9710701 TRAFFIC MARKING MATERIALS
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

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The Continuous Wetting method implied to be used as a Developmental Specification is in the "infancy stage" for any form of use by a regulatory agency. ASTM E2832-12 Standard Test Method for Measuring the Coefficient Luminance of Pavement Markings in a Standard Condition of Continuous Wetting should not be used for legal regulatory enforcement, until it can properly address all pavement markings "reflective media" configurations.
The below attachment shows the large ranges within which a pavement marking material could be considered to be within the uncertainty (reproducibility) limits for a passing product. This might be OK for manufacturing purposes, but does not appear to have any credability for legal enforcement.
Once again, it would appear that some form of a test "data range" number must be looked at for acceptable field test numbers. It should also be noted that each combination of pavement marking/optics package be looked at seperately as each type has its own distinct "wet reflective" numbers to be determined. There is no data available to indicate what are "beneficial and realistic" numbers that correlate to actual threshold numbers that can be used for specification enforcement.

Attachment 1: ASTM E2832-12 Standard Test Method for Measuring the Coefficient Luminance of Pavement Markings in a Standard Condition of Continuous Wetting

TABLE 1 Results of Precision Testing for Coefficient of Retroreflected Luminance in a Standard Condition of Continuous Wetting (mcd/lx/m²)

Test	$\bar{x}$	$s_{\bar{x}}$	S_r	s_{Ri}	r	R	R/mean
5	394.1	28.1	32.7	36.4	91.6	102.0	26 %
6	558.7	61.2	49.1	70.3	137.6	197.0	35 %
10	137.4	17.8	13.2	20.1	37.0	56.3	41 %
9	149.1	25.9	23.8	30.9	66.6	86.5	58 %
4	156.7	25.0	32.2	33.8	90.1	94.7	60 %
7	137.1	37.7	11.3	38.6	31.7	108.0	79 %
8	186.1	58.3	17.6	59.6	49.2	166.8	90 %
3	79.6	24.6	19.2	28.1	53.8	78.7	99 %
2[A]	8.6	3.4	2.8	3.9	7.8	11.0	128 %
1[A]	9.9	4.3	2.7	4.8	7.7	13.3	135 %

[A] This pavement marking system is not traditionally considered to have wet retroreflective performance.

13. Report

13.1 The report shall include the following items:

13.1.1 Test date, ambient temperature, and other pertinent weather conditions.

13.1.2 Identification of the instrument used, value and date of calibration of the reference standard panel used.

13.1.3 Operator name and contact information.

13.1.4 The continuous wetting rate and average and standard deviation of the test result reported in millicandelas per square metre per lux (mcd/m²/lx). The test result shall be reported for each test specimen and direction of travel (as specified by the agency having jurisdiction). If multiple wetting rates are used, they shall be reported independently.

13.1.5 Geographical location of the measurement site. Global positioning system (GPS) location or distance from the nearest permanent site identification, such as a mileage marker or crossroad.

13.1.6 Identification of the pavement marking tested; type (for example, binder type, thickness, and optical media which might include bead type and bead size if known), color, age (date of pavement marking installation if known), location on road (edge line, first line, second line, center line, etc.), and other information and characteristics as specified.

13.1.7 Description of road surface and road texture, that is, portland concrete cement (PCC) (broomed, brushed, worn), bituminous, chip seal, etc.

NOTE 3—Pavement texture may be identified and quantified by Test Method E965.

13.1.8 Grade and cross slope of roadway adjacent to measured pavement marking.

13.1.9 Remarks concerning the overall condition of the line, such as rubber skid marks, carryover of asphalt, snowplow damage, and other factors that may affect the retroreflection measurement.

14. Precision and Bias [4]

14.1 The precision of this test method is based on an interlaboratory study of ASTM E2832, Test Method for Measuring the Coefficient of Retroreflective Luminance of Pavement Markings in a Standard Condition of Continuous Wetting (R_{L-2}), conducted in 2011. Ten laboratories participated in this study. Each of the labs was asked to report two replicate test results for two locations on five different thermoplastic pavement marking systems. Every "test result" reported represents a single determination or measurement. Practice E691 was followed for the design and analysis of the data; the details are given in Research Report No. E12–1007.

14.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the "*r*" value for that material; "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

14.1.1.1 Repeatability limits are listed in Table 1.

14.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the "*R*" value for that material; "*R*" is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

14.1.2.1 Reproducibility limits are listed in Table 1.

14.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

14.1.4 Any judgment in accordance with statements 14.1.1 and 14.1.2 would have an approximate 95 % probability of being correct.

14.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

14.3 The precision statement was determined through statistical examination of 200 results, from ten laboratories, reporting up to two replicate analyses, on a total of ten different test locations on five different pavement marking materials, which were described as:

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:E12-1007.

Attachment 2: Reproducibility ranges from ASTM E2832-12 showing the wide ranges of values possible during inspection

Test	Material	Mean	R	Data Range
5	Inverted Rib Thermoplastic, DD 1 and 1.9	394.1	102.0	292 - 496
6	Inverted Rib Thermoplastic, DD 1 and 1.9	558.7	197.0	362 - 756
10	Thermoplastic flatline, DD 3 and Visimax	137.4	56.3	81 - 190
9	Thermoplastic flatline, DD 3 and Visimax	149.1	86.5	63 - 236
3	Thermoplastic flatline, DD 3 and 3M elements	79.6	78.7	1 - 158
4	Thermoplastic flatline, DD 3 and 3M elements	156.7	94.7	62 - 161
7	Thermoplastic flatline, DD 1 and 4	137.1	108.0	29 - 245
8	Thermoplastic flatline, DD 1 and 4	186.1	166.8	19 - 353
2	Thermoplastic (Audible Vibratory Flatline)	8.6	11.0	0 - 20
1	Thermoplastic (Audible Vibratory Flatline)	9.9	13.3	0 - 23

Response: I agree. That will need to be worked out as we develop a developmental specification. No changes made.

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