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SOIL ANALYSIS, TESTING AND PROTECTIVE SYSTEMS

Because most excavations done by City employees will be conducted in order to repair/replace utilities or equipment (i.e. the soil has been previously disturbed), excavations shall be made to meet the requirements for Type B or Type C soils only, as appropriate.

Type A - Most stable: Clay, silty clay, and hardpan (resists penetration) No soil is Type A if it is fissured, is subject to fissures or vibrations of any type, has previously been disturbed, or has seeping water.

Type B - Medium stability: Silt, sandy loam, medium clay and unstable dry rock, previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil but are fissured or subject to vibration.

Type C - Least stable: Gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping.

Layered geological strata (where soils are configured in layers): The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e. where a Type C soil rests on top of stable rock.

TESTING METHODS

The Responsible Person in charge of the excavation shall be responsible for determining whether the soil is Type B or C. The Responsible Person shall use a visual test and one or more manual tests.

Visual Test

1. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. The Responsible Person also checks for any signs of vibration;
2. During the visual test, the Responsible Person should check for crack-line openings along the failure zone indicating tension cracks, look for existing utilities indicating the soil has been previously disturbed, and observe the open side of the excavation for indications of layered geologic structuring;
3. The Responsible Person should also look for signs of bulging, boiling, or sloughing, as well as signs of surface water seeping from the sides of the excavation or from the water table; and
4. The area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

Manual Tests

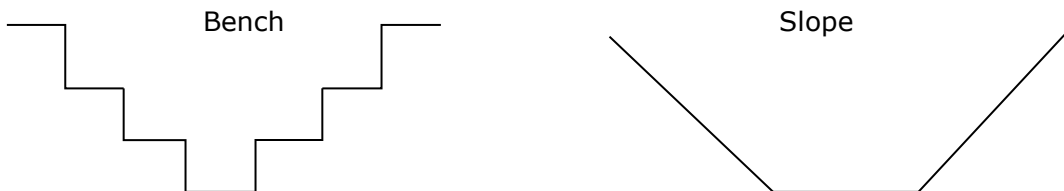
1. Thumb Penetration Test
Attempt to press the thumb firmly into the soil in question. If the thumb penetrates no further than the length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it Type C. It should be noted that the thumb penetration test is the least accurate testing method.
2. Dry Strength Test
Take a sample of dry soil. If it crumbles freely or with moderate pressure into individual grains it is considered granular (Type C). Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can only be broken with difficulty) it is probably clay in combination with gravel, sand, or silt (Type B).
3. Plasticity or Wet Thread Test
Take a moist sample of the soil. Mold it into a ball and then attempt to roll it into a thin tread approximately 1/8 inch in diameter by two inches in length. If the soil sample does not break when held by one end, it may be considered Type B.

PROTECTIVE SYSTEMS

1. Benching and Sloping
Excavations shall not be sloped greater than the following angles or rise/run ratios:

Soil Type	Rise/Run Ratio	Slope Angle
Type B	1:1	45 degrees
Type C	1 1/2:1	34 degrees

All benched excavations 20 ft or less in depth shall have a maximum allowable slope of 1:1. Benching is NOT allowed in Type C soil.



2. Shielding or Trench Boxes
Trench boxes are intended primarily to protect workers from cave-ins and similar incidents. All rented or purchased protective systems shall be used according to the manufacturer's instructions. The Responsible Person shall have the manufacturer's tabulated data on site during use. The excavated area between the outside of the trench box and the face of the trench should be as small as possible to prevent the box from shifting if the soil were to slough. The space between the trench boxes and the excavation side shall be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those the system was designed to withstand.