



Designation: D7015/D7015M – 18

Standard Practices for Obtaining Intact Block (Cubical and Cylindrical) Samples of Soils¹

This standard is issued under the fixed designation D7015/D7015M; 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 practices outline the procedures for obtaining intact block (cubical and cylindrical) soil samples.

1.2 Intact block samples are obtained for laboratory tests to determine the strength, consolidation, permeability, and other geotechnical engineering or physical properties of the intact soil.

1.3 Two sampling practices are presented. Practice A covers cubical block sampling, while Practice B covers cylindrical block sampling.

1.4 These practices usually involve test pit excavation and are limited to relatively shallow depths. Except in the case of large diameter (that is, diameters greater than 0.8 m [2.5 ft]) bored shafts of circular cross-section in unsaturated soils, for depths greater than about 1 to 1½ meters [3 to 5 ft] or depths below the water table, the cost and difficulties of excavating, cribbing, and dewatering generally make block sampling impractical and uneconomical. For these conditions, use of a thin-walled push tube soil sampler (Practice [D1587/D1587M](#)), a piston-type soil sampler (Practice [D6519](#)), or Hollow-Stem Auger (Practice [D6151/D6151M](#)), Dennison, or Pitcher-type soil core samplers, or freezing the soil and coring may be required.

1.5 These practices do not address environmental sampling; consult Guides [D6169/D6169M](#) and [D6232](#) for information on sampling for environmental investigations.

1.6 Successful sampling of granular materials requires sufficient cohesion, cementation, or apparent cohesion (due to moisture tension (suction)) of the soil for it to be isolated in a column shape without undergoing excessive deformations. Additionally, care must be exercised in the excavation, preservation and transportation of intact samples (see Practice [D4220/D4220M](#), Group D).

¹ These practices are 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.

Current edition approved Dec. 1, 2018. Published December 2018. Originally approved in 2004. Last previous edition approved in 2013 as D7015 – 13. DOI: 10.1520/D7015_D7015M-18.

1.7 The values stated in either SI units or inch-pound units [given 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. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

1.8 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice [D6026](#) unless superseded by this standard.

1.8.1 The procedures used to specify how data are collected/recorded or calculated in this standard are regarded as the industry standard. In addition they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analytical methods for engineering design.

1.9 *These practices offer 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 these practices 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.*

1.10 *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. For specific hazard statements, see Section 6.*

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

1.11 *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:²

- B733** Specification for Autocatalytic (Electroless) Nickel-Phosphorus Coatings on Metal
- D653** Terminology Relating to Soil, Rock, and Contained Fluids
- D1587/D1587M** Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes
- D1785** Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D2488** Practice for Description and Identification of Soils (Visual-Manual Procedures)
- D2937** Test Method for Density of Soil in Place by the Drive-Cylinder Method
- D3740** Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D4220/D4220M** Practices for Preserving and Transporting Soil Samples
- D5434** Guide for Field Logging of Subsurface Explorations of Soil and Rock
- D6026** Practice for Using Significant Digits in Geotechnical Data
- D6151/D6151M** Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling
- D6169/D6169M** Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations
- D6232** Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities
- D6519** Practice for Sampling of Soil Using the Hydraulically Operated Stationary Piston Sampler

3. Terminology

3.1 Definitions:

3.1.1 For definition of terms in this standard refer to Terminology **D653**.

4. Significance and Use

4.1 Intact block samples are suitable for laboratory tests where large-sized samples of intact material are required or where such sampling is more practical than conventional tube sampling (Practices **D1587/D1587M** and **D6519**), or both.

4.2 The intact block method of sampling is advantageous where the soil to be sampled is near the ground surface. It is the best available method for obtaining large intact samples of very

stiff and brittle soils, partially cemented soils, and some soils containing coarse gravel.

4.3 Excavating a column of soil will relieve stresses in the soil and may result in some expansion of the soil and a corresponding decrease in its unit weight (density) or increase in sampling disturbance, or both. Usually the expansion is small in magnitude because of the shallow depth. Stress changes alone can cause enough disturbances in some soils to significantly alter their engineering properties.

4.4 The chain saw has proved advantageous in sampling difficult soils, which are blocky, slickensided, or materials containing alternating layers of hard and soft material.³ The chain saw uses a special carbide-tipped chain.⁴

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice **D3740** are generally considered capable of competent and objective sampling. Users of this standard are cautioned that compliance with Practice **D3740** does not in itself assure reliable results. Reliable results depend on many factors; Practice **D3740** provides a means of evaluating some of those factors.

5. Apparatus

5.1 As shown in **Fig. 1**, excavating and trimming tools are required. They may include such items as backhoe, pick, shovel, chain saw, trowel, large and small knives, hacksaw blades, thin wire such as piano wire.

5.1.1 The chain for the chain saw is of standard design except that carbide tips are brazed to the cutting teeth. The chain saw's bar length should be greater than 450 mm [18 in.].

5.2 Sample container having sufficient strength and rigidity to avoid deformations that could damage the sample.

5.2.1 For cubical block sampling, a cubical wooden, steel box or any relatively rigid material that can be assembled into a box 10 mm to 15 mm [0.4 to 0.6 in.] larger than the sample dimensions may be used to contain the cubical block sample during the required cutting process (see **7.1.8**) or transportation or both. The box should be fastened using screws, or bolts and nuts preferably before going to the field to verify that the parts fit together and can be assembled without vibrating or otherwise disturbing the sample. Do not use nails or other devices that require hammering to assemble or disassemble the box.

5.2.2 For cylindrical block sampling, cylindrical tubes made of steel or any relatively rigid material may be used to contain the cylindrical block sample during the required cutting process (see **7.2.5**) or transportation or both. Steel thin-walled tubes as described in Practice **D1587/D1587M** may also be considered for securing samples. One end of the tube should have a sharpened cutting edge to assist in cutting the soil. Cylindrical tubes made of PVC pipe should have a minimum sidewall thickness of no less than that of a Schedule 80 pipe (Specification **D1785**).

NOTE 2—Experience with thin-wall push tube sampling of soils

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 Tiedemann, D. A., GR-83-8, "Undisturbed Block Sampling Using a Chain Saw," Bureau of Reclamation, Denver, CO, 1983, p. 19.

⁴ USBR 7100-89, "Obtaining Undisturbed Block Samples by the Hand and Chain Saw Methods," *Earth Manual—Part 2*, Bureau of Reclamation, Denver, CO, 1990, pp. 1079-1083.

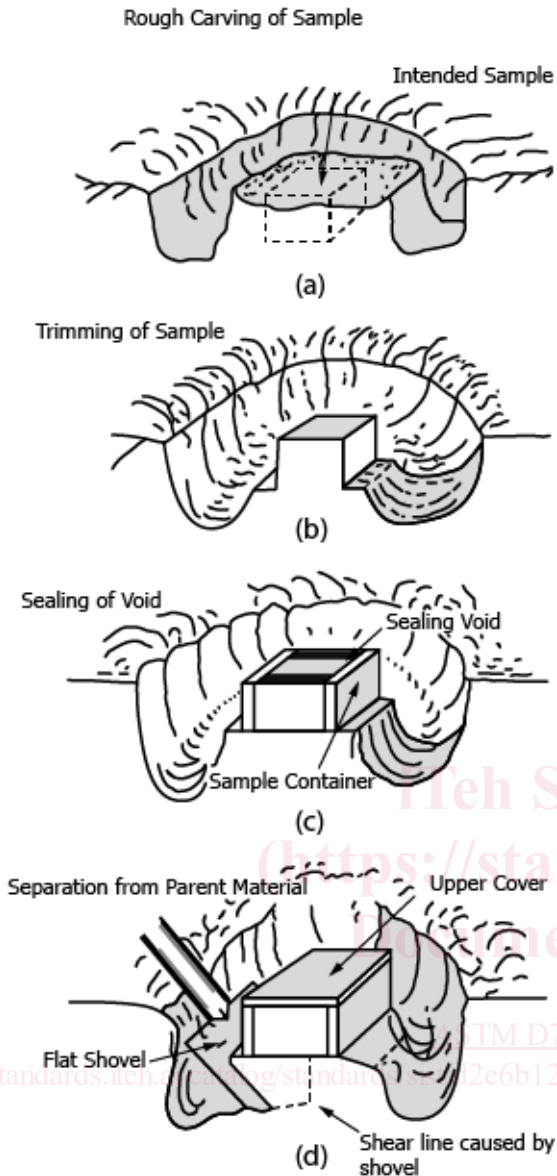


FIG. 1 Procedure for Rectangular Block Sampling

(Practice D1587/D1587M) indicates disturbance is minimized when the cutting edge is about 10 degrees or less. This sharp angle is possible with metal tubes, but may not be with other materials such as PVC, and a sharp angle may not be critical to hand trimmed samples.

5.2.3 *Protective Coating*—Corrosion, whether from galvanic or chemical reaction, can damage both the thin-walled tube and the soil sample. Severity of damage is a function of time as well as interaction between the sample and the steel tubes or boxes. Steel boxes and tubes should have some form of protective coating, unless the soil is to be extruded in less than three days. The type of coating to be used may vary depending upon the material to be sampled. Organic or inorganic lubricants like penetrating oil and non-stick cooking spray have been used to lubricate steel boxes or tubes prior to sampling and also aid in extrusion and reduce friction. Tubes have been coated with lacquer or epoxy for reuse, but lacquer may not be suitable for longer storage periods and must be inspected for inside wear.

5.2.3.1 Stainless steel and brass tubes or boxes are resistant to corrosion. Other types of coatings to be used may vary depending upon the material to be sampled. Plating of boxes or tubes or alternate base metals may be specified. Galvanized boxes or tubes are often used when long-term storage is required. Plating of the boxes or tubes or alternate base metals may be specified. In general, the coating should be of sufficient hardness and thickness to resist scratching that can occur from quartz sand particles, Nickel Electroless plating (Specification B733) has been used with good results.

5.3 *Push Block*—Any rigid material having sufficient strength and rigidity to avoid deformations when forcing downward the cylindrical block sampler tube. The dimensions of the block should be larger in size than the cylindrical block sampler tube.

5.4 Cheesecloth or similar cloth wrapping material.

5.5 Sealing wax, paintbrush, and melting stove or heater. Use a sealing wax that does not shrink appreciably, does not permit evaporation from the sample, and does not exhibit brittle characteristics. Microcrystalline waxes are preferable to paraffin.

5.6 Shipping containers, packing materials, labels, data forms, hand tools, and other necessary supplies. Packing material may be light, resilient polystyrene plastic, sawdust, or smaller material.

5.7 Fuel for the wax melting stove or heater, and fuel and lubricating oil for the chain saw.

5.8 Personal protective equipment (PPE) shall be considered when necessary. If a chain saw is used, eye and hearing protection, gloves, chaps, long-sleeved shirt or jacket, and safety boots should also be considered. A hard hat may also be appropriate. A first aid kit should be available and an appropriate fire extinguisher should also be handy, especially where a stove or heater is being used.

6. Hazards

6.1 *Warning Statement*—Trenching and excavation work presents serious risks, such as buried or overhead hazards, gas/electric lines, slope instability, ventilation, hearing, and like, to all workers involved. All excavations must be constructed in accordance with applicable national, regional, or local regulatory requirements. When using either a gas, hydraulically, or electric powered chain saw, operate in accordance with manufacturer instructions and follow safety precautions recommended by the manufacturer or other national, regional, or local safety regulations that may govern or should be observed.

7. Procedure

7.1 *Practice A—Cubical Block Sampling:*

7.1.1 At the location where the block sample is to be obtained level and smooth the ground surface and mark the outline of a face of the block. Surface soils containing roots or other organic matter must be removed. It is recommended that a density test be obtained near the location of the block. It may be necessary to provide some protection to the sample from

direct sun and/or wind when excavating around the sample to minimize the drying out of the sample.

NOTE 3—The size of the sample depends upon its intended use. For most investigations, a cube about 0.3 m [1 ft] per side, with a mass of about 55 kg [120 lb], provides sufficient material and can be handled easily.

7.1.2 Carefully excavate a trench around the sample to the required depth, removing a sufficient amount of material to provide space in which to work as shown on Fig. 1 (a and b). If a backhoe is used to excavate the trench, first dig out an oversized column (pedestal) large enough that the soil to be sampled is not disturbed by the backhoe operation. The trenches can start as L shape to check lateral changes in lithology then excavated in the U shape as shown in Fig. 1(b).

NOTE 4—Generally, a pedestal 0.9 to 1.2 m [3 to 4 ft] on a side and 0.9 to 1.2 m [3 to 4 ft] high is adequate. If the soil is fragile and easily broken, backhoe usage should be limited to excavation of only two or three sides of the pedestal, with the remaining side or sides excavated by chain saw or by hand methods, or both. In addition, if the soil is fragile and easily broken, the cylindrical block sampling procedure (see 7.2) should be considered, provided the “pushing in one continuous motion” or “drive-cylinder” methods are not used.

7.1.3 Gradually remove excess soil on the sides of the block using the chain saw or hand methods, or both, until a pedestal of the desired size is obtained (see Fig. 1(c)). Water content of the specimen can be determined from the trimmings.

7.1.4 Measure and record the elevation (or depth below the ground surface) to the top of the sample and depth to water level if encountered.

7.1.5 Visually classify the soil(s) in the sample based on the trimmings and exposed surfaces of the block in accordance with Practice D2488, and describe the in-place condition of the soil, such as color, odor, moisture condition, consistency, cementation and structure. Record the soil’s classification and in-place condition on a data sheet, see Section 9. Photographs of the block location (before and after trimming around the block) are desirable.

7.1.6 Cover the freshly exposed faces of the sample (pedestal) with cheesecloth and paint with melted wax as shown in Fig. 2. Apply additional layers of cheesecloth and wax to form a total of three (minimum) layers. Hot wax shall not be poured directly over the sample. If the soil is fragile, apply cheesecloth and then wax to individual faces of the sample as they are exposed.

7.1.7 Identify the sample (number, location, elevation, etc.), and mark the top of sample and the north orientation. A piece of heavy paper showing this information should be waxed to

the top of the sample and if applicable, add a second copy to the top of the box containing the block sample, see Section 8.

7.1.8 To remove the cubical block sample, carefully cut or shear the base of the sample from the underlying soil using a thin wire such as piano wire if in clayey soils, or with either a chain saw, shovels, or knives if in other soil types (see Fig. 1(d)). If the soil is disturbed easily, a sturdy box with both ends removed should be placed over the sample (see Fig. 3). If there is space between the sample and the box, then it should be filled with packing material such as moist sawdust. Attach the top to the box with screws, or with bolts and nuts prior to removing the base of the sample.

7.1.9 Carefully tilt the sample on one side using a flat shovel (see Fig. 1(d)) and continue turning the sample until the bottom of the sample is at the top. After the sample is turned, carefully trim the excessive soil from the sample. Add appropriate packing materials to minimize any voids between the box and sample. Cover the exposed bottom face with at least three layers of cheesecloth and wax as described in 7.1.6 and secure the bottom to the box as covered in 7.1.8.

7.1.10 Record necessary information on a data sheet as specified in Section 9. A copy of a sample data sheet is included in Appendix XI.

7.2 Practice B—Cylindrical Block Sampling:

7.2.1 At the location where the cylindrical sample is to be obtained, level and smooth the ground surface. Surface soils containing roots or other organic matter must be removed. Samples should be obtained from the bottom or the side of a test pit as shown on Fig. 1. Pushing in one continuous motion without hand trimming can be performed in accordance with Practice D1587/D1587M. Another method for advancing cylindrical samples by hammer impact is the Drive-Cylinder method (Test Method D2937) (see Notes 5 and 6).

7.2.2 Carefully excavate a trench around the sample to the required depth, removing a sufficient amount of material to provide space in which to work. If a backhoe is used to excavate the trench, first dig out an oversized column (pedestal) large enough that the soil to be sampled is not disturbed by the backhoe operation.

7.2.3 Place the sample container on the surface and gradually remove excess soil around the perimeter of the container using a tool like a cutter knife to a diameter several millimeters [inches] larger than the inner diameter of the sampling tube until 5 to 10 mm [0.25 to 0.5 in.] of soil is exposed.

7.2.4 Gently force down vertically and uniformly to retain the sample. Repeat the above cutting and forcing downward procedures until the surface of the sample extends above the sampling tube by approximately 3 cm [1 in.] (see Fig. 4).

NOTE 5—For soft soil and soils wet of optimum compaction, the tube can be pushed without any hand trimming using a thin-walled tube as described in Practice D1587/D1587M or by drive cylinder (Test Method D2937).

NOTE 6—For sensitive, fragile or brittle soils, there could be disturbance from pushing or hammering and if disturbance is suspected, consider using smaller trimming and pushing increments as covered in 7.2.4.

7.2.5 After filling the sample container, the bottom is separated from the ground as described in 7.1.8, and the upper and lower ends of the separated sample are trimmed.

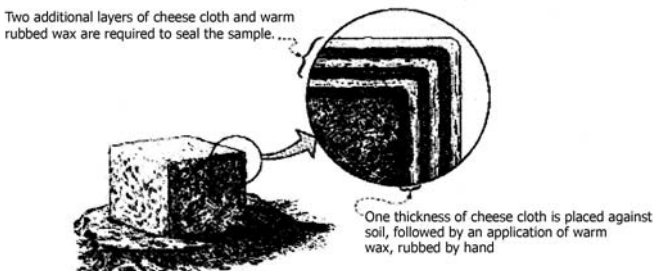


FIG. 2 Procedure for Placing Cheesecloth and Wax