

**TABLE OF CONTENTS**

**DIVISION 2200**  
**REFLECTIVE MATERIALS AND ACCESSORY ITEMS**

<b>SECTION</b>	<b>PAGE</b>
2201 – RETROREFLECTIVE SHEETING.....	2200-1
2202 – PROCESS INK AND ELECTRONIC CUTTABLE FILM.....	2200-4
2203 – ROLL-UP SIGNS.....	2200-6
2204 – CENTER MOUNT REFLECTORS.....	2200-8
2205 – FLEXIBLE DELINEATOR POSTS AND ANCHORING DEVICES.....	2200-10
2206 – PLOWABLE RAISED PAVEMENT MARKERS.....	2200-12
2207 – COLD PLASTIC PAVEMENT MARKING MATERIAL.....	2200-13
2208 – PATTERNED COLD PLASTIC PAVEMENT MARKING TAPE.....	2200-15
2209 – HIGH DURABILITY PAVEMENT MARKING TAPE.....	2200-17
2210 – TEMPORARY PAVEMENT MARKING TAPE.....	2200-19
2211 – THERMOPLASTIC PAVEMENT MARKING MATERIAL.....	2200-21
2212 – PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL.....	2200-24
2213 – SPRAYED THERMOPLASTIC PAVEMENT MARKING MATERIAL.....	2200-26
2214 – EPOXY PAVEMENT MARKING MATERIAL.....	2200-29
2215 – TRAFFIC LINE PAINT.....	2200-32
2216 – POLYMER-MODIFIED CEMENTITIOUS PAVEMENT MARKING MATERIAL.....	2200-34
2217 – MULTI-COMPONENT LIQUID PAVEMENT MARKING MATERIAL.....	2200-36



## 2201 - RETROREFLECTIVE SHEETING

### SECTION 2201

#### RETROREFLECTIVE SHEETING

##### 2201.1 DESCRIPTION

This specification covers Type I and all Types of High Intensity retroreflective sheeting. This includes both non-exposed glass bead lens and microprismatic sheeting.

##### 2201.2 REQUIREMENTS

**a. General.** Provide retroreflective sheeting that complies with ASTM D 4956 (latest revision) except for the color limits as specified in **subsection 2201.2b**. The type to be provided will be shown in the Contract Documents. Types and classes are as defined in ASTM D 4956.

**b. Color.** The colors of the retroreflective sheeting are white, yellow, red, orange, green, blue, brown, fluorescent orange, fluorescent yellow, and fluorescent yellow-green. Provide colors that comply with the chromaticity limits as shown in **TABLE 2201-1** for both Type I and Type III sheeting and **TABLE 2201-2** for all other Types of High Intensity sheeting (Type IV through Type X). Provide fluorescent colors that comply with the chromaticity limits in ASTM D 4956 (latest revision).

<b>TABLE 2201-1: COLOR SPECIFICATION (Type I and Type III)</b>								
<b>COLOR</b>	<b>Chromaticity Coordinates</b>							
	<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>	
	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>
White	0.310	0.313	0.338	0.342	0.325	0.355	0.300	0.327
Yellow	0.496	0.503	0.545	0.454	0.505	0.433	0.460	0.474
Red	0.574	0.337	0.665	0.345	0.708	0.292	0.613	0.297
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Green	0.130	0.387	0.180	0.410	0.140	0.521	0.098	0.490
Blue	0.138	0.065	0.112	0.135	0.160	0.170	0.176	0.120
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390

<b>TABLE 2201-2: COLOR SPECIFICATION (Type IV – Type X)</b>								
<b>COLOR</b>	<b>Chromaticity Coordinates</b>							
	<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>	
	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>	<b>x</b>	<b>y</b>
White	0.310	0.313	0.328	0.331	0.316	0.345	0.300	0.327
Yellow	0.515	0.484	0.545	0.454	0.505	0.433	0.475	0.460
Red	0.586	0.324	0.664	0.336	0.708	0.292	0.613	0.297
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Green	0.130	0.387	0.180	0.410	0.155	0.478	0.107	0.457
Blue	0.138	0.065	0.112	0.135	0.160	0.170	0.176	0.120
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390

**c. Conformable Retroreflective Sheeting.** Provide High Intensity retroreflective sheeting that has a conformable aluminum foil backing with an aggressive pressure sensitive adhesive. This material is designed for application to moderately rough or porous metal, wood or masonry surfaces. Provide material that complies with ASTM D 4956 (latest revision) with the following exceptions and additions:

- (1) Conformable aluminum backing thickness – 0.005 inches to 0.010 inches.
- (2) Follow all manufacturers' recommendations for application procedures and temperatures.

## 2201 - RETROREFLECTIVE SHEETING

### 2201.3 MANUFACTURER WARRANTY

The following warranty conditions apply only to the retroreflective sheeting manufacturer. Provide a product warranty for a minimum period of 10 years on all Types of High Intensity retroreflective sheeting, for placement on permanent signing. Failure to comply with this warranty may be cause for removal from the prequalified list.

The High Intensity retroreflective sheeting warranty must comply with the following requirements and obligations:

- Certification: Submit with each lot or shipment, a certification which states that the material supplied is subject to and complies with the requirements. Include in the certification, the manufacturer's office, address, phone number and the contact for potential claims under the provisions of this warranty. Provide documentation as to which signs were fabricated from each lot.
- Field Performance: Field Performance applies to retroreflective sheeting applied to sign blank materials or overlaid on existing signs. The field performance obligation period begins with the date of erection. The sheeting is considered unsatisfactory if it has deteriorated due to natural causes to the extent that the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions or shows any of the following defects:
  - Cracking discernible with the unaided eye from a driver's position at a distance of 50 feet or greater from the sign;
  - More than 25% loss of specular gloss and cracking, scaling, pitting, orange peel, delamination, edge lifting or curling;
  - Peeling in excess of 3/8 inch;
  - Shrinkage in excess of 3/16 inch total per yard of sheeting width;
  - Fading or loss of color to the extent that retroreflective sheeting color fails to comply with the **subsection 2201.2b.**, or;
  - Loss of retroreflectivity reducing the coefficient of retroreflection as measured by a retroreflectometer to less than the minimum specified in **TABLE 2201-3** at 0.2° observation and -4° entrance angles. Make all measurements after cleaning the sign.

<b>Sheeting Color</b>	<b>Min. Coefficient</b>
White	200
Yellow	136
Green	36
Red	36
Blue	16
Brown	9

Defective Material Replacement: When traffic signs with High Intensity sheeting fail to comply with the field performance requirements, re-sheet or replace the signs at no cost to the KDOT for materials and labor. Employ a contractor qualified by the KDOT to perform signing work. Install highway signs, as shown in the Contract Documents and the M.U.T.C.D. (latest edition) and provide proper traffic control.

Replace all defective material within 60 days after written notification by the KDOT. Signs not corrected within 60 days, will be removed and replaced by the KDOT. Signs removed by KDOT will be placed in storage for inspections by the manufacturer, and the manufacturer will be billed for all costs of replacement of the sheeting.

When more than 25% of the signs within a lot fail to comply with the requirements, replace all signs made from that lot.

### 2201.4 PREQUALIFICATION

Manufacturers desiring to provide material under this specification are to submit prequalification samples of each type, class and color covered by this specification which they wish to prequalify. Each sample consists of 3 pieces 24 inches square.

## 2201 - RETROREFLECTIVE SHEETING

Forward the prequalification samples to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Samples will be tested for compliance with all requirements of this specification. Each Manufacturer will be notified of the test results.

If the prequalification samples of retroreflective sheeting comply with this specification, the product will be placed on a list of prequalified products maintained by the Bureau of Materials and Research. No retroreflective sheeting will be used on KDOT projects unless it has been prequalified. Manufacturers will be required to requalify at intervals determined by the Engineer of Tests.

Testing and evaluation by KDOT may be waived if complete testing has been performed on the identical product by AASHTO National Transportation Product Evaluation Program (NTPEP). Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

### 2201.5 METHODS OF TESTS

All tests will be conducted in accordance with ASTM D 4956 with the exception of artificial weathering. Artificial weathering will be conducted according to ASTM G 155, Cycle 1, with the following additions and exceptions:

- At the end of each 20 hour cycle, the panels will be placed in a cold cabinet at approximately 0°F for one hour. After removal from the cold cabinet, panels will be returned to the weatherometer to await the start of the next cycle.
- Water used in the weatherometer will be city water softened to a total hardness content of less than 5 parts per million expressed as calcium carbonate.

### 2201.6 BASIS OF ACCEPTANCE

#### a. Permanent Sheeting.

- (1) Prequalification as required by **subsection 2201.4**.
- (2) Satisfactory results of tests conducted at MRC. Each lot of sheeting will be sampled at destination by a representative of the KDOT and will be subjected to a visual examination and tested for physical properties as necessary to verify that the sheeting complies with this specification.
- (3) Receipt of the warranty certification as specified in **subsection 2201.3** by the Project Engineer.

**b. Temporary Sheeting.** Retroreflective sheeting used to manufacture temporary traffic control signs will be accepted on the basis of a certification prepared by the contractor stating that the retroreflective sheeting used to manufacture the signs was prequalified under this specification, and visual inspection by the Engineer for condition and other requirements.

## 2202 - PROCESS INK AND ELECTRONIC CUTTABLE FILM

### SECTION 2202

#### PROCESS INK AND ELECTRONIC CUTTABLE FILM

##### 2202.1 DESCRIPTION

This specification covers Process Inks and Electronic Cuttable Films for use on retroreflective sheeting.

##### 2202.2 REQUIREMENTS

**a. General.** Provide transparent or opaque process inks with reducers and thinners as required for proper application. Provide durable, transparent or opaque, colored electronic cuttable films with a pressure sensitive adhesive and a removable liner. Provide materials that are suitable for processing legends, borders, and background colors on retroreflective sheeting. Provide process inks or electronic cuttable films in 2 types as follows:

Type I - For use with Type I retroreflective sheeting.

Type High Intensity - For use with all types of High Intensity retroreflective sheeting.

**b. Color.** The colors of the transparent inks and films are yellow, red, orange, green, blue, and brown. Opaque ink or film is black. Provide colors that comply with the chromaticity limits in **TABLE 2201-1**.

**c. Performance.** Provide process inks and electronic cuttable films that, when applied according to the manufacturer's recommendations, comply with the following:

- (1) They are compatible with the retroreflective sheeting.
- (2) They have good adhesion to the sheeting and do not cause blistering, puckering, shrinkage, expansion or other deterioration of the sheeting.
- (3) After artificial weathering, they have a "good" or better colorfastness, show no more than a 10% loss of gloss and show no evidence of cracking, edge lifting, curling or other surface deterioration.
- (4) Process inks dry hard within 16 hours.

##### 2202.3 TEST METHODS

All tests will be conducted in accordance with ASTM D 4956 with the exception of artificial weathering. Artificial weathering will be conducted according to ASTM G 155, Cycle 1, with the following additions and exceptions:

- At the end of each 20-hour cycle, place the panels in a cold cabinet at approximately 0°F for 1 hour. After removal from the cold cabinet, return the panels to the weatherometer to await the start of the next cycle.
- Water used in the weatherometer is city water softened to a total hardness content of less than 5 parts per million expressed as calcium carbonate.

##### 2202.4 PREQUALIFICATION

Manufacturers desiring to provide material under this specification are to submit prequalification samples of each type and color covered by this specification that they wish to prequalify. Each sample of process ink consists of 1 quart of transparent and opaque inks and any necessary reducer or thinner required for proper application. Each sample of electronic cuttable film consists of 2 pieces 24 inches square.

Manufacturers must supply a sufficient quantity of compatible retroreflective sheeting for the ink or film applications. Directions for proper application must accompany all samples.

Forward the prequalification samples to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Samples will be tested for compliance with all requirements of this specification. Each manufacturer will be notified of the test results.

If the prequalification samples of ink or film comply with this specification, the product will be placed on a list of prequalified products maintained by the Bureau of Materials and Research. No ink or film will be used on

## 2202 - PROCESS INK AND ELECTRONIC CUTTABLE FILM

KDOT projects unless it has been prequalified. Manufacturers will be required to requalify at intervals determined by the Engineer of Tests.

Testing and evaluation by KDOT may be waived if complete testing has been performed on the identical product by AASHTO National Transportation Product Evaluation Program (NTPEP). Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

### 2202.5 BASIS OF ACCEPTANCE

Prequalification as required by **subsection 2202.3**.

Receipt and approval of a Type C certification as specified in **DIVISION 2600**.

Visual observation of performance.

**2203 - ROLL-UP SIGNS**

**SECTION 2203**

**ROLL-UP SIGNS**

**2203.1 DESCRIPTION**

This specification covers white, fluorescent orange, and fluorescent pink retroreflective sheeting used for temporary roll-up warning signs.

**2203.2 REQUIREMENTS**

a. Provide retroreflective sheeting that complies with ASTM D 4956, Type VI, Class 5 with the following exceptions and additions:

(1) Color. Provide white and fluorescent pink sheeting that complies with the chromaticity limits in **TABLE 2203-1**.

<b>TABLE 2203-1: CHROMATICITY LIMITS</b>									
<b>COLOR</b>	<b>Chromaticity Coordinates</b>								<b>Reflectance Limit</b>
	<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>		
	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>	<b>Y</b>
White	.310	.313	.328	.331	.316	.345	.300	.327	27.0 min.
Fluorescent Pink	.450	.270	.590	.350	.644	.290	.536	.230	25.0 min.

(2) Coefficient of Retroreflection. Provide fluorescent pink sheeting that meets or exceeds the following minimum requirements:

<b>TABLE 2203-2: COEFFICIENT OF RETROREFLECTION</b>		
<b>Observation Angle</b>	<b>Entrance Angle</b>	<b>Value</b>
0.2°	-4°	160.0
0.2°	+30°	100.0
0.5°	-4°	100.0
0.5°	+30°	40.0

**b. Mounting Stands.** The type and configuration of stands for mounting and displaying roll-up signs are not specified here, and are at the Contractor's option. However, all stands used must meet the crashworthy criteria for Category 2 devices contained in the testing and acceptance guidelines of the National Cooperative Highway Research Program (NCHRP) Report 350. Retain a copy of the NCHRP Report 350 crashworthy test data and the FHWA acceptance letter to be provided to the Engineer if requested. In addition, the mounted sign and stand must be able to resist normal wind loading without falling over, and be able to maintain a minimum mounting height of 12 inches above the edge of the pavement.

**2203.3 TEST METHODS**

All tests will be conducted in accordance with ASTM D 4956 with the exception of artificial weathering. Artificial weathering will be conducted according to ASTM G 155, Cycle 1, with the following additions and exceptions:

- At the end of each 20-hour cycle, the panels will be placed in a cold cabinet at approximately 0°F for 1 hour. After removal from the cold cabinet, panels will be returned to the weatherometer to await the start of the next cycle.
- Water used in the weatherometer will be city water softened to a total hardness content of less than 5 parts per million expressed as calcium carbonate.



## 2203 - ROLL-UP SIGNS

### 2203.4 PREQUALIFICATION

Only the retroreflective sheeting used to manufacture the signs will be prequalified. Sheeting manufacturers interested in prequalifying material under this specification must submit 3 pieces 24 inches x 24 inches to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Samples will be tested for compliance with all requirements of this specification. Each manufacturer will be notified of the test results.

If the prequalification samples of retroreflective sheeting comply with this specification, the product will be placed on a list of prequalified products maintained by the Bureau of Materials and Research. No retroreflective sheeting will be used on KDOT projects unless it has been prequalified. Manufacturers will be required to requalify at intervals determined by the Engineer of Tests.

Testing and evaluation by KDOT may be waived if complete testing has been performed on the identical product by AASHTO National Transportation Product Evaluation Program (NTPEP). Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

### 2203.5 BASIS OF ACCEPTANCE

Prequalification as required by **subsection 2203.4** above.

Receipt and approval of a certification prepared by the manufacturer stating that the sheeting used to manufacture the roll-up signs is essentially the same as that submitted for prequalification.

Visual inspection on delivery.

## 2204 - CENTER MOUNT REFLECTORS

### SECTION 2204

#### CENTER MOUNT REFLECTORS

##### 2204.1 DESCRIPTION

This specification covers plastic center mount reflectors.

##### 2204.2 REQUIREMENTS

**a. General.** Provide reflectors that are plastic reflector discs with a mounting hole in the center, and a nominal diameter of 3 inches. Provide the reflectors in 3 colors; white, yellow and red. Provide yellow and red reflectors that comply with the limits set by the Highway Yellow and Red Color Tolerance Charts of the U. S. Department of Transportation.

**b. Construction and Materials.**

(1) Plastic Reflector Unit. Provide reflectors that consist of 2 circular pieces of plastic, hermetically sealed together at the edges and at the center mounting hole. Provide units with an air space between the two sealed pieces and permanently sealed against dust, water and vapor.

(a) Front (Lens). Provide reflectors whose front piece of plastic consists of a clear and transparent acrylic plastic of the color shown in the Contract Documents. Provide reflectors whose outer surface of the front piece is smooth and highly polished, free from cracks, checks, projections or indentations. This surface may contain a mounting hole and trademark identification. Legibly mold the manufacturer's name and identification into the face near the edge. Form the inner surface into numerous small reflector elements to affect "cubecorner" retroreflection.

(b) Back. Provide a plastic back that is either transparent or opaque, but sealed to the front to form an airtight seal in order to protect the reflector elements.

(2) Housing and Mounting. Provide reflectors with a center mounting hole with a grommet that uses either of two designs. A Type I grommet is formed as part of the backing and projects through the reflector and beyond the lens by about 1/32 in. The backing, including the grommet, is hermetically sealed to the lens. A Type II grommet is formed from nonferrous metal and applied after the reflector is assembled and sealed. Provide either type of grommet with an inside diameter of 0.19 – 0.24 inches, inclusive.

**c. Performance.** Provide reflectors with the following minimum Reflective Intensity per reflector at a divergence angle of 0.2°:

Angle of Incidence	Reflective Intensity (cd/ft-c)		
	White	Yellow	Red
-4°	90	54	25
20°	45	27	12

##### 2204.3 TEST METHODS

Center mount reflectors will be sampled by a representative of the KDOT and submitted to MRC. A sample consists of 18 reflectors per each 5000 reflectors for each color. For each additional 5000, or fraction thereof, add 4 reflectors to the sample size. Lightly wash the reflectors with a mild detergent and dry with a clean cloth before testing as follows:

**a. Coefficient of Luminous Intensity per Reflector.** Determine the reflective intensity of center mount reflectors according to ASTM E 809. Measure each reflector individually at a divergence angle of 0.2° and incidence angles of -4° and 20°. Average readings taken at every 45° rotation.

## 2204 - CENTER MOUNT REFLECTORS

**b. Heat Test.** After measuring the reflective intensity per reflector, place a minimum of 9 reflectors face up in a horizontal position on the central rack of a forced draft oven maintained between 148° and 150°F for 4 hours. Remove the reflectors from the oven and place them face up on a table to cool. Allow the reflectors to return to room temperature, wipe the reflectors with a clean chamois and measure the reflective intensity of each reflector as described in **subsection 2204.3a**. The reflective intensity of each reflector must not be less than the minimum values shown in **subsection 2204.2c**.

**c. Leakage Test.** After measuring the reflective intensity per reflector, immerse a minimum of 9 reflectors face down in water in a vacuum desiccator under a coarse bronze or stainless steel screen to keep them beneath the water. Cover the desiccator and slowly reduce the air pressure in the desiccator until a vacuum of 20 inches of mercury is obtained. Hold this reduced pressure for 5 minutes and then allow air to slowly enter the desiccator until the pressure is equal to atmospheric pressure. Allow the reflectors to remain under water for an additional 5 minutes. Remove the reflectors from the water and wipe off the excess water with a clean cloth. Measure the reflective intensity of each reflector as described in **subsection 2204.3a**. Any reflectors that have filled with any water will be marked as failures and the reflective intensity will not be measured. The reflective intensity of each reflector must not be less than the minimum values shown in **subsection 2204.2c**.

**d. Resampling.** When only 1 reflector per sample fails **subsection 2204.3a**, **b**, or **c**, the entire sample will be accepted for use on KDOT projects. A failure of 2 reflectors per sample will require resampling and testing. A failure of 3 or more will cause the entire sample to be rejected without resampling.

### 2204.4 PREQUALIFICATION

None required.

### 2204.5 BASIS OF ACCEPTANCE

Each lot or batch will be sampled by a representative of the KDOT and tested as necessary to verify compliance with the specification.

Satisfactory performance in the field.

## 2205 - FLEXIBLE DELINEATOR POSTS AND ANCHORING DEVICES

### SECTION 2205

#### FLEXIBLE DELINEATOR POSTS AND ANCHORING DEVICES

##### 2205.1 DESCRIPTION

This specification covers flexible delineator posts and anchoring devices.

##### 2205.2 REQUIREMENTS

###### a. General.

(1) Provide delineator posts consisting of a flexible, durable, UV resistant and non-discoloring material. Provide posts to which retroreflective sheeting can be applied, and are capable of recovering from 5 cold weather impacts between 27 and 37°F and 5 hot weather impacts between 82 and 90°F. Upon installation, the delineator must be resistant to overturning, twisting, or displacement from wind and vehicle forces. For 2-piece systems, the post must be compatible with an anchor that holds the post in place by a locking mechanism, or with a bolting arrangement.

(2) When shown in the Contract Documents, apply High Intensity retroreflective sheeting to the flattened area. Apply white or yellow retroreflective sheeting to 1 or 2 sides as stated in the Contract Documents. Apply retroreflective sheeting to within 2.0 inches of the top of the post. The total length and color of the post are shown in the Contract Documents.

(3) Delineators are required to meet the crashworthy criteria for category I devices contained in the testing and acceptance guidelines of the National Cooperative Highway Research Program (NCHRP) Report 350.

###### b. Types of Posts.

(1) Tubular. Provide posts that are 2 – 4 inches in diameter and permanently closed or capped to prevent moisture or debris from entering. The upper end, which is flattened or oval shaped, is at least 12 inches in length, and provides a flat surface of at least 3.0 inches wide.

(2) Flat. Provide posts with a surface width of at least 3.0 inches.

(3) Curved. Provide posts with a minimum width of 3.0 inches.

(4) Round. Provide posts that are round from top to bottom with a minimum diameter of 3.0 inches, and are permanently closed or capped to prevent moisture or debris from entering.

###### c. Types of Anchors.

There are 3 types of anchoring systems.

(1) Driveable Anchor.

(2) Embedment Anchor.

(3) Surface Mount Anchor.

**d. Impact Resistance.** The delineator must remain intact and securely anchored, and return to its original vertical orientation within an angle of  $\pm 15$  degree after a series of 10 (5 cold weather and 5 hot weather) impacts by a typical passenger car or pickup traveling at 55 miles per hour.

##### 2205.3 TEST METHODS

**a. Impact Resistance Test.** Test flexible delineators for impact resistance as prescribed by the AASHTO National Transportation Product Evaluation Program (NTPEP) test procedures for flexible delineator posts and plastic barrels.

The manufacturer must submit Impact Resistance data for tests that have been performed on the identical product by the AASHTO NTPEP test location that includes both hot and cold weather conditions. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

**b. Crashworthy Test.** Test delineators as prescribed by the NCHRP Report 350 for category I devices. Federal Highway Administration (FHWA) guidance indicates that category I devices may be accepted based on a

## **2205 - FLEXIBLE DELINEATOR POSTS AND ANCHORING DEVICES**

self-certification by the manufacturer. This certification may be a one-page affidavit signed by the manufacturer, with documentation supporting the certification (crash tests and/or engineering analysis) kept on file by the certifying organization. Forward an official copy of the certification with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

### **2205.4 PREQUALIFICATION**

The flexible delineator post, complete with appropriate anchor, will be prequalified as a system or unit by the KDOT. Manufacturers interested in prequalifying items under this specification must submit 2 complete units (posts with appropriate anchors), the Impact Resistance test data, and the Crashworthy Certification to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. The sample will be tested for compliance with all requirements of this specification and the producer will be notified in writing of the test results. A list of qualified materials will be maintained by the Bureau of Materials and Research.

### **2205.5 BASIS OF ACCEPTANCE**

Prequalification as required by **subsection 2205.4**.

Receipt and approval of a Type C certification in accordance with **DIVISION 2600**.

## 2206 - PLOWABLE RAISED PAVEMENT MARKERS

### SECTION 2206

#### PLOWABLE RAISED PAVEMENT MARKERS

##### 2206.1 DESCRIPTION

This specification covers plowable, raised, prismatic reflective pavement markers for lane marking and delineation.

##### 2206.2 REQUIREMENTS

Provide reflective markers affixed to nodular iron holders by the manufacturer that comply with ASTM D 4383, and are of the type and color shown or in the Contract Documents.

Use a 2-component standard epoxy complying with the AASHTO M 237, Type IV that is recommended by the marker manufacturer to bond the markers to the pavement.

##### 2206.3 TEST METHODS

Test reflective markers and nodular iron holders in accordance with the procedures referenced in ASTM D 4383. Test the epoxy as specified in AASHTO M 237.

##### 2206.4 PREQUALIFICATION

Manufacturers wishing to supply markers to KDOT projects must have their product tested by the AASHTO National Transportation Product Evaluation Program (NTPEP). Forward a sample of each marker for which prequalification is requested, and an official copy of the NTPEP test report to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Include evidence that the product offered is identical to that described in the test report, and information regarding the recommended adhesive, if any. Prequalification will be based on satisfactory compliance of NTPEP results with ASTM D 4383.

##### 2206.5 BASIS OF ACCEPTANCE

a. Plowable Pavement Markers are accepted based on prequalified status as required by **subsection 2206.4** above, receipt and approval of a Type C certification as described in **DIVISION 2600** and visual inspection for conditions and dimensional requirements.

b. Epoxy will be accepted on the basis of the receipt and approval a Type D certification.

## 2207 - COLD PLASTIC PAVEMENT MARKING MATERIAL

### SECTION 2207

#### COLD PLASTIC PAVEMENT MARKING MATERIAL

##### 2207.1 DESCRIPTION

This specification covers cold plastic pavement marking materials for use on both concrete and asphalt surfaces.

##### 2207.2 REQUIREMENTS

Provide preformed pavement markings that comply with ASTM D 4505 with the following exceptions and additions:

- Delete all references to application temperatures.

a. **Retroreflectivity.** Provide pavement markings that comply with the following minimum retroreflectivity requirements in **TABLE 2207-1** using an acceptable 30-meter retroreflectometer:

<b>COLOR</b>	<b>millicandelas/sq m/lux (min.)</b>
White	250
Yellow	175

##### 2207.3 TEST METHODS

KTMR-9, "Field Evaluation of Pavement Marking Materials"

ASTM D 4505

##### 2207.4 PREQUALIFICATION

Submit a sample of at least 100 linear feet of each color of material to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611.

Provide material that complies with **subsection 2207.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

The material will be evaluated for compliance with this specification, and the manufacturer will be notified of the results. The Bureau of Materials and Research will maintain a list of qualified materials. Products will remain on the prequalified list as long as the Field Evaluations and Field Performance are satisfactory. Report any changes in formulation to MRC for review and evaluation to determine if requalification is necessary.

## 2207 - COLD PLASTIC PAVEMENT MARKING MATERIAL

### 2207.5 BASIS OF ACCEPTANCE

#### a. Long Line Markings.

- (1) Prequalification as stated in **subsection 2207.4**.
- (2) Satisfactory results of Verification Testing. Except for symbols, the Engineer will sample each lot or batch. The Engineer will cut perpendicular to the width from the end of the roll.

Pavement Marking width	Sample Size
4, 6 & 8 inch	12 inch
12 & 24 inch	6 inch

- (3) Compliance with **TABLE 2207-1**.

#### b. Preformed Symbols.

- (1) Prequalification as stated in **subsection 2207.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600**. Include all lot numbers from the material used to fabricate the symbols.
- (3) Compliance with **TABLE 2207-1**.



## 2208 - PATTERNED COLD PLASTIC PAVEMENT MARKING TAPE

### SECTION 2208

#### PATTERNED COLD PLASTIC PAVEMENT MARKING TAPE

##### 2208.1 DESCRIPTION

This specification covers patterned cold plastic pavement marking material for use on both concrete and asphalt surfaces.

##### 2208.2 REQUIREMENTS

Provide preformed pavement markings that comply with ASTM D 4505 with the following exceptions and additions:

Delete all references to application temperatures.

**a. Dimensions.** Provide material with a thickness of not less than 0.02 in. at the thinnest portion of the cross section. Provide material whose thickest portion of the cross section is 0.07 – 0.09 in. All measurements are exclusive of the adhesive.

**b. Retroreflectivity.** Provide patterned pavement markings that comply with the following minimum retroreflectivity requirements in **TABLE 2208-1** using an acceptable 30-meter retroreflectometer:

TABLE 2208-1: PATTERNED COLD PLASTIC RETROREFLECTIVITY REQUIREMENTS	
COLOR	millicandelas/sq m/lux (min.)
White	475
Yellow	375

##### 2208.3 TEST METHODS

KTMR-9, "Field Evaluation of Pavement Marking Materials"  
ASTM D 4505

##### 2208.4 PREQUALIFICATION

Submit a sample of at least 100 linear feet of each color of material to be prequalified to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. The sample will be tested for compliance with all requirements of this specification. No material will be used on KDOT projects unless it has been prequalified. The Bureau of Materials and Research will maintain a list of prequalified materials.

Provide material that complies with **subsection 2208.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

## 2208 - PATTERNED COLD PLASTIC PAVEMENT MARKING TAPE

### 2208.5 BASIS OF ACCEPTANCE

#### a. Long Line Markings.

- (1) Prequalification as stated in **subsection 2208.4**.
- (2) Satisfactory results of Verification Testing. Except for symbols, the Engineer will sample each lot or batch. The Engineer will cut perpendicular to the width from the end of the roll.

Pavement Marking width	Sample Size
4, 6 & 8 inch	12 inch
12 & 24 inch	6 inch

- (3) Compliance with **TABLE 2208-1**.

#### b. Preformed Symbols.

- (1) Prequalification as stated in **subsection 2208.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600**. Include all lot numbers from the material used to fabricate the symbols.
- (3) Compliance with **TABLE 2208-1**.

## 2209 - HIGH DURABILITY PAVEMENT MARKING TAPE

### SECTION 2209

#### HIGH DURABILITY PAVEMENT MARKING TAPE

##### 2209.1 DESCRIPTION

This specification covers white or yellow preformed plastic pavement markings designed to be used in severe wear conditions such as repeated shear actions from crossover or encroachment traffic and turning, stopping or starting traffic. This includes material for use on both portland cement concrete and asphalt surfaces.

##### 2209.2 REQUIREMENTS

Provide preformed pavement markings that comply with ASTM D 4505 with the following exceptions and additions:

a. The material must have a strong topcoat with glass beads distributed to provide immediate and continuing retroreflection. Bond ceramic particles to the top layer to provide a skid resistant surface.

b. Delete all references to application temperatures.

c. **Tensile Strength.** The material must have a minimum tensile strength of 500 psi when measured in the direction of the roll.

d. **Adhesion.** 8 lbs per 1.0 inch of width, minimum.

e. **Thickness.** 0.05 inch, minimum.

f. **Retroreflectivity.** Provide material that meets the following minimum retroreflectivity requirements using an acceptable 30-meter retroreflectometer:

<b>TABLE 2209-1: HIGH DURABILITY TAPE RETROREFLECTIVITY REQUIREMENTS</b>	
<b>Color</b>	<b>millicandelas/sq m/lux (min.)</b>
White	225
Yellow	175

##### 2209.3 TEST METHODS

KTMR-9, Field Evaluation of Pavement Marking Materials.

ASTM D 638 with the following exception:

- Test a 1 by 6 inch sample at a temperature between 70 and 80°F using a jaw speed of 10 - 12 inches per minute.

ASTM D 4505.

##### 2209.4 PREQUALIFICATION

Submit at least 100 linear feet of each color, and a complete set of installation recommendations and instructions to Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611.

Provide material that complies with **subsection 2209.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or

## 2209 - HIGH DURABILITY PAVEMENT MARKING TAPE

displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

The material will be evaluated for compliance with this specification, and the manufacturer will be notified of the results. The Bureau of Materials and Research will maintain a list of qualified materials. Products will remain on the prequalified list as long as the Field Evaluations and Field Performance are satisfactory. Report any changes in formulation to MRC for review and evaluation to determine if requalification is necessary.

### 2209.5 BASIS OF ACCEPTANCE

#### a. Long Line Markings.

- (1) Prequalification as required by **subsection 2209.4** above.
- (2) Satisfactory results of Verification Testing. Except for symbols, the Engineer will sample each lot or batch. The Engineer will cut perpendicular to the width from the end of the roll.

Pavement Marking width	Sample Size
4, 6 & 8 inch	36 inch
12 & 24 inch	24 inch

- (3) Visual observation of performance on the project.

#### b. Preformed Symbols.

- (1) Prequalification as required by **subsection 2209.4** above.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600**, which also includes all lot numbers of material used to fabricate the symbols.
- (3) Visual observation of performance on the project.

## 2210 - TEMPORARY PAVEMENT MARKING TAPE

### SECTION 2210

#### TEMPORARY PAVEMENT MARKING TAPE

##### 2210.1 DESCRIPTION

This specification covers preformed plastic pavement markings designed for limited service life. This includes both Removable (Type I) and Non-removable (Type II) materials for use on both portland cement concrete and asphalt surfaces. Type II is further broken out for prequalification by use. Plain Type II is that which is prequalified for general use in all configurations on both portland cement concrete and asphalt surfaces. Type IIA is that which is prequalified for use as temporary skip lines on new asphalt surfaces only.

This specification also covers Removable Line Masking Tape. This is a highly durable, skid resistant, non-reflective, black or dark gray, pliant polymer tape designed for temporary obliteration of existing pavement markings. Provide material in widths or sizes sufficient to extend approximately 1.0 inch beyond the edges of the existing markings. The tape must be able to be removed without damage to the existing marking.

##### 2210.2 REQUIREMENTS

Provide preformed pavement markings that comply with ASTM D 4592 with the following exceptions and additions:

a. Delete all references to application temperatures. Apply all markings according to the manufacturer's recommendations for proper surface conditions and preparation, air and surface temperatures, and other weather conditions.

b. Store all material in accordance with the manufacturer's directions, including temperature and exposure to the elements.

c. If recommended by the manufacturer, use a primer to precondition the pavement surface.

d. **Retroreflection.** The sample size is changed to 1.0 X 2.0 feet. Retroreflection requirements are not applicable for Removable Line Masking Tape.

e. **Durability and Wear Resistance.** The material can suffer no more than a 25% loss of beads, sand, grit or pigmented color layers when subjected to 30,000 revolutions on a small wheel circular track device as defined in subsection 2210.3b.

##### 2210.3 TEST METHODS

a. ASTM D 4592

b. **Durability and Wear Resistance.** ASTM E 660, with the following variations:

(1) Mount two opposite wheels with Goodyear 3.40-5 NHS Industrial Rib tires with a total load of 51.5 pounds on each tire. Maintain tire pressure at 25 psi. Mount the wheels perpendicular to the specimens and toe out 2° to produce a slight abrading action.

(2) Apply specimens to 6 inch diameter dense graded asphalt concrete cores, which have been compacted at 3000 psi for 2 minutes. After application, allow the specimens to cure for 2 hours before beginning the test.

c. **Field Evaluation Test.** KTMR-9, Field Evaluation of Pavement Marking Materials.

d. **Removability Test.** KTMR-10, Removability of Temporary Pavement Marking Tape.

## 2210 - TEMPORARY PAVEMENT MARKING TAPE

### 2210.4 PREQUALIFICATION

Manufacturers interested in prequalifying material under this specification must submit at least 200 linear feet (Type I and Removable Line Masking tapes) or 100 linear feet (Type II) of each color, and a complete set of installation recommendations and instructions to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611.

Provide material that complies with **subsection 2210.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** Subject Type I and Type II material to traffic conditions on both portland cement concrete and asphalt surfaces for 6 months during the period of July through February. Unless field evaluation as Type IIA only is specifically requested by the manufacturer, all Type II submittals will be installed as Type II for full evaluation. If the material fails part of the field evaluation as Type II, it will still be considered for approval as Type IIA. If a Type IIA field evaluation is specifically requested, subject the material to traffic conditions on a asphalt surface for 2 months during the paving season, using only longitudinal lines. Evaluate Removable Line Masking Tape when installed over existing durable pavement markings.

During the field evaluation, the material cannot pick up and retain road grime which causes more than a slight discoloration of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be entirely intact with no evidence of lifting, curling, breaking or displacement. Transverse lines can suffer no more than a 25% loss of beads, sand, grit or pigmented color layers in the wheel path. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow. Contrast requirements are not applicable for Removable Line Masking Tape.

Field evaluation for temporary tape may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. For Type I and Removable Line Masking tapes, testing must include removability. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

The sample will be tested for compliance with all requirements of this specification. The Bureau of Materials and Research will maintain a list of qualified materials and installation instructions. Products will remain on the list as long as field performance is satisfactory, and the results of verification testing are consistently acceptable.

### 2210.5 BASIS OF ACCEPTANCE

Prequalification as required by **subsection 2210.4**.

Receipt and approval of a Type C certification as specified in **DIVISION 2600**.

Visual observation of performance on the project.

# 2211 - THERMOPLASTIC PAVEMENT MARKING MATERIAL

## SECTION 2211

### THERMOPLASTIC PAVEMENT MARKING MATERIAL

#### 2211.1 DESCRIPTION

This specification covers thermoplastic materials suitable for use as retroreflective pavement markings on asphalt and portland cement concrete pavements. Material will be prequalified for use on both asphalt and portland cement concrete surfaces or for use only on asphalt surfaces. The material is applied to the pavement in molten form. Glass beads are pre-mixed into the material furnished, and also dropped on the surface of the molten material immediately after it is applied to the pavement surface, at a rate specified. Upon cooling to normal pavement temperature, it produces an adherent retroreflectorized stripe of specified thickness and width, capable of resisting deformation by traffic.

#### 2211.2 REQUIREMENTS

##### a. General.

- (1) Provide the material in white and/or yellow as specified.
- (2) A binder-sealer is required for applications involving asphalt over 2 years old, or for asphalt surfaces that are worn or oxidized to a condition where 50% or more of the wearing surface is exposed aggregate.
- (3) Do not commingle materials from different manufacturers.

**b. Thermoplastic Material and Premix Beads.** Provide thermoplastic material that complies with AASHTO M 249 with the following restrictions:

- (1) Only maleic modified glycerol ester alkyd based resins will be allowed for the binder system.
- (2) Yellow pigments must comply with the latest OSHA standards for toxic heavy metals.

##### c. Glass Beads for Drop-on Application.

- (1) Provide regular beads that are specifically manufactured to be compatible with the thermoplastic system, and comply with AASHTO M 247, Type I.
- (2) When a double drop system using both regular beads and large beads is specified, provide large beads that are also compatible with the thermoplastic system, and comply with AASHTO M 247, except with the following gradation (FP-96, Type 4):

Sieve Size	Percent Passing
No. 10	100
No. 12.	95-100
No. 14	80-95
No. 16.	10-40
No. 18.	0-5
No. 20.	0-2

**d. Binder-Sealer.** When a binder-sealer is specified, provide one that is recommended by the manufacturer of the thermoplastic material, and apply it according to the manufacturer's instructions. The binder-sealer must be compatible with the pavement material, and form a tight bond between the pavement and the thermoplastic material.

**e. Color.** For yellow, meet the following minimum chromaticity coordinates:

COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

## 2211 - THERMOPLASTIC PAVEMENT MARKING MATERIAL

The yellow lines must also display a nighttime presence of yellow when viewed under automobile headlights.

**f. Retroreflectivity.** Provide thermoplastic that complies with the minimum retroreflectivity requirements in **TABLE 2211-3** using an acceptable 30-meter retroreflectometer:

<b>TABLE 2211-3: THERMOPLASTIC RETROREFLECTIVITY REQUIREMENTS</b>	
<b>Color</b>	<b>millicandelas/sq m/lux (min.)</b>
White	300
Yellow	225

**g. Verification Testing.** The Engineer will take verification samples of thermoplastic material from 1 lot of each color per project, using KT-30. Send the samples to MRC for testing and evaluation. Lots previously tested by MRC will be exempted from testing, and may be exempted from sampling if coordinated with MRC. The Engineer will take 2 one-quart samples of each type of glass bead used on each project. Forward the sample to MRC for verification testing.

### 2211.3 TEST METHODS

**a. Thermoplastic Material.**

- (1) AASHTO T 250, plus,
- (2) Verify the material is alkyd using KTMR-6, Determination of Alkyd Base in Thermoplastic Material.
- (3) Glass Bead Content. ASTM D 4797.
- (4) Titanium Dioxide. ASTM D 1394, Aluminum Reduction Method.

**b. Glass Beads for Drop-On Application.** AASHTO M 247.

**c. Field Evaluation.**

KTMR-9, Field Evaluation of Pavement Marking Materials.

### 2211.4 PREQUALIFICATION

**a.** Manufacturers interested in prequalifying material under this specification must provide a 10-lb sample of each color to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Also include a copy of the quality control test report for each lot of material, material safety data sheets, and a complete set of installation recommendations and instructions. Manufacturers must specify if the material may be used on both asphalt and concrete surfaces or only on asphalt surfaces. If the material complies with all laboratory requirements, the manufacturer will be contacted to arrange for the field evaluation.

**b.** Provide material that complies with **subsection 2211.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

**c.** Provide personnel and equipment to apply manufacturer supplied material from the lots tested above to the test deck selected by the KDOT.



## 2211 - THERMOPLASTIC PAVEMENT MARKING MATERIAL

**d.** The material will be evaluated for compliance with all requirements of this specification, and the manufacturer will be notified of the results. The Bureau of Materials and Research will maintain a list of qualified materials and installation instructions. The list will differentiate between products prequalified for use on asphalt and concrete surfaces, or for use on asphalt surfaces only. Products will remain on the prequalified list as long as the results of verification testing and field performance are satisfactory. Any changes in formulation should be reported to the Engineer of Tests for review and evaluation to determine if requalification is necessary.

### 2211.5 BASIS OF ACCEPTANCE

#### **a. Thermoplastic Material.**

- (1) Prequalification as required by **subsection 2211.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600** for each lot of material used.

**b. Glass Beads for Drop-on Application.** Receipt and approval of a Type D certification as specified in **DIVISION 2600**.

**c. Binder-Sealer.** If binder-sealer is required, it will be accepted on the basis of brand name as recommended by the thermoplastic material manufacturer, and visual observation of performance in the field.

**2212 - PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL**

**SECTION 2212**

**PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL**

**2212.1 DESCRIPTION**

This specification covers preformed thermoplastic materials suitable for use as reflecting pavement markings on either asphalt or concrete pavements. A manufacturer recommended heat source fuses the markings to the asphalt or concrete pavements. Glass beads are pre-mixed into the material furnished, and also must be applied to the surface either before or after fusion to the pavement. Upon cooling, the material produces an adherent reflectorized marking of specified thickness and width, capable of resisting deformation by traffic.

**2212.2 REQUIREMENTS**

**a. General.**

- (1) Provide the material in white and/or yellow as specified.
- (2) Provide material with a minimum thickness of 0.1 inch as supplied by the manufacturer.
- (3) Provide material that is resistant to deterioration due to exposure to sunlight, water, oil, gasoline, salt, or adverse weather conditions.
- (4) After application, the material must exhibit no appreciable deformation or discoloration, remain tack free, and not lift from the pavement under normal traffic conditions within a road temperature range of 20 to 150°F.
- (5) Provide material that is capable of conforming to pavement contours, breaks, and faults through the action of traffic at normal pavement temperatures.

**b. Color.** Provide yellow material that meets the minimum chromaticity coordinates in **TABLE 2212-1**:

1		2		3		4	
X	Y	X	Y	X	Y	X	Y
0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

**c. Retroreflectivity.** Provide preformed thermoplastic that meets the minimum retroreflectivity requirements in **TABLE 2212-2**, using an acceptable 30-meter retroreflectometer.

COLOR	millicandelas/sq m/lux (min.)
White	300
Yellow	225

**d. Thermoplastic Material and Premix Beads.**

- (1) Provide thermoplastic material that complies with AASHTO M 249 with exception of the relevant differences due to the material being supplied in a preformed state.
- (2) All pigments must be heavy metal free, including, but not restricted to lead, cadmium, and mercury.

**e. Glass Beads for Drop-on Application.** Provide glass beads that are specifically manufactured to be compatible with the thermoplastic system, and comply with AASHTO M 247, Type I.

**2212.3 TEST METHODS**

**a. Thermoplastic Material and Premix Beads.** AASHTO T 250

**b. Glass Beads for Drop-On Application.** AASHTO M 247

## 2212 - PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL

c. **Field Evaluation.** KTMR-9, Field Evaluation of Pavement Marking Materials.

### 2212.4 PREQUALIFICATION

a. Manufacturers interested in prequalifying material under this specification must provide at least 100 linear feet of each color to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Also, include a copy of the quality control test report for each lot of material, material safety data sheets, and a complete set of installation recommendations and instructions. If the material complies with all laboratory requirements, the manufacturer will be contacted to arrange for the field evaluation.

b. Provide material that complies with **subsection 2212.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

c. Provide personnel and equipment to apply manufacturer supplied material from the lots tested above to the test deck selected by the KDOT.

d. The material will be evaluated for compliance with all requirements of this specification, and the manufacturer will be notified of the results. The Bureau of Materials and Research will maintain a list of qualified materials and installation instructions. Products will remain on the prequalified list as long as field performance is satisfactory and the results of verification testing are consistently acceptable. Report any changes in formulation to the Engineer of Tests for review and evaluation to determine if requalification is necessary.

### 2212.5 BASIS OF ACCEPTANCE

#### a. Thermoplastic Material.

- (1) Prequalification as required by **subsection 2212.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600** for each lot of material used.
- (3) Visual observation of performance on the project.

**b. Glass Beads for Drop-on Application.** Receipt and approval of a Type D certification as specified in **DIVISION 2600**

2213 - SPRAYED THERMOPLASTIC PAVEMENT MARKING MATERIAL

SECTION 2213

SPRAYED THERMOPLASTIC PAVEMENT MARKING MATERIAL

2213.1 DESCRIPTION

This specification covers thermoplastic materials suitable for use as retroreflecting pavement markings on asphalt pavement. The material is applied to the pavement in molten form by spray means. Glass beads are pre-mixed into the material furnished, and also dropped on the surface of the molten material immediately after it is applied to the pavement surface, at a rate specified. Upon cooling to normal pavement temperature, the material produces an adherent retroreflective marking of specified thickness and width, capable of resisting deformation by traffic.

2213.2 REQUIREMENTS

a. General.

- (1) Provide the material in white and/or yellow as specified.
- (2) Provide 100% solids thermoplastic material that is homogeneously composed of pigment, filler, resins and glass beads. The material must have a minimum binder content of 25% by mass composition and be free of foreign objects that would cause bleeding, staining, or discoloration. Upon heating to application temperature, the material will not exude fumes that are toxic, or injurious to persons or property.

b. Pigment.

- (1) Use high-grade titanium dioxide as the pigment for the white material. The material must contain a minimum of 10% titanium dioxide by mass.
- (2) Use heat resistant and colorfast yellows, golds, or oranges to produce a material to comply with color requirements.
- (3) Yellow pigments must comply with the latest OSHA standards for toxic heavy metals.
- (4) Use a filler consisting of white calcium carbonate, silica, or an approved substitute.

c. Glass Beads.

- (1) Pre-Mix Beads--Provide beads that are specifically manufactured to be compatible with the thermoplastic system, and comply with AASHTO M 247, Type I. The beads must be a minimum of 25% by mass of the thermoplastic material.
- (2) Drop-On Beads--Provide beads which are specifically manufactured to be compatible with the thermoplastic system, and comply with AASHTO M 247, Type I. The beads must have a moisture resistant coating and an adhesion coating.

d. Thermoplastic Material. Provide thermoplastic material that complies with the following:

- (1) Specific Gravity--2.0 maximum
- (2) Daylight Reflectance (Y)
  - (a) White—75% minimum
  - (b) Yellow—42% minimum
- (3) Color—For yellow, comply with the following minimum chromaticity coordinates:

TABLE 2213-1: CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

Yellow lines must display a nighttime presence of yellow when viewed under automobile headlights.

- (4) Retroreflectivity—Provide sprayed thermoplastic that meets the following minimum retroreflectivity requirements using an acceptable 30-meter retroreflectometer:

## 2213 - SPRAYED THERMOPLASTIC PAVEMENT MARKING MATERIAL

<b>Color</b>	<b>Millicandelas/sq m/lux (min.)</b>
White	300
Yellow	225

- (5) Softening Point--180°F minimum
- (6) Cracking Resistance at Low Temperature--No visible cracks when observed from a distance of one foot.

**e. Binder-Sealer.** When a binder-sealer is specified, provide one that is recommended by the manufacturer of the thermoplastic material, and apply it according to the manufacturer's instructions. The binder-sealer must be compatible with the pavement material, and form a tight bond between the pavement and the thermoplastic material.

**f. Verification Testing.** The Engineer will take verification samples of thermoplastic material from 1 lot of each color per project, using KT-30. Send the samples to MRC for testing and evaluation. Lots previously tested by MRC will be exempted from testing, and may be exempted from sampling if coordinated with MRC. The Engineer will take 2 one-quart samples of glass beads used on each project. Forward the sample to MRC for verification testing.

### 2213.3 TEST METHODS

**a. Thermoplastic Material.** Use AASHTO T 250 except for:

- (1) Softening Point-Heat the material for 4 hours  $\pm$  5 minutes at 375  $\pm$  2°F.
- (2) Cracking Resistance at Low Temperature-Heat the material for 4 hours  $\pm$  5 minutes at 375  $\pm$  2°F.
- (3) Glass Beads content. ASTM D 4797 and AASHTO T 247.
- (4) Titanium Dioxide. ASTM D 1394, Aluminum Reduction Method.

**b. Glass Beads for Drop-On Application.** AASHTO M 247.

**c. Field Evaluation.** KTMR-9, Field Evaluation of Pavement Marking Materials.

### 2213.4 PREQUALIFICATION

**a.** Manufacturers interested in prequalifying material under this specification must provide a 10-lb sample of each color to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Also include a copy of the quality control test report for each lot of material, material safety data sheets, and a complete set of installation recommendations and instructions. If the material complies with all laboratory requirements, the manufacturer will be contacted to arrange for the field evaluation.

**b.** Provide material that complies with **subsection 2213.2**. In addition, the following Field Evaluation will be conducted:

- **Field Evaluation.** The material will be subjected to traffic conditions on both portland cement and asphalt surfaces for 6 months during the period of July through February. During this time, the material cannot pick up and retain road grime that causes more than a slight graying of the surface. A strong contrast must remain between the striping material and the pavement surface. At the end of the evaluation period, the material must be intact with no evidence of lifting, curling, breaking or displacement. After 6 months, the material must maintain minimum retroreflectivity values of 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow.

Field evaluation may be waived if a complete field test has been performed on the identical product by another state department of transportation or AASHTO test facility that includes both hot and cold weather conditions, and was a minimum of 6 months in duration. Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification to the Engineer of Tests for evaluation.

## 2213 - SPRAYED THERMOPLASTIC PAVEMENT MARKING MATERIAL

c. Provide personnel and equipment to apply manufacturer supplied material from the lots tested above to the test deck selected by the KDOT.

d. The material will be evaluated for compliance with all requirements of this specification, and the manufacturer will be notified of the results. The Bureau of Materials and Research will maintain a list of qualified materials and installation instructions. Products will remain on the prequalified list as long as the results of verification testing and field performance are satisfactory. Any changes in formulation should be reported to the Engineer of Tests for review and evaluation to determine if requalification is necessary.

### 2213.5 BASIS OF ACCEPTANCE

#### a. Thermoplastic Material.

- (1) Prequalification as required by **subsection 2213.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600** for each lot of material used.

b. **Glass Beads for Drop-on Application.** Receipt and approval of a Type D certification as specified in **DIVISION 2600**.

c. **Binder-Sealer.** If binder-sealer is required, it will be accepted based on brand name as recommended by the thermoplastic material manufacturer, and visual observation of performance in the field.

**2214 - EPOXY PAVEMENT MARKING MATERIAL**

**SECTION 2214**

**EPOXY PAVEMENT MARKING MATERIAL**

**2214.1 DESCRIPTION**

This specification covers epoxy resin and glass beads suitable for use as reflective pavement markings on portland cement concrete or asphalt pavement.

**2214.2 REQUIREMENTS**

**a. Epoxy Pavement Marking Material.**

(1) General. Provide an epoxy resin material that is toxic heavy metal free, 2-component, 100% solids, and is formulated and tested to perform as a pavement marking material with glass beads applied to the surface. The 2 components are an epoxy resin and an amine curing agent. Provide complete manufacturer's specifications and material safety data sheets to the Engineer for all material provided.

Provide a material that does not exude toxic fumes when heated to application temperature.

Provide a material that, when mixed in the proper ratio and applied at 0.02 inch wet film thickness at 75°F with the proper saturation of glass beads, has a no tracking time of less than 40 minutes for slow curing material and less than 10 minutes for rapid curing material. Provide a material that is capable of fully curing under a constant surface temperature of 32°F or above.

(2) Properties of Cured Material.

(a) Color. Provide white and yellow material that complies with the following Daylight Reflectance values:

<b>TABLE 2214-1 DAYLIGHT REFLECTANCE</b>	
<b>Color</b>	<b>45 Degrees-0 Degrees, % Min.</b>
White	75
Yellow	45

Provide yellow that complies with the following minimum chromaticity coordinates:

<b>TABLE 2214-2: CHROMATICITY COORDINATES</b>								
<b>COLOR</b>	<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>	
	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>
Yellow	0.461	0.445	0.476	0.424	0.520	0.450	0.495	0.475

(b) Retroreflectivity. Provide epoxy pavement marking material that meets the following minimum retroreflectivity requirements using an acceptable 30-meter retroreflectometer:

<b>TABLE 2214-3: EPOXY RETROREFLECTIVITY REQUIREMENTS</b>	
<b>Color</b>	<b>millicandelas/sq m/lux (min.)</b>
White	325
Yellow	250

(c) Hardness. Provide material with Shore D hardness of 75 minimum.

(d) Bond Strength to Concrete. Provide material that when catalyzed, has such a high degree of adhesion to the specified concrete surface that there is a 100% concrete failure. Apply the material at a film thickness of 0.01 ± 0.001 inch to concrete with a minimum compressive strength of 4000 psi. Allow the material to cure for 72 hours at 77°F before the test is performed.

(e) Yellowness Index. White only. Value after 72 hours in QUV – 30 maximum when tested at 0.01 ± 0.001 inch and a 72-hour cure.

## 2214 - EPOXY PAVEMENT MARKING MATERIAL

(f) Field Evaluation. Field test materials at AASHTO NTPEP regional test facilities, which include both hot and cold weather conditions and are a minimum of 6 months in duration.

### **b. Glass Beads For Drop-On Application (double drop system).**

(1) For the first drop, provide large beads that are compatible with the epoxy system, and comply with AASHTO M 247 except with the following gradation:

<b>Sieve Size</b>	<b>Percent Passing</b>
No. 10	100
No. 12	95 - 100
No. 14	80 - 95
No. 16	10 - 40
No. 18	0 - 5
No. 20	0 - 2

(2) For the second drop, provide regular beads that are specifically manufactured to be compatible with the epoxy system, and comply with AASHTO M 247, Type I.

(3) Both types of beads are to be coated with a moisture resistant coating and an adhesion promoting coating that is compatible with the epoxy system.

**c. Verification testing.** The Engineer will take a ½-pint sample of each color and a ½-pint sample of the hardener from 1 lot per project. Send the samples to MRC for testing and evaluation. Lots previously tested will be exempted from testing and may be exempted from sampling if coordinated with MRC. Samples will be tested using infrared spectroscopy. Deviations as determined by comparison with the prequalification sample will be cause for removal from the prequalified list. The Engineer will also take (2) one-quart samples of each type of glass bead used on the project. Forward all samples to MRC for verification testing

### **2214.3 TEST METHODS**

**a. Bond Strength to Concrete.** AASHTO T 237

**b. Hardness.** ASTM D 2240

**c. Yellowness Index.** ASTM E 313

**d. Glass Beads.** AASHTO M 247, KTMR-8, “Moisture Resistance of Glass Beads for Traffic Markings,” and KTMR-17, “Adhesion Coating of Glass Beads for Traffic Markings.”

### **2214.4 PREQUALIFICATION**

**a.** Manufacturers interested in prequalifying material under this specification must provide a 1-quart sample of each color plus 1 quart of hardener to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Also include a copy of the quality control test report for each lot of material, an infrared spectroscopy analysis for each component if available, material safety data sheets and a complete set of installation recommendations and instructions. Forward an official copy of the AASHTO NTPEP test report along with evidence that the product in reference is identical to that submitted for prequalification.

**b.** The material will be evaluated for compliance with all requirements of this specification, and the manufacturer will be notified of the results. Each color and the hardener will be analyzed and “fingerprinted” using infrared spectroscopy for use in screening future verification samples to verify that materials submitted for use are of an identical formulation as originally approved.



## 2214 - EPOXY PAVEMENT MARKING MATERIAL

c. The Bureau of Materials and Research will maintain a list of qualified materials and installation instructions. Products will remain on the prequalified list as long as the results of verification testing and field performance are satisfactory. Any changes in formulation should be reported to the Engineer of Tests for review and evaluation to determine if requalification is necessary.

### 2214.5 BASIS OF ACCEPTANCE

#### a. Epoxy Material.

- (1) Prequalification as required by **subsection 2214.4**.
- (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600**.
- (3) Visual observation of performance on the project.

b. **Glass Beads for Drop-on Application.** Receipt and approval of a Type D certification as specified in **DIVISION 2600**.

## 2215 - TRAFFIC LINE PAINT

### SECTION 2215

#### TRAFFIC LINE PAINT

##### 2215.1 DESCRIPTION

This specification covers traffic line paint and glass beads suitable for use as retroreflective pavement markings on portland cement concrete or asphalt pavement.

##### 2215.2 REQUIREMENTS

**a. Paint.** Use white or yellow paint that is specifically manufactured for use as traffic markings. The paint must comply with volatile organic compound (VOC) requirements, be lead and other toxic heavy metal free, and exhibit the following qualities:

- (1) Dry-Opacity: A contrast ratio of not less than 0.96 when the paint is applied with a 0.012 inch film applicator.
- (2) Daylight Reflectance: Daylight Reflectance of the white paint not less than 80% relative to magnesium oxide.
- (3) Color: Yellow color must meet the following minimum chromaticity coordinates:

COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

- (4) Bead Embedment: At least 90% of the glass beads must be embedded between 50 and 70%.

**b. Glass Beads for Traffic Line Paint:** Provide regular beads that are specifically manufactured to be compatible with the paint being used, and which comply with AASHTO M 247, Type I. Beads are to be coated with a moisture resistant coating and an adhesion promoting coating that is compatible with the paint being used.

**c. Verification Sampling and Testing.**

- (1) The Engineer will take 2 one-quart samples of each color of paint used on each project. Forward the sample to MRC for verification testing.
- (2) The Engineer will take 2 one-quart samples of glass beads used on each project. Forward the sample to MRC for verification testing.

##### 2215.3 TEST METHODS

**a. Paint.**

- (1) Dry Opacity. ASTM D 2805.
- (2) Daylight Reflectance. ASTM E 1347.
- (3) Bead Embedment. Apply paint to a Leneta plain white paper chart at a wet film thickness of 0.012 inch followed immediately by an application of glass beads (AASHTO M 247, Type I) dropped onto the surface of the paint. After drying for at least 24 hours observe the amount of bead embedment with a 30-power microscope.

**b. Glass Beads.** AASHTO M 247, plus

- (1) Moisture Resistance. KTMR-8, "Moisture Resistance of Glass Beads for Traffic Markings."

##### 2215.4 PREQUALIFICATION

None Required.

## 2215 - TRAFFIC LINE PAINT

### 2215.5 BASIS OF ACCEPTANCE

Acceptance of traffic line paint and glass beads will be made on the basis of Type D certifications as specified in **DIVISION 2600**, and visual inspection of performance and consistency on the job site.

**2216 - POLYMER-MODIFIED CEMENTITIOUS PAVEMENT MARKING MATERIAL**

**SECTION 2216**

**POLYMER-MODIFIED CEMENTITIOUS PAVEMENT MARKING MATERIAL**

**2216.1 DESCRIPTION**

This specification covers plural component, polymer-modified cementitious materials suitable for use as retroreflecting pavement markings integrated into portland cement concrete. Glass beads are pre-mixed into the material provided, and also dropped at a specified rate on the surface of the liquid material immediately after it is applied to the pavement. Upon curing, it produces an adherent retroreflective marking of specified thickness and width, capable of resisting deformation by traffic.

**2216.2 REQUIREMENTS**

a. Provide the material in white and yellow. The yellow must meet the following minimum chromaticity coordinates:

TABLE 2216-1: CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
YELLOW	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

b. Provide material that is a homogeneous blend of polymer-modified cementitious material, pigments, glass beads, and fillers.

**c. Glass Beads for Drop-on Application (double drop system).**

(1) For the first drop, provide large beads that are compatible with the cementitious material, and comply with AASHTO M 247 except with this gradation:

TABLE 2216-2: GLASS BEADS					
Percent Passing - Square Mesh Sieves					
No. 10	No. 12	No. 14	No. 16	No. 18	No. 20
100	95-100	80-95	10-40	0-5	0-2

(2) For the second drop, provide beads that are specifically manufactured to be compatible with the cementitious system, and comply with AASHTO M 247, Type 1.

(3) Coat both types of beads with a moisture resistant coating and an adhesion promoting coating that is compatible with the cementitious system.

d. Provide application equipment as recommended or approved by the marking manufacturer.

e. **Verification testing.** Verification samples are not required for the cementitious material. The Engineer will take 2 one-quart samples of glass beads used on the project. Forward all samples to MRC for testing.

**2216.3 TEST METHODS**

None required.

**2216.4 PREQUALIFICATION**

a. Successful performance on a KDOT test project.

## **2216 - POLYMER-MODIFIED CEMENTITIOUS PAVEMENT MARKING MATERIAL**

### **2216.5 BASIS OF ACCEPTANCE**

#### **a. Cementitious Material**

- (1) Material will be accepted on the basis of product name and manufacturer.
- (2) Receipt and approval of a Type C Certification as specified in **DIVISION 2600** for each lot of material used.
- (3) Visual observation of performance on the project.

**b. Glass Beads for Drop-on Application.** Receipt and approval of a Type D Certification as specified in **DIVISION 2600**.

**2217 - MULTI-COMPONENT LIQUID PAVEMENT MARKING MATERIAL**

**SECTION 2217**

**MULTI-COMPONENT LIQUID PAVEMENT MARKING MATERIAL**

**2217.1 DESCRIPTION**

This specification covers multi-component, liquid materials suitable for use as retroreflecting pavement markings on portland cement concrete or asphalt pavements\*. Glass beads or other reflective elements are dropped at a specified rate on the surface of the liquid material immediately after it is applied to the pavement surface. Upon curing, it produces an adherent retroreflective marking of specified thickness and width, capable of resisting deformation by traffic.

\*These can be modified urethanes, polyureas, methylmethacrylates, special epoxies or other applicable materials.

**2217.2 REQUIREMENTS**

a. Provide the material in white and yellow. For yellow, meet the following minimum chromaticity coordinates:

TABLE 2217-1: CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
YELLOW	0.461	0.445	0.476	0.424	0.520	0.450	0.495	0.475

b. Provide material that is a homogeneous blend of liquid resins, pigments, and fillers and is also free of lead and other toxic heavy metals.

c. Provide one of the above-mentioned liquid marking materials or a material as approved by the KDOT. The burden of proof of a product rests with the producer. Provide all supporting technical data, including test reports, field test data, etc. for consideration of the product.

d. Glass Beads For Drop-On Application (double drop system).

(1) For the first drop, provide large beads, which are compatible with the liquid system, and comply with AASHTO M 247 except with this gradation:

TABLE 2217-2: GLASS BEADS					
Percent Passing - Square Mesh Sieves					
No. 10	No. 12	No. 14	No. 16	No. 18	No. 20
100	95-100	80-95	10-40	0-5	0-2

(2) For the second drop, provide regular beads that are specifically manufactured to be compatible with the liquid system, and comply with AASHTO M 247, Type I.

(3) Coat both types of beads with a moisture resistant coating and an adhesion promoting coating that is compatible with the marking system.

(4) Other reflective media systems may be used with the approval of the KDOT.

e. **Verification testing.** Verification samples are not required for the liquid pavement marking materials. The Engineer will take (2) one-quart samples of glass beads used on the project. Forward all samples to MRC for testing.

**2217.3 METHODS OF TEST**

None required.

## 2217 - MULTI-COMPONENT LIQUID PAVEMENT MARKING MATERIAL

### 2217.4 PREQUALIFICATION

- a. Successful performance on a KDOT test project.
- b. The Bureau of Materials and Research will maintain a list of qualified materials. Products will remain on the prequalified list as long as field performance is satisfactory. Any changes in formulation must be reported to the Engineer of Tests for review and evaluation to determine if re-qualification is necessary.

### 2217.5 BASIS OF ACCEPTANCE

- a. **Multi-Component Liquid Material**
  - (1) Material will be accepted on the basis of product name and manufacturer.
  - (2) Receipt and approval of a Type C certification as specified in **DIVISION 2600** for each lot of material used.
  - (3) Visual observation of performance on the project.
- b. **Glass Beads/Reflective Elements for Drop-on Application.** Receipt and approval of a Type D certification as specified in **DIVISION 2600**.