



## Standard Practice for Inclusion of Precision Statement Variation in Specification Limits<sup>1</sup>

This standard is issued under the fixed designation D 6607; 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 practice presents a method of determining rational specification limits by inclusion of the precision of the test method used in the specification.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 670 Practice for Preparing Precision And Bias Statements For Test Methods For Construction Materials<sup>2</sup>

C 802 Practice For Conducting An Interlaboratory Test Program To Determine The Precision Of Test Methods For Construction Materials<sup>2</sup>

D 2172 Test Methods for Quantitative Extraction Of Bitumen From Bituminous Paving Mixtures<sup>3</sup>

D 2726 Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures<sup>3</sup>

E 177 Practice for Use Of The Terms Precision And Bias In ASTM Test Methods<sup>4</sup>

#### 2.2 Federal Highway Administration Report:

FHWA Report HI-93-047 Materials Control and Acceptance—Quality Assurance, Federal Highway Administration, May 1993<sup>5</sup>

### 3. Terminology

3.1 For definitions of terms used in this practice, consult Practice E 177.

### 4. Significance and Use

4.1 Each test method has a limited precision. Even if a test is performed as carefully and as correctly as possible on a material which is as homogeneous as can be obtained, the test will still vary from one to another. A widely used measure of the variation of the test results from a test method is the standard deviation ( $\sigma$ ). In an ASTM standard test, the standard

deviation of the test method can be found in the Precision and Bias statement for the test. The “Blue Book,” *Form and Style for ASTM Standards*, requires that all test methods include Precision and Bias statements. Practice C 670 and Practice C 802 provide guidance for determination of these values.

4.2 If the precision of a test method is low and the precision of the test has not been properly considered in a material specification, a uniform material with the right quality may still be rejected most of the time because of the wide variation of the test results. In order to have rational specification limits, the precision of the test used should be properly included in a specification.

4.3 This practice provides a guideline for proper inclusion of precision of the test method in a rational specification.

### 5. Procedure

5.1 Determine the effective standard deviation ( $\sigma_X$ ) of the test results due to the combined effects of materials variation and test variation using Eq 1:

$$\sigma_X = (\sigma_M^2 + \sigma_T^2) \quad (1)$$

where:

$\sigma_M$  = standard deviation of test property due to material variation (see Note 1), and

$\sigma_T$  = standard deviation of test property due to test method (see Note 2).

NOTE 1— $\sigma_M$  is the expected standard deviation of the material property when the material is produced in a properly controlled process. A standard deviation which is representative of the acceptable variation of the material can be used. It can be calculated from the data obtained from properly produced materials.

NOTE 2— $\sigma_T$  is the standard deviation as given in the precision statement for the test method used to measure the test property.

5.2 Determine the standard deviation of the mean of the test results ( $\sigma_{\bar{x}}$ ) using Eq 2:

$$\sigma_{\bar{x}} = \sigma_X / \sqrt{n} \quad (2)$$

where:

$n$  = number of tests performed.

5.3 For a two-ended specification (with both a minimum and maximum limits), the specification limits for the average

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>5</sup> Available from the National Technical Information Service, 5285 Port Royal, Springfield, VA 22165.