



Designation: C1531 – 22

Standard Test Methods for In Situ Measurement of Masonry Mortar Joint Shear Strength Index¹

This standard is issued under the fixed designation C1531; 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 These test methods cover procedures for the determination of the average in situ mortar joint shear strength index in existing unreinforced solid-unit and ungrouted hollow-unit masonry built with clay or concrete units. Three methods are provided:

1.1.1 *Method A (with Flatjacks Controlling Normal Compressive Stress)*—For determining mortar joint shear strength index when the state of normal compressive stress at the test site is controlled during the test using the flatjack method described in Test Method C1197. Horizontal displacement of the test unit is monitored throughout the test. The test setup for Method A is shown in Fig. 1.

NOTE 1—A paper² by Francesco Graziotti et. al of Univ. of Pavia included in ASTM STP 1612 discusses alternative methods for interpreting Method A testing results.

1.1.2 *Method B (without Flatjacks Controlling Normal Compressive Stress)*—For determining mortar joint shear strength index when using an estimate of the normal compressive stress at the location of the test site. Horizontal displacement of the test unit is not monitored during this procedure. The test set up for Method B is shown in Fig. 2.

1.1.3 *Method C (with Flatjack Applying Horizontal Load)*—For determining mortar joint shear strength index using an estimate of the normal compressive stress at the location of the test site, as shown in Fig. 3. Horizontal displacement of the test unit is generally not measured during this procedure.

1.2 The text of this standard refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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:³

C1180 Terminology of Mortar and Grout for Unit Masonry
C1196 Test Method for In Situ Compressive Stress Within Solid Unit Masonry Estimated Using Flatjack Measurements
C1197 Test Method for In Situ Measurement of Masonry Deformability Properties Using the Flatjack Method
C1232 Terminology for Masonry
E4 Practices for Force Calibration and Verification of Testing Machines

C1197 Test Method for In Situ Measurement of Masonry Deformability Properties Using the Flatjack Method

C1232 Terminology for Masonry

E4 Practices for Force Calibration and Verification of Testing Machines

2.2 Other Document:

International Existing Building Code (Appendix A, Chapter A1, Seismic Strengthening Provisions for Unreinforced Masonry Bearing Wall Buildings), 2014⁴

ASCE/SEI 41 Seismic Evaluation and Retrofit of Existing Buildings, ASCE Standard ASCE/SEI 41 (Chapter 11, Masonry)⁵

¹ These test methods are under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and are the direct responsibility of Subcommittee C15.04 on Research.

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² Graziotti, F., Guerrini, G., Rossi, A., Andreotti, G., and Magenes, G., “Proposal for an Improved Procedure and Interpretation of ASTM C1531 for the In Situ Determination of Brick-Masonry Shear Strength,” *Masonry* 2018, ASTM STP 1612, ASTM International, 2018, pp. 13–33, <http://dx.doi.org/10.1520/STP161220170181>

³ 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.

⁴ Available from International Code Council, 4051 Flossmoor Road, Country Club Hills, IL 60478.

⁵ Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, <http://www.asce.org>.

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

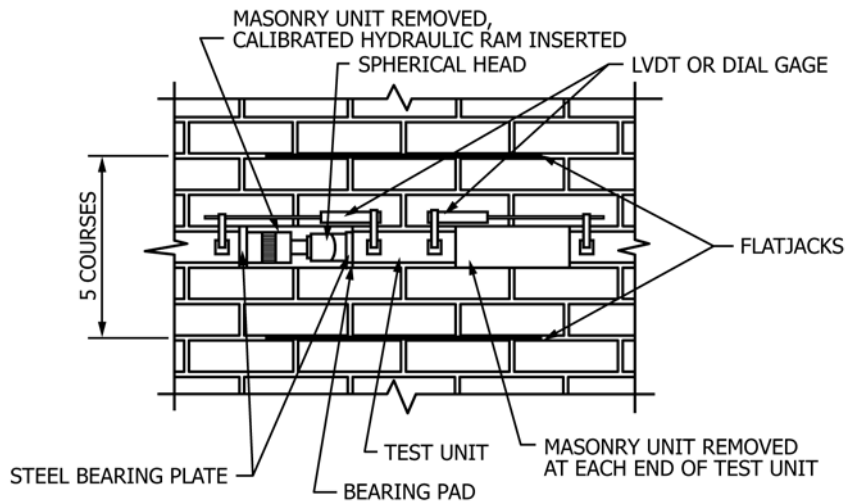


FIG. 1 Test Setup—Method A

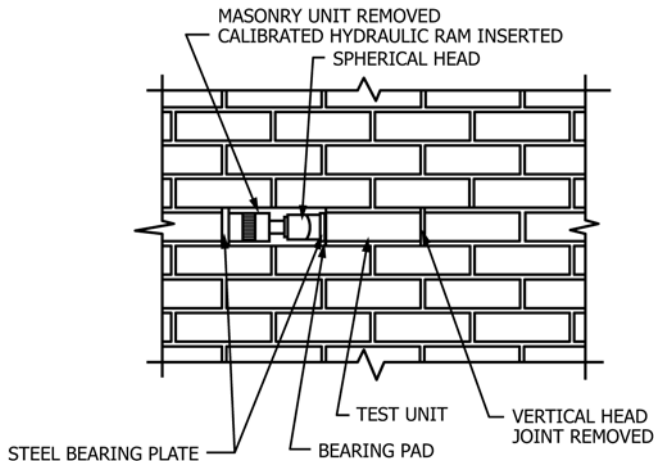


FIG. 2 Test Setup—Method B

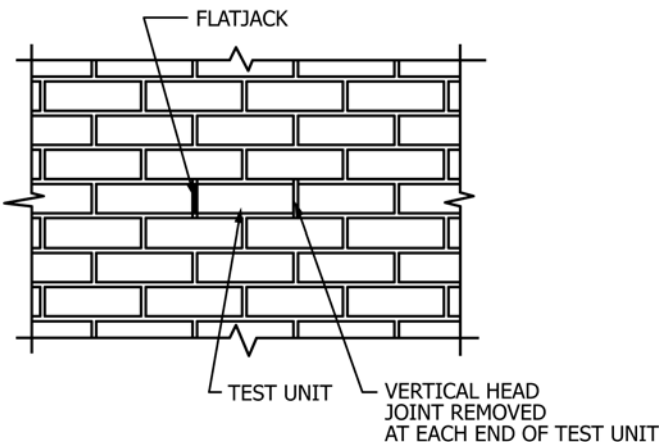


FIG. 3 Test Setup—Method C

4. Summary of Test Method

4.1 The in-place shear test is used to provide an index of the in situ, horizontal shear resistance of mortar joints in unreinforced masonry. For Method A, a single masonry unit is removed from opposite ends of the chosen test unit as shown in Fig. 1. For Method B, a single masonry unit and a head joint are removed from opposite ends of the chosen test unit, as shown in Fig. 2. For Method C, head joints on both ends of the tested unit are removed as shown in Fig. 3. Ensure that the bed joints are not disturbed in the unit to be tested. The test unit is then displaced horizontally relative to the surrounding masonry using a hydraulic jack or specialized flatjacks. The horizontal force required to cause first movement of the test unit provides a measured index of the mortar joint shear strength.

5. Significance and Use

5.1 This test method provides a means of evaluating the horizontal in-plane shear behavior of mortar joints in existing unreinforced masonry assemblies (see Note 2).

NOTE 2—The masonry mortar joint shear strength index obtained by this test method can be related to the masonry wall shear strength by relationships contained in referencing Codes and Standards. For example, formulas relating shear index to wall shear strength are found in Chapter A1 of the International Existing Building Code and Chapter 11 of the Seismic Evaluation and Retrofit of Existing Buildings, ASCE Standard ASCE/SEI 41. The user of this standard is cautioned that these shear strength relationships are typically empirical relationships based on tests of early 20th-century unreinforced brick masonry. These relationships typically assume that wall shear strength is limited by shear of the mortar joints rather than shear through the units

5.2 For hollow ungrouted or solid unit masonry construction the shear strength index is measured only for the mortar bed joints vertically adjacent to the unit being tested. When testing hollow ungrouted masonry construction, the shear strength index is based on the horizontal interface between the mortar and the test unit and the masonry above and below the test unit. In the case of multi-wythe construction, the measured mortar joint shear strength index is applicable only to the wythe in

3. Terminology

3.1 Terminology defined in Terminologies C1180 and C1232 shall apply for these test methods.