



## Performance Examination - Soils

### Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop (AASHTO T 99-19)

Candidate Name: \_\_\_\_\_ NICET ID: \_\_\_\_\_

Apparatus	Trial 1	Trial 2
<b>Manual Rammers</b>		
<b>Circular Face</b> -2.5-kg (5.5-lb), with 4 vent holes approximately 19 mm from each end		
<b>Ram Mass</b> 2.486 – 2.504 kg (5.48 – 5.52 lb)		
<b>Face Diameter</b> 50.42 – 51.05 mm (1.985 – 2.010 in.)		
<b>Drop Height</b> 303 – 307 mm (11.94 – 12.06 in.)		
<b>Mechanical Rammers</b>		
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.)		
<b>Metal Straightedges</b>		
Beveled Edge - one beveled edge		
Planar one edge plane to 0.250 mm (0.01 in.)		
Length at least 250 mm (10 in.) long		
<b>Sieves</b> 19 mm (3/4 in.) and 4.75 mm (No. 4)		
<b>Sample Extruder</b> for solid-walled molds only		
<b>Compaction Base Concrete Block</b> (at least 90 kg or 200 lb) or concrete floor		
<b>Containers</b> Resistant to corrosion, disintegration		
<b>Balances</b> Readable to 1 g, Class G2 and G20		
<b>Drying Oven</b> At 110 ± 5 °C (230 ± 9 °F)		
<b>Manual Rammers</b>		
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.)		
<b>Mechanical Rammers</b>		
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.)		
Mechanical Rammer -4.54-kg (10-lb), 457 mm (18 in.) drop height		
Face Dimensions area 1997 – 2047 mm (3.095 – 3.173 in.)		

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Apparatus (continued)	Trial 1	Trial 2
<b>4-Inch Molds</b>		
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.)		
<b>6-Inch Molds</b>		
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 ft<sup>3</sup> 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 two layers, any excess soil on mold walls trimmed		
5. Collar removed and soil trimmed to top of mold with straightedge		
6. Any holes in top surface filled in with unused or trimmed soil (only allowed for C/D)		

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Procedures (continued)	Trial 1	Trial 2
7. Mold and contents weighed to nearest 5 g (0.01 lb) and wet density calculated		
8. 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		
9. 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		
10. Samples placed in covered containers and allowed to stand for at least 12 hours		
11. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes		
12. Water content and oven-dry unit mass calculated for each sample		
13. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve		
14. Water content at peak of curve taken as optimum water content		
15. 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		
16. Samples placed in covered containers and allowed to stand for at least 12 hours		
17. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes		
18. Water content and oven-dry unit mass calculated for each sample		
19. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve		
20. Water content at peak of curve taken as optimum water content		
21. Dry unit mass at optimum reported as maximum density, to nearest 10 kg/m <sup>3</sup> (or 1 lb/ft <sup>3</sup> )		
22. Dry sample mixed with water to approximately 4% below optimum moisture		
23. 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)		
24. Mold rests on rigid and stable foundation during compaction		
25. Soil compacted with appropriate number layers and blows for method selected		
26. Following compaction of each of first two layers, any excess soil on mold walls trimmed		
27. Collar removed and soil trimmed to top of mold with straightedge		

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28. Any holes in top surface filled in with unused or trimmed soil (only allowed for C/D)		
<b>Procedures (continued)</b>	<b>Trial 1</b>	<b>Trial 2</b>
29. Mold and contents weighed to nearest 5 g (0.01 lb) and wet density calculated		
30. 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		
31. 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		
32. Steps 2 through 7 repeated for each increment of water until wet unit mass either decreases or stabilizes		
33. Water content and oven-dry unit mass calculated for each sample		
34. Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve		
35. Water content at peak of curve taken as optimum water content		
36. Dry unit mass at optimum reported as maximum density, to nearest 10 kg/m <sup>3</sup> (or 1 lb/ft <sup>3</sup> )		

First Attempt: Pass: \_\_\_\_\_ Fail: \_\_\_\_\_ Second Attempt: Pass: \_\_\_\_\_ Fail: \_\_\_\_\_

Exam Administration: Remote \_\_\_\_\_ In-Person \_\_\_\_\_

Comments:

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Examiner Name: \_\_\_\_\_ Examiner Signature: \_\_\_\_\_ Date: \_\_\_\_\_