Marker.**
By count.

~~**O**~~ **P.ITS Test Station.**
By count.

~~P~~ **Q.ITS Isolation Ground Switch.**
By count.

~~Q~~ **R.ITS Ground Rod.**
By count.

~~R~~ **S.ITS Tracer Wire and XHHW Copper Wire, of the type specified.**
Linear feet shown in the contract documents.

~~S~~ **T.Fiber Optic Cable, of the type specified.**
Linear feet shown in the contract documents.

~~T~~ **U.Fiber Optic Cable, Remove.**
Linear feet shown in the contract documents.

~~U~~ **V.Fiber Optic Cable, Lower in Place.**
Linear feet shown in the contract documents.

~~V~~ **W.Expose Existing Direct Buried Fiber Optic Cable.**
Linear feet shown in the contract documents.

~~W~~ **X.ITS Meter Pedestal.**
By count.

Y. Circuit Breaker
By count.

~~X~~ **Z.ITS Transformer.**
By count.

~~Y~~ **AA.Equipment Rack, of the type specified.**
By count.

~~Z~~ **BB.Unit Connector Housing, of the type specified.**
By count.

~~AA~~ **CC.Module Connector Housing Splice Cassettes.**
By count.

~~BB~~ **DD.Connector Adaptor Panel, Six Duplex SC.**
By count.

~~CC~~ **EE.Single Panel Housing.**
By count.

~~DD~~ **FF.UPC/SC Factory Terminated Fiber Connector and Pigtails.**
By count.

~~EE~~ **GG.Fiber Optic Splice Closure.**
By count.

~~FF~~ **HH.Existing Fiber Optic Splice Closure Work.**
By count.

~~GG~~ II.**Fiber Optic Splice Tray, of the type specified.**
By count.

~~HH~~ JJ.**Fiber Optic Splice.**
By count.

~~II~~ KK.**Fiber Optic Cable Acceptance Testing.**
Lump sum item; no measurement will be made.

23058.05 BASIS OF PAYMENT.

A. ITS Construction Survey.
Payment will be at the lump sum price for ITS Construction Survey. Payment is full compensation for staking and re-staking.

B. ITS Power Installed Foundation.

1. Each.

2. Payment is full compensation for:
- **a.** The furnishing, if specified, and installation of all power installed foundations.
- **b.** Including all surface excavations, repair or restoration of any nearby areas.
- **c.** Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

C. ITS Steel Pole.

1. Each.

2. Payment is full compensation for:
- **a.** The furnishing, if specified, and installation of all poles and accessories,
- **b.** Including all conduit entrances and attachments, all necessary electric grounding materials, and
- **c.** Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

D. ITS Steel Pole, Remove and Reinstall.

1. Each.

2. Payment is full compensation for:
- **a.** The removal, storage, and installation of all poles and accessories,
- **b.** Including all conduit entrances and attachments, all necessary electric grounding materials, and
- **c.** Furnishing new pole mounting hardware, all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

E. ITS Steel Pole, Remove.

1. Each.

2. Payment is full compensation for:
- **a.** The removal and salvaging of all poles and accessories.
- **b.** Furnish all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

F. ITS Cabinet Foundation.

1. Each.

2. Payment is full compensation for:
- **a.** The furnishing and installation of all cabinet foundations,
- **b.** Including all surface excavations, repair or restoration of any nearby areas, concrete, steel reinforcement, and anchors, and
- **c.** Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

G. ITS Device Cabinet.

1. Each.

2. Payment is full compensation for:
- **a.** The furnishing, if specified, and installation of all cabinets,
- **b.** Including all internal components and accessories required to provide a complete cabinet installation per the contract documents,
- **c.** Providing and installing all mounting materials, cable pulling, routing and management, cable termination, and all necessary electric grounding materials, and
- **d.** Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

H. ITS Device Cabinet, Remove.

1. Each.

2. Payment is full compensation for:
- **a.** The removal and salvaging of all ITS cabinets and accessories.
- **b.** Furnish all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~H~~ I. ITS Device Cabinet, Remove and Reinstall.

1. Each.

2. Payment is full compensation for:
- **a.** The removal, storage, and installation of all cabinets,
- **b.** Including all internal components and accessories required to provide a complete cabinet installation per the contract documents,
- **c.** Providing and installing all mounting materials, cable pulling, routing and management, cable termination, and all necessary electric grounding materials, and
- **d.** Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~I~~ J. ITS Conduit, of the type and install method specified.

1. Per linear foot.

2. Payment is full compensation for:
- **a.** The furnishing and installation of all conduits per the contract documents.
- **b.** Including all surface excavations or surface preparation work, repair or restoration of any disturbed areas to pre-construction conditions, proper water/moisture drainage materials.
- **c.** Open trench installation is incidental to bored or plowed conduit installations and will not be paid for separately.

d. Boring in lieu of plowing is allowed at the Contractor's expense.
~~d~~ e. Conduit mounting on new or existing infrastructure.
e f. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents

~~J~~ K.ITS Conduit, Lower in Place.

1. Per linear foot.

2. Payment is full compensation for:
   a. Lowering of existing conduit in place per the contract documents.
   b. Including all surface excavations and restoration.
   c. Furnishing all labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~K~~ L.Expose Existing Conduit.

1. Per linear foot.

2. Payment is full compensation for:
   a. Exposing of existing conduit per the contract documents.
   b. Including all surface excavations and restoration.
   c. Furnishing all labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.

~~L~~ M.ITS Handhole, of the type specified.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all handholes and lids.
   b. Including all surface excavations, repair or restoration of any nearby areas, concrete, proper water/moisture drainage materials, all necessary electric grounding materials and installation.
   c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~M~~ N.ITS Handhole, Remove.

1. Each.

2. Payment is full compensation for:
   a. The removal and disposal of all handholes and lids per the contract documents.
   b. Including all surface excavations and restoration.
   c. Furnishing all labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~N~~ O.ITS Fiber Marker.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all fiber markers.
   b. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~O~~ P.ITS Test Station.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all test stations.
   b. Including all necessary electric grounding materials and installation.
   c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~P~~ Q.TS Isolation Ground Switch.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all test stations.
   b. Including all necessary electric grounding materials and installation.
   c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~Q~~ R.ITS Ground Rod.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all ground rods.
   b. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~R~~ S.ITS Tracer Wire and XHHW Copper Wire, of the type specified.

1. Per linear foot.

2. Payment is full compensation for:
   a. The furnishing and installation of all wire per the contract documents.
   b. Including the proper installation of the wire into existing conduit and new conduit systems, supply and installation of splices and connectors, and slack, coiled, or stored wire.
   c. Furnishing all materials, labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.
   d. Prior to final acceptance, meet with the Engineer to demonstrate the locate system is working properly throughout the entire locate system.

~~S~~ T.Fiber Optic Cable, of the type specified.

1. Per linear foot.

2. Payment is full compensation for:
   a. The furnishing, if specified, and installation of all cable per the contract documents.
   b. Including the proper installation of the cable into existing conduit and new conduit systems, and slack, coiled, or stored cables.
   c. Furnishing all labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.

3. Payment for fiber optic cable installation will not be made until fiber optic cable is tested by the Contractor and OTDR results are accepted by the Engineer.

~~T~~ U.Fiber Optic Cable, Remove.

1. Per linear foot.

2. Payment is full compensation for:
   a. The removal and disposal of all cable per the contract documents.
   b. Furnishing all labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.

~~U~~ V.Fiber Optic Cable, Lower in Place.

1. Per linear foot.

2. Payment is full compensation for:

   a. Lowering of existing direct buried fiber optic cable in place per the contract documents.
   b. Including all surface excavations and restoration.
   c. Furnishing all labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.

~~V~~ W.Expose Existing Direct Buried Fiber Optic Cable.

1. Per linear foot.

2. Payment is full compensation for:
   a. Exposing of existing fiber optic cable per the contract documents.
   b. Furnishing all labor, tools, equipment, consumable items, and other incidental items necessary to meet the requirements of the contract documents.

~~W~~ X.ITS Meter Pedestal.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all meter pedestals.
   b. Providing and installing all mounting materials, cable pulling, cable coil, routing and management, cable termination, and all necessary electric grounding materials.
   c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

Y. Circuit Breaker.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all circuit breakers.
   b. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~X~~ Z.ITS Transformer.

1. Each.

2. Payment is full compensation for:
   a. The furnishing and installation of all transformers.

b. Providing and installing all mounting materials, cable pulling, routing and management, cable termination, and all necessary electric grounding materials.
c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~Y~~ AA.Equipment Rack, of the type specified.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all equipment racks.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~Z~~ BB.Unit Connector Housing, of the type specified.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all unit connector housings.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~AA~~ CC.Module Connector Housing Splice Cassettes.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all module connector housings splice cassettes.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~BB~~ DD.Connector Adaptor Panel, Six Duplex SC.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all connector adaptor panels.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~CC~~ EE.Single Panel Housing.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all single panel housings.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~DD~~ FF.UPC/SC Factory Terminated Fiber Connector and Pigtails.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all fiber optic splice closures.

b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~EE~~ GG.Fiber Optic Splice Closure.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all UPC/SC factory terminated fiber connectors and pigtails.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~FF~~ HH.Existing Fiber Optic Splice Closure Work.

1. Each.

2. Payment is full compensation for:
a. Providing all coordination, materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~GG~~ II.Fiber Optic Splice Tray, of the type specified.

1. Each.

2. Payment is full compensation for:
a. The furnishing and installation of all fiber optic splice trays.
b. Providing and installing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~HH~~ JJ.Fiber Optic Splice.

1. Each.

2. Payment is full compensation for:
a. Providing all coordination, materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

~~II~~ KK.Fiber Optic Cable Acceptance Testing.
Payment will be at the lump sum price for Fiber Optic Cable Acceptance Testing. Payment is full compensation for providing testing results of installed fiber optic cable in a format that is accepted by the Engineer as described in the contract documents.

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Todd Hanson / Eric Johnsen	**Bureau/Office:** Construction & Materials / Specifications	**Item 14**
Submittal Date: 4/22/2024	**Proposed Effective Date:** July 16, 2024	
Article No.: **Title:**	**Other:** DS-23053, PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems	

Specification Committee Action: Approved as recommended.			
Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:**
Specification Committee Approved Text: See attached Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems.			
Comments: None.			
Specification Section Recommended Text: See attached Draft Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems.			
Comments:			

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

Reason for Revision: Correct the definition of a lot.

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

DS- 23059
(Replaces DS-23053)

DEVELOPMENTAL SPECIFICATIONS
FOR
PCC PAVEMENT NON-DESTRUCTIVE THICKNESS DETERMINATION CONTRACTOR QUALITY CONTROL AND ACCEPTANCE FOR LOCAL SYSTEMS

Effective Date
July 16, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

This developmental specification is not to be used on contracts involving the National Highway System (NHS).

Replace Article 2301.04, A, 2 with the following.

2. Requirements for thickness do not apply to detour pavements, paved drives, and temporary pavements. The thickness of pavement constructed will be determined as follows:

a. The division of sections, lots, and thickness measurement locations will be ~~determined by the Engineer according to Materials I.M. 346~~ according to Appendix A.

b. ~~For Interstate and Primary projects, evaluate pavement thickness for sections of the same design thickness more than 3500 square yards using non-destructive testing according to Materials I.M. 346 Method A.~~ At locations determined by the Engineer.

~~**c.** For non-Primary projects evaluate pavement thickness for sections of the same design thickness more than 3500 square yards by coring according to Materials I.M. 346 Method B. The specification will be adopted in its entirety.~~

~~**d**~~ **c.** Determine thickness for sections of the same design thickness 3500 square yards or less, by probing plastic concrete in accordance with Materials I.M. 396.

~~**e**~~ **d.** Only sections which are evaluated for thickness will be included in the thickness index determination. Areas not evaluated for thickness will be paid for at the contract unit price.

APPENDIX A
EVALUATING PORTLAND CEMENT
CONCRETE PAVEMENT THICKNESS

SCOPE

Thickness measurements will be taken on Portland Cement Concrete (PCC) pavement, to determine the pavement thickness and the thickness index for each section. Refer to ~~Specification DS-15XXX~~ Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance for Local Systems.

APPARATUS

1. An MIT Scan T2 or T3 gauge will be used to perform thickness measures.
2. Steel Targets will be 11.81 inches in diameter, 24 gauge, meeting ASTM A 653, commercial steel with a G90 coating (about 275 g/m^2 total both sides).

DEFINITIONS

Section: All Portland Cement Concrete in a project of the same bid item. Irregular areas, as defined herein, of the same bid item shall form a separate section. On multiple year projects, a separate section will be formed for each year. If less than 20,000 square yards are placed in one year, that section will be grouped with a previous or subsequent year.

Lot: A portion of a section normally ~~200 feet in length~~ 2000 square yards and 2 traffic lanes wide.

Regular area pavement sections:

- All mainline pavement for normal travel lanes. Includes middle (both direction) turn lanes
- Paved shoulder – if same thickness as pavement and part of pavement bid item include with pavement. If separate bid item, treat as separate section.
- Paved median - if same thickness as pavement and part of pavement bid item, and longer than 300 feet, include with pavement.
- Auxiliary lanes of full width longer 300 feet.
- Widening greater than 6 feet.

Irregular areas:

- Widening less than 6 feet.
- Side street connections.
- Ramps, including gore areas, and collector distributor roads.
- Deceleration and acceleration lanes.
- Turn lanes, including taper sections.
- Tapers.
- Radiuses.
- Median crossovers

PROCEDURES

The Engineer will determine the location of each lot, the random location of each metal target, and the random thickness measuring scheme for each section using an Iowa DOT developed MSExcel spreadsheet. Immediately prior to paving, the Engineer will place the target or observe the contractor place the target.

A. Target Location for Regular Areas

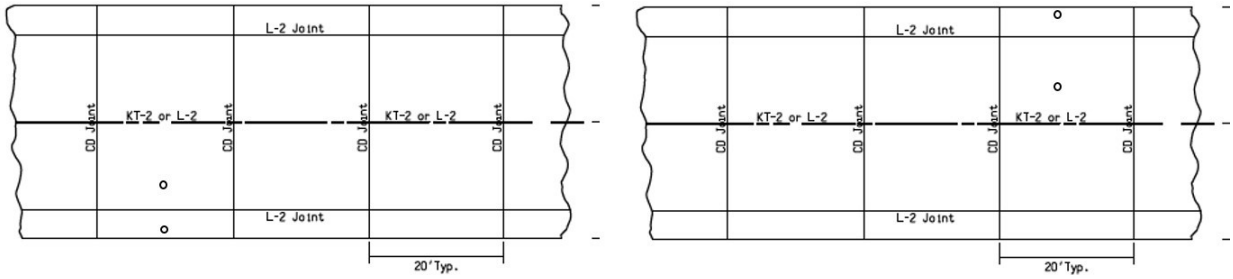
1. Divide the section longitudinally into 2000 square yard lots. One target will be located in each lot based on the spreadsheet selection. Beginning with the first station at +00, place a target from the edge of the pavement half way between dowel baskets~~)~~. See Figure 1. If the +00 station falls on a basket, move the target location ahead halfway between the dowel baskets. A minimum of ten targets will be tested. If a target location falls on a bridge or in an approach section, it will be eliminated.

2. The transverse location of the targets will be randomly determined by the spreadsheet program. The random locations will be 4 foot from edge of pavement, left or right. For ease of measuring, plates may be placed 18 inches from the edge if there is no tie steel or a work bridge is not available.

3. The program will randomly determine which targets to measure. If a measurement location falls on a bridge or bridge approach pavement, it will be eliminated and the next closest target not in the original random selection will be used for measurement.

4. Shoulders. Divide the section into 800 foot long lots including both shoulders. Beginning with the first station at +00, locate a target every 400 feet, alternating between the inside and outside shoulder (or every 800 feet on one side). On 6 foot shoulders or wider, the targets should be 4 feet from the edge of the pavement. On 4 foot shoulders, the targets should be 3 feet from the edge of the pavement.

Figure1. Target Location



B. Target Location for Irregular Areas

1. All irregular areas of the same design thickness will be grouped together for determining the number of lots. The Engineer may waive sections of the same design thickness that total less than 5000 square yards.

2. Place targets randomly in all irregular areas larger than 100 square yards. One target will be randomly located in each selected irregular area For irregular areas greater than 1000 square yards, randomly place a minimum of two targets. Targets must be placed at least 2 feet away from tie steel and 4 feet from dowel bars. A minimum of ten targets will be tested to represent each section of irregular areas. For projects with less than ten irregular areas larger than 100 square yards, select a minimum of three areas to place targets. All targets will be measured. If more than 20 targets are located in irregular areas, randomly select 50% to be tested.

C. Testing
Follow the manufacturer's instructions for operating the thickness gauge. It is important to avoid testing close to any steel including vehicles, equipment, steel toed shoes as well as tie bars, dowel bars and baskets, and manhole covers. When wearing steel toed shoes, always keep both toes at least 2 feet from the gauge during the test. Three total repeat readings will be taken. The readings should all be within 4 mm (0.15 in.) of each other.

D. Section Evaluation

1. Use the following formula to determine the mean thickness for the section:

$$\overline{X} = \frac{\sum X}{n}$$

Where: $\overline{X}$ = mean length for the section

$\sum X$ = sum of core lengths for the section

n = number of cores taken within the section

Round the mean thickness to two decimal places.

2. Use the following formula to determine the sample standard deviation of the thickness of the section:

$$S = \sqrt{\frac{\sum \left(X - \overline{X}\right)^2}{n - 1}}$$

Where:

S = thickness standard deviation for the section.
$\overline{X}$ = mean thickness for the section
X = individual thickness values for the section.
n = number of tests representing the section.

$$\sum = \text{sign indicating the sum of all values of } (X - \overline{X})^2$$

Round the sample standard deviation to two decimal places.

NOTE: Calculations of the standard deviation are best made with an electronic calculator with standard deviation capability that uses the formula containing the quantity (n-1).

3. Use the following formula to determine the thickness index for the section of pavement thickness.

$$TI = (\overline{X} - S) - T$$

Where:

TI = thickness index for the section
$\overline{X}$ = mean thickness length for the section
T = design thickness, including subbase adjustment in IM 346
S = measurement thickness standard deviation (of the sample) for the section

Round the thickness index to two decimal places.

NOTE: If the mean thickness minus the standard deviation is less than T of the section, the thickness index will be a negative number.

4. Basis of Payment. Payment for the quantities of pavement in square yards in each section will be as shown in Article 2301.05 of the Standard Specifications and based on the thickness index as determined in accordance with these instructions.

E. Quality Assurance Testing
The Engineer will perform quality assurance testing by probing.

1. Probing – The Engineer may probe a minimum of one (1) test per seven (7) plates at random locations during paving operations in accordance with Materials IM 396. Plates may be moved to 18 inches from the edge of the pavement to allow easier testing.

2. The Engineer may utilize a MIT SCAN T2 or T3 gage, other than the one used by the contractor, to test a minimum of ten random locations.

3. The Engineer may also survey, to a minimum of 0.005 foot, on the plate prior to paving and on top of the pavement directly over the plate after placement to determine an accurate thickness verification.

F. Deficient Areas

1. If any measurement is deficient from T by 1 inch or more, the measurement should be rechecked to confirm the reading and the equipment. If the repeat measurement is also 1 inch or more below T, mark the location directly over the target. The Contractor shall drill a 4.0 inch diameter core at that location. If the core length confirms the pavement is deficient by 1 inch or more, continue to drill cores as described below.

2. Deficient areas, represented by cores deficient in length by 1 inch or more from design thickness, are to be replaced. These areas will be determined by drilling a core 60 feet in each direction longitudinally at the

same transverse location from the deficient core. Drilling will be continued at 60 feet intervals until a core is obtained which is not deficient by 1 inch or more from design thickness. Interpolate between this core and the adjacent core to determine the limits of the deficient area. This is the area to be removed and replaced at contractor's expense. These additional cores are to be used to define the deficient area and will not be used in the thickness index calculation. When an obstruction, such as a bridge, intersection, previous work, etc., prevents drilling a core at the required 60 feet interval in either direction longitudinally, continue the balance of the distance on the other side of the obstruction.

3. Any readings taken in the area for removal will be eliminated from the analysis for the entire section. A minimum of two plates will be placed on alternate sides prior to placement. After replacement, the contractor measure the thickness using the MIT SCAN to verify the thickness. The engineer will witness the measurement.

G. Final Pavement Thickness Measurement

1. Include all MIT SCAN measurements and probe measurements. The final pavement thickness will be determined by one of the following:
    a. If all the probe measurements are within ±0.25" of the MIT SCAN measurements, the MIT SCAN measurements will be considered validated. The Engineer will determine final thickness based on the average MIT SCAN measurements.
    b. If at any one location, the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the contractor will core at the plate location and 2 feet away from the plate location. If the core at the plate location indicates that it has moved during placement, use the core thickness from the core taken two feet away as the pavement thickness. The Engineer will replace the MIT SCAN thickness at the location with the core thickness taken two feet away along with the average MIT SCAN measurements as final pavement thickness.
    c. If all of the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the Engineer will randomly select a minimum of 10 random locations, at two feet from the plate location, for coring by the contractor. The Engineer will use the average core thickness, tested in accordance with IM 346, to determine final pavement thickness.

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Elijah Gansen	**Office:** Construction & Materials	**Item 15**
Submittal Date: April 22, 2024	**Proposed Effective Date:** June 18,2024	
Article No.: **Title:**	**Other:** DS-23055, Diamond Ground Rumble Strips	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:**

Specification Committee Approved Text: See attached Developmental Specifications for Diamond Ground Rumble Strips.

Comments: None.

Specification Section Recommended Text: See attached Draft Developmental Specifications for Diamond Ground Rumble Strips.

Comments:

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

23055.01

Apply diluted asphalt emulsion to the ~~milled~~ diamond ground shoulder rumble strips on HMA surfaces by means of a bituminous distributor.

23055.03, B, 2

Do not use grinding equipment that causes excessive ravels, aggregate fractures, spalls, or excessive disturbance of the transverse and/or longitudinal joints. The finished surface after grinding the rumble strips should have a corduroy like texture.

23055.03, D, 3

Ensure residue from grinding operations does not flow across lanes occupied by public traffic. ~~or into gutters or other drainage facilities.~~ This residue may be spread on the foreslope or removed according to Article 1104.08. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or waterbodies.

Add attached detail sheets to the DS.

Reason for Revision: Clarification added for the desired surface texture after grinding process for the rumble strips.

- On past projects the residue from diamond grinding has been distributed in a manner that causes issues with guard rail repairs and vegetation. The added language provides additional restrictions on how the material is to be distributed to ensure compliance with water quality regulations.

Added detail sheets to the DS since it was not available when the original DS was prepared.

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: None		
Industry Comments: None		

DS- 23060
(Replaces DS-23056)

DEVELOPMENTAL SPECIFICATIONS
FOR
DIAMOND GRINDING RUMBLE STRIPS

Effective Date
July 16, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23060.01 DESCRIPTION.
Provide equipment, furnish all necessary labor and materials, and perform all operations necessary for diamond grinding standard or sinusoidal rumble strips in HMA or PCC surfaces. Diamond grind rumble strips to the dimensions and spacing shown in the contract documents. Apply diluted asphalt emulsion to the ~~milled~~ diamond ground shoulder rumble strips on HMA surfaces by means of a bituminous distributor.

23060.02 MATERIALS.

A. Use asphalt emulsion Grade CSS-1, CSS-1h, SS-1, or SS-1h meeting requirements of Section 4140 of the Standard Specifications.

B. Dilute the asphalt emulsion with water prior to application to the milled shoulder rumble strip. The dilution rate is one part of asphalt emulsion to one part of water.

23060.03 CONSTRUCTION.

A. General.

1. Notify the Engineer if degraded areas are encountered that will not accommodate diamond ground rumble strips. Skip those sections.

2. Allow PCC to cure for a minimum of 14 days prior to placing diamond ground rumble strips.

B. Equipment.

1. Perform grinding using stacked diamond blades mounted on a self propelled machine that has been designed for grinding PCC or HMA surfaces. Ensure the equipment will not cause strain or damage to the underlying pavement.

2. Do not use grinding equipment that causes excessive ravels, aggregate fractures, spalls, or excessive disturbance of the transverse and/or longitudinal joints. The finished surface after grinding the rumble strips should have a corduroy like texture.

3. For standard rumble strips use grinding equipment with a minimum effective head width suitable for grinding the entire width of the rumble strip in one pass. For centerline rumble strips use a grinding head equipped to grind the rumble strip on each side of the centerline in one pass.

4. Select the blade type and number of blades per foot to provide proper surface texture based on the material being ground, in particular, the coarse aggregate type.

C. Test Strip.
Demonstrate to the Engineer on an initial 500 foot test section that the equipment and method will provide the desired diamond ground rumble strip and surface inside each depression without damaging the adjacent pavement. If the desired results are not being provided, as determined by the Engineer, provide different equipment or methods, or make necessary adjustments to provide the desired results. If the initial 500 foot section results are unsatisfactory, repair or replace the section as determined by the Engineer, at no additional cost to the Contracting Authority.

D. Grinding.

1. Grind shoulder rumble strips in a straight line, offset from the painted edge line as shown in the contract documents. Do not deviate from that offset more than ± 2 inches. Ensure the depth of the rumble strips is as shown in the contract documents. The Engineer will randomly check the alignment and depth.

2. Grind centerline rumble strips in a straight line, on the centerline joint as shown in the contract documents. Do not deviate from that location more than ± 1 inch. Ensure the depth of the rumble strips is as shown in the contract documents. The Engineer will randomly check the alignment and depth.

3. Continuously remove all slurry or residue resulting from the grinding operations. Do not deposit on the slab or shoulder. Leave pavement and paved shoulders in a clean condition. Ensure residue from grinding operations does not flow across lanes occupied by public traffic ~~or into gutters or other drainage facilities~~. This residue may be spread on the foreslope or removed according to Article 1104.08 of the Standard Specifications. When residue is deposited on the foreslope in areas where cable guardrail is present, spread the residue in a manner that prevents it from collecting in the sockets for the cable guardrail system. Take measures to prevent damage to vegetation during spreading of residue. If damage occurs, repair at no cost to the Contracting Authority. Do not allow discharge of slurry or residue into gutters, drainage facilities, or bodies of water.

E. Asphalt Emulsion Fog Seal.
Per Article 2548.03, C of the Standard Specifications.

F. Limitations.
Do not disturb desirable grass areas and desirable trees outside the construction limits. Do not park or service vehicles and equipment or use these areas for storage of materials. Obtain the Engineer's approval for storage, parking, and service areas.

23060.04 METHOD OF MEASUREMENT.
Measurement will be as follows:

A. Diamond Ground Shoulder Rumble Strips.
Stations shown in the contract documents for each type, measured along each edge of mainline pavement. Unless stated otherwise in the contract documents, no deduction will be made for gapped areas. The quantity will be adjusted for the length of degraded shoulders skipped, as defined in Article DS-23060.03 of this specification. The quantity will be adjusted for test sections

that were deemed unsatisfactory.

B. Diamond Ground Centerline Rumble Strips.
Stations shown in the contract documents for each type, measured along the centerline of mainline pavement. Unless stated otherwise in the contract documents, no deduction will be made for gapped areas. The quantity will be adjusted for the length of degraded pavement skipped, as defined in Article DS-23060.03 of this specification. The quantity will be adjusted for test sections that were deemed unsatisfactory.

C. Asphalt Emulsion for Fog Seal (Shoulder Rumble Strips).
Gallons computed from field measurements of distributors or from tank cars or transport trucks as provided in Article 4100.03 of the Standard Specifications. When quantities computed from field measurements check within 1.0% of the billed gallons, payment will be based on billed gallons. When quantities computed from field measurements differ from billed gallons by more than 1.0%, payment will be based on the quantity from field measurements. From these quantities, any amount used by the Contractor as fuel, left in cars, or otherwise not delivered to the road surface will be deducted. The Engineer will advise the Contractor promptly, in writing, of quantities deducted.

23060.05 BASIS OF PAYMENT.
Payment will be the contract unit price as follows:

A. Diamond Ground Shoulder Rumble Strips.
Per station for the type specified.

B. Diamond Ground Centerline Rumble Strips.
Per station for the type specified.

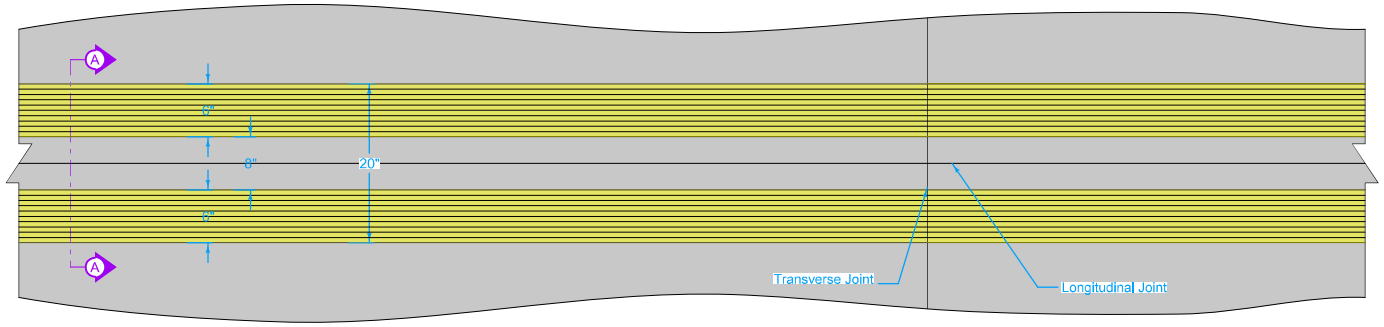
C. Asphalt Emulsion for Fog Seal (Shoulder Rumble Strips).

1. Per gallon for undiluted Asphalt Emulsion for Fog Seal (Shoulder Rumble Strips) that is mixed and used on the project. Diluted asphalt emulsion that is delivered to the project site, but not applied to the roadway surface will not be considered for payment.

2. Payment is full compensation for cleaning the shoulder surface, furnishing and applying diluted asphalt emulsion, mixing water, and protecting the adjacent pavement and edge lines.

Centerline rumble strip placement is the same regardless of centerline pavement marking.

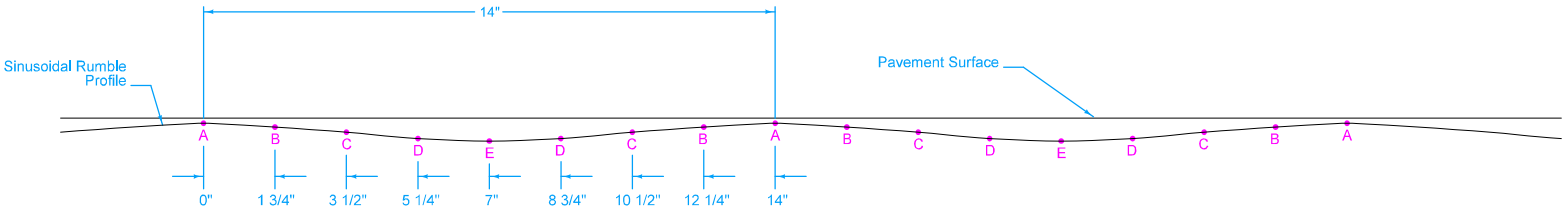
(1) Depth tolerance is ±1/16.



PLAN

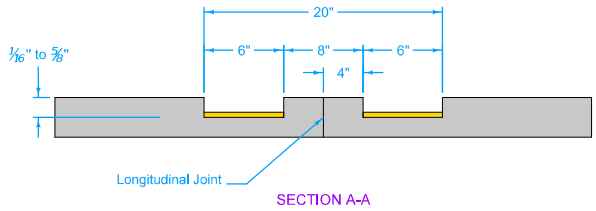
Rumble Strip

Possible Pavement Marking



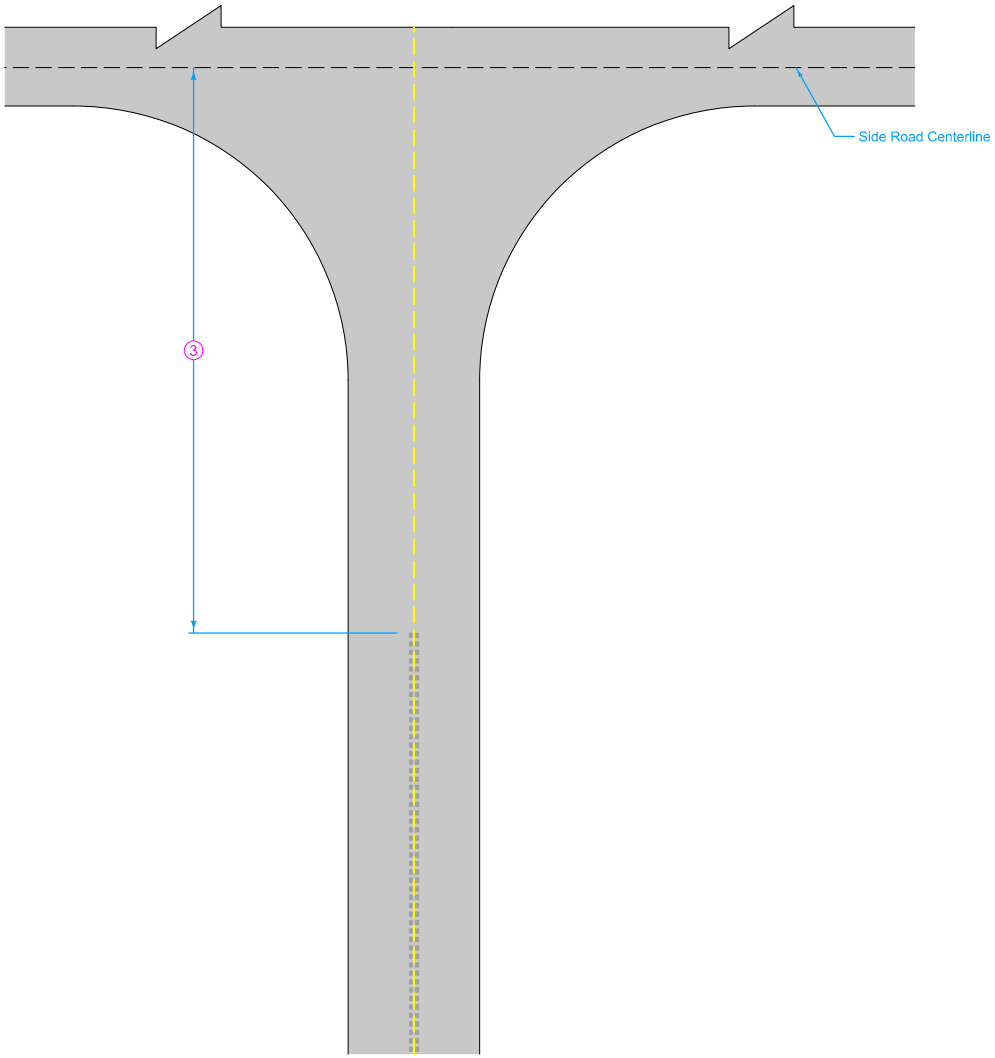
PROFILE

Location	Depth (1) (inches)
A	1/8
B	7/32
C	11/32
D	1/2
E	9/16

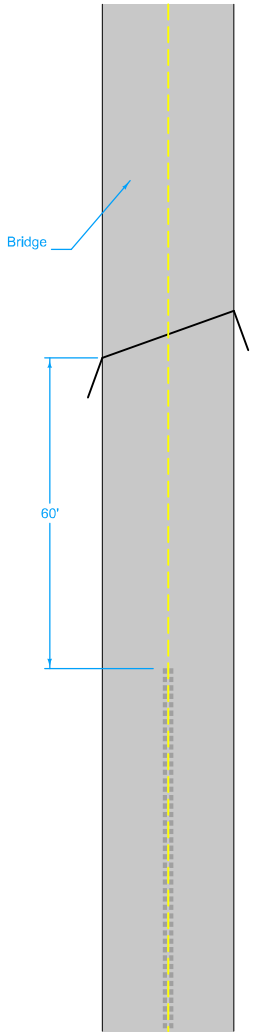


SECTION A-A

DIAMOND GROUND SINUSOIDAL CENTERLINE RUMBLE STRIPS



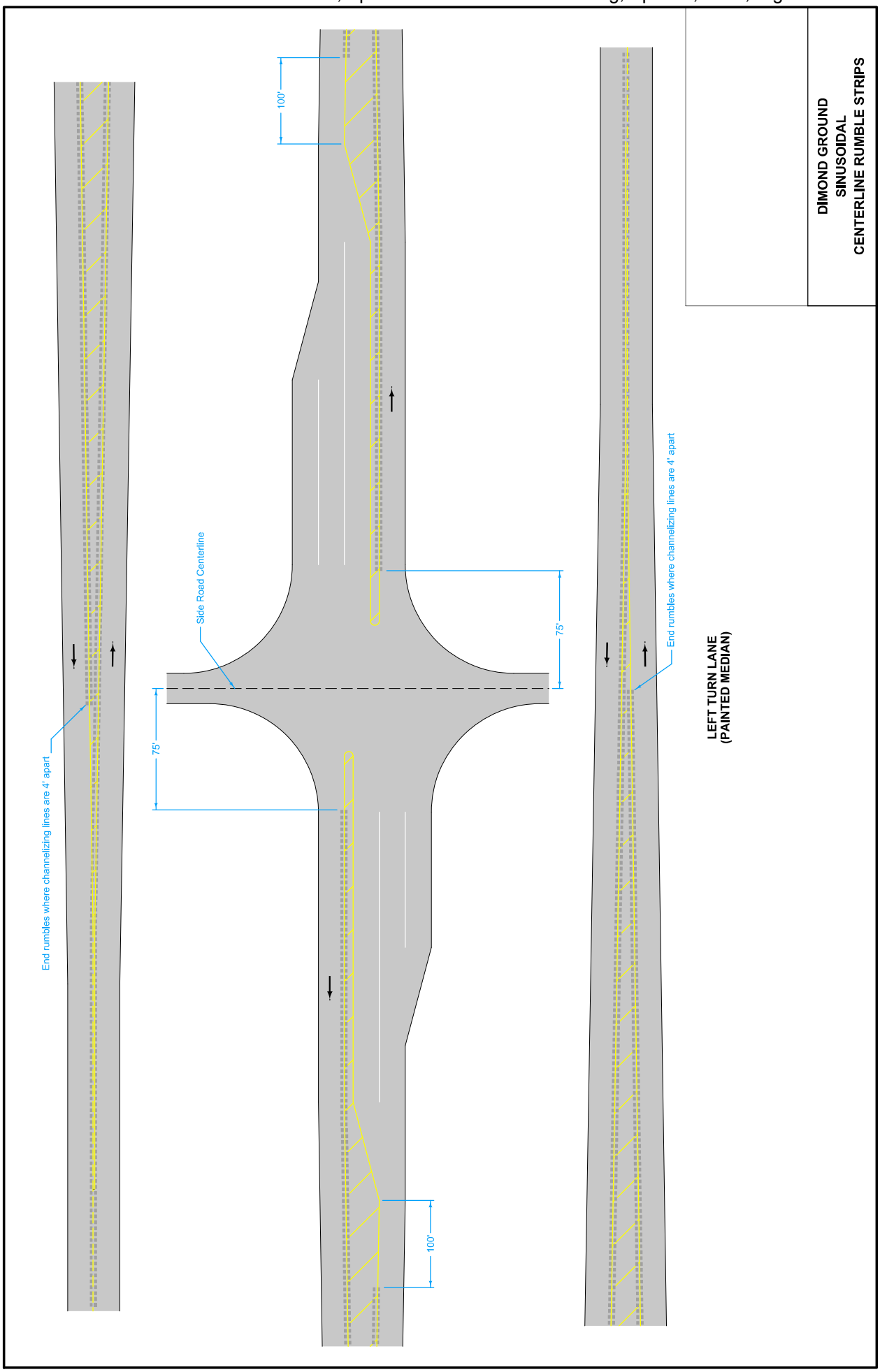
INTERSECTION WITH
SIDE ROAD



BRIDGE APPROACH

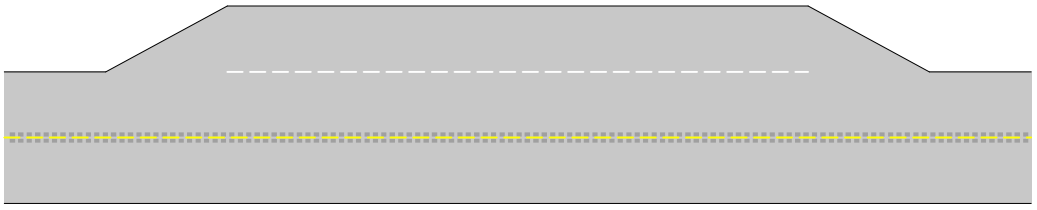
③ Stop rumbles 180 feet in advance of paved side roads or 75 feet for granular side roads.

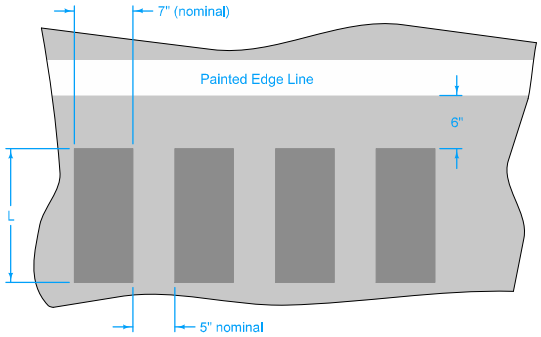
DIMOND GROUND
SINUSOIDAL
CENTERLINE RUMBLE STRIPS


DIMOND GROUND
SINUSOIDAL
CENTERLINE RUMBLE STRIPS
100'
Side Road Centerline
75'
75'
End rumbles where channelizing lines are 4' apart
End rumbles where channelizing lines are 4' apart
LEFT TURN LANE
(PAINTED MEDIAN)
100'

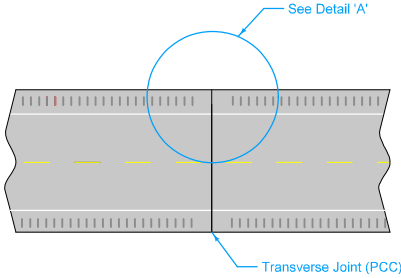
DIMOND GROUND
SINUSOIDAL
CENTERLINE RUMBLE STRIPS

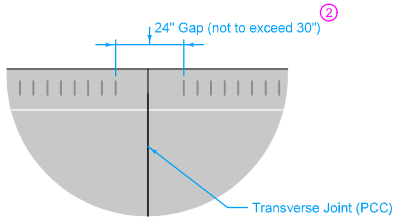
PASSING LANE SITUATIONS





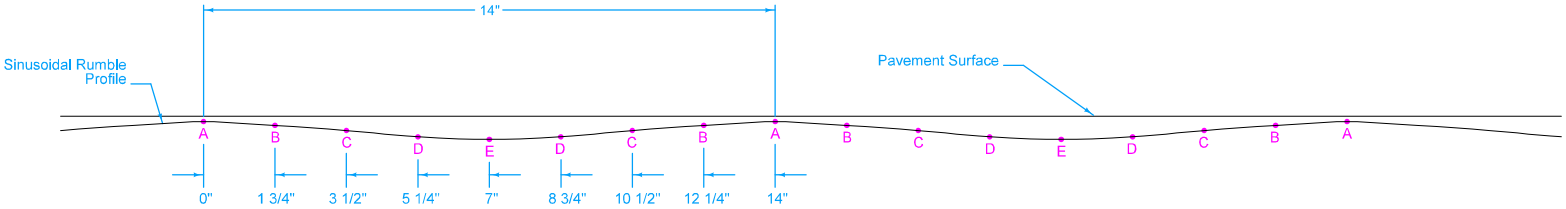
PLAN





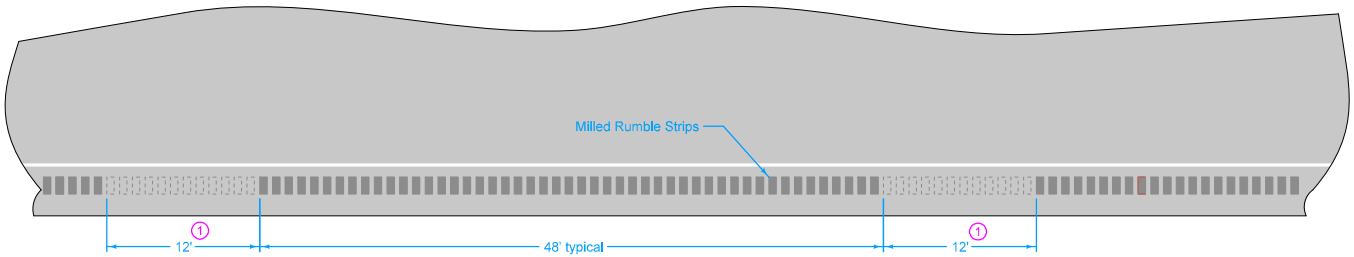
Detail 'A'

1. Place continuous Diamond Ground Rumble Strips (no 12 foot gaps) on all median side shoulders and on all interstate shoulders.
2. Gap rumble strips at transverse joints. Centering the gap about the joint is desireable. Maintain a minimum of 3 inches between rumble and transverse joint.
3. Depth tolerance is $\pm 1/16$.



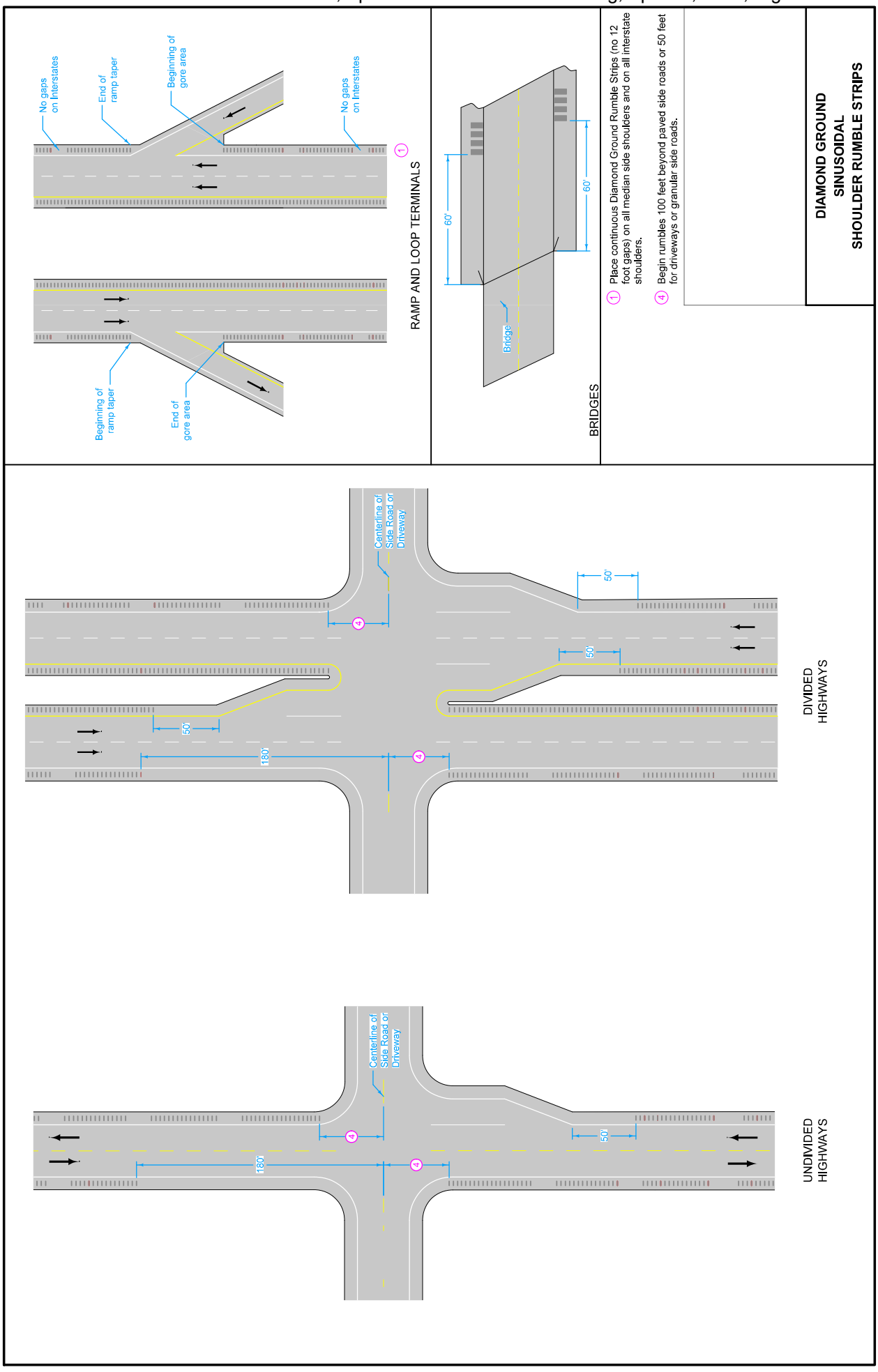
PROFILE

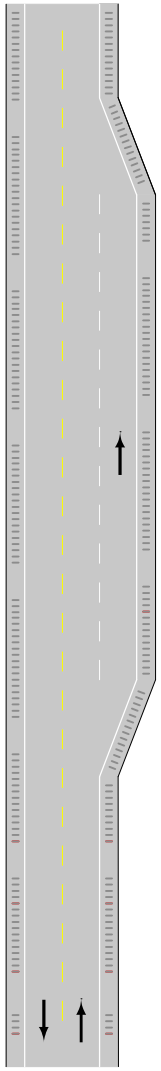
Location	Depth (3) (inches)
A	1/8
B	7/32
C	11/32
D	1/2
E	9/16



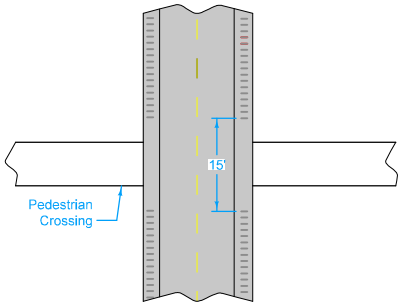
GAP DETAILS

DIAMOND GROUND SINUSOIDAL SHOULDER RUMBLE STRIPS

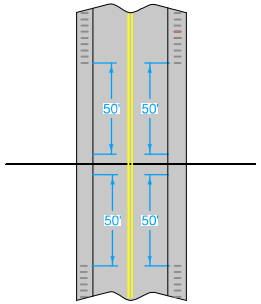

DIAMOND GROUND
SINUSOIDAL
SHOULDER RUMBLE STRIPS
1 Place continuous Diamond Ground Rumble Strips (no 12 foot gaps) on all median side shoulders and on all interstate shoulders.
4 Begin rumbles 100 feet beyond paved side roads or 50 feet for driveways or granular side roads.
BRIDGES
60'
60'
Bridge
RAMP AND LOOP TERMINALS
No gaps on Interstates
End of ramp taper
Beginning of gore area
No gaps on Interstates
1
Beginning of ramp taper
End of gore area
DIVIDED HIGHWAYS
Centerline of Side Road or Driveway
4
50'
50'
50'
180'
4
UNDIVIDED HIGHWAYS
Centerline of Side Road or Driveway
4
50'
180'
4



PASSING LANE



PEDESTRIAN
CROSSING



RAILROAD
CROSSING

DIAMOND GROUND
SINUSOIDAL
SHOULDER RUMBLE STRIPS

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Curtis Carter	**Bureau/Office:** Construction & Materials	**Item 16**
Submittal Date: May, 2024	**Proposed Effective Date:** October, 2024	
Article No.: **Title:**	**Other:** DS for Fiber Reinforcement for Structural Concrete	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 10/15/2024

Specification Committee Approved Text: See attached Developmental Specifications for Fiber Reinforcement for Structural Concrete.

Comments: Curtis Carter will be the controller for this DS.

Specification Section Recommended Text: See attached Draft Developmental Specifications for Fiber Reinforcement for Structural Concrete.

Comments:

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

See attached document for proposed new DS for Fiber Reinforcement for Structural Concrete.

Reason for Revision: Use of fiber reinforcement for structural concrete has increased over the past few years. Currently, the specifications for fiber reinforcement for structural concrete are added to projects by Special Provision. With use of fiber reinforcement becoming more mainstream, a new Developmental Specification is merited, in effort to help simplify and unify the process for specifying this material.

This new proposed Developmental Specification is based extensively on the most recently used Special Provisions for Fiber Reinforced Concrete. The primary changes compared to the recent Special Provisions include:

- Changes to accommodate a broader range of structural applications, instead of single, project-specific application.
- Changes to how the material is measured and paid. Fiber Reinforcement for Structural Concrete will be measured and paid as an additive to the concrete, separate from the concrete. New bid items for Fiber Reinforcement for Structural Concrete will be required for this purpose.

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:

DS- 23063
(New)

DEVELOPMENTAL SPECIFICATIONS
FOR
FIBER REINFORCEMENT FOR STRUCTURAL CONCRETE

Effective Date
October 15, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23063.01 DESCRIPTION.

A. Fiber reinforcement shall be incorporated in the locations and quantities of concrete designated in the contract documents. Work types for structures which may be designated for incorporation of fiber reinforcement could include bridge substructures, bridge decks, bridge deck overlays, structural repairs, or other applications.

B. Use approved products and proportions of synthetic micro and macro fiber and incorporate into the concrete mix in accordance with these developmental specifications. The purpose of the fiber reinforcement is to mitigate risk and effects of cracking and improve the durability of the concrete.

C. Apply Section 2403 of the Standard Specifications, subject to the modifications herein. When relevant to the work type, also apply Sections 2412 or 2413 of the Standard Specifications, subject to the modifications herein.

D. The contract documents may designate incorporation of fiber reinforcement into concrete mixes governed under other developmental specifications. Examples could include High Performance Concrete for Structures, or Structural Concrete (4500 psi or Greater). Meet the provisions of applied developmental specifications concurrently. The provisions for concrete slump specified in DS-23063.02, A, 3, shall prevail over provisions for concrete slump specified in other applied developmental specifications.

23063.02 MATERIALS.

A. General.

1. Fibers shall be incorporated as an admixture to the concrete mix. Adjustments to the base volumetric proportions of mix constituents are not required to compensate for the volumetric proportion of fiber admixture.

2. Select a concrete mix which satisfies all applicable requirements and achieves appropriate workability upon incorporation of fibers at the required dosage rate.

3. Material properties of the fiber reinforced concrete (FRC) shall comply with the material properties for concrete specified elsewhere in the contract documents, except the following relaxations are permissible for FRC slump:
   a. **Bridge Decks.**
      When mid-range water reducer is used with Class C or Class HPC-D mix, target slump may be increased to 5 inches, allowing a maximum of 6 inches as a tolerance. Commence testing for slump within 0 to 4 minutes after the FRC is discharged.
   b. **Bridge Deck Overlays.**
      When mid-range water reducer is used with Class HPC-O mix, target slump may be increased to 5 inches, allowing a maximum of 6 inches as a tolerance. Commence testing for slump within 0 to 4 minutes after the FRC is discharged.

B. Fiber.

1. **General.**
   Fiber reinforcement shall consist of micro and macro fibers. Micro and macro fibers may be supplied as separate products to be proportioned and blended with the mix at the time of concrete production, or may be supplied as a pre-combined, pre-packaged blended fiber product.

2. **Micro Fiber.**
   For micro fiber supplied as a separate product:
   a. Use product approved in accordance with Materials I.M. 491.27 Appendix A.
   b. Dose micro fiber at a minimum rate of 1 pound per cubic yard of concrete.

3. **Macro Fiber.**
   For macro fiber supplied as a separate product:
   a. Use product approved in accordance with Materials I.M. 491.27 Appendix B.
   b. Dose macro fiber at a minimum rate of 4 pounds per cubic yard of concrete.

4. **Pre-Combined Micro / Macro Fiber Blend.**
   For micro fiber and macro fiber supplied as a pre-combined, pre-packaged product:
   a. Use product approved in accordance with Materials I.M. 491.27 Appendix C.
   b. When pre-combined micro / macro fiber blends are used, the entire dosage of fiber shall be made using a single blended product. Do not mix blended fiber products with other blended or non-blended fiber products.
   c. Dose pre-combined micro / macro fiber blend at a minimum rate of 5 pounds per cubic yard of concrete.

C. Documentation and Acceptance of Fiber Reinforced Concrete.

1. FRC shall comply with ASTM C1116, Type III. Furnish documentary evidence by the fiber manufacturer demonstrating satisfactory performance history and compliance with ASTM C1116, Type III for fiber product(s) used.

2. When separately packaged micro and macro fiber products are used, furnish a statement by the fiber manufacturer verifying product compatibility and fitness for intended purpose at the specified dosage rates.

3. A trial batch and test placement will be required in accordance with DS-23063.03, A. Acceptance of the FRC mix shall be contingent on successful completion of the trial batch and test placement. At a minimum, the trial batch and test placement must demonstrate all the following:
   - Compliance with the contract documents and specified material properties.
   - Acceptable workability.
   - Batching and finishing processes representative of the proposed means and methods of

construction for production work.
- No detrimental effects associated with mix inconsistency, mix segregation, bleeding, or balling of fibers.

23063.03 CONSTRUCTION.

A. Trial Batch and Test Placement.

1. General.
- **a.** Provide the Engineer notice, mix proportions, and scheduled date at least 7 calendar days prior to trial batch and test placement. Do not proceed with trial batch and test placement without authorization of the Engineer.
- **b.** Conduct trial batch and test placement at least 7 calendar days prior to planned placement of production FRC.
- **c.** Do not place production FRC until the trial batch and test placement have been accepted by the Engineer. Trial batches or test placements which fail to meet acceptance criteria must be repeated at no additional cost to the Contracting Authority, following appropriate material and/or procedure modifications by the Contractor.
- **d.** After acceptance of the trial batch and test placement, any contractor-initiated changes to the mix design, fiber product or dosage, mix batching process, and/or methods of installation shall constitute basis for requiring a new trial batch and test placement at no additional cost to the Contracting Authority.
- **e.** The Engineer may waive the trial batch and test placement on the basis of past successful placement of the same combination of mix design, fiber product and dosage, mix batching process (including key personnel), and installation process (including key personnel).

2. Trial Batch.
- **a.** Identify dedicated batching personnel for FRC.
- **b.** Establish and demonstrate the sequence of constituent material introduction during the trial batch. Ensure the fiber manufacturer's technical representative is available for advice and guidance regarding fiber inclusion into the mix, as needed.
- **c.** Batch the trial batch concrete for slump within 1 inch of the maximum slump permitted, air content of 6% +/- 1%, and w/c ratio typical of the production FRC to be placed. Include any other admixtures proposed for use in the production FRC, including but not limited to water reducers, viscosity modifiers and set retarders as applicable, at their respective intended production dosage rates.
- **d.** Sample and test the trial batch placement for the following:
  - Materials I.M. 340 – Unit Weight of Plastic Concrete.
  - Materials I.M. 318 – Air Content of Plastic Concrete.
  - Materials I.M. 317 – Slump of Plastic Concrete
  - Visual Stability of Plastic Concrete – Following slump test performed in accordance with Materials I.M. 317, leave slumped concrete undisturbed on the test board for 3 minutes and observe for mortar ring or bleed water at the base of the concrete. Report presence, description, and size of any mortar ring and/or bleed water halo.
- **e.** Trial batch volume shall be in accordance with the following:
  - **Bridge Decks and Deck Overlays:** 6 cubic yards, minimum.
  - **Non-Deck Applications;** 3 cubic yards, minimum.

3. Test Placement.
- **a. General.**
  - **1)** Utilize the trial batch concrete to conduct a test placement. Subject to the requirements herein, the test placement may not require use of the full volume of trial batch concrete.
  - **2)** Test placement shall be made within side/edge forms, on sufficiently rigid subbase, to

allow representative demonstration of the placement and finishing methods proposed for production work. Use a durable, impermeable separation barrier between the subbase and test placement.

3) Place, consolidate and finish the concrete within the test placement using methods that are representative of the methods to be used with the production concrete. For production methods deemed impractical to duplicate during the test pour (e.g. pump placement, self-propelled machine finishing), substitute methods may be used subject to the Engineer's approval, provided the substitute methods allow full evaluation of any/all mix properties that may affect the actual production methods. Evaluate workability, finishability, and general suitability of the mix for production use.

4) Following completion of the test placement, deposit any remaining trial batch concrete to an open container or other accessible location to allow further inspection for potential mix inconsistency, mix segregation, bleeding, balling of fibers, or other detrimental properties. Do not obscure or dispose of the trial batch or test placement concrete until a minimum time of 2 hours has elapsed after completion of the test placement, or until authorized by the Engineer, whichever comes first.

b. Test Placement for Bridge Decks and Deck Overlays.

1) Simulate the general placement conditions for production concrete. Conduct the test placement in open air, during weather generally consistent with the anticipated conditions during production placement.

2) Following trial batching, suspend the test placement for a period of time approximately equal to the anticipated delivery time for production concrete. During this suspension, maintain the concrete in a state of agitation generally representative of the anticipated delivery conditions for production concrete.

3) The area of the test placement shall be a minimum of 200 square feet. The least horizontal dimension of the test placement shall be a minimum of 12 feet. Nominal thickness of the test placement shall match as close as practical the nominal thickness of the production concrete, except nominal thickness of the test placement need not exceed 9 inches.

4) Test placements for bridge decks shall include reinforcing steel, oriented in two mats of two layers each (longitudinal and transverse). Reinforcing steel shall have similar size, spacing, top clearance to top mat and bottom clearance to bottom mat, as shown in the contract documents for the production work. No reinforcing steel is required for test placements for bridge deck overlays.

c. Test Placement for Non-Deck Applications.

Deposit the trial batch concrete into formwork with minimum dimensions of at least 3 feet length by 3 feet width by 3 feet depth. Alternate formwork dimensions may be permitted, subject to approval by the Engineer.

B. Production FRC.

1. Batching.

a. Production batching methods, equipment, sequence and personnel shall match those used for the approved trial batch.

b. Introduce fibers into the mix in accordance with the fiber manufacturer's recommendations, unless otherwise approved by the Engineer.

c. Mix FRC in accordance with the Standard Specifications applicable for concrete, unless otherwise approved by the Engineer.

d. Ensure uniform distribution and random orientation of fibers throughout the concrete.

2. Placing, Consolidating, Finishing and Curing.

Comply with provisions for concrete specified in Sections 2403, 2412, and 2413 of the Standard Specifications, as well as other applied developmental specifications, as applicable to the contract and the work type.

23063.04 METHOD OF MEASUREMENT.

A. Fiber Reinforcement for Structural Concrete.

1. Fiber reinforcement for structural concrete shall be measured and paid separate from the concrete the fiber reinforcement is incorporated in. Measurement and payment for the concrete shall be as specified elsewhere in the contract documents.

2. The unit of measurement for Fiber Reinforcement for Structural Concrete shall match the unit of measurement applicable to the concrete the fiber reinforcement is incorporated in (ex. per square yard or per cubic yard).

3. The quantity of Fiber Reinforcement for Structural Concrete will be the quantity shown in the contract documents. The quantity of Fiber Reinforcement for Structural Concrete shall match the quantity of the concrete the fiber reinforcement is incorporated in.

B. Trial Batch and Test Placement.
Trial Batch and Test Placement is a combined item. The measured quantity of Trial Batch and Test Placement includes the combination of one trial batch and one test placement. Measurement will not be made for trial batch without a test placement.

23063.05 BASIS OF PAYMENT.

A. Fiber Reinforcement for Structural Concrete.
Payment with be at the contract unit price for Fiber Reinforcement for Structural Concrete. Payment includes all cost of furnishing and incorporating fiber reinforcement, at the specified dosage rate, per applicable unit of concrete.

B. Trial Batch and Test Placement.
Payment will be at the contract unit price each for the combined bid item Trial Batch and Test Placement. Payment includes full compensation for Trial Batch and Test Placement, inclusive of all materials and labor for furnishing, forming, placing, finishing, and evaluating. The paid quantity of Trial Batch and Test Placement shall be limited to one successful trial batch and test placement. Unsuccessful and/or unrepresentative trial batch(es) and test placement(s) will not be paid.

Form 510130 (02-24)

IOWA | DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove / Ben Hucker	**Office:** Construction & Materials	**Item 17**
Submittal Date: 4/19/2024	**Proposed Effective Date:** 6/18/2024	
Article No.: **Title:**	**Other:** DS-XXXXX, Preformed Thermoplastic Pavement Markings	

Specification Committee Action: Approved with a correction.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2024	**Effective Date:** 8/20/2024

Specification Committee Approved Text: See attached Developmental Specifications for Preformed Thermoplastic Pavement Markings

Comments: Ben Hucker will be the controller of this DS.
The width of measurement for pavement markings was corrected in Article DS-23061.04, A from 4 inches to 6 inches.

Specification Section Recommended Text: See attached Developmental Specifications for Preformed Thermoplastic Pavement Markings

Comments:

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

Reason for Revision: Move from Special Provision into Developmental Specifications with some updates to language in Specifications.

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- 23061
(New)

DEVELOPMENTAL SPECIFICATIONS
FOR
PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

Effective Date
August 20, 2024

THE STANDARD SPECIFICATIONS, SERIES OF 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23061.01 DESCRIPTION.
Under this work, the Contractor shall furnish and apply preformed thermoplastic pavement markings at the location and in accordance with patterns indicated on the plans or as ordered by the Engineer, and in conformance with the MUTCD and these specifications. This work may also include, when shown on the plans, grooves cut for lines and symbols and legends.

23061.02 MATERIALS.

A. Preformed Thermoplastic.

1. Preformed Thermoplastic shall meet the requirements of Materials I.M. 483.05. Approved manufacturers and brand names are listed in MAPLE.

2. Preformed thermoplastic shall be capable of application on bituminous and concrete pavements.

3. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids, antifreeze, exposure to sunlight, water, salt or adverse weather conditions.

4. Lines, legends and symbols must be capable of being affixed to bituminous and/or Portland cement concrete pavements by heating.

5. Follow manufacturers recommendations for storage, handling and application temperatures and conditions.

6. Store markings in accordance with the manufacturer's instructions and manufacturer's requirements for shelf life and storage conditions. Ensure markings are clearly labeled and in a dry and clean condition prior to use. Shipping documents and containers shall have identification numbers or batch dates for confirmation of when products were manufactured, brand name, name of manufacturer, lot or batch number, temperature range for storage, expiration date, the quantity contained and include material safety data sheets. Place markings within the manufacturers published shelf life for the material. Do not place markings outside of expiration dates for the markings without written consent from the manufacturer provided to the engineer PRIOR to placement.

7. Use Markings conforming to the Chromaticity limits and within the coordinates for the respective colors for daytime and nighttime as indicated in ASTM D6628 Tables 1 and 2. Lightness Limits shall conform to ASTM D6628 Table 3 for each respective color of marking.

8. **Pigments.**
   - **a.** White: The material shall be manufactured with sufficient titanium dioxide pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.
   - **b.** Red, Blue, and Yellow: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected. The yellow pigments must be organic and must be heavy-metal free.
   - **c.** Other Colors: The pigments must be heavy-metal free.

9. Skid Resistance: The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E 303. If enhanced skid resistance is specified on plans provide a minimum resistance value of 60 BPN.

10. Thickness: The material must be supplied at a minimum thickness of 125 mils.

B. Primer.
Primer shall be applied as recommended by the manufacturer.

C. Glass Beads.

1. Glass beads, if applied to the surface of pre-formed thermoplastic markings, shall comply, at a minimum, with the requirements of AASHTO M247 Type 1 and / or Type 3 and / or Section 4184 of the Standard Specifications.

2. The material must contain a minimum of 30% intermixed graded glass beads by weight. The intermixed beads shall be conforming to AASHTO designation M247, with minimum 80% true spheres and minimum refractive index of 1.50.

3. The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of 1 pound (± 10%) per 10 square feet. These factory applied coated surface beads shall have a minimum of 80% true spheres, minimum refractive index of 1.50.

D. Acceptance.
Acceptance of material shall be based on final inspection per Article 23061.03, F and satisfactory field performance. Pavement markings shall be approved prior to installation on a project. Approval does not preclude the need for acceptance sampling and testing on a project-by-project basis.

23061.03 CONSTRUCTION.

A. Contractor Qualifications.
Provide a letter of certification from the preformed thermoplastic pavement marking manufacturer indicating the Contractor’s qualifications to install their product.

B. Equipment.
All equipment shall be of such design and maintained in such condition as to properly heat, mix, and apply the material.

C. Surface Preparation.

1. Grooving for pavement markings and legends / symbols and shall be 130 mils -0/+10 mils.

2. The pavement surface on which the thermoplastic material is to be placed shall be clean and dry. Even if the pavement is visibly dry, subsurface moisture may be present in amounts sufficient to affect bonding. To test for dryness, a 3 to 6 foot section of tar paper shall be laid on the pavement and molten thermoplastic applied on top. After 30 seconds, lift the paper and check for moisture on the bottom of the paper. If the paper is dripping wet, wait until the pavement has dried before applying the thermoplastic. If the paper shows only a damp spot, proceed with the thermoplastic application.

3. Pavement surfaces shall be inspected for cleanliness and any dirt, debris, or other contaminants on the surface to be marked shall be removed.

D. Application.

1. **Asphalt.**
The material shall be applied as recommended by the manufacturer. The material must be able to be applied without preheating of the pavement. A primer may be required pursuant to manufacturers installation requirements.

2. **Portland Cement Concrete.**
The same application procedure shall be used as described in Article 23061.03, D, 1. However, a primer shall be applied and cured in accordance with the recommendations of the manufacturer of the thermoplastic material.

3. **Glass Beads.**
Glass beads shall be applied as recommended by the manufacturers of the thermoplastic material.

E. General Requirements.
The applied thermoplastic markings will be inspected continually for overall workmanship. Markings shall have clean cut edges and the color shall be distinctive. The glass beads shall appear uniform on the entire marking surface.

F. Final Inspection.

1. Provide an acceptable 30 meter geometry retro-reflectometer to use on the project which will remain the property of the Contractor. In the presence of the Engineer, measure the retro-reflectivity of selected preformed thermoplastic markings. Take a minimum of five randomly spaced readings per color line every 1 mile, or per legend or symbol randomly selected per tenth symbol. Provide the engineer a document indicating results of retro-reflective testing for the project files. The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of sufficient nighttime retroreflection when tested in accordance to ASTM E 1710. The minimum retro-reflectivity shall be:

Minimum Coefficient of Retroreflected Luminance (mcd / sq. ft. / ft.-cdl.)	
White lines / Symbols / Legends	300
Yellow lines / Symbols / Legends	200

2. If the marking does not meet these initial retro-reflectivity readings, if the marking does not have the required minimum thickness, or if the marking does not comply with the specifications for any other reason, the Engineer may require complete removal or correction at the Contractor's expense.

23061.04 METHOD OF MEASUREMENT.
Measurement for pavement markings or symbols and legends, satisfactorily placed, will be as follows:

A. Preformed Thermoplastic Pavement Markings.
The number of stations of markings placed will be calculated by the Engineer, using the beginning and ending points for each type of line placed, based on a single 4 inch width as outlined in plans. The types are as shown in the plans. The calculations for broken or dotted lines are adjusted in the table to exclude skips as specified. The calculation for solid lines will be adjusted to exclude breaks. The quantities for several types of lines will be totaled to a single quantity of thermoplastic longitudinal 6 inch lines in stations.

B. Preformed Thermoplastic Symbols and Legends.
Each precut symbol or legend is indicated on the plans, and the units will be counted. Each of the following is a complete unit: each STOP; each SCHOOL legend (one lane or two lane); each RxR marking for railroad and highway grade crossing; each ONLY; each AHEAD; each freeway, expressway, and ramp arrow; each straight, curve, or combined arrow; each route shield.

C. Grooves Cut for Pavement Markings or Symbols and Legends.
Per Articles 2527.04, A, 11 and 12 of the Standard Specifications.

23061.05 BASIS OF PAYMENT.

A. Payment for pavement markings or symbols and legends, satisfactorily placed, will be at the contract unit price as follows:

1. **Preformed Thermoplastic Pavement Markings.**
For the number of stations of thermoplastic longitudinal lines and transverse markings placed, the Contractor will be paid the contract price per station.

2. **Preformed Thermoplastic Symbols and Legends.**
For each unit of precut symbol and legend placed, the Contractor will be paid the contract price.

3. **Grooves Cut for Pavement Markings or Symbols and Legends.**
Per Articles 2527.05, A, 11 and 12 of the Standard Specifications.

B. This compensation will be full payment for all work involved in cleaning and preparing the surface and furnishing, applying, and maintaining the pavement marking, and for furnishing all equipment, tools, and labor necessary to complete the work. Removal of existing markings is included as a bid item in the plans and paid for at the contract unit price. The accepted quantity of thermoplastic pavement marking will be paid for at the contract unit price.