



Designation: D 6916 – 06a

Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks)¹

This standard is issued under the fixed designation D 6916; 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 test method is used to determine the shear strength between two layers of segmental concrete block units used in construction of reinforced soil retaining walls. The test is carried out under conditions determined by the user that reproduce the facing system at full-scale. The results of a series of tests are used to define a relationship between shear strength developed between segmental concrete units and normal load.

1.2 This is a performance test used to determine properties for design of retaining wall systems utilizing segmental concrete units and soil reinforcing geosynthetics, either geotextiles or geogrids. The test is performed on a full-scale construction of the facing system and may be run in a laboratory or the field.

1.3 The values stated in SI units are regarded as the standard. The values stated in inch-pound units are provided for information only.

1.4 *This standard may involve hazardous materials, operations, and equipment. 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:²

D 448 Classification for Sizes of Aggregate for Road and Bridge Construction

D 4354 Practice for Sampling of Geosynthetics for Testing

D 4439 Terminology for Geosynthetics

D 4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

D 6637 Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

¹ This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties.

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² For referenced ASTM standards, visit the ASTM Web Site, 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 web site.

3. Terminology

3.1 Definitions:

3.1.1 *displacement criteria, n*—a user prescribed maximum movement, mm (in.), of the top segmental concrete unit out from the back of lower segmental concrete units.

3.1.2 *geosynthetic, n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a man-made project, structure or system. **D 4439**

3.1.3 *granular infill, n*—coarse grained soil aggregate used to fill the voids in and between segmental concrete units.

3.1.4 *peak shear strength, n*—the maximum shear capacity between segmental concrete units.

3.1.5 *segmental concrete depth, n*—the segmental concrete unit dimension perpendicular to the wall face.

3.1.6 *segmental concrete unit (modular concrete block), n*—a concrete unit manufactured specifically for mortarless, dry-stack retaining wall construction.

3.1.7 *segmental concrete unit width, n*—the segmental concrete unit dimension parallel to the wall face.

3.2 For definition of other terms relating to geosynthetics, refer to Terminology **D 4439**.

4. Summary of Test Method

4.1 In this test method, segmental concrete units are assembled in two rows (layers). The bottom row is laterally restrained. The top row is loaded vertically to a constant surcharge load and the interface is sheared at a constant rate of displacement until a drop of load after the peak load occurs. The test may be run with the geosynthetic reinforcement sandwiched between the two rows of segmental concrete units to determine the shear strength between segmental concrete units at the connection between the units and the geosynthetic reinforcement.

5. Significance and Use

5.1 The shear strength between segmental concrete units (with and without geosynthetic reinforcement) and is used in design of reinforced soil retaining walls.

5.2 This test is used to determine the shear strength for the design of the facing stability of segmental retaining walls. Performing a series of these shear tests at varying normal loads



permits development of a relationship between shear strength and normal load. This relationship may be linear, bi-linear, or some other complex mathematical expression.

5.3 This shear strength test is meant to be a performance test (laboratory or field), therefore, it should be conducted using full-scale system components. The conditions for the test are selected by the user and are not for routine testing.

5.4 As a performance test on full-scale system components it accounts for some of the variables in construction procedures and materials tolerance normally present for these types of retaining wall systems.

6. Apparatus

6.1 *Testing System*—An example of a test apparatus and setup is illustrated in Fig. 1. The principal components of the test apparatus are:

6.1.1 *Loading Frame*.

6.1.2 *Normal Load Piston/Actuator*.

6.1.3 *Vertical Loading Platen*, with stiff rubber mat or airbag to apply uniform vertical pressure to top of concrete blocks.

6.1.4 *Vertical Load Cell*, to measure normal load.

6.1.5 *Horizontal Piston/Actuator*, to apply horizontal load on the top segmental concrete unit.

6.1.6 *Horizontal Load Cell*, to measure applied force on the top segmental concrete unit.

6.1.7 *Two (2) Horizontal Displacement Measurement Devices*, to record displacement of the top segmental concrete unit.

6.2 *Loading Frame*—The loading frame shall have sufficient capacity to resist the forces developed by the horizontal and vertical loading pistons/actuators.

6.3 *Shear Loading Plate*—The shear loading plate must be sufficiently rigid to apply a uniform force across the full width of the top course. For some segmental units it may be necessary to apply the load through a deformable material (that is, stiff rubber) which will conform to an irregular block surface, thereby allowing for a uniform load distribution.

6.4 *Restraining Box/Plate*—A rigid restraining box/plate is required to prevent horizontal movement of the lowermost segmental concrete units during shear testing. The restraining box/plate area shall be of sufficient width and depth to accommodate the full scale “as manufactured” segmental concrete units being tested.

6.5 *Shear Loading Assembly*—The tensile loading unit will generally be a constant rate of extension screw jack or hydraulic actuator that can be displacement rate controlled. The loading equipment shall have a capacity that is at least equal to 120 % of the anticipated shear strength of the segmental concrete units. The piston shall be capable of at least 150 mm (6 in.) of movement in order to facilitate test set up and to ensure that there is adequate stroke to achieve peak load. The orientation of the tensioning force shall be horizontal and perpendicular to the back of the segmental units. The horizontal loading arrangement must not permit rotation of the top concrete unit during shear.

6.6 *Load Cells*—A calibrated load cell shall be used to measure the shear force and normal load during the test. The

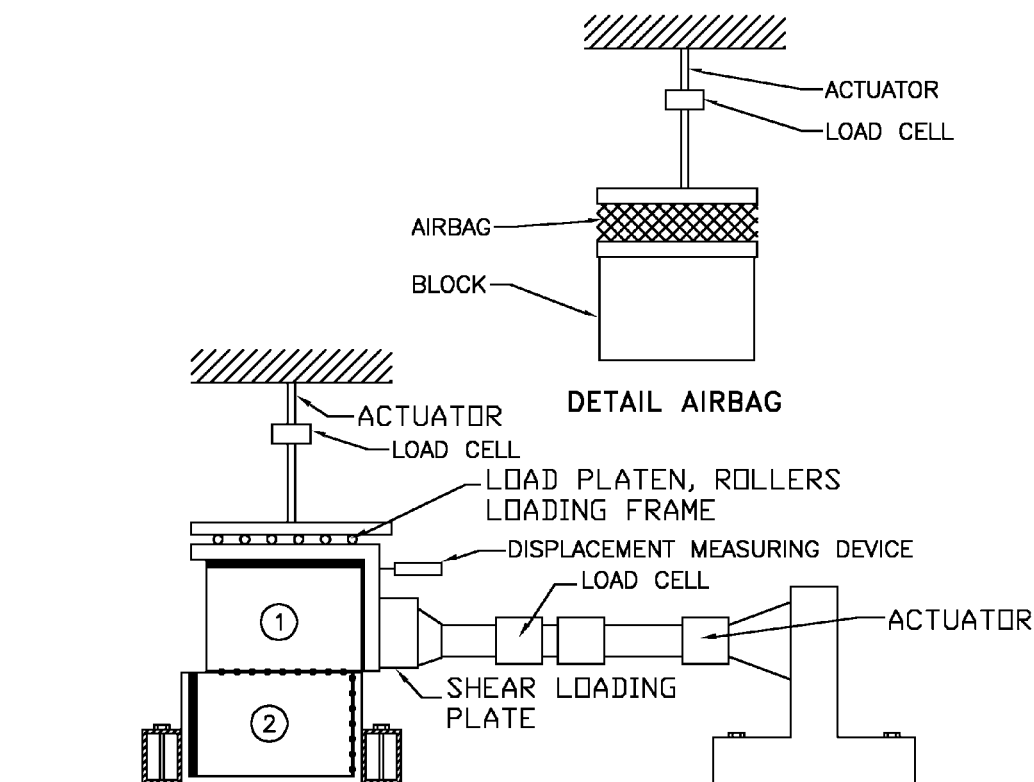


FIG. 1 Shear Test Apparatus (Cross Section View)