Hellman & ASSOCIATES
BUILDING PARTNERSHIPS FOR A SAFER WORKPLACE

Safety Meeting Topic:
Excavation – Soil Classification

Soil Classification

Competent persons are required to analyze and classify excavation soil to understand the risks and necessary precautions needed to protect employees from cave-ins. This classification must be based on at least one visual and at least one manual analysis.

Visual tests are conducted to gather qualitative information regarding the excavation in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material. The area around an excavation and soil that is being excavated or found on the sides of the excavation shall be evaluated as follows:

- Particle size, with finely grained material more likely to be cohesive and coarsely grained material more likely to be granular;
- The tendency of freshly excavated soil to clump together versus break apart easily, with cohesive soil tending to form clumps and granular soil more apt to not stick together;
- Crack-like openings, such as tension cracks, or chunks sloughing off of the sides of the excavation that could indicate fissured material;
- Soil layering to determine if the layers slope toward the excavation, as well as the degree of the slope;
- Existing utilities and other underground structures to identify previously disturbed soil;
- Evidence of surface water, water seepage, and the level of the water table; and
- Sources of vibration that may affect the stability of the excavation face.

Manual tests are conducted to gather quantitative as well as qualitative properties of soil and provide more information in order to classify soil properly. Examples of manual tests that can be performed to evaluate soil include:

- Plasticity – Mold a moist or wet sample of soil into a ball and attempt to roll it into treads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling (i.e., if at least a two-inch length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive).
- Thumb penetration – The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. The test should be conducted on a fresh, undisturbed soil sample to minimize the effects of exposure to drying. Type A soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) can be readily indented by the thumb, but only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb and can be molded by light finger pressure.
- Pocket penetrometer or hand-operated shearvane – Works best with a fresh, undisturbed soil sample and reads unconfined compressive strength. Type A soil has an unconfined compressive strength of 1.5 tsf or more, Type B has a strength of 0.5-1.5 tsf, and Type C has a strength of 0.5 tsf or less.

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Soil Types

OSHA divides soil up into the following types: stable rock, Type A, Type B, and Type C. Additional criteria concerning each soil type is provided below.

Stable Rock (e.g., granite and sandstone)
- Solid mineral that can be excavated with vertical sides and remain intact while exposed.
- Solid rock may contain cracks, which can make it difficult to make a definitive determination.

Type A (e.g., clay, silty clay, and sandy clay)
- Cohesive soil with an unconfined compressive strength of 1.5 tsf
- Cannot be Type A if it is fissured, subject to vibration, previously disturbed, seeping water, or part of a sloped or layered system of 4H:1V

Type B (e.g., silt, silt loam, and angular gravel)
- Cohesive soils with an unconfined compressive strength of 0.5-1.5 tsf
- Granular cohesionless soils
- Also includes Type A soil that has been fissured or is subject to vibration; dry rock that is not stable; and layered systems (with slope ≤ 4:1) where material would otherwise be classified as Type B

Type C (e.g., gravel, sand, loamy sand, submerged rock that is not stable, and soil from which water is seeping)
- Cohesive soils with an unconfined compressive strength of 0.5 tsf or less
- Granular soils
- Also includes layered systems (with slope ≥ 4:1)

Always assume that soil is Type C until proven otherwise by visual and manual tests or a detailed soil analysis performed by a soil engineer.

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Photos for presentation:

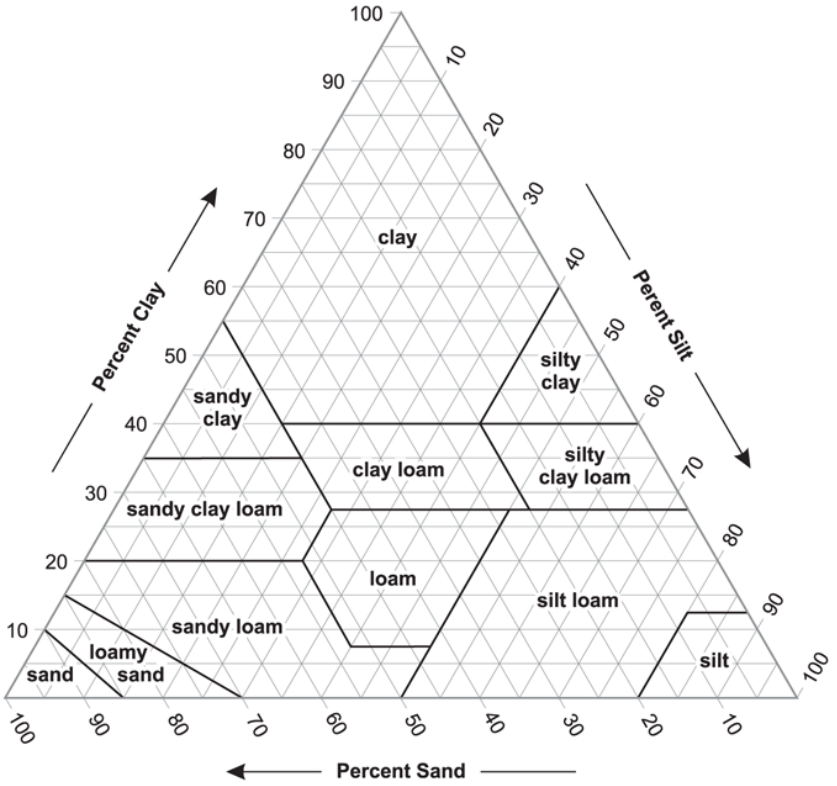

Photo showing the composition of different soils

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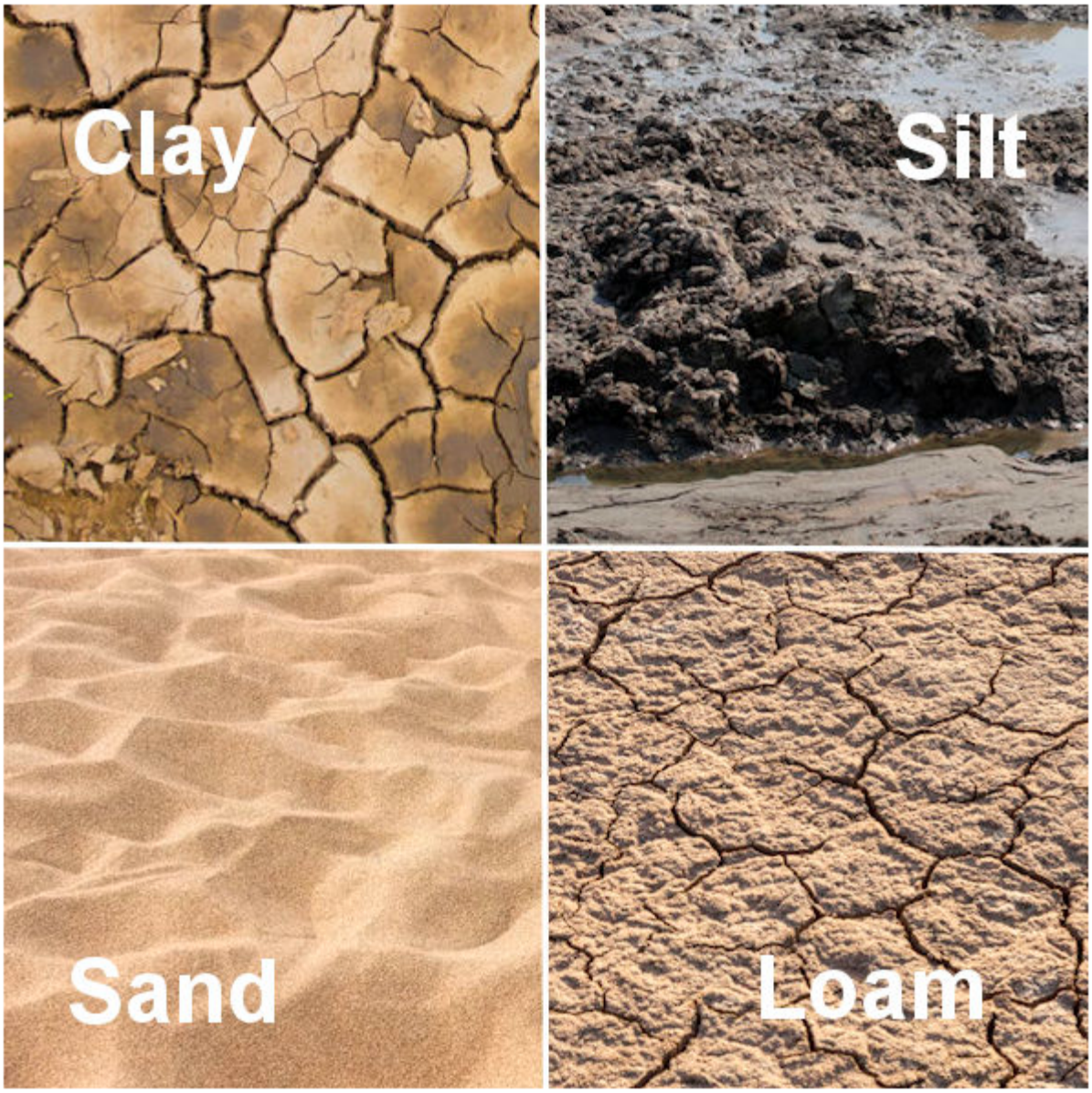

Photo showing the appearance of different soils

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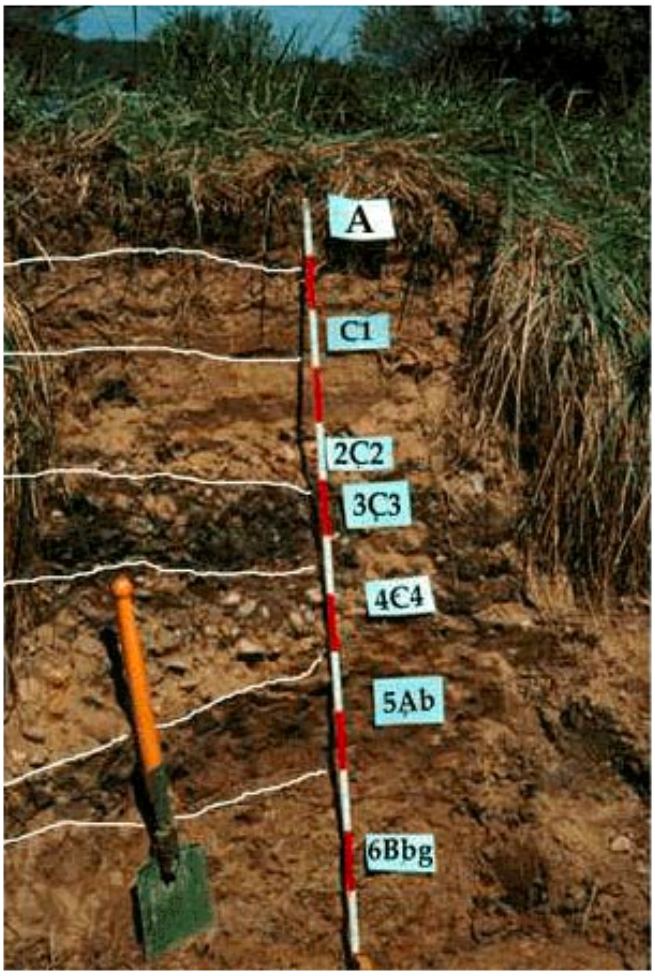

Photo showing a layered soil system

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Flat face of sample ready for testing.

Testing with a penetrometer.

Photo showing the method of testing soil strength with a pocket penetrometer

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Photo showing the method of testing soil strength with a shearvane

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Photos showing the process of preparing a soil sample and results of a plasticity test

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Photo demonstrating the results of a thumb penetration test based on soil type

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