Performance Examination - Soils

Standard Test Methods for Density and Unit Weight of Soil in Place by Sand-Cone Method[1] (ASTM D1556 / D1556M-15e1)

Candidate Name: _____ **NICET ID:** _____

Apparatus	Trial 1	Trial 2
Density Apparatus		
4 L (1 gal.) jar (or sand container of suitable volume)		
Detachable double funnel top connected by a cylindrical valve with opening 12.7 mm (½ in.) diameter		
Valve has stops preventing rotation past open or closed		
Walls of cone form angle of approximately 60º with the base		
Base plate has a flanged center hole cast to receive a large funnel		
Base plate is a minimum of 3 in. larger than funnel and calibration container		
Approximately same size and allows sand to fall approx. same distance as the test hole		
Molds from D698 (Proctor) are recommended containers		
Of a known volume, calibrated according to D4253		
Sand		
Clean, dry, uniform in density and grading, uncemented, durable, and free-flowing		
Gradation has a uniformity coefficient (Cu = D60/D10) < 2.0, max particle size < 2 mm (No.10)		
<3% by weight passing the 250-µm (No. 60) sieve		
Bulk density determined on each container or bag of sand, with not more than 1% variation between any determination and the average value, in the air-dried state before use		
Sand not re-used without removing any contaminating soil, checking the gradation, and drying		
Re-determining the bulk density. Note: reclaiming sand after testing is not desirable		
Bulk density test of sand made at an interval not exceeding 14 days (not required if using cone correction Method B), always after significant changes in atmospheric humidity, before reusing, and before use of a new batch		
Balances Class G20 readable to 5 g or better		
Drying Equipment for Moisture Content Stove, oven, or other suitable equipment.		
Moisture Content Containers		

Procedures	Trial 1	Trial 2
Cone Correction Factor (Method A by Mass)		
1. Empty apparatus placed upright on the firm level surface with the valve closed		
2. Apparatus filled with sand		

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Procedures (continued)	Trial 1	Trial 2
3. Mass of apparatus with sand determined		
4. A base plate placed on a clean, level, plane surface		
5. Sand cone inverted and the funnel seated in the recess of the base plate		
6. Apparatus and base plate marked so that they can be reseated in the same position during testing		
7. Valve opened fully until sand stops flowing (ensure apparatus is not jarred or vibrated)		
8. Valve closed sharply and mass of apparatus and remaining sand determined		
9. Mass of sand required to fill cone and base plate. (cone correction) Calculated by subtracting the final mass of apparatus and sand from the initial mass of apparatus and sand (cone correction $C_C = m_1 – m_2$)		
10. Procedure repeated a minimum of three times and results averaged		
11. Maximum variation between any one determination and average does not exceed 1%, average value used in calculations		
12. Mass of sand required to fill apparatus determined according to Method A for each batch of sand		
13. The volume of the funnel and base plate determined (volume equals the bulk density of sand divided by cone correction determined in Method A)		
14. Minimum of three determinations performed and the average value calculated		
15. Maximum volume variation between any one determination and average does not exceed 1%, average value used in test calculations		
Sand Bulk Density Determination		
Bulk Density Factor (Bulk Density Determination, Method A (Preferred))		
1. Sand removed during the Cone Correction determination replaced and valve closed		
2. Mass of apparatus with sand determined (m_3)		
3. Calibration container placed on clean, level plane surface		
4. A base plate placed on calibration container, apparatus inverted and seated in the recess of base plate		
5. Valve opened fully until sand stops flowing		
6. Valve closed sharply and mass of apparatus and remaining sand determined (m_4)		

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Procedures (continued)	Trial 1	Trial 2
Bulk Density Calculated as Follows		
$DB = (m3 - m4 - CC) / VC$ D_B = bulk density of the sand m_3 = initial mass of apparatus and sand m_4 = final mass of apparatus and sand C_C = Cone Correction V_C = volume of calibration container		
7. Each sand-cone and matched base plate has unique cone correction and bulk sand densities		
8. Procedure repeated a minimum of three times and results averaged		
9. The maximum variation between any one determination and average does not exceed 1%, average value used in calculations		
Bulk Density Determination, Method B (Alternative)		
Metal Straightedge: about 2 in. (50 cm) wide at least ⅛ in. (3 mm) thick with a length of approximately 1.5 times the diameter of the calibration container		
1. Apparatus filled with sand		
2. Mass of empty calibration container determined		
3. Apparatus inverted and supported over the calibration container so that sand falls approximately same distance and location as in the field		
4. Valve opened and a container filled until just overflowing and valve closed		
5. Minimum number of strokes used to strike off excess material with care taken not to vibrate the container		
6. Any excess sand cleaned off outside of the container		
7. Mass of container and sand determined		
8. Net mass of sand calculated by subtracting the mass of empty container from the mass of container and sand		
9. Bulk density calculated as in Method A		
10. Procedure repeated a minimum of three times and results averaged		
11. The maximum variation between any one determination and average does not exceed 1%. Average value used in calculations		
Sand Bulk Density Determination		
Preparation		
1. Apparatus inspected for damage, free rotation of valve and matching base plate		
2. Container filled with sand (bulk density of sand previously determined)		
3. Mass of the filled sand cone apparatus determined		

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Procedures (continued)	Trial 1	Trial 2
Sand Bulk Density Determination		
Testing		
1. Test location prepared so that it is a level plane and base plate seated on the prepared surface		
2. Base plate makes contact with the ground around the flanged hole, base plate outlined to check for movement during the test, and if needed baseplate secured using nails or other means		
3. Test hole dug inside the opening of the base plate without disturbing the soil that will bound the hole		
4. Test hole volume as large as practical (to minimize errors), hold depth selected to be a representative of soil, should approximate the thickness of or more compacted lifts		
5. Sides of hole slope slightly inward, bottom reasonably flat and concave, granular soils may require digging a conical-shaped hole		
6. Hole kept as free as possible of pockets, overhangs, and sharp obtrusions		
7. All loosened soil placed in a container, loss of material and moisture avoided		
8. Base plate flange cleaned		
9. Apparatus placed on the base plate (at the same position as marked during calibration)		
10. Vibrations from nearby personnel or equipment eliminated or minimized during testing		
11. Valve opened, sand allowed to fill the hole, base plate, and funnel until sand stops flowing		
12. Valve closed and mass of apparatus and remaining sand determined		
13. Mass of moist material removed from test hole determined		
14. Material mixed thoroughly and a representative sample removed for moisture determination (or use the entire sample)		
15. Volume of test hole by ASTM standards		

First Attempt: Pass: _____ Fail: _____ **Second Attempt:** Pass: _____ Fail: _____

Exam Administration: Remote _____ In-Person _____

Comments:

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Examiner Name: _____ **Examiner Signature**: _____ **Date:** _____