Designation: D6628 – 16

# Standard Specification for Color of Pavement Marking Materials[1]

This standard is issued under the fixed designation D6628; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers the daytime and nighttime color of retroreflective pavement marking materials used for traffic control lane markings and symbols on road surfaces. It is intended to apply throughout the service life of the material.

1.2 This specification applies to both painted and tape lines, including thermoplastic, epoxy and other types.

1.3 This specification is not applicable to the testing, for quality control purposes, of marking material without added drop-on beads.

1.4 In addition, it does not describe requirements other than color such as retroreflectance.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5.1 *Exception*—This specification is noted to be a SI document, where angles are generally expressed in radians. However, as angles used in retroreflection have historically been identified in degrees, the International Committee for Weights and Measures (CIPM, Comité International des Poids et Mesures) accepts the use of degrees with SI units, and European Normatives and documents from the International Commission on Illumination (CIE) use degrees for retroreflection geometry.

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4061 Test Method for Retroreflectance of Horizontal Coatings

D7585/D7585M Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments

E284 Terminology of Appearance

E308 Practice for Computing the Colors of Objects by Using the CIE System

E811 Practice for Measuring Colorimetric Characteristics of Retroreflectors Under Nighttime Conditions

E1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry

2.2 *CIE Publications:*

No. 15.2 Colorimetry[3]

No. 39.2 Recommendations for Surface Colours for Visual Signalling[3]

## 3. Terminology

3.1 *Definitions:*

3.1.1 Definitions in Practice E308 and of appearance terms in Terminology E284are applicable to this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *pavement marking structured materials*—a structured road marking has faces or edges in a regular or random pattern that are tilted towards the direction of traffic in order to enhance retroreflection in wet or rainy conditions or to produce acoustic or vibrational effects by the passage of wheels, or both.The pattern can be produced by non-uniform application of material in the liquid state, by reworking the surface of applied material while still liquid, or by other suitable means.

## 4. Significance and Use

4.1 This specification is intended for use during the lifetime of the retroreflective pavement marking on the road surface. Specifications for characteristics other than color are found in other ASTM documents.

## 5. Performance Requirements

5.1 *Chromaticity Limits*—The material must plot within the boundaries described by the four corner points listed in Tables 1 and 2 when measured in accordance with the test methods in Section 7.

5.1.1 Table 1—Daytime (x,y) chromaticity coordinates of the corners of the regions for the colors of white, yellow, blue and red pavement markings. See Fig. 1.

[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.38 on Highway Traffic Control Materials.

Current edition approved Oct. 1, 2016. Published October 2016. Originally approved in 2001. Last previous edition approved in 2015 as D6628 – 03 (2015). DOI: 10.1520/D6628-16.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from USNC-CIE Publications Office, TLA Lighting Consultants, Inc., 7 Pond Street, Salem, MA 01970.

**TABLE 1 Daytime Color**

NOTE 1—Daytime, Geometry – 45/0 (0/45), CIE illuminant D65 and the CIE 1931 (2°) standard observer.

| Color | Daytime Chromaticity Coordinates (Corner Points) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| | x | y | x | y | x | y | x | y |
| White | 0.355 | 0.355 | 0.305 | 0.305 | 0.285 | 0.325 | 0.335 | 0.375 |
| Yellow | 0.560 | 0.440 | 0.490 | 0.510 | 0.420 | 0.440 | 0.460 | 0.400 |
| Red | 0.480 | 0.300 | 0.690 | 0.315 | 0.620 | 0.380 | 0.480 | 0.360 |
| Blue | 0.105 | 0.100 | 0.220 | 0.180 | 0.200 | 0.260 | 0.060 | 0.220 |
| Purple | 0.300 | 0.064 | 0.309 | 0.260 | 0.362 | 0.295 | 0.475 | 0.144 |

**TABLE 2 Nighttime Color**

NOTE 1—Nighttime, Geometry – observation angle of 1.05° and entrance angle of 88.76°. CIE illuminant A and the CIE 1931 (2°) standard observer.

| Color | Nighttime Chromaticity Coordinates (Corner Points) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| | x | y | x | y | x | y | x | y |
| White | 0.480 | 0.410 | 0.430 | 0.380 | 0.405 | 0.405 | 0.455 | 0.435 |
| Yellow | 0.575 | 0.425 | 0.508 | 0.415 | 0.473 | 0.453 | 0.510 | 0.490 |
| Purple | 0.338 | 0.080 | 0.425 | 0.365 | 0.470 | 0.385 | 0.635 | 0.221 |

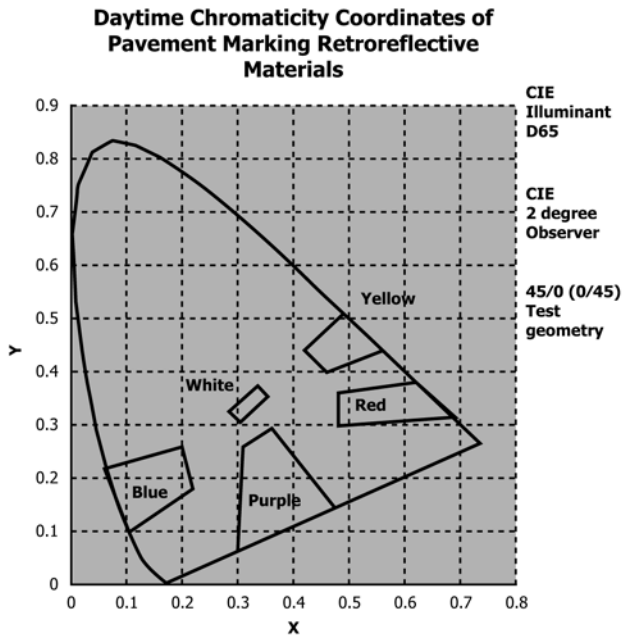


**FIG. 1 Daytime Chromaticity of Pavement Markings**

5.1.2 Table 2—Nighttime (x,y) chromaticity coordinates of the corners of the regions for the colors of white and yellow pavement markings. See Fig. 2.

5.1.3 *Chromaticity and Retroreflectance*—The third dimension of the perceived appearance of the road marking at night is the retroreflectance. This quantity is specified in other ASTM documents on pavement markings and is not part of pavement marking nighttime color specification. Research has shown that the nighttime color as specified by chromaticity is sufficient and adequate for the color naming of the material as viewed under nighttime conditions.

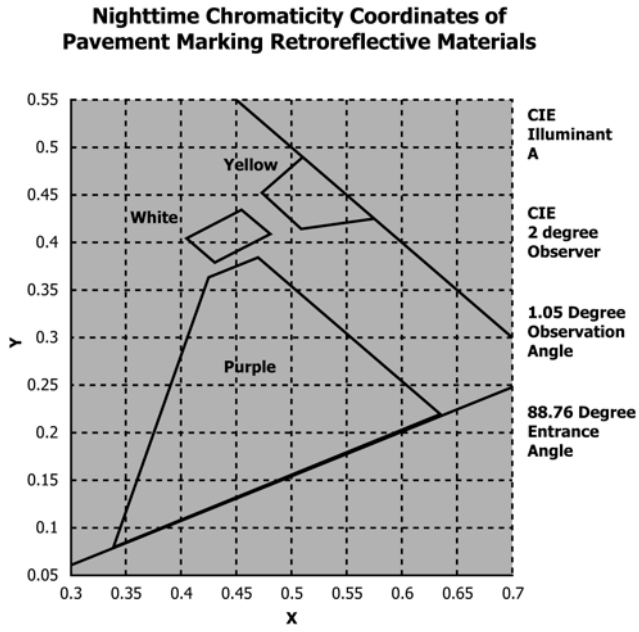


**FIG. 2 Nighttime Chromaticity of Pavement Markings**

5.2 *Daytime Lightness Limits (Y Tristimulus Coordinate)*—The lightness limits shall conform to Table 3. (The 45/0 and 0/45 geometry is the current standard practice for these measurements.

NOTE 1—Daytime luminance factor testing of pavement markings excludes structured materials. They should be tested at the viewing angle encountered in usage using diffuse illumination and 87.71° viewing angle, which is not covered in this standard.

## 6. Specimen Preparation

6.1 The test specimen shall be measured mounted on a flat test panel with a minimum test area of 0.1 $m^2$ in size. Typical test panels are 100 by 1000 mm.

## 7. Test Methods

7.1 *Sample Conditioning*—For new material conditioning, see Practice D7585/D7585M. For in-service testing, sample should be free of dirt or other obvious contamination.

7.2 *Daytime Color*—Daytime color shall be measured in accordance with Test Method E1349, using 45/0 (0/45) geometry, CIE illuminant D65 and the 1931 CIE 2° standard observer. (See Annex A1 for correction factors when using illuminant C).

**TABLE 3 Luminance Factor, Y[A]**

| Color | With Glass Beads | |
|---|---|---|
| | Y | Y |
| | Minimum | Maximum |
| White | 35 | . . . |
| Yellow | 25 | . . . |
| Red | 6 | 15 |
| Blue | 5 | 14 |
| Purple | 5 | 15 |

[A] The following in-service daytime luminance factor limits (tristimulus value Y expressed as a percent) apply when measured with 45/0 (0/45) geometry and illuminant D65 using the 1931 CIE 2° standard observer.

7.3 *Nighttime Color*—The measurement of nighttime chromaticity shall be in accordance with Test Method E811 using the geometric tolerance and sample positioning (including angle setting techniques) as described in Test Method D4061.

NOTE 2—The referenced nighttime color test method is primarily a laboratory procedure, and may not be convenient for use in the field for the measurement of material in service. More convenient field test instruments complying with this test method are expected to be available in the near future.

NOTE 3—A precision statement for this specification has not been developed at this time. Therefore, this specification should not be used for acceptance or rejection of a material for purchasing purposes. This specification does not include a test method, but refers to Test Method E1349 and Practice E811, neither of which contain precision and bias statements. The subcommittee established a task group to develop a precision and bias statement on measurement of the color of pavement marking materials, which will be coordinated with Committee E12 for inclusion in Test Method E1349. Additional study is required regarding development of a test method from the standard practice documented in Practice E811 for measurement of nighttime color of pavement markings.

## 8. Keywords

8.1 pavement marking; retroreflective materials

## ANNEX

**(Mandatory Information)**

## A1. CHANGE OF ILLUMINANT FACTORS

A1.1 The correction factors given in Table A1.1 change measurements made using illuminant C to approximate measurements made using illuminant D65.

**TABLE A1.1 Correction Factors**

NOTE 1—For Example—A blue sample which measured (x, y, Y) = (0.150, 0.150, 5.0) using illuminant C would be converted to (0.149, 0.158, 5.0) to provide the result using illuminant D65.

| Color | x | y | Y |
|---|---|---|---|
| White | +0.003 | +0.014 | 0.00 |
| Yellow | +0.001 | +0.002 | 0.00 |
| Red | 0.000 | +0.001 | 0.00 |
| Blue | –0.001 | +0.008 | 0.00 |