Designation: C802 – 14 (Reapproved 2022)

Standard Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials[1]

This standard is issued under the fixed designation C802; 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 describes techniques for planning, conducting, and analyzing the results of an interlaboratory study (ILS) with the objective of developing the precision statement of a test method. It is designed to be used in conjunction with Practice C670. The methods used in this standard are consistent with those in Practice E691.

1.2 This practice is not intended for use in programs whose purpose is to develop a test method or to assess the relative variability of two or more test methods. Refer to Practice C1067 for procedures to evaluate the ruggedness of a test method.

1.3 The system of units for this practice has not been specified. Dimensional quantities in the practice are presented only in examples of calculations.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

C311/C311M Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C1067 Practice for Conducting a Ruggedness Evaluation or Screening Program for Test Methods for Construction Materials

E105 Guide for Probability Sampling of Materials

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E178 Practice for Dealing With Outlying Observations

E456 Terminology Relating to Quality and Statistics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of general statistical terms, refer to Terminology E456.

3.1.2 For definitions of terms associated with precision of test methods for construction materials, refer to Practice C670.

4. Significance and Use

4.1 This practice provides requirements for planning and conducting an interlaboratory study to obtain data to develop single-operator and multilaboratory precision statements for a test method. It includes methods to evaluate data consistency before carrying out the calculations to develop the precision statement. The procedures are compatible with those in Practice E691.

4.2 The ILS data obtained from this practice are intended for developing the precision values for writing single-operator and multilaboratory precision statements in accordance with Practice C670.

4.3 Appendix X1 provides an example to illustrate the calculations to obtain the precision values of the test method from the ILS data. This may be used to check a user-developed electronic spreadsheet for carrying out the calculations.

[1] This practice is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates. This practice was developed jointly by ASTM Committee C01, C09, D04, and D18, and is endorsed by all four committees.

Current edition approved Oct. 1, 2022. Published October 2022. Originally approved in 1974. Last previous edition approved in 2014 as C802 – 14. DOI: 10.1520/C0802-14R22.

[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.

*A Summary of Changes section appears at the end of this standard

4.4 Appendix X2 discusses the additional calculations required for an interlaboratory study of a test method that includes making test specimens as part of the procedure. In this case, batch-to-batch variability needs to be considered.

4.5 Appendix X3 discusses the use of analysis of variance as an alternative approach to obtain the precision values from the ILS data.

5. General Requirements

5.1 Certain criteria need to be met before undertaking an interlaboratory study to determine the precision of a test method. If some conditions are not met or are met incompletely, the program will become more complicated to administer and require more work and expense, or may result in impaired information. The requirements outlined in this section are intended to ensure that the test method is free of technical difficulties to the greatest extent possible before an expensive and time-consuming interlaboratory study is undertaken.

5.2 The first requirement is the existence of a valid and well-written test method that has been developed in one laboratory and has been subjected to ruggedness evaluation of the testing procedure and conditions as described in Practice C1067. As a result of the screening procedure and some experience with the test method in the sponsoring laboratory and one or two others, a written version of the test method has been developed (but not necessarily published as a standard) that describes the test procedure in terms that can be followed by a competent operator in any properly equipped laboratory. Critical conditions that affect the test results need to be identified and the proper and realistic degree of control of those conditions have to be specified in the description of the test procedure.

5.2.1 The tolerances established for various conditions in a test method provide reasonable ranges for these conditions and recognize that precise values with small tolerances may not be achievable in practice. Variations in test results due to variations in such conditions contribute to the total variation, which determines the precision of the test method. If the resulting variation is so great that uncertainties in average values obtained by the test method are unacceptably high, the test method itself is at fault and it will need to be improved or replaced by a better one. An expensive and time-consuming interlaboratory study is not recommended for such a test method.

5.2.2 Apparatus required for performing the test must be defined clearly and must be available or able to be produced. If alternative apparatus is permitted, criteria need to be provided on the performance requirements of the apparatus, such as by specifying acceptable limits of measurements on standard reference materials.

5.3 Personnel in laboratories participating in the ILS should have adequate experience with routine laboratory procedures so that they are competent to run the test. The importance of this requirement will vary with the complexity of the method and the degree to which it departs from familiar procedures.

5.4 It is helpful to have preliminary knowledge about how changes in materials and conditions affect the test results. There should be a reasonable degree of certainty that the single-operator variances are the same in different laboratories, and that troublesome interactions do not exist. These conditions are investigated in the initial analysis of the data of an interlaboratory study, and are discussed further in 10.4.

5.5 Facilities and procedures for procurement, preparation, and distribution of samples or test specimens must be available.

5.6 Selection of samples or test specimens must be done by a randomization process, and one person who is familiar with randomization procedures needs to be responsible for seeing that an appropriate randomization technique is used. Refer to Practice E105.

5.7 The precision of the test method should be evaluated on different materials with a range of the characteristic being measured that encompasses the typical use of the method in practice. (See 7.1 and 7.2.)

5.8 Adequate numbers of participating laboratories, operators, and materials must be available. Requirements in these areas are specified in Sections 6 and 7.

5.9 The entire interlaboratory test program should be developed from the beginning with the help and advice of persons familiar with statistical procedures and with the materials involved. The ASTM International Interlaboratory Study Program can support subcommittees in the development of precision statements by assisting in the design of an interlaboratory study, distribution of specimens or samples, data analysis, and preparation of a draft research report. Additional information about the ASTM ILS program can be obtained from the ASTM Website.

5.9.1 It may not always be possible to obtain people who are familiar with the materials involved and who have a sufficient knowledge of the proper statistical techniques and their proper use. In this case, the subcommittee should obtain the services of a statistician who has experience in practical work with data from materials testing, and provide that person with an opportunity for learning something about the particular materials and test method involved. Planners of an interlaboratory study need to avoid the pitfall of assuming that the use of statistical analysis software programs necessarily results in special expertise in manipulating the data or interpreting the results.

5.10 It is important to bear in mind that estimates of the precision of a test method are always based on a particular set of data obtained at a particular time and precision values need to be kept up-to-date. As materials, apparatus, and conditions change, and operators change or gain more experience, the characteristic precision of the results obtained may change, especially if the test method is new. In some cases, it may be desirable to conduct more tests at a later date (though not necessarily a repetition of the complete interlaboratory study) in order to provide a check on estimates previously obtained and either verify them or introduce revisions. When a subcommittee revises a test method, it should consider whether the proposed changes might affect the precision of the method. If there is a possibility that precision will be affected, limited