



**PDHonline Course C650 (2 PDH)**

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# **Soil Identification by Visual-Manual Methods**

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**2020**

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## RECOMMENDED PRACTICE FOR DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE)

### 1. SCOPE

- 1.1 This recommended practice describes a procedure for the identification and description of soils for engineering purposes based on visual and manual examination.
- 1.2 This recommended practice is intended to be used not only for identification of soils in the field, but also in the office or in the laboratory or wherever soil samples are inspected and described.
- 1.3 The ability to identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and physical characteristics while performing the identification procedures.

### 2. DEFINITIONS

- 2.1 Rock – Natural solid mineral matter occurring in large masses of fragments.
- 2.2 Broken Rock – Angular fragments of rock which will be retained on a 3 inch (75 mm) sieve.
- 2.3 Boulders – Rounded fragments of rock which will be retained on a 3 inch (75 mm) sieve.
- 2.4 Stone – Crushed or naturally angular particles of rock which will pass a 3 inch (75 mm) sieve and be retained on a No. 10 (2.00 mm) sieve.
  - 2.4.1 Coarse Stone – Stone passing the 3 inch (75 mm) sieve and retained on the 1 inch (25 mm) sieve.
  - 2.4.2 Medium Stone – Stone passing the 1 inch (25 mm) sieve and retained on the 3/8 inch (9.5 mm) sieve.
  - 2.4.3 Fine Stone – Stone passing the 3/8 inch (9.5 mm) sieve and retained on the No. 10 (2.00 mm) sieve.
- 2.5 Gravel – Rounded particles of rock which will pass a 3 inch (75 mm) sieve and be retained on a No. 10 (2.00 mm) sieve.
  - 2.5.1 Coarse Gravel – Gravel passing the 3 inch (75 mm) sieve and retained on the 1 inch (25mm) sieve

2.5.2 Medium Gravel – Gravel passing the 1 inch (25 mm) sieve and retained on the 3/8” (9.5 mm) sieve.

2.5.3 Fine Gravel – Gravel passing the 3/8” (9.5 mm) sieve and retained on the No. 10 (2.00 mm) sieve.

2.6 Sand – Granular materials resulting from the disintegration, grinding, or crushing of rock and which will pass the No. 10 (2.00 mm) sieve and be retained on the No. 200 (0.075 mm) sieve. For field classification of sand it is simplest to set the upper limit at a diameter of 2.00 mm and the lower limit at the size of smallest diameter than can be seen by the naked eye and separately distinguished by the fingers. Dividing this range into three groups will approximate the foregoing size ranges.

2.6.1 Coarse Sand – Sand passing the No. 10 (2.00 mm) sieve and retained on the No. 30 (0.595 mm) sieve

2.6.2 Medium Sand – Sand passing the No. 30 (0.595 mm) sieve and retained on the No. 40 (0.425 mm) sieve.

2.6.3 Fine Sand – Sand passing the No. 40 (0.425 mm) sieve and retained on the No. 200 (0.075 mm) sieve.

2.7 Silts – Material passing the No. 200 (0.075 mm) sieve but larger than 0.002 mm. A fine grained soil having apparent plasticity when wet but easily powdered when dried, i.e. a low dry strength. When wet, the shaking of a small pat of silt causes water to appear on its surface. The water will then disappear if the pat is pressed between the fingers.

2.8 Clays – Material smaller than 0.002 mm. A fine grained soil exhibiting high plasticity when remolded in a moist state and, when dried, having a high dry strength.

### **3. DESCRIPTION OF SOIL CLASSIFICATION**

3.1 Soil deposits in nature very rarely consist of one type of material. Usually these deposits consist of mixtures of the different soil components in varying proportions. In order to avoid confusion between persons identifying soils in the field and persons interpreting data in the laboratory, it is essential that a standard method of describing soils be established.

3.2 The predominance of different sized grain is established in the following manner. The sizes are mentioned in decreasing order of importance.

3.2.1 Fine to medium sand - grading contains more fine than medium sand.

3.2.2 Coarse to fine sand – grading contains more coarse than medium or fine sand.

3.2.3 Medium to fine gravel – grading contains more medium than fine gravel.

3.3 Natural soils consist of combinations of various percentages of soil groups. Soil containing 35% or less passing the No. 200 (0.075 mm) sieve are designated as sands. Soils containing greater than 35% passing the No. 200 (0.075 mm) sieve are designated as silts or clays depending upon their plasticity index (P.I.); a P.I. of 10 or less designates silt; a P.I. greater than 10 designates clay. A secondary group would be described by the word “trace” if it comprises 1 to 10% of the soil and the word “some” if it comprises 11 to 20% of the soil. Soils containing greater than 20% of the secondary group shall be designated as sandy, silty, or clayey.

3.3.1 Fine sandy silt – 36 to 79% silt, 21 to 64% fine sand

3.3.2 Medium to fine sand, some silt – 80 to 89% medium to fine sand, 11 to 20% silt.

3.3.3 Silty fine to coarse sand, trace fine gravel – 55 to 78% fine to coarse sand, 21 to 35% silt, 1 to 10% fine gravel.

3.3.4 Medium to coarse sand, some gravel, trace of silt – 70 to 88% medium to coarse sand, 11 to 20% gravel, 1 to 10% silt.

3.3.5 Fine to medium sandy silty clay – 36 to 79% silty clay, 21 to 64% fine to medium sand.

3.3.6 Clayey silt, trace fine sand – 90 to 99% clayey silt, 1 to 10% fine sand.

3.4 It should be emphasized that a clayey silt has physical properties of a silt, not a clay, and a silty clay the properties of a clay. Often these two descriptions must be substantiated by laboratory tests.

3.5 The color of the soil should be placed before the soil types.

3.5.1 Brown silty fine sand.

3.5.2 Blue gray silty clay.

3.5.3 Reddish brown silty coarse to fine sand.

3.6 The consistency of clays and silts and the compactness of sands and gravels are reported as follows:

3.6.1 Sands and gravels are reported as being loose or dense.

3.6.2 Clays and silts are reported as:

3.6.2.1 Soft, if the sample is easily penetrated several inches by the thumb

3.6.2.2 Firm, if the sample is penetrated several inches by the thumb with moderate effort

3.6.2.3 Stiff, if the sample is readily indented by the thumb, but penetrated only with great effort

3.6.2.4 Very stiff, if the sample is readily indented by the thumb nail

3.6.2.5 Hard, if the sample is indented with difficulty by the thumb nail.

3.7 The following chart is used when samples are obtained by means of the standard penetration test.

Degree of Density or Consistency			
Non-Cohesive Soils (Sand)		Cohesive Soils (Clay)	
Descriptive Term	Standard Penetration "N" – blows per foot	Descriptive Term	Standard Penetration. "N" – blows per foot
Very Loose	0-4	Soft	0-4
Loose	5-10	Firm	5-8
Medium	11-30	Stiff	9-15
Dense	31-50	Very Stiff	16-30
Very Dense	> 50	Hard	> 30

3.8 The consistency or degree of compactness is placed before the color and the soil type.

3.8.1 Soft gray clayey silt, trace of sand.

3.8.2 Firm to stiff brown silty clay.

3.8.3 Very stiff brown fine sandy silt.

3.8.4 Dense brown coarse sand and gravel.

3.8.5 Very loose light brown medium to coarse sand.

3.9 The moisture condition of the soil is described as follows:

3.9.1 Dry – if the soil required addition of considerable moisture to achieve optimum moisture content

3.9.2 Moist – if the soil is near optimum moisture content

3.9.3 Wet – if the soil required drying to obtain optimum moisture content.

3.9.4 Saturated – if the soil comes from below the water table.

3.10 The moisture condition of the soil should be placed first in the description.

3.10.1 Saturated loose gray medium to fine sand

3.10.2 Moist firm brown silty clay.

3.11 It is essential that any evidence of organic material in all stages of decomposition be reported, such as roots, plant fragments, wood, peat, etc. Also, any strong odor given off by the soil should be noted.

3.12 In certain areas different soil types are found in repeating layers of thickness from 1/16 inch (1.5 mm) up to 2 feet (61 cm) or more. It is important that all such formations and their thickness are noted, and individual descriptions for each layer are given.

3.13 In certain areas decomposed rock is found in varying degrees of decomposition. For this material it is important to describe it as a normal soil sample with the notation "Decomposed Rock" at the end of the description.