IOWA DEPARTMENT OF TRANSPORTATION

To Office:	Specification Committee	**Date:**	August 4, 2025
Attention:		**Ref. No.:**	305
From:	Eric Johnsen, P.E.		
Office:	Specifications		
Subject:	Agenda for August 14, 2025, Specification Committee Meeting		

The Specification Committee will meet on Thursday, August 14, 2025, at 9:00 a.m.

The agenda is as follows:

1. Article 1113.02, B, 2, Contractor Responsibilities (Electronic Document Storage).

District 1 Materials requests to clarify that the Contractor is responsible for reviewing certifications for compliance prior to submission.

2. Article 2303.03, C, 5, b, 2, e, Test Strip Construction for Class I Compaction (Flexible Pavement).

The Construction and Materials Bureau requests to specify that the Contractor is only allowed one test strip per bid item unless the Engineer requires additional test strips.

3. Article 2303.03, D, 4, f, 8, Compacted Pavement Cores (Flexible Pavement).

The Construction and Materials Bureau requests a change to require placement 10 working days after the start of scarification, not after the entire project is scarified.

4. Article 2317.01, D, General (Pavement Smoothness).

The Construction and Materials Bureau requests to clarify the length of a segment.

5. Article 2317.03, A, 4, Testing (Pavement Smoothness).

The Construction and Materials Bureau requests to clarify when the pavement should be tested.

6. Article 4183.06, Pavement Marking Tape.

The Construction and Materials Bureau requests to update tape markings needed based on updates to ASTM standards, measurement units and alignment with accessibility requirements.

7. DS-23061, Preformed Thermoplastic Pavement Markings.

The Construction and Materials Bureau requests updates to the Developmental Specifications for Preformed Thermoplastic Pavement Markings.

Form 510130 (07-24)

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Shane Neuhaus for Mike Lauritsen	**Bureau/Office:** D1 Materials	Item 1
Submittal Date: 7/8/2025	**Proposed Effective Date:** April 21, 2026	
Article No.: 1113.02, B, 2 **Title:** Contractor Responsibilities (Electronic Document Storage)	**Other**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:
1113.02, B, 2.

Add to the end of the Article:

When submitting documents to Doc Express, the Contractor certifies that they have thoroughly reviewed the documents and that they accurately represent the items included in the project. The Contractor further certifies that both the items and the accompanying certifications comply with all requirements of the contract document including, but not limited to, compliance with Buy America and Build America Buy America (BABA) requirements as outlined in Article 1107.06 and Materials I.M. 107.

Comments:

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

2. Submit electronic documentation per type defined in Doc Express. Each electronic submittal may contain multiple pages of documentation but shall provide information required for the specified type only. When submitting documents to Doc Express, the Contractor certifies that they have thoroughly reviewed the documents and that they accurately represent the items included in the project. The Contractor further certifies that both the items and the accompanying certifications comply with all Contract, Specification, and Instructional Memorandum (IM) requirements. This certification includes, but is not limited to, compliance with Buy America and Build America Buy America (BABA) requirements as outlined in Section 1107.06 and IM 107.

Reason for Revision: Often the Contractor does not review the submission and places in DocExpress for agency staff to do the review for them. The change will emphasize that the Contractor is responsible for cert compliance as well as product compliance.

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:

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Brian Johnson	**Bureau/Office:** Construction and Materials	Item 2
Submittal Date: 7/2/2025	**Proposed Effective Date:** April 21, 2026	
Article No.: 2303.03, C, 5, b, 2, e **Title:** Test Strip Construction for Class I Compaction (Flexible Pavement)	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**
Specification Committee Approved Text:			
Comments:			

Specification Section Recommended Text:
2303.03, C, 5, b, 2, e.

Replace the first sentence:

Only one test strip will be allowed for each mixture bid item and shall be declared to the Engineer prior to placement.

Comments:

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

2303.03 C.5.b.2.e

e) Only one test strip will be allowed for each mixture bid item and shall be declared to the Engineer prior to placement. The Engineer may require additional test strips if a complying HMA mixture or rolling pattern was not established.

Reason for Revision: We want to specify that each mixture "bid item" is allowed only one test strip unless the Engineer requires additional. We have had contractors place a test strip, make changes to the mix design, and then claim it is a different mixture. Then they ask for an additional test strip.

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:		

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Brian Johnson	**Bureau/Office:** Construction and Materials	Item 3
Submittal Date: 7/7/2025	**Proposed Effective Date:** April 21, 2026	
Article No.: 2303.03, D, 4, F, 8 **Title:** Compacted Pavement Cores (Flexible Pavement)	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2303.03, D, 4, F, 8.

Replace the second sentence:

The Engineer will test, record, and document each lot of cores according to Materials I.M. 321 at the Contractor's field quality control laboratory.

Comments:

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

2303.03 D.4.f.8

8) The compacted HMA pavement will be tested in a timely manner by the Engineer's personnel. The Engineer will test, record and document according to Materials I.M. 321 each lot of cores at the Contractor's field quality control laboratory. Cores may also be tested by the Contractor; however, the Contractor's test results will not be used for material acceptance.

Reason for Revision: We need to have agency inspectors document and record cores weights. This will alleviate any disputes if contractor's weights submitted on plant report do not match the agencies recorded weights. We are supposed to be doing this currently but have had some cases where they were not recorded.

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 (07-24)

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Musgrove/De Vries	**Bureau/Office:** Construction and Materials Bureau	Item 4
Submittal Date: 07/31/25	**Proposed Effective Date:** April 21, 2026	
Article No.: 2317.01, D **Title:** General (Pavement Smoothness)	**Other**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2317.01. D.

Replace the first sentence:

A pavement segment is defined as a continuous area of finished pavement ~~0.1 mile~~ 528 feet in length and one lane (10 to 12 foot nominal) in width.

Comments:

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

2317.01 GENERAL.

Evaluate pavement smoothness for all Interstate and Primary main line pavement surfaces, and all other road surfaces included on Primary projects, except when specifically excluded or modified by the contract documents. For non-Primary projects, do not evaluate pavement smoothness unless specified in the contract documents. If this specification is required by contract documents on non-Primary projects let by the Department, it will be added in its entirety. Selected portions of the specification will not be deleted.

A. Main line pavement is defined as all permanent pavement for through lanes.

B. The index used for determining the pavement smoothness is the Mean Roughness Index (MRI) per segment as determined by the latest version of the FHWA's software, ProVAL.

C. The other measure of pavement smoothness is the Area of Localized Roughness (ALR) based on a continuous MRI computed over a 25-foot distance as determined by the latest version of ProVAL.

D. A pavement segment is defined as a continuous area of finished pavement 528 feet ~~0.1 mile~~ in length and one lane (10 to 12 foot nominal) in width. A partial segment may result from an interruption of the continuous pavement surface (in other words, bridge approaches, side road tie-ins, the completion of the daily paving operations, and so forth). Pay adjustments will be prorated for partial segments. If a segment is less than 100 feet in length and requires corrective work, the Engineer will waive the corrective work requirement for the segment and instead assess a prorated disincentive. The Contracting Authority will still subject the segment to ALR correction in accordance with Table 2317.05-1 and Table 2317.05-2.

Reason for Revision: MRI is measured in 528 feet segments not 0.1 mile segments

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 (07-24)

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Musgrove/De Vries	**Bureau/Office:** Construction and Materials Bureau	Item 5
Submittal Date: 04/04/25	**Proposed Effective Date:** April 21, 2026	
Article No.: 2317.03, A, 4 **Title:** Testing (Pavement Smoothness)	**Other**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:
2317.03, A. 4.

Replace the Article:

Test the pavement within 5 working days of ~~completion of~~ the day's paving.

Comments: Construction and Materials Bureau asked the following:

Are we sure we want to use working days as the timeframe? Not all contracts charge working days (i.e. – completion dates), and do we really want working days to dictate when pavements are tested for smoothness. For instance, if grading were the controlling operation on a grade and pave contract, and weather delays work on the controlling operation for an extended period, technically we would not be charging working days if work cannot be performed on the controlling operation. 5 working days could turn into 20 calendar days. I don't think that is our intent. I'd suggest that we use 7 calendar days for the required timeframe for testing.

Member's Requested Change: (Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)
2317.03 TESTING AND EVALUATION.

A. Testing.

4. Test the pavement within 5 working days of ~~completion of~~ the day's paving.

Reason for Revision: To eliminate the confusion about when the when the pavement should be tested.

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 (07-24)

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Ben Hucker	**Bureau/Office:** Construction and Materials / Maintenance	Item 6
Submittal Date: July 2025	**Proposed Effective Date:** April 21, 2026	
Article No.: 4183.06, **Title:** Pavement Marking Tape	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

4183.06, A, 3, Retroreflectance.

Replace the Article:

a. Ensure ~~white and yellow~~ markings have initial ~~expected~~ minimum retroreflectance values of ~~as shown in Table 4183.06-1~~ 150 mcd/sq m/lux for white markings and 100 mcd/sq m/lux for yellow markings under dry, wet, and rainy conditions.

b. Measure and report dry retroreflectance values according to ASTM E 1710.

~~**b**~~ **c.** Measure and report wet retroreflectance values under a "condition of wetness" according to ASTM E 2177.

~~**c**~~ **d.** Measure and report wet retroreflectance values under a "condition of continuous wetting" (simulated rain) according to ASTM E 2832.

~~**Table 4183.06-1: Expected Initial R_L under dry, wet, and rainy conditions**~~

~~**WHITE**~~	~~**Dry, Wet, & Rainy**~~
~~Entrance Angle~~	~~88.76 degrees~~
~~Observation Angle~~	~~1.05 degrees~~
~~Retroreflected Luminance R_L [(mcd • ft^{-2}) • fc^{-1}]~~	~~150~~
~~**YELLOW**~~	~~**Dry, Wet, & Rainy**~~
~~Entrance Angle~~	~~88.76 degrees~~
~~Observation Angle~~	~~1.05 degrees~~
~~Retroreflected Luminance RL [(mcd • ft-2) • fc-1]~~	~~100~~

4183.06, B, 2, Retroreflectance.

Replace the Article:

~~For white or yellow~~ Ensure tapes~~, meet the following~~ have initial minimum retroreflectance values ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer:~~ of 550 mcd/sq m/lux for white markings and 325 mcd/sq m/lux for yellow markings according to ASTM E 1710.

	~~**White**~~	~~**Yellow**~~
~~Specific luminance, mcd/sq.ft./ft.-cdl.~~	~~550~~	~~325~~

4183.06, C, 3, Retroreflectance.

Replace the Article:

~~For white or yellow~~ Ensure tapes~~, meet the following~~ have initial minimum retroreflectance values ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer:~~ of 325 mcd/sq m/lux for white markings and 150 mcd/sq m/lux for yellow markings according to ASTM E 1710.

	~~White~~	~~Yellow~~
~~Specific luminance, mcd/sq.ft./ft.-cdl.~~	~~325~~	~~150~~

4183.06, E, 3, Retroreflectance.

Replace the Article:

~~For white or yellow films, meet the following~~ Ensure tapes have initial minimum retroreflectance values ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer:~~ of 700 mcd/sq m/lux for white markings and 350 mcd/sq m/lux for yellow markings according to ASTM E 1710.

	~~White~~	~~Yellow~~
~~Specific luminance, mcd/sq.ft./ft.-cdl.~~	~~700~~	~~350~~

4183.06, F, 3, Retroreflectance.

Replace the Article:

~~For white or yellow~~ Ensure tapes~~, meet the following~~ have initial minimum retroreflectance values ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer:~~ of 150 mcd/sq m/lux for white markings and 100 mcd/sq m/lux for yellow markings according to ASTM E 1710.

	~~White~~	~~Yellow~~
~~Specific luminance, mcd/sq.ft./ft.-cdl.~~	~~150~~	~~100~~

Comments:

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

4183.06 PAVEMENT MARKING TAPE.

A. Wet, Retroflective Removable Tape Markings.
Comply with Materials I.M. 483.06 and meet the following requirements:

1. Ensure film is free of lead, chrome, and other heavy metals as defined by the EPA.

2. Precoat markings with pressure sensitive adhesive capable of adhering to the pavement at temperatures as low as 50°F in accordance with the manufacturer's recommendations.

3. Retroreflectance.

a. Ensure white and yellow markings have initial minimum ~~expected~~ retroreflectance values as follows ~~shown in Table 4183.06-1~~ under dry, wet, and rainy conditions.
White 150 mcd/sq m/lux
Yellow 100 mcd/sq m/lux

b. Measure and report wet retroreflectance values under a "condition of wetness" according to ASTM E 2177.

c. Measure and report wet retroreflectance values under a "condition of continuous wetting" (simulated rain) according to ASTM E 2832.

d. Measure and report dry retroreflectance values according to ASTM E 1710.

~~**Table 4183.06-1: Expected Initial R_L under dry, wet, and rainy conditions**~~

~~**WHITE**~~	~~**Dry, Wet, & Rainy**~~
~~Entrance Angle~~	~~88.76 degrees~~
~~Observation Angle~~	~~1.05 degrees~~
~~Retroreflected Luminance R_L [(mcd • ft^{-2}) • fc^{-1}]~~	~~150~~
~~**YELLOW**~~	~~**Dry, Wet, & Rainy**~~
~~Entrance Angle~~	~~88.76 degrees~~
~~Observation Angle~~	~~1.05 degrees~~
~~Retroreflected Luminance RL [(mcd • ft-2) • fc-1]~~	~~100~~

4. Removability.
Pavement markings shall be removable from the pavement intact or in large pieces, at temperatures above freezing without the use of heat, solvents, grinding, or blasting; and with no permanent scarring of the roadway surface.

5. Patchability.
Pavement marking material shall be capable of being patched in accordance with manufacturer's instructions.

B. Regular Marking Tape.

Comply with Materials I.M. 483.06 and meet the following requirements:

1. Thickness.

Average thickness of the film, including glass spheres, no less than 15 mils or more than 50 mils.

2. Retroreflectance.

For white or yellow tapes, meet the following initial minimum retroreflectance values as measured by ASTM E 1710 ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer:~~

	White	Yellow
Specific luminance, ~~mcd/sq.ft./ft.-cdl.~~ mcd/sq m/lux	550	325

C. Preformed Polymer Marking Material.

Comply with Materials I.M. 483.06 and meet the following requirements:

1. Color.

White or yellow, complying with standard highway markings.

2. Thickness.

Marking film thickness from 60 mils to 90 mils, as measured to include adhesive and glass beads.

3. Retroreflectance.

For white or yellow tapes, meet the following initial minimum retroreflectance values as measured by ASTM E 1710 ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer~~.

	White	Yellow
Specific luminance, ~~mcd/sq.ft./ft.-cdl.~~ mcd/sq m/lux	325	150

D. Removable, Preformed, Nonreflective Tape.

Comply with Materials I.M. 483.06 and meet the following requirements:

1. Color.
Dark grey or black in order to blend with the pavement surface color.

2. Thickness.
Average film thickness no less than 30 mils.

3. Reflectance.
No nighttime reflective characteristics.

E. Profiled Pavement Marking Tape.
Comply with Materials I.M. 483.06 and meet the following requirements:

1. Color.
White or yellow, complying with standard highway markings.

2. Thickness.
Profiled surface. Thickness of the tape including glass beads no less than 30 mils or greater than 100 mils. Height of the profiles (measured from lowest point to highest point) no less than 35 mils.

3. Retroreflectance.
For white and yellow films, meet the following initial minimum retroreflectance values as measured by ASTM E 1710 ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer.~~

	White	Yellow
Specific luminance, ~~mcd/sq.ft./ft.-cdl.~~ mcd/sq m/lux	700	350

F. Intersection Marking Tape.
Intersection marking tape is intended for cross walks, gore lines, and symbols at intersections where marking tape is subjected to high shear from turning traffic. Comply with Materials I.M. 483.06 and meet the following requirements:

1. Color.
White or yellow, complying with standard highway markings.

2. Initial Skid Resistance.
Initial skid resistance a minimum of 55 British Pendulum Number (BPN) when tested according to ASTM E 303.

3. Retroreflectance.
For white or yellow tapes, meet the following initial minimum retroreflectance as measured by ASTM E 1710 ~~at 1.05 degree observation angle and 88.76 degree entrance angle, measured by a LTL 2000 retroreflectometer.~~

	White	Yellow
Specific luminance, ~~mcd/sq.ft./ft.-cdl.~~ mcd/sq m/lux	150	100

Reason for Revision: Update to Tape markings needed based on updates to ASTM standards, measurement units and alignment with accessibility requirements.

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 (07-24)

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SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Ben Hucker	**Bureau/Office:** Construction and Materials / Maintenance	Item 7
Submittal Date: July 2025	**Proposed Effective Date:** October 21, 2025	
Article No.: **Title:**	**Other:** DS-23061, Preformed Thermoplastic Pavement Markings	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text: See attached draft Developmental Specifications for Preformed Thermoplastic Pavement Markings.

Comments:

Member's Requested Change: **(Do not use '<u>Track Changes</u>', or '<u>Mark-Up</u>'. Use ~~Strikeout~~ and Highlight.)**
See attached DS-23061

Reason for Revision: Update to Tape markings needed based on updates to ASTM standards, measurement units and alignment with accessibility requirements.

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:

DRAFT DS- 23XXX
(Replaces DS-23061)

DEVELOPMENTAL SPECIFICATIONS
FOR
PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

Effective Date
October 21, 2025

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.

23XXX.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.

23XXX.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.

11. **Bond Strength.**
    Able to achieve 200 psi Minimum bond strength per ASTM D 4796.

12. **Binder Content.**
    Minimum Binder content of 18% per ASTM D 4797.

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.

23XXX.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~~ initial minimum retroreflectance values of 300 mcd/sq m/lux for white markings and 200 mcd/sq m/lux for yellow markings according 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.

23XXX.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.

23XXX.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.