KANSAS DEPARTMENT OF TRANSPORTATION SPECIAL PROVISION TO THE STANDARD SPECIFICATIONS, 1990 EDITION

NOTE: This special provision is generally written in the imperative mood. The subject, "the Contractor" is implied. Also implied in this language are "shall", "shall be", or similar words and phrases. The word "will" generally pertains to decisions or actions of the Kansas Department of Transportation.

Create a new Subsection in Section 2200:

SECTION 2200

PRISMATIC RETROREFLECTIVE SHEETING

1.0 DESCRIPTION.

This material is flexible, colored, wide angle prismatic retroreflective sheeting.

2.0 REQUIREMENTS.

Provide retroreflective sheeting capable of being used to reflectorize any properly prepared, smooth, flat, plastic, wood, fiberglass, metal or enameled metal surface. The sheeting consists of prismatic lenses formed in a transparent colored resin, sealed and backed with a pressure sensitive adhesive protected by a removable liner. Make orientation marks visible from the face.

a. Pressure Sensitive Adhesive: Use a pressure sensitive adhesive which requires no heat, solvent, or other preparation for adhesion to smooth, dry, clean surfaces.

b. Liner. Completely cover the adhesive backing of the sheeting with a protective liner which can be easily removed without soaking in water or other solvents. During removal, the liner can not break or tear or remove the adhesive from the backing when tested according to ASTM D4956. Removal of the liner may cause no dimension change or defect in the sheeting.

c. Color. Prismatic retroreflective sheeting for Department use is white, yellow, red, orange, green or blue. The colors conform to the chromaticity limits as shown in Table I when tested as specified in ASTM D4956.

<table>
<thead>
<tr>
<th>Chromaticity Coordinates*</th>
<th>Reflectance</th>
</tr>
</thead>
</table>
d. **Uniformity.** The surface appearance of the sheeting must be uniform, with no streaks, discoloration or other condition that will cause the sheeting to show a nonuniform appearance when examined at a distance of 15 m, in daylight or under simulated nighttime viewing at a divergence angle of 0.2° in a light tunnel.

e. **Adhesive Backing.** The adhesive backing must produce sufficient bond to support an 800 g mass for five minutes without the bond peeling more than a distance of 50 mm with no delamination.

f. **Specular Gloss.** Provide sheeting which has a specular gloss reading of not less than 50 when measured with a 85° Gloss Meter according to ASTM D4956.

g. **Reflective Intensity.** Minimum reflective intensity values of the sheeting are specified in Table II. Determine the reflective values according to ASTM D4956.

<table>
<thead>
<tr>
<th>Color</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Limit Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>0.306</td>
<td>0.307</td>
<td>0.324</td>
<td>0.327</td>
<td>0.312</td>
<td>0.337</td>
</tr>
<tr>
<td>Yellow</td>
<td>.495</td>
<td>.440</td>
<td>.550</td>
<td>.446</td>
<td>.522</td>
<td>.487</td>
</tr>
<tr>
<td>Red</td>
<td>.611</td>
<td>.296</td>
<td>.682</td>
<td>.318</td>
<td>.660</td>
<td>.340</td>
</tr>
<tr>
<td>Orange</td>
<td>.583</td>
<td>.416</td>
<td>.523</td>
<td>.397</td>
<td>.562</td>
<td>.358</td>
</tr>
<tr>
<td>Green</td>
<td>.130</td>
<td>.369</td>
<td>.180</td>
<td>.391</td>
<td>.155</td>
<td>.460</td>
</tr>
<tr>
<td>Blue</td>
<td>.130</td>
<td>.100</td>
<td>.176</td>
<td>.120</td>
<td>.176</td>
<td>.180</td>
</tr>
</tbody>
</table>

* The four pairs of chromaticity coordinates determine the acceptable chromaticities on the CIE Chromaticity diagram.

h. **Shrinkage.** The sheeting may not shrink more than 800 µm in 10 minutes or more than 3 mm in 24 hours when tested according to ASTM D4956.

I. **Accelerated Weathering.** When subjected to 2200 hours of accelerated weathering, the sheeting must retain at least 60% of its original reflective intensity as measured at 0.2° divergence angle and -4° incidence angle and show "good" or better colorfastness when tested as in ASTM D4956. An exception to this would be orange or white sheeting to be used for construction work zone signs, barricades and channelizing drums. Subject these to 500 hours of accelerated weathering and comply with the requirements for reflective intensity and colorfastness as previously stated. Both types of sheeting may show no more than a 25% loss of specular gloss and
no evidence of cracking, peeling, pitting, orange peel, delamination, edge lifting or curling and no more than 800 µm of shrinkage or expansion of a 150 mm panel.

j. Field Durability Evaluation. This requirement applies only for orange or white sheeting to be used for construction work zone applications. Subject the material to actual construction work zone conditions for the period of one construction season. At the end of the evaluation period, the material cannot exhibit excessive cracking, peeling, pitting, delamination, edge lifting, or curling.

3.0 METHODS OF TESTS.

a. Adhesion Test. Bring the material to equilibrium at room temperature. Remove 100 mm of the liner by hand, note whether any of the liner breaks, tears or removes any adhesive from the binder. Apply 100 mm of one end of each specimen to a test panel according to manufacturer's directions. A hole may be punched in the end of the unapplied portion of the specimen for attaching the weight. Apply two of the pieces of sheeting to aluminum test panels with a chromate conversion coating meeting requirements of ASTM B449 Class 2. Apply the remaining two specimens to fiberglass panels. All panels will be 35 x 150 mm. Condition the panels at room temperature for 48 hours. Suspend the panels in a horizontal position with the specimen facing down. Attach an 800 g mass to the free end of each specimen and allow it to hang free at an angle of 90° to the panel surface for five minutes. At the end of the five minute period remove the weight, check the distance of peeling and check for delaminations. Failure of any one specimen constitutes failure of the test.

b. Accelerated Weathering Test. Accelerated weathering will be conducted in a twin arc ATLAS WEATHEROMETER operated according to ASTM G23, Apparatus D, with the following additions and exceptions:

(1) At the end of each 20 hour cycle the panels will be placed in a cold cabinet at -18±3 °C, for one hour. After removal from the cold cabinet, panels will be returned to the Weatherometer to await the start of the next cycle.

(2) Water used in the Weatherometer will be city water softened to a total hardness content of less than five parts per million expressed as calcium carbonate.

(3) After the required hours of exposure, the surface of the panels shall be washed with five percent HCl solution for 45 seconds, rinsed with distilled water and washed with a mild detergent solution, thoroughly rinsed with distilled water, blotted with a soft clean cloth and allowed to dry before completing tests.

c. Field Evaluation. Submit sufficient material to the Kansas Department of Transportation Sign Shop for fabrication into four 1.3 m and four 1 m construction work zone signs. Furnish the completed signs to a contractor for normal use during a construction season. At the end of the construction season, return the signs to the KDOT Sign Shop for evaluation.
4.0 PREQUALIFICATION.

Manufacturers desiring to furnish material under this specification must submit prequalification samples to the Engineer of Tests. Each color of sheeting covered by this specification will be prequalified individually. Each sample of sheeting consists of three pieces, 600 mm x 600 mm. Samples will be tested for compliance with all requirements of this specification.

If the prequalification samples of prismatic retroreflective sheeting comply with the requirements of this specification, the product will be placed on a list of prequalified products maintained by the Bureau of Materials and Research. Manufacturers will be required to requalify the product at five year intervals unless results of acceptance and verification testing indicate a need to re-evaluate the material earlier. Any change in the manufacturing process or the materials used, shall be reported to the Engineer of Tests, who will determine if requalification is necessary.

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.
5.0 Basis of Acceptance.

a. The basis of acceptance of prismatic retroreflective sheeting furnished under these specifications for permanent signs, is prequalification as outlined above, satisfactory results of tests conducted at the Materials and Research Center and visual inspection by the Engineer for condition. Each lot of sheeting will be sampled at destination by a representative of the Department, and tested for all physical properties under these specifications, except gloss, shrinkage and accelerated weathering.

b. Prismatic 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 prismatic retroreflective sheeting used to manufacture the signs was prequalified under this specification, and visual inspection by the Engineer for condition.

02-02-98  M&R(MT) (RTS)

90P129001  PRISMATIC RETROREFLECT SHEET PS (WHITE)  m²  90M-129-R*
PRQA
90P129002  PRISMATIC RETROREFLECT SHEET PS (YELLOW) m²  90M-129-R*  PRQA
90P129003  PRISMATIC RETROREFLECT SHEET PS (RED) m²  90M-129-R*  PRQA
90P129004  PRISMATIC RETROREFLECT SHEET PS (ORANGE) m²  90M-129-R*  PRQA
90P129005  PRISMATIC RETROREFLECT SHEET PS (BLUE) m²  90M-129-R*  PRQA