Raised Pavement Marker

Series 290

Product Bulletin 290 **February 2012**

Replaces PB 290 August 2010

Description

3M™ Raised Pavement Markers Series 290 are designed for application on asphalt and Portland cement concrete road surfaces. The markers are designed to provide highly effective, long-term nighttime visibility in non-snow plow regions.

The marker bodies are produced of an engineered thermoplastic that gives maximum impact resistance and weatherability. The retroreflective element that provides wet and dry reflectance and long-term nighttime visibility is available in white, yellow/amber, red, blue or green.

Series 290 markers are designed for application directly to the pavement surfaces and are compatible with commercially available bitumen and epoxy adhesives. The use of any other type of adhesive should be thoroughly evaluated prior to any large-scale applications.

3M manufactures a Series 290 marker fitted with a pressure sensitive adhesive (PSA) pad. To use the marker with PSA, a liner is removed from the adhesive pad on the bottom of the marker before placing the marker on the road surface. Ask your 3M sales representative or call 3M Technical Service at 1-800-553-1380 for more information on the Series 290 marker with PSA. Request Information Folder 290 PSA.

For application information, refer to 3M Information Folder 290, "3M Raised Pavement Markers Series 290 with Pressure Sensitive Adhesive Surface Preparation and Application Procedures." For situations not specifically covered, it is the responsibility of the installer to contact the appropriate 3M sales representative or 3M technical service representative for guidance at 1-800-553-1380.

Type Retroreflectance

Type retroreflectance refers to marker luminance measured using simplified viewing conditions as a convenient means of describing uniformity of marker characteristics. Type retroreflectance is used for quality control purposes when specifying a unique marker type. The white, yellow/amber, red, blue or green markers have initial minimum retroreflectance values specified as the product of the values in Table 1 when measured in accordance with ASTM E809. The photometric quantity to be measured is the coefficient of retroreflected luminous intensity (RI), expressed as millicandelas per lux (mcd/lx). One candela per lux equals 10.76 candelas per foot-candle.

Marker Type	Identification
One-way yellow, white body	290-Y
One-way yellow, yellow body	291-Y
Two-way yellow, yellow body	291-2Y
Two-way yellow and red, yellow body	291-YR
One-way white, white body	290-W
Two-way white, white body	290-2W
Two-way white and red, white body	290-WR
Two-way white and yellow, white body	290-WY
Two-way red, white body	290-2R
Two-way blue, blue body	295-2B
Two-way green, green body	297-2G

Product Features

- Durable
- Wet and dry retroreflective
- Impact resistant
- Abrasion resistant
- Molded-in body colors
- Rumble effect
- Lightweight
- Application finger grips
- Compatible with standard bitumen and epoxy adhesives

Product Dimensions	
The typical dimensions of the Series 290 marker are:	
Height:	0.625 ± 0.050 in. (15.88 ± 1.27 mm)
Width:	4.00 ± 0.50 in. (101.6 ± 12.7 mm)
Length:	3.50 ± 0.50 in. (89.2 ± 12.7 mm)

Table 1: Minimum R_I Values

Entrance angle β_2 (β_1 = 0º)	0º		±20º	
Observation angle	.2º		.2º	
Color	Minimum R_I (mcd/lx)	Minimum R_I (cd/ftcd)	Minimum R_I (mcd/lx)	Minimum R_I (cd/ftcd)
White	279	3.00	112	1.20
Yellow/Amber	167	1.80	67	0.72
Red	70	0.75	28	0.30
Blue	26	0.28	10	0.11
Green	93	1.00	37	0.40

Performance Retroreflectance

Performance retroreflectance refers to marker luminance as viewed by the driver under standardized road and vehicle conditions. This property is often called "Driver Geometry Retroreflection." Measurement under simulated use conditions ensures that all geometric viewing angles are taken into account during testing, including the rotation angle, which is an important consideration when evaluating markers with prismatic retroreflective lenses. The markers have initial minimum retroreflectance values specified as the product of the values in **Table 2 and Table 3** when measured in accordance with ASTM E809. In **Table 2**, the angles referenced correspond to the entrance, rotation and observation geometry for a driver in a standard vehicle with pavement markers placed on a lane line to the left of the vehicle. The measured value at each simulated distance is the sum of the marker retroreflection from the incident illumination of the left and right headlights. Test set up and measurement geometry is illustrated in **Figure 1**.

Retroreflected Color

The retroreflected color of the markers lies within the respective retroreflected color gamut coordinates, plotted on the 1931 CIE Chromaticity (x,y) diagram, described in Table 4 and Figure 2 when tested in accordance with ASTM E811 using CIE Illuminant Source A and viewing conditions of 0.2° observation angle, 0° entrance angle. The source and receptor angular apertures are each 6 minutes of arc.

Table 2: R_I "Driver Geometry"

Simulated Distance			Observation Angle (α)	Rotation Angle (ε)	Entrance Angle (ß)		MinimumR$_I$ (mcd/lux)	Typical R_I (mcd/lux)
Feet	Meters	Headlight	(degrees)	(degrees)	$ß_1$	$ß_2$	left + right	left + right
100	30	Left	0.95	19	-2.0	-1.6	40	80
		Right	2.91	-72	4.6	-2.9		
300	91	Left	0.35	24	-0.7	-0.5	350	500
		Right	0.90	-69	1.4	-1.0		
500	152	Left	0.22	24	-0.4	-0.3	600	1000
		Right	0.53	-68	0.8	-0.6		

Note: In laboratory testing Entrance Angles $ß_1$ and $ß_2$ are set to equal 0º and Left/Right Rotation Angles ε are set to 20º/-70º as an approximation with little loss of accuracy.

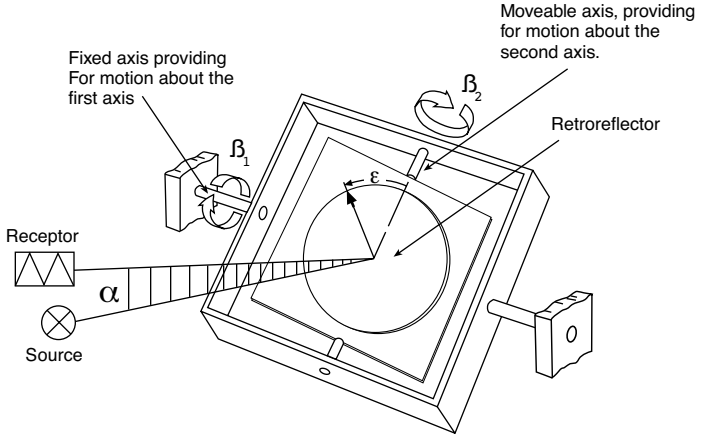

Figure 1: Driver Geometry (CIE Notation)

Table 3:
Color Multiplying Factors

Color	Multiplying Factor
White	1
Yellow/Amber	0.6
Red	0.25
Blue	0.1
Green	0.33

Table 4: Retroreflected Color Gamut Coordinates

	White		Yellow		Red		Blue		Green	
Point Number	**x**	**y**	**x**	**y**	**x**	**y**	**x**	**y**	**x**	**y**
1	0.310	0.348	0.545	0.424	0.650	0.330	0.039	0.320	0.009	0.733
2	0.453	0.440	0.599	0.439	0.668	0.330	0.160	0.320	0.288	0.520
3	0.500	0.440	0.609	0.390	0.734	0.265	0.160	0.240	0.209	0.395
4	0.500	0.380	0.597	0.390	0.721	0.259	0.183	0.218	0.012	0.494
5	0.440	0.380	–	–	–	–	0.088	0.142	–	–
6	0.310	0.283	–	–	–	–	–	–	–	–

If two points lie on the spectrum locus line, they must not be connected by a straight line but rather should, in this case, be joined by the boundary of the spectrum locus.

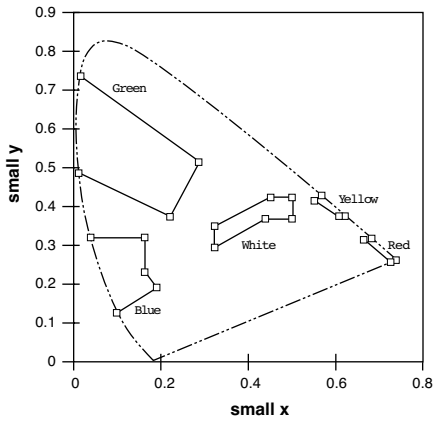

Figure 2: CIE 1931 Chromaticity Chart

Abrasion Resistance

The coefficient of retroreflected luminous intensity of the markers is measured after subjecting the entire lens surface to the test described in ASTM D 4280 section 9.5 using a sand drop apparatus. After the exposure described above, retroreflected values shall not be less than 0.5 times the values listed in Table #1.

Temperature Resistance

The marker shall comply with the initial minimum brightness requirements as specified in **Table 1** and the product of the values in **Tables 2 and 3** after conditioning for 12 hours at 145°F ± 5°F (62.7°C ± 2.5°C).

Impact Resistance

The marker body displays no cracking or breakage when tested according to ASTM D2444 Tup A, using a 1000 gm weight from a height of 1 meter. The marker is positioned in such a way that the Tup strikes the top of the marker. The marker lens displays no cracking outside the impact area when tested according to ASTM D2444 Tup A, using a 1000 gm weight from a height of 1 meter. The marker is placed in a steel fixture designed to hold the marker lens horizontal and positioned such that the Tup strikes the center of the lens.

Resistance to Penetration of Water

The markers are conditioned for 10 minutes at 145°F ± 5°F (62.7°C ± 2.5°C) and then immediately submerged in a water bath at 70°F ± 5°C (21°F ± 2.5°C) for 10 minutes. The markers should then be removed from the water bath, wiped dry with a soft cloth, visually inspected for penetration of water behind the lens, and measured for reflectivity in accordance with ASTM E809. The markers meet the initial minimum retroreflectance specified values in **Table 1** and the product of the values in **Tables 2 and 3.**

Health and Safety Information

Read all health hazard, precautionary, and first-aid statements found in the Material Safety Data Sheet and/or product label of chemicals prior to handling or use. Also refer to the MSDS for information about the volatile organic compound (VOC) content of chemical products. Consult local regulations and authorities for possible restrictions on product VOC content and/or VOC emissions. Electronically, visit us at www.3M.com/us and select MSDS search.

General Performance Considerations

Maximum durability of retroreflective raised pavement markers will be achieved when markers are properly applied according to the manufacturer's recommendations provided in product bulletins and information folders. Because reflective performance is reduced by wear, the lens of the raised pavement marker is coated with an abrasion-resistant material which provides acceptable reflective performance under normal traffic wear. Minimal marker loss may occur under normal traffic conditions when markers are applied with standard bitumen or epoxy adhesives designed for use with raised pavement markers and as recommended by the manufacturer.

Warranty

Markers will only be warranteed for performance parameters stated in this document or for defects from manufacture. 3M is not responsible for damage or losses due to application.

Warranty

3M Warrants that Series 290 Markers will meet the performance requirements contained in the current ASTM D 4280 for series 290 markers -- Raised Retro-reflective Pavement Markers.

This warranty excludes (without limitation) damage from improper installation, exposure to chemicals or mishandling. Physically missing markers are NOT considered under warranty.

If Series 290 markers, installed in accordance with 3M recommendations, fail to conform to this warranty, 3M's sole responsibility and purchaser's and user's exclusive remedy shall be that 3M will, at its expense for materials ONLY, furnish replacement markers for those non-conforming markers.

Customer will maintain and track all installation information. Claims made under this warranty will ONLY be honored if 3M is notified of a product failure within a reasonable amount of time of the failure, reasonable information requested by 3M is provided, or 3M is permitted to investigate and verify the cause of the failure.

Limitations of Liability

3M's liability under this warranty is limited to replacement or allowance as stated herein. 3M assumes no liability for incidental or consequential damages including but not limited to lost profits, business or revenue regardless of legal theory on which the claim is based.

THIS WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF TRADE, EXCEPT OF TITLE AND AGAINST INFRINGEMENT.

Literature Reference

For additional information, refer to the following publications:

IF 290: 3MTM Raised Pavement Markers Series 290 with Pressure Sensitive Adhesive Surface Preparation and Application Procedures

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1-800-553-1380

IN CANADA CALL:
1-800-265-1840

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www.3M.com/tss

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