
Standard Method of Test for

**Measuring Retroreflectivity of
Pavement Marking Materials Using
a Mobile Retroreflectivity Unit**

AASHTO Designation: TP 111-14 (2020)¹

Technical Subcommittee: 4c, Markings and Coatings

Release: Group 2 (June)



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1. SCOPE

- 1.1. This test method covers measurement of the retroreflective properties of dry, horizontal pavement marking materials, using a Mobile (vehicle-mounted) Retroreflectivity Unit (MRU) operated at posted roadway speeds at a prescribed geometry. The prescribed geometry corresponds to the European Committee for Standardization (CEN) geometry and is the standard geometry adopted by ASTM E1710.
- 1.2. This test method ensures that night-time visibility provided by pavement markings is adequate. This applies to the measurement of the pavement marking retroreflectivity using mobile instruments.
- 1.3. *This test method does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

- 2.1. *ASTM Standards:*
 - D4061, Standard Test Method for Retroreflectance of Horizontal Coatings
 - D7585/D7585M, Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
 - E284, Standard Terminology of Appearance
 - E808, Standard Practice for Describing Retroreflection
 - E1710, Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer

3. TERMINOLOGY

- 3.1. The definition of all the terms used in this document as well as other relevant terms can be found in ASTM E284, ASTM E808, ASTM E1710, ASTM D7585/D7585M, and ASTM D4061. The definitions listed below are direct excerpts from the above references for the terms that are most relevant to the content of this document.

- 3.2. *Definitions:*
- 3.2.1. *retroreflection*—a reflection in which the reflected rays are returned preferentially in directions close to the opposite of the direction of the incident rays, this property being maintained over wide variations of the direction of the incident rays.
- 3.2.2. *coefficient of retroreflected luminance, R_L* —the ratio of the luminance of a projected surface to the normal illuminance at the surface on a plane normal to the incident light, expressed in candelas per square meter per lux ($\text{cd}/\text{m}^2/\text{lux}$).
- 3.2.3. *Discussion*—The measurements are commonly expressed in units of millicandelas per square meter per lux ($\text{mcd}/\text{m}^2/\text{lux}$) because pavement markings have a relatively low luminance spectrum.

4. APPARATUS

- 4.1. *Field Test Apparatus*—The required field test apparatus consists of a vehicle equipped with the following devices:
- 4.1.1. *Retroreflectometer*—One or more retroreflectometers mounted on either side of the host vehicle.
- 4.1.1.1. The retroreflectometer must be capable of collecting data in accordance to the 30-m geometry conforming to ASTM E1710. See Section 5.1 for more information regarding the 30-m geometry.
- 4.1.1.2. The retroreflectometer must be capable of collecting pavement marking data while accounting for the horizontal wander and vertical movement of the host vehicle.
- 4.1.1.3. The equipment must be capable of measuring retroreflectivity of pavement markings ranging from 75 to 1200 $\text{mcd}/\text{m}^2/\text{lux}$.
- 4.1.2. *Distance Measuring Instrument (DMI)*—a distance measuring instrument with an accuracy of ± 0.1 percent per mile.
- 4.1.3. *Global Positioning System (GPS)*—a Global Positioning System with an instantaneous horizontal positioning accuracy of 10 ft or better (optional).
- 4.1.4. *Data Acquisition System*—a ruggedized computer system for data entry, acquisition, display, and storage
- 4.1.5. *Event Marker*—In addition to a manual triggering system, an automated system should be provided that detects a reference mark to start, stop, and event mark points of interest during the measurement process, such as bridges, intersections, horizontal and vertical curves, etc.

5. SUMMARY OF TEST METHOD

- 5.1. Measurement of retroreflected luminance using an MRU should be conducted using the 30-m geometry shown in Figure 1. The angles specified for the 30-m geometry are as follows:
- 5.1.1. The entrance angle is fixed at 88.76° (co-entrance angle 1.24°).
- 5.1.2. The observation angle is fixed at 1.05° .