

808-R-551 PERFORMANCE BASED PAVEMENT MARKINGS

(Revised 03-18-10)

The Standard Specifications are revised as follows:

SECTION 109, AFTER LINE 808, INSERT AS FOLLOWS:

(f) Pavement Traffic Markings, PTM

Quality adjustments will be calculated in accordance with 808.07

SECTION 801, BEGIN LINE 602, INSERT AS FOLLOWS:

(a) Temporary Pavement Marking Methods

Pavement markings shall be installed in accordance with 808.07 except that measurement of retro-reflectivity is not required by the Contractor and quality adjustments will not apply. All other performance measures shall apply.

SECTION 808, BEGIN LINE 1, DELETE AND INSERT AS FOLLOWS:

SECTION 808 – PAVEMENT TRAFFIC MARKINGS

808.01 Description

This work shall consist of furnishing and installing, or removing, pavement traffic markings and snowplowable raised pavement markers in accordance with the MUTCD, these specifications and as shown on the plans. Markings shall be installed as required unless written approval is obtained from the District Traffic Engineer to make modifications at specific locations.

MATERIALS

808.02 Materials

Materials shall be in accordance with the following:

Cones.....	801.08
Epoxy Multi-Component.....	921.02(c)
Glass Beads.....	921.02(e)
Preformed Plastic.....	921.02(b)
<i>Extended Warranty Preformed Plastic.....</i>	<i>921.02(b)</i>
Snowplowable Raised Pavement Markers.....	921.02(d)1
Thermoplastic.....	921.02(a)
Traffic Paint.....	909.05

A certification which shows the paint meets all IDEM and EPA regulatory requirements for VOC levels and lead, chromium or other heavy metals from the paint manufacturer shall be provided.

CONSTRUCTION REQUIREMENTS

808.03 General Requirements

Permanent pavement markings shall be placed on the surface course in a standard pavement marking pattern. Center lines shall be placed on two-way two-lane roads, lane

lines shall be placed on multi-lane divided roads, and both center lines and lane lines shall be placed on multi-lane undivided roads. ~~The markings shall be of the same material as the existing pavement markings or any durable pavement marking material.~~

The pavement shall be cleaned of all dirt, oil, grease, excess sealing material, excess pavement marking material and all other foreign material prior to applying new pavement traffic markings. New paint pavement markings may be placed over sound existing markings of the same color. New thermoplastic, preformed plastic, or epoxy multi-component markings may be applied over sound existing markings of the same a compatible type if permitted by manufacturer's recommendations, a copy of which shall be supplied to the Engineer prior to placement; otherwise, existing markings shall be removed in accordance with 808.10 prior to placement of the new markings. Removal of pavement marking material shall be in accordance with 808.10. The pavement surface shall be dry prior to applying pavement traffic markings.

SECTION 808, BEGIN LINE 131, DELETE AND INSERT AS FOLLOWS:

808.07 Pavement Marking Material Application, and Equipment, and Performance Requirements

All double line markings, such as a no passing zone or the center line of an undivided multi-lane roadway, shall be applied in one pass. *When a hand propelled machine is used, the single pass application of double line markings will not be required and control points shall be spaced at a maximum of 10 ft longitudinally.*

~~Stop lines and crosswalk lines for new or modernized traffic signal installations shall be durable pavement marking material. For this application, preformed plastic may be used on concrete if permitted by manufacturer's recommendations. However, for new or modernized traffic signal installation contracts with completion dates in winter months when conditions do not permit application of durable markings, traffic paint markings may be substituted with an appropriate unit price adjustment if approved by the Engineer.~~

Markings shall be installed in accordance with the manufacturer's recommendations, except that the minimum requirements stated herein shall also apply. Products specifically designed for application temperatures below the stated minimums herein are not required but may be used if approved by the Engineer. When directed, the Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals prior to beginning installation work, and no installation work shall begin prior to the Department's receipt of these manuals. These manuals shall become the property of the Department.

The markings shall be protected from traffic until dry to eliminate tracking.

The markings shall meet or exceed the following performance criteria:

1. *Color.*

The daytime and nighttime color of the applied markings shall be in accordance with ASTM D 6628 when determined in accordance with ASTM E 811 and E 1349.

2. *Durability.*

The pavement markings shall have a minimum resistance to wear of 97% in accordance with ASTM D 913.

3. Retro-reflectivity.

Contracts with 50,000 lft (15 000 m) or more of longitudinal paint line or 10,000 lft (3 000 m) or more longitudinal durable marking line shall have retro-reflectivity measured. Longitudinal lines shall meet required minimum initial and retained average retro-reflectivity measurements. All other contracts and markings shall meet the required longitudinal line minimum measurements and will be measured by the Department at the discretion of the Engineer, except that quality adjustments will not apply. Retained retro-reflectivity is the value at the time of the warranty expiration in accordance with 808.09 and will be measured by the Department at the discretion of the Engineer.

Retro-reflectivity testing equipment shall be furnished, calibrated, and operated in accordance with ITM 931. The markings shall be tested in a period of not less than 14 days to not more than 30 days after the materials are applied. The retro-reflectivity equipment shall remain the property of the Contractor. The measurement of retro-reflectivity shall be supervised or performed at all times by an operator trained and certified by the unit's manufacturer. A report as described in the ITM and including the specified test results and calculations shall be prepared and provided to the Engineer within 3 days of each day of testing.

Quality adjustments will be applied to the payment of markings which fail to meet the required minimum initial average retro-reflectivity values. The required minimum initial and retained average retro-reflectivity values for longitudinal line measured in mcd/m²/lx are as follows:

Material Type	White	Yellow	Quality Adjustment*	Retained White	Retained Yellow
Paint	≥ 250	≥ 175	1.00	n/a	n/a
Required Minimum	150 to 249	125 to 174	0.70		
Thermoplastic	≥ 300	≥ 200	1.00	200	150
Required Minimum	250 to 299	150 to 199	0.70		
Multi-Component	≥ 300	≥ 200	1.00	200	150
Required Minimum	250 to 299	150 to 199	0.70		
Preformed Plastic	≥ 300	≥ 200	1.00	200	150
Required Minimum	250 to 299	150 to 199	0.70		
Ext. Warranty Preformed Plastic	≥ 650	≥ 450	1.00	See 808.09.1	See 808.09.1
Required Minimum	550 to 649	350 to 449	0.70		

* Quality Adjustments do not apply to the retained retro-reflectivity values.

(a) Traffic Paint

1. Application

Standard dry and fast dry traffic paint shall be applied only when the pavement temperature is 40°F (5°C) or above.

Waterborne traffic paint shall be applied only when the *ambient air and pavement* temperature is 50° F (10°C) or ~~above~~ *higher and will remain 50° F (10°C) or higher for two hours after application. Standard dry or fast dry traffic paint will only be permitted between October 1 and the following April 30. Traffic paints which are not waterborne shall be applied only when the ambient air and pavement temperature is 40° F (5° C) or higher and will remain 40° F (5°C) or higher for two hours after application.*

The wet film thickness of the traffic paint shall be a minimum of 15 mils (380 µm). Painted lines and markings shall be immediately reflectorized by applying glass beads at a uniform minimum rate of 6 lb/gal. (0.7 kg/L) of traffic paint. *Only standard or modified standard beads shall be used for paint markings.*

~~Painted markings on newly constructed surfaces shall receive two applications of paint and glass beads. The second application shall be applied as soon as practical after the first application dries.~~

2. Equipment

Traffic paint shall be applied with a spray type machine capable of applying the traffic paint under pressure through a nozzle directly onto the pavement. The *truck-mounted* machine shall be equipped with the following: ~~an air blast device for cleaning the pavement ahead of the painting operation; a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; paint agitator(s); a control device to maintain uniform flow and application; an automatic device which will provide a broken line of the required length; and an automatic glass bead dispenser which is synchronized with the marking application. When fast drying traffic paint or waterborne traffic paint is used, the machine shall be capable of heating the paint to application temperatures in accordance with 909.05.~~

- a. *air blast device for cleaning the pavement ahead of the application;*
- b. *guide pointer to keep the machine on an accurate line;*
- c. *spray guns which can be operated individually or simultaneously;*
- d. *agitator(s) or recirculation system as appropriate;*
- e. *control device to maintain uniform flow and application;*
- f. *capability of heating the material to application temperatures;*
- g. *automatic device which will provide a line of the required pattern;
and*
- h. *automatic bead dispenser which is synchronized with the marking application.*

~~A brush or small hand propelled machine, designed for that purpose, may be used if approved to apply some painted markings. A brush may be used if approved to apply some markings.~~

3. Performance Requirements

The color and durability requirements shall be met for a minimum of 90 days after application.

Pavement marking segments which are found to have an average retro-reflectivity reading below the minimum required shall be re-stripped with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be re-stripped with no additional payment. The re-stripping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-stripped with no additional payment. Following each re-stripping, additional retro-reflectivity measurements shall be made with no additional payment. Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-stripped pavement markings shall be placed within ± 0.25 inches in width and ± 2.0 inches in length of the original placed markings. Re-stripping will not be permitted more than two times, after which removal and replacement of the markings will be required.

(b) Durable Pavement Marking Material

Durable pavement marking material consists of thermoplastic, preformed plastic, or epoxy multi-component markings.

1. Thermoplastic

a. Application

~~Thermoplastic marking material shall be used on asphalt pavements unless otherwise specified or directed. The pavement surface shall be primed with a binder material in accordance with the manufacturer's recommendations. Thermoplastic marking shall be applied in molten form by spray, conventional extrusion, or ribbon type extrusion airless spray when the pavement and ambient air temperatures is are 50°F (10°C) or above; or by ribbon type extrusion or spray when the pavement and ambient air temperatures are 60°F (16°C) or above. Heat bonded preformed thermoplastic may be used for transverse or message markings. The average final thickness of each 36 in. (910 mm) length of thermoplastic marking shall be no less than ~~3/32 in.~~ 90 mil (2.53 mm) nor more than ~~3/16 in.~~ 125 mil (3.2 mm). Immediately following the application of the thermoplastic markings, additional retro-reflectorization shall be provided by applying glass beads to the surface of the molten material at a uniform minimum rate of 68 lb/100 sq ft (23.9 kg/10 m²) of marking. Individual passes of markings shall not overlap or be separated by gaps greater than 1/4 in (6 mm) longitudinally.~~

b. Equipment

The ~~machine~~ equipment used for the spray application of thermoplastic markings shall consist of a kettle for melting the material and an applicator for applying the markings. All of the equipment required for ~~preheating~~ melting and applying the material

shall maintain a uniform material temperature within the *manufacturer* specified limits, without scorching, discoloring or overheating any portion of the material.

~~The~~ *A truck-mounted* machine shall be equipped with the following: an air blast device for cleaning the pavement ahead of the marking operation; a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; agitators; a control device to maintain uniform flow and application; an automatic device which will provide a broken line of the required length; and an automatic ~~glass~~ bead dispenser which is synchronized with the marking application.

A hand-propelled machine may be used to apply markings.

The equipment for applying heat bonded preformed plastic shall be in accordance with the manufacturer's recommendations. An open flame shall not come into direct contact with the pavement.

c. Performance Requirements

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be removed and replaced with no additional payment.

2. Preformed Plastic and Extended Warranty Preformed Plastic

a. Application

~~The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals prior to beginning installation work. No installation work shall begin prior to the Department's receipt of these manuals. These manuals will become the property of the Department.~~

The installation method for extended warranty preformed plastic markings shall be the overlay method for PCCP and the inlay or overlay method for HMA. The overlay method is defined as placement of preformed plastic markings on the finished pavement surface. The inlay method is defined as placing preformed plastic markings on newly placed HMA immediately prior to the last roller pass. The pavement shall be grooved prior to the placement using the overlay method. This groove shall not exceed 110 mils (3 mm) in depth or one inch (25 mm) wider than the pavement marking to be placed. The equipment used for grooving shall not damage pavement joints.

For non-extended warranty preformed plastic, the overlay installation method is acceptable for both HMA and PCCP pavements, and no grooving is required.

~~Preformed plastic~~ *The markings shall be applied when the air temperature is a minimum of 60°F (16°C) and rising, and the pavement temperature is a minimum of 70°F (21°C). Preformed plastic* *The markings shall not be applied if the ambient air temperature is expected to drop to below 4540°F (74°C) within 24 h after application. The pavement surface shall be primed with a binder material in accordance with the*

manufacturer's recommendations. ~~The pavement surface shall be primed prior to the placement of preformed plastic transverse markings.~~

If there is a dispute regarding installation, the manufacturer shall provide a ~~properly~~ trained representative to ensure that the installation is *properly* performed ~~in accordance with the manufacturer's recommendations.~~

b. Equipment Performance Requirements

~~The equipment for applying preformed plastic, furnished in rolls, shall be a portable hand propelled machine capable of carrying and applying at least two rolls of 4 in. (100 mm) to 16 in. (50 mm) widths. The machine shall be equipped with a guide pointer to keep the machine on an accurate line. The machine shall also be equipped with guide rollers and a pressure roller. The pressure roller may be a separate unit. The machine shall feed the marking material from its original carton through the guide rollers and under the pressure roller onto the pavement. The pressure roller shall be a minimum of 2 in. (50 mm) wider than the width of the marking material and shall weigh a minimum of 200 lb (91 kg). The machine shall also be capable of removing the backing paper from the marking material during the application process. Preformed plastic furnished in strip, symbol, or legend form shall be applied with suitable equipment such as hand rollers.~~

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be removed and replaced with no additional payment.

3. Epoxy Multi-Component

a. Application

~~Epoxy shall be used on portland cement concrete pavement unless otherwise specified or directed.~~ This material shall be applied only when the pavement *and ambient air* temperatures *isare* 40°F (5°C) or above. The wet film thickness of the epoxy marking material shall be a minimum of ~~4520~~ *380510* mils (μm). Immediately following the application of the epoxy markings, additional reflectorization shall be provided by applying glass beads to the surface of the wet marking at a uniform *minimum* rate of 20 lb/100-sq-ftgal ($9.82.4 \text{ kg}/40\text{-m}^2\text{L}$) of marking.

b. Equipment

The machine used to apply the epoxy marking material shall precisely meter ~~the two each~~ components, *and* produce and maintain the necessary mixing head temperature within the required tolerances, ~~all in accordance with the manufacturer's recommendations.~~ The machine shall be equipped with a high pressure water blast device ahead of a high pressure air blast device, both as an integral part of the gun carriage, for cleaning the pavement ahead of the marking application *in accordance with 808.07(a)2*. ~~The machine shall also be equipped with the following: a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; an automatic device which will provide a broken line of the required~~

~~length; and automatic glass bead dispensers which is synchronized with the marking application.~~

c. Performance Requirements

Pavement marking segments which are found to have an average retro-reflectivity reading below the required minimum shall be re-stripped with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be re-stripped with no additional payment. The re-stripping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-stripped with no additional payment. Following each re-stripping, additional retro-reflectivity measurements shall be made with no additional payment. Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-stripped markings shall be placed within ± 0.25 inches in width and ± 2.0 inches in length of the original placed markings. Re-stripping will not be permitted more than two times, after which removal and replacement of the markings will be required.

SECTION 808, BEGIN LINE 328, DELETE AND INSERT AS FOLLOWS:

808.09 Warranty for Durable Pavement Marking Material

Durable pavement marking material shall be warranted against failure resulting from material defects, method of application, *or the result of snowplowing and deicing activities*. The material shall be warranted to retain its color, retro-reflectivity, ~~adherence to the pavement~~ *durability* and shall be free of other obvious defects or failures.

All pavement traffic markings which have failed to meet the warranted conditions shall be replaced with no additional payment.

For the terms of the warranty a unit shall be defined as a 1,000 ft (~~305~~ 300 m) section of line of specified width in any combination or pattern.

The warranty period shall be 180 days beginning with the last working day for the total contract as defined in the final acceptance letter, but not prior to November 1 of the calendar year in which the last pavement markings were installed. If more than 3% of a unit or 3% of the total of any one intersection or set of transverse markings fails, the failed portion shall be replaced. All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

808.09.1 Extended Warranty for Preformed Plastic Pavement Marking Material

Extended warranty markings shall be warranted for a period of two years beginning with the last working day for the total contract as defined in the final acceptance letter. The markings will be subject to snowplowing and deicing chemicals. The material shall be warranted to retain its color, retro-reflectivity, and durability and shall be free of other obvious defects or failures.

For the terms of the warranty a unit shall be defined as a 1,000 ft (300 m) section of line of specified width in any combination or pattern.

The retained retro-reflectivity (mcd/m²/lx) as determined by ITM 931 shall meet or exceed the minimum values at all times during the warranty period as follows:

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<i>Year</i>	<i>White</i>	<i>Yellow</i>
<i>1</i>	<i>400</i>	<i>300</i>
<i>2</i>	<i>300</i>	<i>200</i>

When a unit of markings is found to have an average retro-reflectivity reading below the required value, the entire unit of markings shall be removed and replaced. If more than 5% of a unit of markings fails due to color or durability, the entire unit shall be removed and replaced.

All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

SECTION 808, BEGIN LINE 402, INSERT AS FOLLOWS:

(d) Installation

Marker installation shall be in accordance with the manufacturer's recommendations. The pavement surface temperature and the ambient *air* temperature shall be at least 50°F (10°C). The pavement surface shall be dry at the time of marker installation. The installation slot shall be clean and dry before the adhesive is applied. The slot shall be filled with sufficient adhesive to provide a water tight seal between the marker base and the pavement, and to fill all voids between the marker base and the surfaces of the slot. The marker shall be placed in the slot so that the tips of the snowplow deflecting surfaces are below the pavement surface.

SECTION 808, BEGIN LINE 422, DELETE AND INSERT AS FOLLOWS:

(e) Removal of Markers

Markers designated for removal shall be as located on the plans or as otherwise specified or directed. If the pavement surface or bridge deck surface is to be removed, the markers shall be removed prior to any surface removal operation.

The markers shall be removed with a jack hammer or other approved equipment. ~~Care shall be taken so as not to damage the marker base during its removal.~~ The area of the pavement or bridge deck disturbed by the marker removal shall not exceed 3 in. (75 mm) in depth nor 3 in. (75 mm) out from all sides of the marker base. The marker removal operation shall stop if it is determined that excessive damage is occurring to the pavement, ~~or bridge deck or marker base.~~

The resulting holes shall be filled with the appropriate patching material as described herein or as otherwise directed. Concrete pavement which is to be overlaid as part of the contract and HMA pavement shall be patched with HMA intermediate materials. Concrete pavement which is not to be overlaid as part of the contract and concrete bridge decks shall be patched with magnesium phosphate concrete patching material. Overlaid bridge decks and bridge decks which are to be overlaid as part of the contract shall be patched with patching material which is compatible with the deck overlay material. All patching material shall be placed in accordance with the appropriate specifications for the patching material.

Removed markers shall ~~remain~~ *become* the property of the ~~Department unless otherwise specified~~ *Contractor and removed from the jobsite prior to the completion of the work.*

~~Removed snowplowable raised pavement markers shall be delivered to the District Traffic Division. The markers shall be delivered in 55 gal. (210 L) metal containers with lids which may be sealed. The metal containers shall be furnished either by the Contractor or by the District Traffic Division as specified in the contract. Approximately 50 markers shall be placed in each container. Each container shall be labeled as to how many markers it contains.~~

~~All metal containers used for delivering removed markers will remain the property of the Department when no longer required for the contract.~~

SECTION 808, BEGIN LINE 472, DELETE AS FOLLOWS:

Transverse marking lines will be measured as the total distance in linear feet (meters) of lines placed or removed. Curb markings will be measured by the linear feet (meters) along the front face of the curb. ~~The “No Parking Any Time” sign will be measured in accordance with 802.~~ Pavement message markings will be measured by the total number of each type placed. A railroad crossing pavement message marking shall include the two R’s, the X, and the three stop lines per traffic lane. Railroad crossing pavement message markings will be measured by the total number of each marking place. Lane indication arrow pavement message markings will be measured by the number of lane indication arrowheads placed. Removal of pavement message markings will be measured in square yards (square meters) using areas shown in the following table. The material will not be considered when measuring such markings for pavement.

SECTION 808, BEGIN LINE 510, DELETE AND INSERT AS FOLLOWS:

808.13 Basis of Payment

Lines and transverse markings placed will be paid for at the contract unit price per linear foot (meter) for the material, type, color, and width specified. Curb markings will be paid for at the contract unit price per linear foot (meter) for curb painting, of the color specified. ~~The “No Parking Any Time” sign will be paid for in accordance with 808.13.~~ Pavement message markings placed will be paid for at the contract unit price per each, for the material and message specified. Lines and transverse markings removed will be paid for at the contract unit price per linear foot (meter). Pavement message markings removed will be paid for at the contract unit price per square yard (square meter).

Snowplowable raised pavement markers, furnished and installed, or removed will be paid for at the contract unit price per each. Prismatic reflectors will be paid for at the contract unit price per each. ~~e~~Each 2-way prismatic reflector will be paid for as one reflector.

Payment for furnishing, calibrating, and operating retro-reflectivity testing equipment will be paid for at the contract price for lump sum. The cost of report preparation shall be included in the cost of retro-reflectivity testing. Adjustments to the contract payment with respect to retro-reflectivity of performance based pavement markings will be included in a quality adjustment in accordance with 109.05.1. The Engineer may waive retro-reflectivity testing due to weather limitations. Retro-reflectivity

testing will be waived for markings applied after October 31 and before April 1. If retro-reflectivity testing is waived, no payment will be made for retro-reflectivity testing and no quality adjustment for retro-reflectivity will be made. If retro-reflectivity testing is not performed and is not waived by the engineer due to weather, no payment will be made for retro-reflectivity testing and payment for the marking items will be made at 0.70 of the required minimum level, per 808.07(c).

~~If no pay items are shown in the Schedule of Pay Items for the required permanent pavement markings, a change order will be executed.~~

Payment will be made under:

Pay Item	Pay Unit Symbol
Curb Painting, _____ color	LFT (m)
Line, _____, _____, _____, _____ in. (mm) material type color width	LFT (m)
Line, Remove	LFT (m)
Pavement Message Marking, _____, _____ material message	EACH
Pavement Message Marking, Remove	SYS (m2)
Prismatic Reflector.....	EACH
<i>Retro-Reflectivity Testing</i>	<i>LS</i>
Snowplowable Raised Pavement Marker.....	EACH
Snowplowable Raised Pavement Marker, Remove	EACH
Transverse Marking, _____, _____, _____, _____ in. (mm) material type color width	LFT (m)
Transverse Marking, Remove	LFT (m)

~~No additional payment will be made for the second application of traffic paint and glass beads as required in 808.07(a)1.~~

No additional payment will be made for the *removal and or* replacement of markings that fail to meet the *performance or* warranty conditions of 808.07 and 808.09.

~~The cost of metal containers for disposal of removed snowplowable raised pavement markers, if furnished by the Contractor, shall be included in the cost of other pay items. The cost of picking up and returning such metal containers, if furnished by the District Traffic Division, shall be included in the cost of other pay items.~~

~~The cost of delivering removed and packaged snowplowable raised pavement markers to the designated location shall be included in the cost of transportation of salvageable materials.~~

The cost of removal of existing prismatic reflectors shall be included in the cost of prismatic reflectors.

~~Glass beads~~, binder material for thermoplastic and preformed plastic, adhesive for snowplowable markers, patching material for snowplowable marker removal, pavement cleaning *and surface preparation*, ~~removal of excess or loose existing pavement marking material, where new pavement markings are being placed in the same location,~~ and all necessary incidentals shall be included in the cost of the pay items.

The cost of grooving prior to placing extended warranty preformed plastic shall be included in the cost of the pay item.

SECTION 921, BEGIN LINE 1, DELETE AND INSERT AS FOLLOWS:

SECTION 921 – PAVEMENT MARKING MATERIALS

921.01 ~~Traffic Paint~~ Blank

~~Traffic paint shall be in accordance with 909.05.~~

921.02 Durable Marking Material

Durable marking material shall be thermoplastic, preformed plastic, or 100% ~~solids epoxy multi-component pavement markings~~. *The materials shall not contain any toxic heavy metals above the limits of the regulatory levels of 40 CFR 261.24, table 1, when tested in accordance with EPA TCLP, or contain any other material which will require characterization as a hazardous waste when removed from the pavement surface.*

(a) Thermoplastic

This material shall be in *solid form* in accordance with AASHTO M 249 *or supplied in a preformed state and shall not contain lead chromate pigments.*

Heat bonded preformed thermoplastic shall be in accordance with AASHTO M 249 with the exception of the application properties outlined in section 5 of AASTHO M 249 shall not apply. Drying time and short term and long term flowability requirements are not applicable at time of installation. The material shall be capable of fusing to itself and previously applied thermoplastic pavement markings when heated. The material shall contain a minimum of 30% beads by weight. The beads must be homogeneously blended throughout the material. The marking thickness throughout its width, before the material is heated up, shall be supplied at a minimum average thickness of 90 mils (2.3 mm).

(b) Preformed Plastic and Extended Warranty Preformed Plastic

This material shall consist of a homogeneous preformed plastic film with a ~~minimum thickness of 60 mils (1.5 mm) and a width as specified. The preformed plastic material shall have a precoated adhesive and an easily removable backing which shall protect the adhesive in storage and facilitate rapid application. The adhesive shall allow the preformed plastic material to be repositioned on the pavement surface to which it is applied before permanently fixing it in its final position with downward pressure.~~ *Dimensional requirements shall meet one of the following:*

1. *Preformed plastic material shall have a smooth plane surface, with a minimum thickness of 60 mils (1.5 mm) throughout the entire cross section, or*

2. *Preformed plastic material shall have an embossed patterned surface with 35% to 65% of the surface area raised. The edges of the raised areas shall present a near vertical face to traffic from any direction. The minimum thickness of the raised area shall be 60 mils (1.5 mm). The area between the raised areas shall be a minimum of 20 mils (0.5 mm) measured at the thinnest section of the cross section.*

The material shall have a precoated adhesive. The adhesive shall allow the preformed plastic material to be repositioned on the pavement surface to which it is applied before permanently fixing it in its final position with downward pressure.

The plastic material shall be capable of being affixed to either HMA or PCCP by means of the precoated adhesive and, following the initial application of pressure, shall mold itself to pavement contours, breaks, and faults by traffic action at normal pavement temperatures.

The near vertical faces of patterned preformed plastic shall be coated with a layer of beads.

A type C certification in accordance with 916 shall be furnished for the marking materials except materials used for temporary pavement markings.

SECTION 921, DELETE LINES 27 THROUGH 81.

SECTION 921, AFTER LINE 82, DELETE AND INSERT AS FOLLOWS:

21. Packaging

Each package shall be marked to indicate the color of the material, specific symbol or word message, the batch number, the manufacturer's name, address, and the date of manufacture.

32. Basis For Use

A type C certification in accordance with 916 shall be furnished for the preformed plastic material except materials used for temporary pavement markings.

(c) ~~100% Solids Epoxy Multi-Component~~

~~This material shall be a two component material. Component A shall consist of pigment and epoxy resins formulated as set out by the manufacturer. The mixing ratio for the two components of the material shall be as recommended by the material manufacturer. This ratio shall not vary more than $\pm 2\frac{1}{2}\%$ during the mixing operation or the application procedures of these materials.~~

The material shall be for use on both HMA and PCC pavements. The material shall consist of a pigmented resin system of epoxy. The multi-component pavement markings shall be ultra-violet light resistant and shall not darken during the heating conditions of application, chalk, crack, show appreciable degradation or discoloration due to sunlight exposure and aging of the markings. The cured multi-component pavement markings shall be impervious to salts, grease, oil, fuels, acids, alkalies and other common chemicals that may be found in or on HMA and PCC pavements. The

pigment in the white material shall contain titanium dioxide in accordance with ASTM D 476.

The material shall be provided in containers, which are in accordance with current Federal DOT regulations. Each container shall be labeled in accordance with 29 CFR 1910.1200 and include the trade name or trade mark, formulation or product identification, date of manufacturer, color, batch or lot number, component identification and mixing instructions.

SECTION 921, DELETE LINES 99 THROUGH 186.

SECTION 921, AFTER LINE 188, DELETE AND INSERT AS FOLLOWS:

4. Basis For Use

~~Multi-component Ppavement marking material, except glass beads and material used for temporary pavement markings, furnished under this specification shall be covered by a type A C certification in accordance with 916. A type A certification shall be furnished for each batch supplied. The material manufacturer shall perform all tests included elsewhere herein on each batch and shall provide these test results as part of the type A certification.~~

~~(d) Raised Pavement Marker~~

~~The raised pavement marker shall be either snowplowable, which is inset into the pavement, or temporary, which is affixed with adhesive to the pavement surface.~~

~~1. (d) Snowplowable Raised Pavement Marker and Cast Metal Base~~

~~Snowplowable raised pavement marker shall consist of a durable cast metal base to which is attached a replaceable prismatic retro-reflector for reflecting light longitudinally along the pavement from a single or from opposite directions. Both ends of the casting shall be shaped to deflect a snowplow blade upward.~~

~~The prismatic reflectors and cast metal bases shall be in accordance with ASTM D 4383. Only prismatic reflectors and cast metal bases from the Department's list of approved snowplowable pavement markers shall be used.~~

SECTION 921, DELETE LINES 206 THROUGH 327.

SECTION 921, AFTER LINE 328, DELETE AND INSERT AS FOLLOWS:

~~(8) Basis For Use~~

~~The prismatic reflector shall be covered by a type B certification in accordance with 916. A type B certification in accordance with 916 shall be furnished for the epoxy material.~~

~~2. Cast Metal Base~~

~~The base shall be a ductile iron casting made of modular iron in accordance with ASTM A 536, Grade 70-50-05 hardened to 52-54 RHC. The cast iron base shall be marked with the manufacturer's name and model number. The maximum dimensions shall be 2.00 in. (50 mm) high, 6 in. (152 mm) wide, and 10.0 in. (250 mm) long.~~

~~The exposed height of the casting after installation shall not exceed 0.50 in. (13 mm). The bottom of the casting shall have two parallel keels and a shaped web designed to fit into an accurately sawed, grooved slot in the pavement surface as shown on the plans.~~

a1. Epoxy Adhesive

The epoxy adhesive shall be in accordance with AASHTO M 237, type IV, Table 3 with respect to composition and performance. ~~For sampling purposes, a batch shall consist of a single charge of all components into a mixing chamber. A type B certification in accordance with 916 shall be furnished for the epoxy material.~~

SECTION 921, DELETE LINES 349 THROUGH 394.

SECTION 921, AFTER LINE 395, DELETE AND INSERT AS FOLLOWS:

(e) Glass Pavement Marking Beads

~~Glass beads shall be in accordance with AASTHO M 247, type I except sampling shall be in accordance with the frequency manual. The beads shall have a moisture resistant coating. A type C certification in accordance with 916 shall be furnished for the beads~~

1. Standard Beads

Beads shall be glass in accordance with AASHTO M 247, Type I. The beads shall have a moisture resistant coating.

2. Modified Standard Beads

The modified standard beads shall be glass in accordance with AASHTO M 247, Type IM. These beads shall have a moisture resistant coating and may have an adhesion promoting coating.

3. Supplemental Beads

The supplemental beads shall be glass in accordance with AASHTO M 247 except the beads shall have a minimum roundness of 80 percent by weight and the gradation shall be as follows:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
<i>No. 10 (2.0 mm)</i>	<i>100</i>
<i>No. 12 (1.7 mm)</i>	<i>95 – 100</i>
<i>No. 14 (1.4 mm)</i>	<i>80 – 95</i>
<i>No. 16 (1.18 mm)</i>	<i>10 – 40</i>
<i>No. 18 (1.0 mm)</i>	<i>0 – 5</i>
<i>No. 20 (850 μm)</i>	<i>0 – 2</i>

These beads shall have a moisture resistant coating and may have an adhesion promoting coating.

4. Supplemental Elements

These shall be for color, skid resistance, or wet weather retro-reflectivity and may be used provided they do not exhibit a characteristic of toxicity referenced in AASHTO M

247. A type D certification in accordance with 916 shall be furnished for the supplemental elements.
