Designation: D1452/D1452M – 16

Standard Practice for Soil Exploration and Sampling by Auger Borings[1]

This standard is issued under the fixed designation D1452/D1452M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This practice covers equipment and procedures for the use of earth augers in shallow depth geotechnical exploration. This practice does not apply to hollow-stem augers. Uses of hollow-stem auger drilling methods for geotechnical exploration are addressed in Test Method D6151. Samples recovered from this standard are considered as belonging to Group A or B in accordance with D4220. The samples are disturbed and can generally be used for classification testing (D2487, D2488), determination of compaction characteristics (D698, D1557), or any other standard that requires bulk samples. For obtaining intact samples use of thin-walled sample tubes (D1587) in conjunction with fluid rotary drilling (D5783) or hollow-stem augers (D6151) may be considered.

1.2 This practice does not include considerations for geoenvironmental site characteristics and installation of monitoring wells which are discussed in Guide D5784.

1.3 The values stated in either inch-pound units or SI units presented in brackets are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard

1.4 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026 unless superseded by this method.

1.5 *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.*

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

D1586 Test Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils

D1587 Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes

D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)

D4220 Practices for Preserving and Transporting Soil Samples

D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock

D4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well) (Withdrawn 2010)[3]

D5783 Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Evaluations.

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[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

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

D5784 Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices
D6026 Practice for Using Significant Digits in Geotechnical Data
D6151 Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling

3. Terminology

3.1 *Definitions:*

3.1.1 For common definitions of terms in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cutter bit*—a bit where there are no moving parts, but drilling occurs due to shearing, scraping or abrasion of the rock. Cutter bits can be either polycrystalline diamond compact (PDC) or grit hot-pressed inserts (GHI) or natural diamond.

3.2.2 *pilot bit*—a small bit that drills a first hole to guide a larger drill bit - the cutting part of a drill; usually pointed and replaceable.

4. Significance and Use

4.1 Auger borings often provide the simplest method of soil exploration and sampling. They may be used for any purpose where disturbed samples can be used and are valuable in connection with groundwater level determination and indication of changes in strata and advancement of hole for split-barrel penetration tests and sampling (Test Method D1586) and thin-walled tube sampling (Practice D1587). Equipment required is simple and readily available. Depths of auger explorations are, however, limited by groundwater conditions, soil characteristics, and the equipment used.

5. Apparatus

5.1 *Hand-Operated Augers:*

5.1.1 *Screw Type Augers,* (Fig. 1) consisting of a flat thin metal strip, machine twisted to a spiral configuration of uniform pitch; having at one end, a sharpened or hardened point, with a means of attaching a shaft or extension at the opposite end. Small lightweight augers are generally available in sizes from 1 through 3 in. [25 through 75 mm].

5.1.2 *Ship-Type Auger,* (Fig. 2) similar to a carpenter's wood bit. It is generally forged from steel and machined to the desired size and configuration. It is normally provided with sharpened and hardened nibs at the point end and with an integral shaft extending through its length for attachment of a handle or extension at the opposite end.

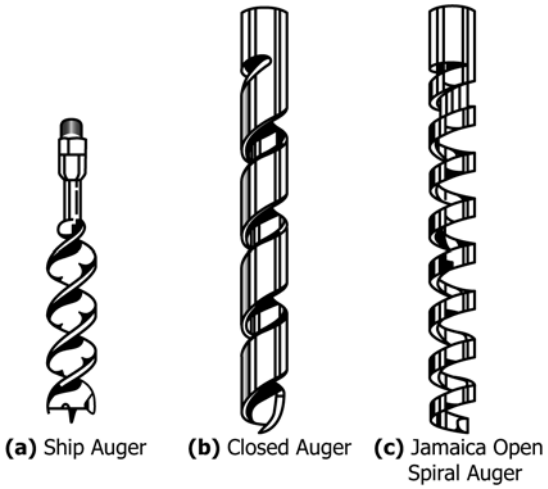

FIG. 2 Ship-Type Auger

5.1.3 *Open Tubular Augers,* (Fig. 3) ranging in size from 1.5 through 8 in. [40 through 200 mm] and having the common characteristic of appearing essentially tubular when viewed from the digging end.

5.1.4 *Barrel Auger Types,* (Fig. 4) the barrel auger is a complete cylinder. The cutting blades are cupped so that soil is loosened and forced into the barrel as the unit is rotated and pushed into the ground. Each filling of the barrel corresponds to a depth of penetration of 3 to 5 in. [75 to 125 mm]. The most popular barrel diameter is 3.5 in. [90 mm], but sizes ranging from 1.5 to 7 in. [40 to 180 mm] are available.

5.1.4.1 *Sand Augers,* (Fig. 4 (c))—For dry, sandy soils it may be necessary to use a variation of the regular barrel auger that includes a specially-formed bit to retain the sample in the barrel. Sand augers with 2, 3, or 4-in. [50, 75, or 100-mm] diameters are available.

5.1.4.2 *Mud Augers,* (Fig. 4 (d))—Another variation on the regular barrel auger design is available for sampling wet, clayey soils. As shown in Fig. 4(d), the barrel is designed with open sides to facilitate extraction of samples. The bits are the same as those used on the regular barrel auger. Mud augers with 2, 3, or 4-in. [50, 75, or 100-mm] diameters are available.

FIG. 1 Screw-Type Auger

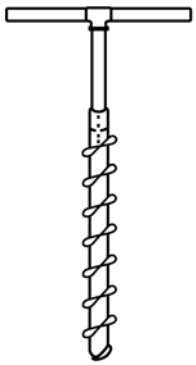

FIG. 3 Open Tubular Auger

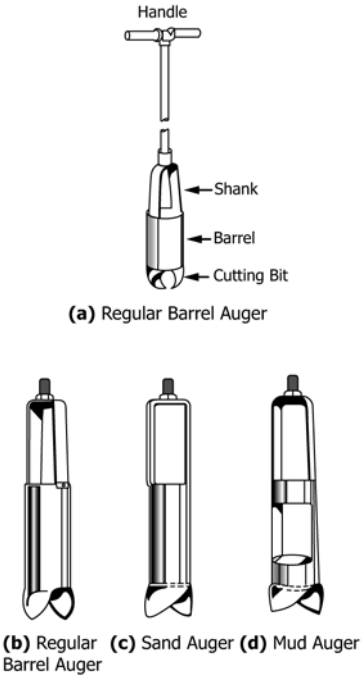

FIG. 4 Barrel Auger Types

5.1.5 *Post-Hole Augers,* generally 2 through 8 in. [50 through 200 mm], and having in common a means of blocking the escape of soil from the auger.

5.1.5.1 *Iwan Type,* (Fig. 5) consisting of two tubular steel segments, connected at the top to a common member to form a nearly complete tube, but with diametrically opposed openings. It is connected at the bottom by two radial blades pitched to serve as cutters which also block the escape of contained soil. Attachment of handle or extension is at the top connector.

5.1.5.2 *Dutch-Type Augers,* (Fig. 6) is a smaller variation of the post-hole auger design. The pointed bit is continuous with two, narrow part-cylindrical barrel segments, welded onto the shanks. The barrel generally has a 3 in. [75 mm] outside diameter. This tool is best suited for sampling wet, clayey soils.

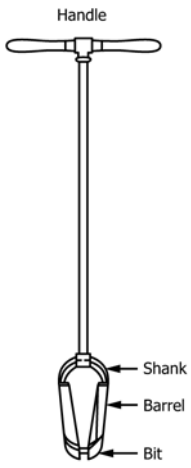

FIG. 5 Iwan-Type Auger

FIG. 6 Dutch-Type Auger

5.2 *Machine-Operated Augers*—A drill rig is commonly employed to rotate and advance an auger column. The drill rig should be capable of applying the rated power at a rotary velocity of 50 to 100 r/min. The drill rig should have a feed stroke of at least the effective length of the auger sections plus the effective length of the auger couplings.

5.2.1 *Helical Augers,* (Fig. 7) generally 4 through 48 in. [100 through 1200 mm], consisting essentially of a center shaft fitted with a shank or socket for application of power, and having one to six complete 360° [6-rad] spirals for conveyance and storage of cut soil. Cutter bits and pilot bits are available in moderate and hard formation types and normally replaceable in the field. They are normally operated by heavy-duty, high-torque machines, designed for heavy construction work.

5.2.2 *Stinger Augers,* generally 3 through 30 in. [75 through 750 mm], are similar to the helical auger in 5.2.1, but lighter and generally smaller. They are commonly operated by light-duty machines for post and power pole holes.

5.2.3 *Disk Augers,* (Fig. 8) generally 10 through 30 in. [250 through 750 mm], consisting essentially of a flat, steel disk with diametrically opposed segments removed and having a shank or socket located centrally for application of power. Replaceable cutter bits, located downward from the leading edges of the remaining disk, dig and load soil that is held on the disk by valves or shutters hinged at the disk in order to close

FIG. 7 Helical Auger

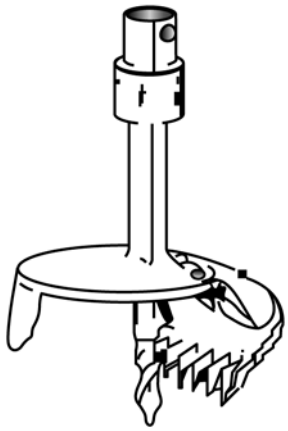

FIG. 8 Disk Auger

the removed segments. The disk auger is specifically designed to be operated by machines having limited vertical clearance between spindle and ground surface.

5.2.4 *Bucket Auger,* (Fig. 9) shows various types of bucket augers, generally 12 through 48 in. [300 through 1200 mm], consisting essentially of a disk auger, without shank or socket, but hinge-mounted to the bottom of a steel tube or bucket of approximately the same diameter as the disk auger. A socket or shank for power application is located in the top center of the bucket diametral cross piece provided for the purpose.

5.3 *Casing* (when needed), consisting of pipe of slightly larger diameter than the auger used.

5.4 *Accessory Equipment*—Labels, field log sheets, sample jars, sealing wax, sample bags, coolers, and other necessary tools and supplies.

6. Procedure

6.1 *General*—Perform a survey of underground and all other utilities prior to beginning exploration to identify and evaluate possible hazards. Check overhead obstructions or hazards, such as, power lines, before raising the mast of a drill rig or lifting equipment overhead.

6.2 Advance the auger boring by rotating and advancing to the desired depth into the soil.

6.3 Withdraw the auger in a straight pull from the hole leaving the auger materials as nearly in place as practical.

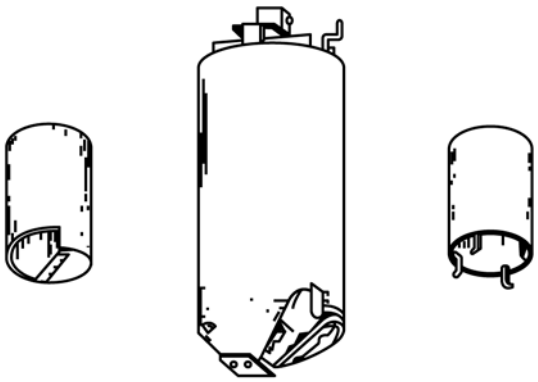

FIG. 9 Bucket Augers

6.4 Remove the soil for examination and classify the soil samples recovered in accordance with Practice D2488.

6.5 Place one or more representative portions of each different soil type into sealable moisture-proof containers, such as jars or plastic bags in sufficient quantity for the type of lab test contemplated. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, and sample depth.

6.6 Protect the samples against extreme temperature changes, if necessary place sample in a cooler.

6.7 Samples should be preserved and transported in accordance with Practice D4220 using Group B.

6.8 Return the empty auger to the hole and repeat the procedure.

6.9 Continue the sequence 6.2 through 6.8 until the required depth is reached.

6.10 Casing is required in unstable soil in which the auger hole fails to stay open and especially when the augering is extended below the groundwater level. The inside diameter of the casing must be slightly larger than the diameter of the auger used. The casing shall be driven to a depth not greater than the top of the next sample and shall be cleaned out by means of the auger. The auger can then be inserted into the auger hole and turned below the bottom of the casing to obtain a sample.

6.11 The soil auger can be used both for advancing the hole and for bringing up disturbed samples of the soil encountered. The structure of the soil sample is completely destroyed and the moisture may be changed by the augering process. Seal all samples in a jar or other airtight container and label appropriately. If more than one type of soil is picked up in the sample, prepare a separate container for each type of soil.

6.12 *Monitoring Water Level*—It is advisable to monitor groundwater levels, if present, in the augered hole during and after removal of the augering equipment. Groundwater elevation should be measured and documented during augering to include datum, date and time measured. Method or equipment used to determine depth of groundwater level, such as Test Method D4750 should also be noted. If groundwater is not encountered or if the level is of doubtful reliability, such information should also be documented.

NOTE 1—The user is cautioned that there are many factors which can influence augered hole water level measurements and the interpretation of augered hole water level measurements. These factors are not described or discussed in this practice. The interpretation and application of augered hole water level information should be done by a trained specialist. Installation of piezometers should be considered where complex groundwater conditions prevail.

7. Report: Test Data Sheet(s)/Form(s)

7.1 Report information in accordance with Guide D5434. The data obtained from the boring shall be recorded on the field logs and shall include the following:

7.1.1 Name of client and project location,

7.1.2 Date of start and completion of augering,

7.1.3 Identifying number of augering,

7.1.4 Names of crew,

7.1.5 Reference datum including direction and distance of boring relative to reference line of project or other suitable reference points,

7.1.6 Type and size of auger used in augering,

7.1.7 Depth of changes in strata to the nearest 0.1 ft [30 mm] or less,

7.1.8 Sample number and depth sample was obtained to the nearest 0.1 ft [30 mm] or less,

7.1.9 Description of soil in each major stratum in accordance with Practice D2488,

7.1.10 Groundwater elevation and location of seepage zones to the nearest 0.1 ft [30 mm] or less, when found,

7.1.11 Datum, date and time of augered hole water-level measurement and method or equipment used, and

7.1.12 Condition of augered hole upon removal of auger, that is, whether the hole remains open or the sides caved in, when such can be observed.

8. Keywords

8.1 auger borings; geotechnical exploration; sampling; soil explorations

APPENDIX

(Nonmandatory Information)

X1. EXAMPLE DATA SHEET

X1.1 Fig. X1.1 provides an example data sheet.

DRILLERS BORING LOG

Client: _____ **Prjoect No.:** _____ **Boring No:** _____

Project: _____ Sheet _____ of _____

Location: _____

Drill Crew: _____

_____

Boring Location
Station _____ **Offset** _____

Date Started: _____ **Date Completed:** _____

Boring Elevation: _____

Reference:

_____

GPS Coordinates

Easting: _____

Northing: _____

Strata Depth		Soil Description and Remarks	Sample Type	No.	Depth	
From	To				From	To

Method Of Drilling:

Auger _____ Size _____

Weather _____

Non-Drilling Time (Hrs.)

Boring Layout _____ Moving _____

Hauling Water _____ Standby _____

Water Level @ _____ Date _____

@ _____ Date _____

@ _____ Date _____

Cave-in Depth @ _____ Date _____

FIG. X1.1 Example Data Sheet

SUMMARY OF CHANGES

Committee D18 has identified the location of selected changes to this standard since the last issue (D1452 – 09) that may impact the use of this standard. (November 1, 2016)

(1) Revised Units statement in 1.3.
(2) Added additional ASTM references to 2.1.
(3) Revised Section 3 to comply with Form and Style Manual.
(4) Revised Section 5 to be consistent with other D18 standards.
(5) Added cooler to 5.4.
(6) Added clarity to Section 6.
(7) Added items to Section 7 Data Sheet.
(8) Defined sensitivity to the depth measurements.
(9) Changed Boring Logs to include client and GPS information.
(10) Other minor grammatical corrections throughout.