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# Standard Guide for Classification of Automated Pavement Condition Survey Equipment<sup>1</sup>

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## 1. Scope

1.1 This guide covers information for classifying the measurement capability of pavement condition survey equipment or instrumentation that measures longitudinal profile, transverse profile or cracking of pavement surfaces while operating at or near traffic speeds.

1.2 The measuring equipment or instrumentation, addressed by the guide, samples and stores measurement data while operating at or near traffic speeds.

1.3 This guide does not address equipment that operates at traffic speeds but is incapable of measuring profile or individual crack characteristics, such as response-type roughness measuring systems and semi-automated distress recording systems.

1.4 This guide provides measurement criteria and classification for use in a range of applications.

1.5 The measurement criteria apply to longitudinal profile, transverse profile, or the cracking of pavement surfaces.

1.6 This guide does not address the processing of measured data.

1.7 *This standard 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 standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**E456 Terminology Relating to Quality and Statistics**

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.42 on Pavement Testing and Evaluation.

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<sup>2</sup> 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.

3.1.1 *characteristic*—a directly measurable distinguishing property of the pavement surface. Examples are pavement longitudinal profile, transverse profile, and separations in the continuity of a pavement surface.

3.1.2 *dynamic intermediate precision*—the precision of the measurement of a characteristic determined under dynamic intermediate precision conditions in which the same equipment moving at operating speed measures the characteristic at the same location repeatedly, in accordance with the procedure specified in 7.2.

3.1.3 *longitudinal profile*—the perpendicular deviations of the pavement surface from an established reference parallel to the lane direction, usually measured in the wheel tracks.

3.1.4 *resolution*—the smallest increment that a characteristic-measuring process must distinguish and display.

3.1.5 *stationary repeatability precision*—the precision of the measurement of a characteristic determined under repeatability condition with the instrumented equipment stationary, in accordance with the procedure specified in 7.1.

3.1.6 *tolerance*—the defined limits of allowable (acceptable) departure from the true value of a measured quantity.

## 4. Significance and Use

4.1 Highway agencies, equipment manufacturers, and other organizations can use this guide to classify the measuring capabilities of pavement condition survey equipment that operates at traffic speeds and collect some of the data useful in characterizing pavement conditions.

4.2 The vertical measurement resolution, sample interval, and crack width capabilities as specified in Section 5 are subject to user verification.

## 5. Guidelines

5.1 *Classification:*

5.1.1 *Attribute Measurement Category:*

5.1.1.1 The measuring capability of condition survey equipment is described by a set of attribute measurement categories, each designating the capability of measuring an individual pavement attribute. The designated attributes covered are:

- (1) longitudinal profile,
- (2) transverse profile, and
- (3) crack width.

### 5.1.2 Code:

5.1.2.1 The measurement capability in each category is designated by the sequence of codes each representing a type or level of measurement capability, as follows:

- (1) First code—Measured attribute (alphabetic),
- (2) Second code—Stationary repeatability precision (numeric),
- (3) Third code—Longitudinal sampling interval (numeric),
- (4) Fourth code—Transverse sampling interval (numeric), and
- (5) Fifth code—Transverse coverage (numeric).

### 5.1.3 Code values:

5.1.3.1 The values of each code are defined in the following sections:

**5.2 Equipment for Measuring Longitudinal Profile—**Equipment capability is defined by vertical-measurement stationary repeatability precision, transverse sampling frequency, and longitudinal sampling interval. Equipment capability is divided into the classes shown in **Table 1**.

5.2.1 If equipment can measure vertically with a stationary repeatability precision of 0.15 mm (0.06 in.), a moving longitudinal sampling interval of 125 mm (5 in.) and a transverse sampling of three profiles per pass, it is a Code L221 unit.

**5.3 Equipment for Measuring Transverse Profile—**Equipment capability is defined by vertical-measurement stationary repeatability precision, transverse sampling interval and longitudinal sampling interval. Equipment capability is divided into the classes shown in **Table 2**.

5.3.1 If equipment can measure vertically with a stationary repeatability precision of 0.3 mm (0.012 in.), a moving longitudinal sampling interval of 2 m (6.5 ft), a transverse sampling interval of 150 mm (6 in.) and a transverse coverage of 2.0 m (6.5 ft), it is a Code T3233 unit.

**5.4 Equipment for Measuring Cracking of Pavement Surfaces—**Equipment capability depends on the stationary repeatability precision with which crack width can be measured, the transverse sampling interval and the longitudinal sampling interval. The capability of equipment is divided into the classes shown in **Table 3**.

**TABLE 1 Equipment Capability—Measuring Longitudinal Profile**

| Characteristic        | Code                                      | Description                                            |
|-----------------------|-------------------------------------------|--------------------------------------------------------|
| Measured Attribute    | L                                         | Longitudinal Profile                                   |
| Vertical measurement  | <i>Stationary Repeatability Precision</i> |                                                        |
|                       | 1                                         | Less than or equal to 0.1 mm (0.004 in.)               |
|                       | 2                                         | Greater than 0.1 mm to 0.2 mm (0.004 in. to 0.008 in.) |
|                       | 3                                         | Greater than 0.2 mm to 0.5 mm (0.008 in. to 0.020 in.) |
|                       | 4                                         | Greater than 0.5 mm (0.20 in.)                         |
| Longitudinal sampling | <i>Interval</i>                           |                                                        |
|                       | 1                                         | Less than or equal to 25 mm (1 in.)                    |
|                       | 2                                         | Greater than 25 mm to 150 mm (1 in. to 6 in.)          |
|                       | 3                                         | Greater than 150 mm to 300 mm (6 in. to 12 in.)        |
|                       | 4                                         | Greater than 300 mm (12 in.)                           |
| Transverse sampling   | <i>Number of profiles per pass</i>        |                                                        |
|                       | 1                                         | 3 or more profiles                                     |
|                       | 2                                         | 2 profiles                                             |
|                       | 3                                         | 1 profile                                              |
| Transverse coverage   | NA <sup>A</sup>                           | NA <sup>A</sup>                                        |

<sup>A</sup>Not applicable.

**TABLE 2 Equipment Capability—Measuring Transverse Profile**

| Characteristic        | Code                                      | Description                                            |
|-----------------------|-------------------------------------------|--------------------------------------------------------|
| Measured Attribute    | T                                         | Transverse Profile                                     |
| Vertical measurement  | <i>Stationary Repeatability Precision</i> |                                                        |
|                       | 1                                         | Less than or equal to 0.1 mm (0.004 in.)               |
|                       | 2                                         | Greater than 0.1 mm to 0.2 mm (0.004 in. to 0.008 in.) |
|                       | 3                                         | Greater than 0.2 mm to 0.5 mm (0.008 in. to 0.020 in.) |
|                       | 4                                         | Greater than 0.5 mm (0.20 in.)                         |
| Longitudinal sampling | <i>Interval</i>                           |                                                        |
|                       | 1                                         | Less than or equal to 300 mm (1 ft)                    |
|                       | 2                                         | Greater than 300 mm to 3 m (1 ft to 10 ft)             |
|                       | 3                                         | Greater than 3 m to 30 m (10 ft to 100 ft)             |
|                       | 4                                         | Greater than 30 m (100 ft)                             |
| Transverse sampling   | <i>Interval</i>                           |                                                        |
|                       | 1                                         | Less than or equal to 25 mm (1 in.)                    |
|                       | 2                                         | Greater than 25 mm to 100 mm (1 in. to 4 in.)          |
|                       | 3                                         | Greater than 100 mm to 300 mm (4 in. to 12 in.)        |
|                       | 4                                         | Greater than 300 mm to 600 mm (12 in. to 24 in.)       |
| Transverse coverage   | <i>Width</i>                              |                                                        |
|                       | 1                                         | Greater than 3.7 m (12 ft)                             |
|                       | 2                                         | Greater than 2.7 m to 3.7 m (9 ft to 12 ft)            |
|                       | 3                                         | Greater than 1.8 m to 2.7 m (6 ft to 9 ft)             |
|                       | 4                                         | Less than or equal to 1.8 m (6 ft)                     |

**TABLE 3 Equipment Capability—Measuring Cracking of Pavement Surfaces**

| Characteristic        | Code                                      | Description                                           |
|-----------------------|-------------------------------------------|-------------------------------------------------------|
| Measured Attribute    | C                                         | Cracking of Pavement Surface                          |
| Crack width           | <i>Stationary Repeatability Precision</i> |                                                       |
|                       | 1                                         | Less than or equal to 0.50 mm (0.02 in.)              |
|                       | 2                                         | Greater than 0.50 mm to 1.0 mm (0.02 in. to 0.04 in.) |
|                       | 3                                         | Greater than 1.0 mm to 3 mm (0.04 in. to 0.12 in.)    |
|                       | 4                                         | Greater than 3 mm to 5 mm (0.12 in. to 0.20 in.)      |
| Longitudinal sampling | <i>Interval</i>                           |                                                       |
|                       | 1                                         | Less than or equal to 0.50 mm (0.02 in.)              |
|                       | 2                                         | Greater than 0.50 mm to 1 mm (0.02 in. to 0.04 in.)   |
|                       | 3                                         | Greater than 1 mm to 3 mm (0.04 in. to 0.12 in.)      |
|                       | 4                                         | Greater than 3 mm to 5 mm (0.12 in. to 0.20 in.)      |
| Transverse sampling   | <i>Interval</i>                           |                                                       |
|                       | 1                                         | Less than or equal to 0.50 mm (0.02 in.)              |
|                       | 2                                         | Greater than 0.50 mm to 1 mm (0.02 in. to 0.04 in.)   |
|                       | 3                                         | Greater than 1 mm to 3 mm (0.04 in. to 0.12 in.)      |
|                       | 4                                         | Greater than 3 mm to 5 mm (0.12 in. to 0.20 in.)      |
| Transverse coverage   | <i>Width</i>                              |                                                       |
|                       | 1                                         | Greater than 3.7 m (12 ft)                            |
|                       | 2                                         | Greater than 2.7 m to 3.7 m (9 ft to 12 ft)           |
|                       | 3                                         | Greater than 1.8 m to 2.7 m (6 ft to 9 ft)            |
|                       | 4                                         | Less than or equal to 1.8 m (6 ft)                    |

5.4.1 If equipment can measure vertically with a crack width stationary repeatability precision of 0.7 mm (0.028 in.), a longitudinal sampling of 0.3 mm (0.012 in.), a transverse sampling interval of 5 mm (0.20 in.) and a transverse coverage of 2.0 m (6.5 ft), it is a Code C3253 unit.

## 6. Applications

6.1 The measures addressed by this guide support pavement management for roads, airfields, and other paved areas. Longitudinal profile, transverse profile, and crack width are