

STATE OF NEBRASKA
DEPARTMENT OF ROADS
ADDENDUM NO. 3
AND
ELECTRONIC BIDDING SYSTEM
AMENDMENT NO. 3
PROJECT NO. RD-680-9(1161)
CONTROL NO. 22263
CALL NO. 200
I-680, I-80 – FORT STREET, OMAHA
LETTING DATE: FEBRUARY 2, 2012

The Schedule of Items for Group 8 is amended as follows:

1. The bid item “5” White Wet Reflective Polyurea Pavement Marking, Grooved” is incorrect and should read 45,640.000 LF.
2. The bid item “7” White Preformed Contrast Pavement Marking, Type 4, Grooved” has been added with a quantity of 15,160.000 LF.

The EBS generated bid items sheets must show these corrections or the bid will be considered void.

The Special Provisions are amended to include the following:

7” White Preformed Contrast Pavement Marking, Type 4, Grooved

I. Description

This work shall consist of furnishing and installing retroreflective preformed patterned pavement markings in Contractor-installed grooves in accordance with this provision and in reasonably close conformance to the dimensions and lines shown on the plans and/or required by the engineer.

II. Materials - General

The preformed patterned markings shall consist of white films with clear microcrystalline ceramic beads incorporated to provide immediate and continuing retroreflection during both wet and dry conditions and a black preformed patterned film border, bonded to the edges to form a continuous roll. This film shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

The total width of the preformed contrast tape shall be an additional three inches wider than the standard width specified. This additional three inch width shall be a black non-reflective film with one and a half inches on both sides of the white film.

The preformed markings shall be capable of adhering to asphaltic cement concrete and Portland cement concrete by use of a pre-coated pressure sensitive adhesive. A

surface preparation adhesive may be used to precondition the pavement surface. The preformed markings shall conform to pavement contours by the action of traffic. The pavement markings shall be capable of application on new, dense and open-graded asphalt concrete wearing courses during the paving operation in accordance with the manufacturer's instructions. After application, the markings shall be immediately ready for traffic. The bidder shall identify proper surface preparation adhesives (where necessary) to be applied at the time of application, all equipment necessary for proper application, and recommendations for application that will assure effective product performance. The preformed markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

III. **Surface Preparation**

The grooves for tape widths equal to or less than 8 inches shall preferably be made in a single, dry-cut pass. However, alternate (multiple pass) methods may be used, provided they produce the desired result- a groove, the bottom of which has a fine corduroy or textured appearance, is of a uniform depth with no visible ridge(s), and does not significantly and obviously deviate from a plane. (If the tape manufacturer publishes any type of grooving and application guidelines, the Contractor shall provide the engineer with the most current information available prior to commencing work and make reference to it.)

The equipment and method used shall be approved by the tape manufacturer and shall leave the cut groove ready for tape installation. If self-vacuuming equipment is not used, the groove shall be immediately vacuumed

The pavement marking tape shall be placed in the grooves the same day the grooves are cut. Grooves shall be clean and dry prior to tape application. All conflicting pavement markings remaining after tape installation shall be removed; and this removal shall be subsidiary to the pavement marking.

Groove width: tape width + 1 inch to 2 inch max
Groove depth: per manufacturer's recommendations
Groove length: full length of tape + required grooving transition
Groove position: 2 inches off of joint line (per plan)

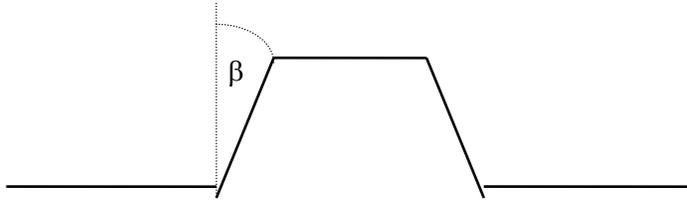
IV. **Classification**

The contrast marking shall consist of higher durable, retroreflective white pliant polymer materials with durable matte black, non-reflective pliant polymer borders. This material shall be designed for typical longitudinal pavement marking configurations such as lane lines, edge lines, and gore markings.

V. **Composition and Retroreflectivity Requirements**

Composition: The retroreflective pliant polymer pavement markings shall consist of a mixture of high-quality polymeric materials, pigments, and glass beads distributed throughout their base cross-sectional area, with a reflective layer of microcrystalline ceramic beads bonded to a durable polyurethane topcoat surface. The patterned surface shall have approximately 50% ± 15% of the surface area raised and presenting a near

vertical face (β angle of 0° to 60°) to traffic from any direction. (See diagram below.) The channels between the raised areas shall be substantially free of exposed beads or particles.



Retroreflectance: The white markings shall have the initial expected retroreflectance values as shown in Table 1 under dry, wet, and rainy conditions. The photometric quantity to be measured shall be coefficient of retroreflected luminance (R_L) and shall be expressed as millicandelas per square foot per foot-candle $[(\text{mcd} \cdot \text{ft}^{-2}) \cdot \text{fc}^{-1}]$. The metric equivalent shall be expressed as millicandelas per square meter per lux $[(\text{mcd} \cdot \text{m}^{-2}) \cdot \text{lx}^{-1}]$.

Retroreflectance values shall be measured under dry conditions in accordance with the testing procedures of ASTM D4061.

Table 1
Expected Initial R_L under

	White	Yellow
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retroreflected Luminance $R_L [(\text{mcd} \cdot \text{m}^{-2}) \cdot \text{lx}^{-1}]$	500	300

Note: The test instrument shall use an Entrance Angle of 88.76° and Observation Angle of 1.05° which represent a simulated driver viewing geometry at a 30 meter distance.

Beads: Index of Refraction: All “dry-performing” microcrystalline ceramic beads bonded to the polyurethane-coated, patterned surface of the material shall have a minimum index of refraction of 1.70 when tested using the liquid oil immersion method. The glass beads mixed into the pliant polymer shall have a minimum index of refraction of 1.5 when tested by the liquid oil immersion method.

Testing Procedure For Refractive Index of Beads By Liquid Immersion

Equipment Required:

1. Microscope (minimum 100X magnification)

2. Light source - preferably sodium light or other monochromatic source, but not absolutely essential
3. Refractive index liquids*
4. Microscope slide and slide cover
5. Mortar and pestle

*Available from R.P. Cargille Laboratories, Inc., Cedar Grove, NJ.

Procedure:

1. Using the mortar and pestle, crush a few representative beads and place a few of these crushed particles on a microscope slide.
2. Place a drop of a refractive index liquid, with an index as close to that of the glass as can be estimated, on the particles.
3. Cover the slide with a microscope slide cover and view the crushed particles by transmitted light normal to the slide surface (illuminated from the bottom).
4. Adjust the microscope mirror to allow a minimum light intensity for viewing. This is particularly important if sodium light is not used.
5. Bring a relatively flat and transparent particle into focus.
6. By slightly raising and lowering the objective (microscope tube), look for one or both of the following:
 - a. Becke Line - This light line will appear to move either into the particle or away from it. In general, if the objective is raised, the line will move toward the material of higher refractive index; if the objective is lowered, the line will move toward the material of lower index.
 - b. Variation in Particle Brightness - When raising the object from a sharp focus, the particle will appear to get brighter or darker than the surrounding field. If it becomes brighter, the glass has a higher refractive index than the liquid. If it becomes darker, the glass has a lower refractive index than the liquid. In both cases, the opposite will be true if the object is lowered.
7. This test can be used to confirm that the beads are above or below a specified index. It can also be used to give an accurate determination of the index (± 0.001). This is done by using several refractive index liquids until a match or near match of indices occurs. The index of the glass will equal that of the liquid when no Becke line and no variation in bead brightness can be observed.

The size and quality of the beads shall be such that the performance requirements for the retroreflective pliant polymer shall be met.

Acid Resistance: The beads shall show resistance to corrosion of their surface after exposure to a 1% solution (by weight) of sulfuric acid. The 1% acid solution shall be made by adding 5.7cc of concentrated acid into 1000cc of distilled water. **CAUTION:** Always add the concentrated acid into the water, not the reverse. The test shall be performed as follows:

Take a 1-inch x 2-inch sample, adhere it to the bottom of a glass tray and place just enough acid solution to completely immerse the sample. Cover the tray with a piece of glass to prevent evaporation and allow the sample to be exposed for 24 hours under these conditions. Then decant the acid solution (do not rinse, touch or otherwise disturb the bead surfaces) and dry the sample while adhered to the glass tray in a 150° F. (66° C.) oven for approximately 15 minutes.

Microscopic examination (20X) shall show no more than 15% of the beads having a formation of a very distinct opaque white (corroded) layer on their entire surface.

Color: The preformed markings shall consist of white film with pigments selected and blended to conform to standard highway colors.

Skid Resistance: The patterned surface of the retroreflective pliant polymer shall provide an initial average skid resistance value upon manufacturing of 45 BPN when tested according to ASTM E303 except values shall be taken in one direction and then at a 45° angle from that direction. These two values shall then be averaged to find the skid resistance of the patterned surface.

Patchability: The pavement marking material shall be capable of use for patching worn areas of the same type in accordance with manufacturer's instructions.

Thickness: The patterned material without adhesive shall have a minimum caliper of 0.065 inches (1.651mm) at the thickest portion of the patterned cross-section and a minimum caliper of 0.02 inches (.508mm) at the thinnest portion of the cross-section.



VI. **Installation**

The markings shall be applied in accordance with the manufacturer's installation instructions. Marking configurations shall be in accordance with the "Manual on Uniform Traffic Control Devices." Tape shall not be installed unless the surface and air temperatures are in compliance with the manufacturer's specifications.

VII. **Observation**

Following initial completion of all pavement marking, there will be a 180-day observation period before final acceptance. During the observation period, the contractor, at no expense to the Department of Roads, shall replace any markings that the Engineer determines are not performing satisfactorily due to defective materials and/or workmanship in manufacture and/or application. At the end of the observation period, the minimum required retention percentage for markings installed shall be 90%.

Determination of Percentage Retained - The percentage retained shall be calculated as the nominal area of the strip less the area of loss divided by the nominal area and expressed as a percentage of the nominal area. A claim, made by the State against the Contractor, shall be submitted to the Contractor in writing within 30 days after the 180 day observation period. When such a claim is made prior to August 1, the replacement material shall be installed during that same construction season. Replacement material for any claim after August 1, shall be installed prior to June 1, of the following year. Marking replacement shall be performed in accordance with requirement specified herein for the initial application, including but not limited to surface cleaning, sealer application, etc.

Final acceptance of all marking will include an inspection of the appearance of the markings during daylight and darkness. Any markings that fail to have a satisfactory appearance during either period, as determined by the Engineer, shall be reapplied at no expense to the Department of Roads.

Final acceptance of the pavement marking will be: (1) 180 days after the initial completion of all work, or (2) upon completion of all corrective work, whichever occurs last.

VIII. Contract Units And Basis For Payment

Subsection 423.01 of the 2007 Standard Specifications is amended to include the item: "7" White Preformed Contrast Pavement Marking, Type 4, Grooved". The price shall be full compensation for grooving the pavement surface, furnishing and installing all markings, and for all materials (including adhesive), labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
7" White Preformed Contrast Pavement Marking, Type 4, Grooved	Linear Foot

Upon execution of the contract, the plans will be revised to reflect these changes.

DEPARTMENT OF ROADS

Original Signed by Kendall Stege

For Claude Oie
Construction Engineer

Issued: January 27, 2012

CO:200AD302

NOTICE: Only the contractors issued bidding proposals receive this addendum and responsibility for notifying any potential subcontractors or suppliers remains with the contractor.