



Performance Examination-Soils

Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop (AASHTO T 180-19)

Candidate Name: _____ NICET ID: _____

Apparatus	Trial 1	Trial 2
Manual Rammers		
Circular Face -2.5-kg (5.5-lb), with 4 vent holes approximately 19 mm from each end		
Ram Mass 2.486 – 2.504 kg (5.48 – 5.52 lb)		
Face Diameter 50.42 – 51.05 mm (1.985 – 2.010 in.)		
Drop Height 303 – 307 mm (11.94 – 12.06 in.)		
Mechanical Rammers		
Circular Face -2.5-kg (5.5-lb), 305 mm (12 in.) drop height		
Face Diameter 50.42 – 51.05 mm (1.985 – 2.010 in.)		
Mechanical Rammer-Sector Face -2.5-kg (5.5-lb), 305 mm (12 in.) drop height		
Face Dimensions area 1997 – 2047 mm (3.095 – 3.173 in.)		
Metal Straightedges		
Beveled Edge – one		
Planar one edge plane to 0.250 mm (0.01 in.)		
Length at least 250 mm (10 in.) long		
Sieves 19 mm (¾ in.) and 4.75 mm (No. 4)		
Sample Extruder For solid-walled molds only		
Compaction Base Concrete Block (at least 90 kg or 200 lb) or concrete floor		
Containers Resistant to corrosion, disintegration		
Balances Readable to 1 g, Class G2 and G20		
Drying Oven at 110 ± 5 °C (230 ± 9 °F)		
Manual Rammers		
Circular Face -4.54-kg (10-lb), with 4 vent holes approximately 19 mm from each end		
Ram Mass 4.527 – 4.545 kg (9.98 – 10.02 lb)		
Face Diameter 50.42 – 51.05 mm (1.985 – 2.010 in.)		
Drop Height 455 – 459 mm (17.94 – 18.06 in.)		
Mechanical Rammers		
Circular Face 4.54-kg (10-lb), 457 mm (18 in.) drop height		
Face Diameter 50.42 – 51.05 mm (1.985 – 2.010 in.)		
Face Dimensions area 1997 – 2047 mm (3.095 – 3.173 in.)		

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Apparatus (continued)	Trial 1	Trial 2
4-INCH MOLDS		
Detachable Collar detachable collar fits mold		
Internal Diameter 101.19 – 102.01 mm (3.984 – 4.016 in.)		
Height of Mold 116.30 – 116.56 mm (4.579 – 4.589 in.)		
Base Plate detachable, planar to 0.005 in.		
Diameter 100.99 - 102.21 mm (3.976 - 4.024 in.)		
Height 116.23 - 116.64 mm (4.576 - 4.592 in.)		
6-INCH MOLDS		
6-in. molds are not required.		
Internal Diameter 151.74 – 153.06 mm (5.974 – 6.026 in.)		
Height of Mold 116.30 – 116.56 mm (4.579 – 4.589 in.)		
Base Plate detachable, planar to 0.005 in.		
Diameter 151.41 - 153.39 mm (5.961 - 6.039 in.)		
Height 116.23 - 116.64 mm (4.576 - 4.592 in.)		
If molds are calibrated according to T 19 (water-filled method), tolerances may be exceeded by up to 50%.		
<i>Alternative type molds, volumes of 1/30 or 1/13.33 ft³ are acceptable if comparative tests are made against conforming cylindrical molds.</i>		
<i>Split molds may be used provided the test results are correlated with those of the solid-wall mold on several soil types and the same moisture-density results are obtained. Records of this correlation must be available for inspection.</i>		

Procedures	Trial 1	Trial 2
1. Dry sample mixed with water to approximately 4% below optimum moisture.		
2. Layer of soil placed in mold and soil lightly tamped with manual rammer or 2-in. diameter similar device until it is not in a fluffy or loose state (prior to compaction).		
3. Soil compacted with appropriate number layers and blows for method selected.		
4. Following compaction of each of first four layers, any excess soil on mold walls trimmed.		
5. Collar removed and soil trimmed to top of mold with straightedge.		
6. Mold and contents weighed to nearest 5 g (0.01 lb) and wet density calculated.		

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Procedures (continued)	Trial 1	Trial 2
7. Soil removed from mold (using the sample extruder for solid molds), sample sliced vertically through center, moisture sample removed from one cut face (as shown in Figure 3 in the standard), and weighed immediately – minimum mass 100 g (A/B) or 500 g.		
8. Material broken up to passing 4.75-mm size, recombined, and water content increased by 2% or if soil is fragile in character or soil is a heavy-textured clayey material, new sample used for each point: Samples mixed with water varying by 2% moisture, bracketing optimum moisture content.		
9. Samples placed in covered containers and allowed to stand for at least 12 hours.		
10. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes.		
11. Water content and oven-dry unit mass calculated for each sample.		
12. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve.		
13. Water content at peak of curve taken as optimum water content.		
14. Material broken up to passing 4.75-mm size, recombined, and water content increased by 2% or if soil is fragile in character or soil is a heavy-textured clayey material, new sample used for each point: Samples mixed with water varying by 2% moisture, bracketing optimum moisture content.		
15. Samples placed in covered containers and allowed to stand for at least 12 hours.		
16. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes.		
17. Water content and oven-dry unit mass calculated for each sample.		
18. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve.		
19. Water content at peak of curve taken as optimum water content.		
20. Dry unit mass at optimum reported as maximum density, to nearest 10 kg/m ³ (or 1 lb/ft ³).		
21. Dry sample mixed with water to approximately 4% below optimum moisture.		
22. Layer of soil placed in mold and soil lightly tamped with manual rammer or 2-in. diameter similar device until it is not in a fluffy or loose state (prior to compaction).		
23. Mold rests on rigid and stable foundation during compaction.		
24. Soil compacted with appropriate number layers and blows for method selected.		
25. Following compaction of each of first four layers, any excess soil on mold walls trimmed.		
26. Collar removed and soil trimmed to top of mold with straightedge.		
27. Mold and contents weighed to nearest 5 g (0.01 lb) and wet density calculated.		

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Procedures (continued)	Trial 1	Trial 2
28. Soil removed from mold (using the sample extruder for solid molds), sample sliced vertically through center, moisture sample removed from one cut face (as shown in Figure 3), and weighed immediately – minimum mass 100 g (A/B) or 500 g.		
29. Material broken up to passing 4.75-mm size, recombined, and water content increased by 2% or if soil is fragile in character or soil is a heavy-textured clayey material, new sample used for each point: Samples mixed with water varying by 2% moisture, bracketing optimum moisture content.		
30. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes.		
31. Water content and oven-dry unit mass calculated for each sample.		
32. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve.		
33. Water content at peak of curve taken as optimum water content.		
34. Dry unit mass at optimum reported as maximum density, to nearest 10 kg/m ³ (or 1 lb/ft ³).		

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

Exam Administration: Remote _____ In-Person _____

Comments:

Examiner Name: _____ Examiner Signature: _____ Date: _____