

**Derry/Londonderry Exit 4A  
13065**

August 6, 2020

**SPECIAL PROVISION****AMENDMENT TO SECTION 632 -- RETROREFLECTIVE PAVEMENT MARKINGS****Item 632.712XX\_\_ - Grooved Retroreflective Polyurea Pavement Marking, \_\_" Line**

*This special provision provides for polyurea pavement markings applied to a recessed pavement surface (within a groove). All provisions of Section 632, except as modified or changed below, shall apply.*

**Add** to Description:

**1.4** This work shall consist of furnishing and installing retroreflective liquid pavement markings, including grooving the pavement in accordance with this provision and in reasonably close conformance to the dimensions and lines shown on the plans or established by the engineer.

**1.5** The liquid marking material shall be applied by spray method onto asphalt cement concrete and Portland cement concrete surfaces. Following an application of retroreflective optics, and upon curing, the resulting marking shall be an adherent reflectorized stripe during dry and wet conditions of the specified thickness and width that is capable of resisting deformation by traffic.

**Add** to Materials:

**2.10 Polyurea material** shall be formed by the reaction of two components (Part A and Part B). The two components shall be formulated such that proper cure occurs when they are mixed at the manufacturer's specified ratio (e.g. 2:1, volumes of Part A to Part B respectively).

**2.10.1** At least one component shall be composed of secondary amines, pigments and fillers as needed to meet performance requirements of this specification.

**2.10.2** These films shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

**2.10.3** The white polyurea shall contain not less than 13% by weight rutile titanium dioxide pigment to ensure adequate opacity, hiding power and reflective properties.

06/25/2020

SSD: 03/17/11, 08/09/12, 04/04/14, 04/06/17

2 of 5

**2.10.4** The reflective media shall consist of composite optical elements and glass beads applied in two consecutive drops. The optical elements and beads shall be for drop-on application applied simultaneously with polyurea by pressurized or mechanical means. The optical elements shall be a composite consisting of an outer layer of microcrystalline ceramic beads partially embedded into composite cores and colored to match the respective line color to provide high performance wet reflectivity. The glass beads shall conform to ASTM M247, except beads retained on a 30 sieve or larger shall have a roundness of minimum 80% true spheres as determined by ASTM D1155 or AASHTO PP-74 and beads shall have gradation meeting Missouri Specification Type P or Utah Specification 02765 for longitudinal lines (18/50). Reflective media shall be selected and applied at application rates specified by the material manufacturers such that, when placed in combination, the resultant markings shall meet the requirements of this section.

### **2.10.5 Performance Requirements.**

**2.10.5.1 Color.** The liquid-applied markings shall consist of white and yellow films with pigments selected and blended to conform to standard highway colors.

**2.10.5.2 Color and Weathering Resistance.** The mixed polyurea compound, both white and yellow, when applied to a 3" x 6" aluminum panels at 15±3 mil in thickness with no glass beads and exposed for 500 hours in a Q.U.V. Environmental Testing Chamber, as described in ASTM G-154, Cycle #1, shall conform to the following minimum requirements. The color of the white polyurea system shall not be darker than Federal Standard No. 595A-17778. The color of the yellow polyurea system shall be reasonably close to Federal Standard No. 595A-13538.

**2.10.6 Skid Resistance.** The surface of the retroreflective marking shall provide an initial average skid resistance value of 45 BPN when tested according to ASTM E303.

**2.10.7 Dry Time (Laboratory).** When tested in accordance with ASTM D-711 the polyurea marking material shall reach a track-free condition in 7 minutes or less at 15 mils with no retroreflective material.

**2.10.8 Dry Time (Field).** When installed at 77° F, at a wet film thickness of 25-30 mils and reflectorized with optical elements and glass beads, the polyurea markings shall reach a no-track condition in less than 6 minutes. Dry to "no-tracking" shall be considered as the condition where no visual deposition of the polyurea marking to the pavement surface is observed when viewed from a distance of 50 feet, after a traveling vehicle's tires have passed over the line.

**2.10.9 Adhesion to Concrete.** The polyurea pavement marking materials, when tested according to ACI Method 503, shall demonstrate 100% concrete failure in the performance of this test. The prepared specimens shall be conditioned at room temperature (75° ± 2° F) for a minimum of 24 hours and maximum of 72 hours prior to the performance of the tests indicated.

**2.10.10 Adhesion to Asphalt.** The polyurea pavement marking materials, when tested according to ACI Method 503, shall demonstrate 100% asphalt failure in the performance of this test. The prepared specimens shall be conditioned at room temperature (75° ± 2° F) for a minimum of 24 hours and maximum of 72 hours prior to the performance of the tests indicated.

06/25/2020

SSD: 03/17/11, 08/09/12, 04/04/14, 04/06/17

3 of 5

**2.10.11 Hardness.** The material shall have a minimum Shore D Hardness of between 70 and 100 when tested in accordance with ASTM D 2240

**2.10.12 Abrasion Resistance.** The material shall have a maximum abrasion resistance of 150 mg at  $15 \pm 1$  mil ( $0.375 \pm 0.025$  mm) when tested in accordance with ASTM D-4060.

**2.10.13 Certificate of Compliance.** The Contractor shall furnish a certificate of compliance showing the Polyurea material conforms to all requirements of this specification.

**Add** to Construction Requirements:

### **3.7 Polyurea Retroreflective Pavement Marking.**

**3.7.1 Equipment.** Polyurea marking equipment shall be a truck mounted, self-contained pavement marking machine, specifically designed for the application of the polyurea and reflective media in accordance with the material manufacturers recommendations in continuous and skip-line patterns. The marking equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in true arc. At any time throughout the duration of the project, the Contractor shall provide free access to the polyurea marking equipment for inspection by the Engineer.

**3.7.1.1** The marking equipment shall be equipped with integral electronic material data logging equipment, properly calibrated and functioning, to continuously monitor and record application rates of the various components of marking materials (liquids and optics), locations, line lengths and patterns, and ambient and dynamic conditions such as velocity, air temperature, humidity, surface temperature.

**3.7.1.2** At any time throughout the duration of the project, the Contractor shall provide free access to his application equipment for inspection by the Engineer, his authorized representative, or the materials representative.

**3.7.2 Weather Limitations.** Polyurea markings shall only be applied during conditions of dry weather and subsequently dry pavement surfaces. At the time of installation, the pavement surface temperature and the ambient temperature shall be above 32° F. The Engineer shall determine the atmospheric conditions and pavement surface conditions that produce satisfactory results.

**3.7.3 Surface Preparation.** At the time of Polyurea application all pavement surfaces shall be free of moisture, oil, dirt, dust, grease and similar foreign materials. In addition, concrete curing compounds on new Portland cement concrete surfaces and existing pavement markings on both concrete and asphalt surfaces shall be removed. The Contractor shall clean the pavement surface to the satisfaction of the Engineer and the Material Manufacturer.

**3.7.4 Retroreflectivity.** White and yellow markings shall meet the following initial dry and wet minimum retroreflectivity values as tested per ASTM E1710 for dry measurements and ASTM E2177 for wet recovery measurements and paragraph 3.2.8.

06/25/2020

SSD: 03/17/11, 08/09/12, 04/04/14, 04/06/17

4 of 5

MINIMUM AVERAGE RETROREFLECTIVITY (mcd/m<sup>2</sup>/lx)

	White	Yellow
Dry Retroreflected Luminance, R <sub>L</sub>	700	525
Wet Retroreflected Luminance, R <sub>L</sub> ,	275	225

**3.7.6 Application:** The pavement markings shall be applied at a minimum uniform wet thickness of 25 mils, except on bonded wearing course, the minimum uniform wet thickness shall be 30 mils.

**3.7.6.1** Using the application equipment, the pavement markings shall be applied in the following manner as a simultaneous operation:

**3.7.6.1.1** The grooved surface is air-blasted to remove any dirt and residues if present. See 3.7.8 for groove specifications.

**3.7.6.1.2** The resin, mixed and heated in accordance with the manufacturer's recommendations, is sprayed onto the pavement surface. The specified reflective media is dropped onto the liquid marking.

**3.7.7 Verification:** The Engineer may check application rates at convenient intervals by comparing the amount of material used to the lengths of pavement marking placed. The Engineer may also check application rates by use of a wet film thickness gauge or by reviewing dry thickness as measured on a test panel. Reflective media shall not be applied for testing polyurea application rates.

**3.7.7.1** Data logging equipment shall be operating continuously during markings application. Contractor shall provide to the Engineer daily application reports furnished by such data logging equipment to document and verify line lengths completed, material application rates and operating conditions. Contractor shall also furnish or provide full access to all project data recorded by the system in digital format such as Excel or delimited text files.

**3.7.8 Groove:** The Polyurea marking shall be placed in a groove with a minimum depth of 110 mils and a maximum depth of 120 mils. The groove width shall be 1 inch wider than the specified marking width. The waiting period after the final wearing course is placed before the groove can be cut shall be a minimum of 30 days, unless otherwise approved by the Engineer.

**3.7.8.1** Cutting blades shall be gang stacked diamond tipped or polycrystalline diamond (PCD). The spacers between each blade must be such that there is less than a 10 mil rise in the finish grade between the blades giving the finished surface a smooth appearance.

**3.7.8.2** Pavement shall be sufficiently dry during the grooving operation to prevent asphalt grindings from bonding together thereby preventing the groove from being cleaned completely.

**3.7.8.3** The edge of the groove shall not be closer than 2 inches from any pavement joint.

06/25/2020

SSD: 03/17/11, 08/09/12, 04/04/14, 04/06/17

5 of 5

**3.7.8.4** Contractor shall utilize truck mounted (minimum 26,000 GVW) grooving equipment for all longitudinal lines. The equipment shall be designed specifically for the grooving and removal of pavement. Grooving equipment shall be equipped with self-propelled drive systems and vacuum systems that are designed to, and capable of, picking up 80% or more of millings and debris from the roadway surface as determined by the Engineer. Equipment used must have the ability to properly dispose of the millings, either on to the gravel shoulder while in motion and/or to a dump truck vehicle, without the need to leave the traffic control package.