



Standard Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading¹

This standard is issued under the fixed designation E 695; 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.

^{ε1} NOTE—Keywords were added editorially in March 1997.

1. Scope

1.1 This method covers the measurement of the relative resistance of wall, floor, and roof construction to impact loading. The test is not applicable to doors.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *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:

D 1517 Definitions of Terms Relating to Leather²

E 73 Practice for Static Load Testing of Truss Assemblies³

E 575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies³

E 661 Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads³

2.2 Other Standards:

ANSI Z 299.2 Voluntary Industry Performance Standards for Pressure and Velocity of Shotgun Ammunition for the Use of Commercial Manufacturers⁴

Federal Specification V-T-291E (1) Thread, Linen⁵

3. Significance and Use

3.1 The procedures outlined will provide data that can be used to evaluate the relative performance of wall, floor, and

roof constructions under conditions representative of those sustained in actual service when subjected to impact by a heavy blunt object. See Test Method E 661 for evaluation of floor and roof sheathing and Practice E 73 for evaluation of roof trusses.

3.2 The method is intended to be applied to relatively light construction, including but not limited to wood floor and roof systems, partitions framed with wood or steel studs, steel floor or roof decking systems, steel siding and wall panels, or thin concrete and masonry walls or slabs and similar assemblies.

4. Summary of Method

4.1 Specimens of wall, floor, and roof construction are subjected to the impact force of a standard impact instrument. Wall sections are tested in the vertical position. Floor and roof sections are tested only in the horizontal position. Because of the inherent differences in the method of applying load, measurements obtained from tests in a horizontal mode are not comparable to measurements obtained from tests in the vertical mode.

5. Apparatus for Floor and Roof Systems, Specimen Horizontal (see Fig. 1)

5.1 *Supports*, steel rollers, two, on a rigid base.

5.2 *Impact Instrument*, made with a lead shot-filled leather bag as specified in 5.2.1-5.2.6.

5.2.1 *Leather*—The leather used in construction of the bag should be harness leather (Note 1), oak tanned (Note 1) from packer hides (Note 1) or latigo leather (Note 1), alum and vegetable tanned, or both. Leather thickness shall be expressed in ounces (Note 1) (1 oz = 0.4 mm (1/64 in.)).

NOTE 1—See Definitions D 1517.

5.2.2 *Thread*—Thread used in fabrication of the bag shall be linen thread of four or more plies, meeting the requirements for Type B, Class 1 or 2, of Federal Specification V-T-291E (1).

5.2.3 *Fabrication*—The side of the bag shall be 710 mm (28 in.) high by 735 mm (29 in.) wide of 8-oz leather 3 mm (1/8 in.) thick. The vertical edges shall be sewed together flesh side out and the seam shall be reinforced with a piece of 8-oz leather overlapping 10 mm (3/8 in.) each side. The side shall then be turned hair side out and sewed to the bottom. The base (bottom

¹ This method is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.11 on Horizontal and Vertical Structures/Structural Performance of Completed Structures.

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² *Annual Book of ASTM Standards*, Vol 15.04.

³ *Annual Book of ASTM Standards*, Vol 04.11.

⁴ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

⁵ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

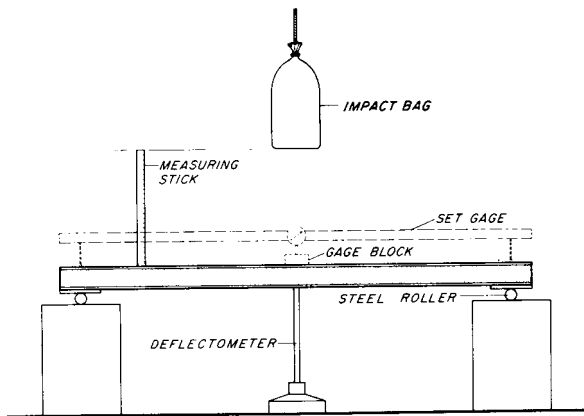


FIG. 1 Impact Load Test (Specimen Horizontal)

5.6 *Gage Blocks*, 300 by 300 mm (12 by 12 in.) in area, and constructed of metal or other hard surface material.

5.7 *Hold-Downs*—Clamps or other restraining devices at the specimen ends to minimize translation.

6. Apparatus for Wall Systems, Specimen Vertical (see Fig. 2)

6.1 *Steel Channels*, for support of the specimen at top and bottom.

6.2 *Rollers*, cylindrical rollers and two supporting rollers.

6.3 Impact bag, measuring sticks, deflectometer, set gage, and gage blocks conforming to the requirements specified in 5.2-5.7.

6.4 *Rigid Supporting Frame*, to which the supporting channels and deflection gage are attached.

7. Test Specimen

7.1 *Size*—The specimens shall be representative of the actual construction as to material, method of assembly, and workmanship.

7.2 *Length or Height*—The length or height of specimen for each element shall be chosen to conform approximately to the length or height of that element in actual size.

7.3 *Width*—The width of specimen shall be chosen, insofar as feasible, to include several of the principal load-carrying members to ensure that the behavior under load will simulate that anticipated under service conditions. The actual width of specimens shall be a whole number multiplied by the spacing of the principal load-carrying members, except for prefabricated panels for which the actual width shall be the width of panel used. If the structural properties of a particular construction are to be compared with another construction, there should not be a great difference in the actual widths of the specimens.

7.4 *Age*—Constructions such as concrete and masonry (brick, structural clay tile, concrete block) for which the structural properties depend upon the age of the specimen, shall be tested not less than 25 days nor more than 56 days after fabrication except in special instances such as the case of existing panels. This age requirement applies also to plastered and stuccoed constructions. Other assemblies affected by moisture shall be conditioned to constant weight or moisture content, or for at least 2 weeks at $20 \pm 3^\circ\text{C}$ ($68 \pm 6^\circ\text{F}$) and $65 \pm 5\%$ relative humidity.

7.5 *Number*—Tests shall be made on a minimum of three like specimens. However, more tests may be necessary depending upon information and accuracy desired.

8. Procedure

8.1 For symmetrical walls apply the impact load to the outside face from at least one of the specimens, and to the inside face of the other two specimens. For asymmetrical walls, test both sides an equal number of times. This will require a minimum of four test specimens. Exception: only one side need be tested at the option of the client and laboratory depending upon information required. The report shall record which side or sides of the specimen that is tested. For floor and roof assemblies apply the impact loads only to the upper finish-floor face of the specimen.

disk) shall be 230 mm (9 in.) in diameter of 12-oz leather 5 mm ($\frac{3}{16}$ in.) thick. The seam attaching the wall to the base shall be 6 mm ($\frac{1}{4}$ in.) from the edge of the base. Two rows of stitching shall be used for the vertical wall seam and the seam attaching the wall to the base.

5.2.4 *Hoisting Strap*—The strap to hoist the bag shall be made from 8-oz leather 3 mm ($\frac{1}{8}$ in.) thick by 15 mm ($\frac{5}{8}$ in.) wide by 610 mm (24 in.) long. The strap shall be passed through holes, diametrically opposite, in the side walls 40 mm ($1\frac{1}{2}$ in.) from the top of the wall. These holes shall be reinforced with pieces of 8-oz leather and 75 mm (3 in.) square. The leather strap shall be passed twice through a 50-mm (2-in.) diameter lifting ring and the ends fastened by sewing, riveting, or by use of a buckle. To avoid excessive stretching of the leather wall or failure of the vertical seam, a sleeve, made from 12-oz leather, of the same type as the base of the bag, shall be fitted to slip tightly around the lower portion of the bag. This sleeve should be 250 mm ($9\frac{5}{8}$ in.) high.

5.2.5 *Lead Shot*—The bag shall be loosely filled with No. $7\frac{1}{2}$ (2.4 mm (0.095 in.) in diameter) chilled lead shot, in conformance with ANSI Z 299.2. Two layers of 75-mm (3-in.) thick foam rubber or similar padding shall be placed over the lead shot to prevent spillage during testing.

5.2.6 The total mass of the bag, including shot, shall be adjusted to the desired level with an accuracy of $\pm 1\%$. The mass of the bag may be adjusted to any specified mass, depending upon the information desired.

5.3 *Measuring Sticks*—A stick, laid off in 150-mm (6-in.) increments, or a series of sticks the lengths of which are multiples of 150 mm (6 in.), to measure the height of drop accurately. A graduated sliding pointer, a standard metal tape measure, or any similar device that can accurately measure the height of drop may be substituted.

5.4 *Deflectometer*, or other suitable deflectometer equipment, consisting of a metal tube having a base at the lower end and a clamp at the upper end which supports, by friction, a light metal rod. The rod shall be movable inside the tube and shall be graduated to 0.25-mm (0.01-in.) divisions.

5.5 *Set Gage*, consisting of a light, rigid frame having two legs at one end and one leg at the other end, with the distance between the legs equal to the span of the specimen. A dial micrometer graduated to 0.025-mm (0.001-in.) divisions shall be attached to the frame at midlength.