
Test Procedure for**SURVEYING AND SAMPLING SOILS FOR
HIGHWAYS****TxDOT Designation: Tex-100-E****Effective Date: August 1999**

1. SCOPE

- 1.1 This method provides definitions of some basic terms and describes the procedures for surveying and sampling soils for highways. It describes the information required from the survey and the sampling methods required, and it discusses the apparatus necessary to carry out the sampling process.
- 1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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2. DEFINITIONS

- 2.1 *Aggregate*—Aggregate is granular material of mineral composition such as sand, gravel, shell, slag, crushed stone or lightweight. Aggregate may be used with a cementing medium to form mortars or concrete, or alone in base courses or as a surface treatment.
- 2.2 *Bank Gravel*—Bank Gravel is found in natural deposits, usually intermixed with fine material, such as sand or clay, or combinations thereof; the terms “gravelly clay,” “gravelly sand,” “clayey gravel,” or “sandy gravel” indicate the varying proportions of the materials in the mixture.
- 2.3 *Blast Furnace Slag*—Blast furnace slag is a non-metallic by-product, developed in a blast furnace simultaneously with iron in a molten condition, essentially consisting of silicates and alumina-silicates of calcium and other bases.
- 2.4 *Bottom Ash*—Bottom Ash is the heavy residue from the combustion of ground or powdered coal or lignite.
- 2.5 *Clay*—Clay is a fine grained soil that can be made to exhibit plasticity (putty-like properties) within a range of water contents and that exhibits considerable strength when air dry.
- 2.6 *Clay Size*—Clay size refers to any material finer than 0.002 mm (2 μm), though not necessarily exhibiting clay characteristics.
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- 2.7 *Coarse Aggregate*—Coarse aggregate is the portion of aggregate retained on the 2.00 mm (No. 10) sieve for Bituminous Concrete or retained on the 4.75 mm (No. 4) sieve for Portland Cement Concrete.
- 2.8 *Concrete*—Concrete is a composite material consisting of a binding medium within which are embedded particles or fragments of aggregate; in hydraulic cement concrete, the binder is formed from a mixture of hydraulic cement and water.
- 2.9 *Conglomerate*—Conglomerate is the coarse grained, clastic, sedimentary accumulation of particles, composed of rounded to sub-angular fragments larger than 2 mm (0.08 in.) in diameter, set in a fine-grained matrix of sand or silt and commonly cemented by calcium carbonate, iron oxide, silica or hardened clay.
- 2.10 *Crushed Face*—Crushed face is a fractured surface produced by the mechanical crushing of an aggregate. Crushed aggregate faces are identified by fresh fractures and lack of evidence of weathering.
- 2.11 *Crushed Gravel*—Crushed gravel is the product resulting from the mechanical crushing of gravel, with substantially all fragments having at least one face resulting from a fracture.
- 2.12 *Crushed Stone*—Crushed stone is the product excavated from an in-situ deposit of rock, crushed and processed for construction purposes with substantially all faces resulting from the crushing operation.
- 2.13 *Detrital (Weathered)*—Detrital material consists of particles that have been formed through the disintegration of other particles by erosion or weathering.
- 2.14 *Fine Aggregate*—Fine aggregate is the portion of the aggregate passing the 2.00 mm (No. 10) sieve for Bituminous Concrete or passing the 4.75 mm (No. 4) sieve for Portland Cement Concrete.
- 2.15 *Fly Ash*—Fly ash is the finely divided residue from the combustion of ground or powdered coal or lignite that is transported from the firebox through the boiler by flue gases.
- 2.16 *Granite*—Granite is an igneous rock consisting of quartz and alkali feldspars.
- 2.17 *Gravel*—Gravel consists of unconsolidated or loose detrital sediment (aggregate resulting from natural disintegration and abrasion of rock) with particle sizes passing the 76.2 mm (3 in.) sieve and retained on the 2.00 mm (No. 10) sieve.
- 2.18 *Lightweight Aggregate*—Lightweight aggregate consists of expanded shale, clay, or slate, and is produced by the rotary kiln method.
- 2.19 *Limestone Rock Asphalt*—Limestone rock asphalt is limestone impregnated with naturally occurring asphalt.
- 2.20 *Lithification*—Lithification is the process of hardening, induration, and compaction of sediments, leading to the formation of solid materials.

- 2.21 *Mineral Filler*—Mineral filler is a fine aggregate or manufactured material used to supply particle sizes where the mix design is deficient in gradation.
- 2.22 *Quarry*—A quarry is an open surface excavation of minerals or construction materials.
- 2.23 *Riprap*—Riprap is quarried stone especially selected, graded, and placed to prevent erosion and thereby preserve the shape of a surface, slope, or underlying structure.
- 2.24 *Rock*—Rock is a mass of solid, naturally occurring material from an in-situ deposit, excluding conglomerates. The formation may or may not be laminated.
- 2.25 *Sand*—Sand consists of fine aggregate particles that are retained on the 75 μm (No. 200) sieve, either as natural sand resulting from natural disintegration and abrasion of rock, or as manufactured sand, which is produced by the crushing of rock, gravel, slag, etc.
- 2.26 *Sandstone*—Sandstone is sedimentary rock consisting predominantly of weathered sand-sized particles naturally cemented together.
- 2.27 *Silt*—Silt is soil passing the 75 μm (No. 200) sieve that is non-plastic or very slightly plastic and that exhibits little or no strength when air dry.
- 2.28 *Silt Size*—Silt size is any material passing the 75 μm (No. 200) sieve that is coarser than 0.002 mm (2 μm), though not necessarily exhibiting silt characteristics.
- 2.29 *Slag*—Slag is a non-metallic by-product of the smelting or refining of metals and consists of calcium and alumina-silicates.
- 2.30 *Soil*—Soil is a superficial, unconsolidated deposit of disintegrated and decomposed rock material produced by surface weathering.
- 2.31 *Source*—A source is a geographical location of naturally occurring material that can be mined or quarried from the original in-situ deposit. In the case of manufactured or by-product material, it is the location of the plant at which the material is produced.
- 2.32 *Stone*—Stone consists of crushed, angular particles of rock.
- 2.33 *Traprock*—Traprock consists of various fine-grained, dense, dark colored igneous rocks, typically basalt or diabase; also called “trap.”
- 2.34 *Virgin Material*—Virgin material is material not previously used in construction.

Note 1—The Specification Committee has approved the above definitions.

3. APPARATUS

- 3.1 Many factors, such as the nature of the terrain, the kind of material, the depth of material below the surface, the equipment available, and the use to be made of the survey information, will affect the type and amount of equipment to be used in sampling.

- 3.2 Small hand tools are satisfactory for sample collection where the materials are at a shallow depth and can be easily dug. However, if the materials are very hard, power equipment may be more economical. The only feasible method of sampling strata located at a considerable depth below the surface is the use of a power drill machine with a core or auger attachment.
- 3.3 The following equipment should suffice for ordinary conditions:
- *Sample bags and moisture cans* for disturbed samples
 - *Materials*, to maintain moisture content, and *boxes* for packing undisturbed cores
 - *Power drill rig*, with core and/or auger attachments
 - *Metallic tape*, 30 m (100 ft.) long
 - *Post hole digger, shovel, prospector's pick, other hand tools*
 - *Jackhammer and air compressor*
 - *Sample splitter or quartering cloth*
 - *Engineer's level and level rod*
 - *Stakes*
 - *Gasoline burner and pan*
 - *Ruler*, 2 m (6 ft.)
 - *Soil auger.*

4. SOIL SURVEY

- 4.1 The soil survey is an important part of the engineering survey for the design, location and construction of a highway. The investigation should furnish the following information:
- The extent and location of each type of soil or rock in the subsurface
 - The condition of subsoils (moisture and density) upon which embankments will be constructed
 - The design of ditches and backslopes in cut sections to prevent slides
 - The location and selection of suitable material for fills, sub-grade treatment and backfill adjacent to structures
 - The location of local material for base and aggregate
 - The need for stabilization of sub-grade, sub-base and base materials
 - The supporting values of soils as foundation materials.

5. SAMPLING

- 5.1 A representative sample of disturbed soil consists of a combination of the various particles in exactly the same proportion as they exist in the natural ground, roadway, or pit.

- 5.1.1 The proper method of obtaining a sample will depend on the place, the quantity of material, the proposed treatment, and tests to be performed in the laboratory.
- 5.1.2 Unless different types of materials are to be uniformly mixed in certain proportions, samples should contain only materials of like color and texture, and should not be composite of materials apparently different in character.
- 5.2 It is impossible to obtain a sample from the earth that is entirely undisturbed, because the removal of the surrounding soil releases the pressure from the specimen, which causes a certain amount of disturbance.
- 5.3 The intent of sampling, however, is to obtain a core of soil from the earth with as little disturbance as possible to the natural density, moisture content, and structural arrangement of the particles.
- 5.3.1 Such a soil core is satisfactory for all practical purposes and can be classified as an undisturbed sample of soil.