



Designation: C 1354 – 96 (Reapproved 2004)

# Standard Test Method for Strength of Individual Stone Anchorages in Dimension Stone<sup>1</sup>

This standard is issued under the fixed designation C 1354; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method provides procedures for determining the ultimate strength of an assembly consisting of stone with mechanical anchor (anchorage). Load is applied, separately, perpendicular to the surface of the panel and parallel to the surface of the panel. This test is intended to represent the interaction of the anchor with the stone panel. However, influence of the backup structure on the strength of the assemblies is not included.

1.2 This method is applicable to stone panels supported by mechanical anchors.

1.3 The values stated in SI units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

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

C 1242 Guide for Design, Selection, and Installation of Exterior Dimension Stone Anchors and Anchoring Systems

E 4 Practices for Force Verification of Testing Machines

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

## 3. Terminology

### 3.1 Definitions:

3.1.1 *anchor, n*—in general, a metal shape inserted into a slot or hole in the stone panel that provides for the transfer of

loads from the stone to the building structure, either directly or through an intermediate structure.

3.1.2 *anchorage, n*—assembly consisting of a stone panel with a mechanical anchor.

3.1.3 *panel, n*—cut stone with large face dimensions in relation to its thickness, for placement in a building structure or frame assembly.

## 4. Summary of Test Method

4.1 Test specimens consisting of a stone panel sample and a mechanical anchor are fabricated in the same manner and of the same materials as their intended construction uses. The mechanical anchor is connected to a test support. A test load is applied perpendicular or parallel to the face of the stone panel. The test load is applied gradually using a calibrated test machine; load is increased until the stone or the mechanical anchor fails.

4.2 The load at failure and mode of failure of each test specimen is observed and recorded. The test as described above is repeated five times for each combination of stone and anchor to be tested and for each direction of load to be tested.

## 5. Significance and Use

5.1 This test method is intended to provide information from which applicable design data can be determined for a given anchor used to support a dimension stone panel. The strength of a limited length of anchor may be related to a longer length of support when the flexibility of the support is properly considered by the designer. Refer to Guide C 1242.

## 6. Testing Machine

6.1 The testing machine shall conform to the requirements of Practices E 4.

6.2 The load from the testing machine shall be applied through appropriate devices (a lubricated ball-and-socket or a lubricated universal joint) to apply direct tension to the test specimen without bending.

## 7. Support Frame and Loading Device

7.1 The support frame (excluding the anchor to be tested) shall have sufficient strength to not yield while supporting maximum applied load. In addition, the support frame shall be

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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.

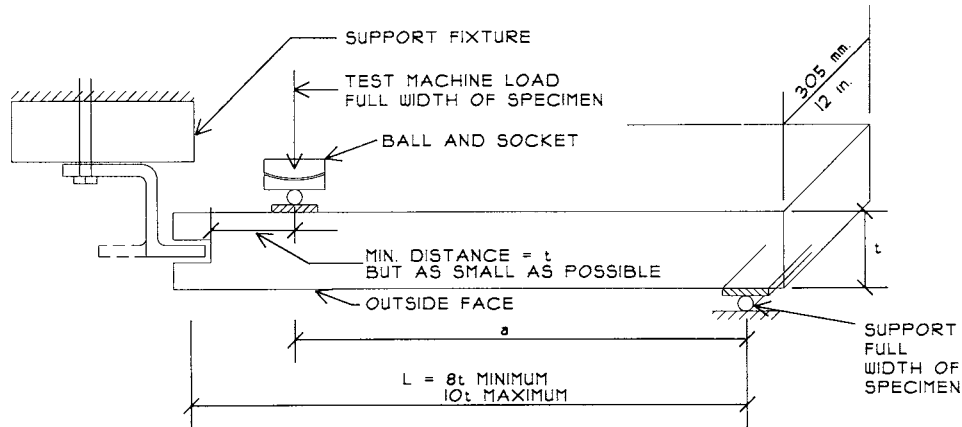


FIG. 1A Edge of Panel Supported by Tab Inserted into Kerf in Edge of Panel

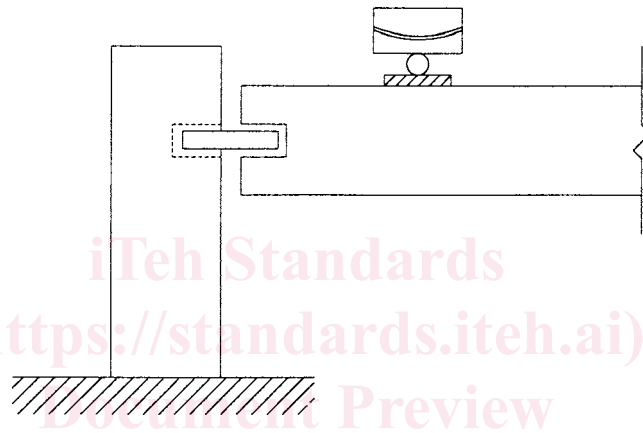


FIG. 1B Edge of Panel Supported by Pin Installed into Hole Drilled into Edge of Panel

FIG. 1 Setup for Testing Connection in Edge of Sample—Test Procedure A

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sufficiently stiff to limit deflection to less than 1 mm (0.04 in.) at maximum test load and to limit rotation to less than 2°.

7.2 For load perpendicular to the surface of the stone panel:

7.2.1 A rubber pad or a setting gypsum bed shall be used between the stone and the loading or restraint surface to avoid concentration of stress in the surface of the stone sample.

7.2.2 A frame to support a stone sample with anchor in the side edge of the stone is shown in Fig. 1. Fig. 1 represents outward loading on a single stone panel. At the designer's option, two stone panels can be tested on a single split anchor.

7.2.2.1 The test specimen is supported at one end by the anchor. The anchor shall be attached to the support frame in the same way it will be attached to the backup structure in construction. The sample of stone is supported at the opposite end by a 25 mm (1 in.) diameter rod.

7.2.2.2 The load from the testing machine is applied to the stone sample through a 25 mm (1 in.) diameter rod, located as close as possible to the anchor that supports the stone but at a distance not less than the thickness of the panel.

7.2.3 A frame to test a stone sample with anchor in back of the stone and the load applied in a direction perpendicular to the panel are shown in Figs. 2 and 3. The sample of stone panel is held down while the upward load is applied through a single

sample of anchor. The stone sample may be held down by independent anchors as shown in Fig. 2 or by the device used to apply load as shown in Fig. 3.

7.3 For load parallel to the surface of the stone panel:

7.3.1 The stone panel sample is restrained in the plane of the panel while a test load is applied parallel to the plane of the panel as shown in Fig. 4. The area beneath the anchor shall be kept unsupported to prevent restraint of spalls that may artificially increase the strength. The surface between the loading plate and the stone panel sample shall be lubricated.

## 8. Test Specimens

8.1 *Anchorage System*—The anchorage system shall be representative of the type to be used in field construction and shall include the anchor to be used and all accessories normally required to attach the anchor to the backup structure. If sealant, epoxy, or other form of kerf filler is specified to be used in field construction, the bond between the sealant, epoxy, or other form of kerf filler shall be intentionally prevented in the test assembly. Alternatively, provisions may be made to distribute the load from the anchor to the stone with a soft bearing material. At the designer's option, the sealant or epoxy may be allowed to bond.