STIMSONITE MODEL 980

PERFORMANCE SPECIFICATION

GENERAL DESCRIPTION

Markers shall consist of durable all-thermoplastic housing. The housing shall have one or two glass covered prismatic retroreflecting lenses as required to reflect incident light from a single or opposite directions.

DETAILED SPECIFICATIONS

1. DESIGN AND FABRICATION

A. Dimensions and Construction Details

1) Housing 11.6 cm × 8.1 cm × 1.8 cm (nominal)

4.55 in × 3.20 in × 0.69 in (nominal)

2) Lens shall comprise a series of integral cells containing unmetallized prismatic cubes capable of providing total internal reflection of the light entering the lens face.

Slope of Lens	35° to base
Normal Area of Each Lens Face	16.8 sq. cm. (2.60 sq. in.)

3) The lenses will be permanently welded to the housing creating a hermetic seal for each cell.

B. Material

The marker shall be comprised of materials with adequate chemical, water and UV resistance for the intended use.

C. Surface

Thin untempered glass shall be bonded to the prismatic retroreflective lens faces to provide an extremely hard durable abrasion resistant surface. The glassed prismatic retroreflective faces shall be recessed with respect to the marker base's outer surface. The remainder of the base's outer surface shall be smooth except for purposes of identification.

The base of the marker shall be substantially free from gloss and substances that may reduce its bond to adhesive.

2. OPTICAL REQUIREMENTS

A. DEFINITIONS

Retroreflector Axis shall mean the line from the center of the lens that is in a plane parallel to the base of the marker and also in a plane perpendicular to the leading edge of the marker.

Illumination Axis shall mean the line from the center of the lens to the source of illumination.

Observation Axis shall mean the line from the center of the lens to the point of observation.

Entrance Angle shall mean the angle formed between the Retroreflector Axis and the Illumination Axis.

Observation Angle shall mean the angle formed between the Illumination Axis and the Observation Axis.

Coefficient of Luminous Intensity (R_I) shall mean the ratio of the luminous intensity of the marker lens in the direction of observation to the illuminance at the marker lens on a plane perpendicular to the direction of the incident light. R_I is expressed in millicandelas per incident lux (mcd/lx). The corresponding English measure is Specific Intensity (SI) expressed in candles per foot candle (cd/fc). One cd/fc is equivalent to 92.9 mcd/lx.

ENNIS
TRAFFIC SAFETY SOLUTIONS

STIMSONITE MODEL 980

PERFORMANCE SPECIFICATION

B. OPTICAL PERFORMANCE

1) Coefficient of Luminous Intensity
For each lot select 30 markers at random for Coefficient of Luminous Intensity check. Photometer in accordance with procedure 2C. Coefficient of Luminous Intensity of each marker lens shall be not less than shown in Table 1. Failure of more than 10% of the lenses shall be cause for rejection of the lot. In this event, and at the discretion of the purchaser, a resample may be taken consisting of 40 markers at random. Failure of more than 10% of their lenses shall then be cause for rejection of the lot.

TABLE 1 COEFFICIENT OF LUMINOUS INTENSITY REQUIREMENTS

Observation Angle (degrees)	Entrance Angle (degrees)	Coefficient of Luminous Intensity mcd/lx					Specific Intensity cd/fc				
		White	Yellow	Red	Green	Blue	White	Yellow	Red	Green	Blue
0.2	0	279	167	70	93	26	3.0	1.8	0.75	1.0	0.28
0.2	20	112	67	28	37	10	1.2	0.72	0.30	0.4	0.11

2) Abrasion Resistance

Select at random five retroreflective lenses that previously passed the Coefficient of Luminous Intensity requirements as stated in Table 1. Place each retroreflective face beneath the sand drop apparatus and allow 2.5 ± 0.05 kilograms of natural silica sand from the St. Peters or Jordan sandstone deposits fall 3.00 ± 0.03 meters. The sand shall fall uniformly onto the abrasion resistive retroreflective surface of the lens at a rate of 0.4 to 1.0 kilograms per minute. Measure the Coefficient of Luminous Intensity of each abraded lens. The Coefficient of Luminous Intensity shall be not less than shown in Table 2. The failure of more than one retroreflective face shall be cause for rejection of the lot. (Note: On two color units the red lens may not be covered with the abrasion resistant coating and if so should not be abraded.)

TABLE 2 COEFFICIENT OF LUMINOUS INTENSITY REQUIREMENTS AFTER ABRASION RESISTANCE TESTING

Observation Angle (degrees)	Entrance Angle (degrees)	Coefficient of Luminous Intensity mcd/lx					Specific Intensity cd/fc				
		White	Yellow	Red	Green	Blue	White	Yellow	Red	Green	Blue
0.2	0	140	84	35	47	13	1.5	0.90	0.38	0.50	0.14
0.2	20	56	34	14	19	5	0.60	0.36	0.15	0.20	0.06

3) Optical Testing Procedure

When Coefficient of Luminous Intensity is measured at 15 m (50 ft) test distance, receptor diameter and source diameter shall each be 2.6 cm (1.0 in.). Other test distances may be used, provided they are no shorter than 7.5 m (25 ft), and provided that the receptor and source apertures each subtend 0.1° at the marker.

The testing arrangement shall have the entrance angle in a plane parallel to the base of the marker and the observation angle in a plane perpendicular to that plane. The test shall include both possible 20° entrance angles, left and right. This geometry is consistent with that in ASTM D 4280, Specification for Extended Life Type, Nonplowable, Raised Retroreflective Pavement Markers, which includes illustrations.

C. COLOR

Retroreflected color shall conform to the requirements of ASTM D 4280, when tested according to the test method therein.

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TRAFFIC SAFETY SOLUTIONS

STIMSONITE MODEL 980

PERFORMANCE SPECIFICATION

3. PHYSICAL PROPERTIES

A. LONGITUDINAL FLEXURAL STRENGTH REQUIREMENTS

A random sample of three markers shall be selected for test purposes.

Condition markers at 23°±2°C (73.4°±3.6°F) for 4 h prior to testing.

In accordance with ASTM D 4280, place two 12.7 mm × 25.4 mm (0.5 in. × 1.0 in.) steel bars, each longer than the width of the marker base, on their 12.7 mm (0.5 in.) faces, onto the platen of the compression apparatus. Place durometer 70 Shore A elastomeric pads approximately 3 mm (0.12 in.) thick onto the bars. Place the marker base down onto the pads. Marker shall have its lengthwise (roadway) direction perpendicular to the two bars. Spacing of the bars shall depand on the length of the marker base, being as great as possible without the bars protruding beyond the lengthwise points of the marker base. Place a durometer 70 Shore A elastomeric pad approximately 25 mm (1 in.) thick and larger than the marker top on top of the marker. Place a third 12.7 mm × 25.4 mm (0.5 in. × 1.0 in.) steel bar, longer than the width of the marker top, on its 12.7 mm (0.5in.) face onto the top of the pad, positioned parallel to the other bars and centered over the marker top.

Apply load to the top of the marker at a rate of 5.0 mm (0.2 in.) per min through the top steel until the marker breaks. Breakage shall constitute complete rupture or other loss of integrity evidenced by a sudden decrease in load. Each marker shall withstand a load of 1818 kg (4000 lb) without breakage.

B. COMPRESSIVE STRENGTH REQUIREMENTS

A random sample of three markers shall be selected for test purposes.

Condition markers at 23°±2°C (73.4°±3.6°F) for 4 h prior to testing.

In accordance with ASTM D 4280, position marker base down at the center of a 13 mm (0.5 in.) thick steel plate larger than the marker. Place a 9.5 mm (3/8 in.) thick Shore A 60 rubber pad larger than the marker atop the marker. Apply a load to the top of the marker through a 13 mm (0.5 in.) thick steel plate larger than the marker that is placed atop the rubber pad. Rate of loading shall be 2.5 mm (0.1 in.) per minute. Each marker shall withstand a load of 16329 kg (36000 lbs) without either breakage or significant deformation.

3. FIELD TRIALS – AASHTO NTPEP TEST DECK

A. TERMINAL ADHESION AND OPTICAL REQUIRMENTS

The marker shall be tested on the AASHTO (American Association of State Highway and Transportation Officials) NTPEP (National Transportation Product Evaluation Program) test deck. The testing protocol is laid out in the Project Work Plan document. In accordance with the Project Work Plan, the duration of the test deck shall be two years, and shall test the markers on both Asphaltic Concrete and Portland Cement Concrete pavements.

ADHESION REQUIREMENT

At the end of the two-year test period, a minimum of 90% of installed markers must remain adhered to the test deck, for each of the pavement types.

COEFFICIENT OF LUMINOUS INTENSITY REQUIRMENT

As tested according to the Project Work Plan, the average values for coefficient of luminous intensity noted on the one-year interim report for white lenses shall be no less than 140 mcd/lux; the average values for coefficient of luminous intensity noted on the final report shall be no less than 100 mcd/lux.

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