Performance Examination - Soils

Standard Method of Test for The California Bearing Ratio (AASHTO T 193-13)

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

Apparatus	Trial 1	Trial 2
Metal Cylindrical Molds		
Inside diameter: 151.74 – 153.06 mm (5.974 - 6.026 in.)		
Height: 177.34 – 178.26 mm (6.982 - 7.018 in.)		
Extension collar approx. 50 mm (2.0 in) high		
Perforated base plate with 1.6-mm ($^{1}/_{16}$-in.) holes		
Surcharge Weights		
One annular metal surcharge weight		
Center hole approx. 54.0 mm (2⅛ in.) diameter		
Diameter: 147.6 – 150.8 mm ($5^{7}/_{8} \pm {}^{1}/_{16}$ in.)		
Mass: 2.23 – 2.31 kg (4.90 - 5.10 lb)		
Slotted or split weights with same dimensions as above *(Note: Mass of split weight pair shall total 2.27 ± 0.04 kg (5 ± 0.10 lb).)*		
Metal Spacer Disk		
Diameter: 150.0 – 151.6 mm ($5^{15}/_{16} \pm {}^{1}/_{32}$ in.)		
Height: 61.12 – 61.62 mm (2.4106 – 2.426 in.)		
Rammer As specified in T 99 or T 180		
Expansion Measuring Apparatus		
Metal swell plate; Diameter: 147.6 – 150.8 mm ($5^{7}/_{8} \pm {}^{1}/_{16}$ in.); Perforated with 1.6 mm ($^{1}/_{16}$ in.) diameter holes		
Fitted with adjustable stem		
Tripod to support dial indicator		
Dial Indicators (Two)		
Readable to 0.02 mm (0.001 in.)		
Have 25-mm (1-in.) throw		
Metal Penetration Piston		
Diameter 49.63 ± 0.13 mm (1.954 ± 0.005 in.) area = 1935 mm^2 (3 $in.^2$)		
At least 102 mm (4 in.) long		

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Apparatus (continued)	Trial 1	Trial 2
Loading Device		
Can load at a rate of 1.3 mm/min. (0.05 in./min.)		
Capable of applying uniformly increasing load up to a capacity sufficient for the material being tested		
Soaking Tank Capable of maintaining water level 25 mm (1 in.) above the top of specimens		
Drying Oven Maintains 110 ± 5°C (230 ± 9°F)		
Moisture Containers Resistant to corrosion and weight change with close-fitting lids, as specified in T 265		
Miscellaneous Mixing pans, spoons, straightedge, filter paper, balances, etc.		

Procedures	Trial 1	Trial 2
Sample Preparation		
The sample prepared for compaction according to T 99 or T 180, using 152.4-mm (6-in.) mold. If all material passes 19.0-mm (3/4-in.) sieve, the entire sample used. If some +19.0 mm material, that material removed and replaced by the equal amount of -19.0 mm, +4.75 mm (No. 4) material from the unused sample		
Bearing Ratio at Optimum Water Content		
A representative portion of the initial sample, weighing approximately 11 kg (25 lb), selected for the moisture-density test. Remainder of the sample divided to obtain three representative portions weighing approx. 6.8 kg (15 lb) each. **Moisture-Density Relation:** Using 11 kg (25 lb) portion, optimum moisture content and maximum dry density determined according to T99 or T180. Three specimens compacted (generally at 10, 30, and 65 blows per layer for specimens 1, 2, and 3 respectively) with densities ranging from 95% (or lower) to 100% (or higher) of maximum dry density or One specimen compacted to maximum dry density at optimum water content determined by T 99.		
Bearing Ratio for a Range of Water Content		
From a sample having a mass of 113 kg (250 lb) or more, select at least five representative portions having a mass of approximately 6.8 kg (15 lb) each for use in developing each compaction curve.		

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Procedures (continued)	Trial 1	Trial 2
Bearing Ratio at Optimum Water Content (Moisture-Density Relation)		
If CBR is desired at 100% maximum dry unit weight and optimum water content, specimen compacted according to D698 or D1557, from soil prepared to within .0.5% of optimum water content or If CBR is desired at optimum water content and some percentage of maximum dry unit weight, three specimens compacted from soil to within .0.5% of optimum moisture content using a different number of blows per layer for each specimen (number of blows per layer varied to bracket unit weights above and below desired value)		
Sample Preparation – Range of Water Content		
1. At least five representative portions weighing approximately 6.8 kg (15 lb) each selected for developing each compaction curve		
2. Using 6.8 kg (15 lb) specimens, optimum water content and maximum dry density determined according to T 99 (Method D) or T 180 (Method D), except that CBR molds are used and each specimen is penetrated for CBR determination		
3. The complete moisture-density relationship developed for 10 and 25 blow per layer compactions, and each the compacted specimen is penetrated (all compactions performed in CBR molds)		
4. If specified unit weight is at or near 100% maximum dry unit weight, is compaction effort greater than 56 blows per layer included.		
Sample Compaction Procedure		
1. Mold clamped to base plate and extension collar attached		
2. Spacer disk placed in mold and filter paper placed on disk		
3. Each sample mixed with water and compacted in a mold according to the desired method. Moisture content is taken according to one of the following: both, Un-soaked CBR moisture sample taken according to T 99 or T180		
4. Soaked CBR-moisture sample was taken at the beginning of compaction of each sample and at the end of the compaction procedure, and water content determined by T 265		
5. Extension collar removed and compacted soil trimmed even with the top of the mold using a straightedge		
6. Surface irregularities patched with small-sized material		
7. Spacer disk removed		
8. Filter paper placed on the perforated base plate		
9. Mold inverted and placed on filter paper (compacted soil contacts paper)		
10. Base plate clamped to mold		
11. Collar attached to mold and assembly weighed to nearest 5 g (0.01 lb)		

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Procedures (continued)	Trial 1	Trial 2
Soaking		
19. A swell plate placed on the sample in a mold		
20. Sufficient weights, at least 4.54 kg (10 lb), placed on a swell plate for the desired load		
21. Tripod and dial indicator placed on top of the mold and an initial reading is taken		
22. Mold immersed in water, allowing free access of water to the top and bottom of the specimen		
23. The water level in mold and tank maintained approx. 1 in. above the top of the specimen during soaking. Specimen soaked for 96 hours (4 days)		
24. Not less than 24 hours may be used for materials that drain readily, if tests show that shorter period doesn't affect test results. Soaking period greater than four days may be required for some clays.		
25. Final dial reading is taken and percent swell calculated		
26. Specimen removed from the tank, water poured off the top, and allowed to drain downward for 15 minutes		
27. Surcharge weights, perforated plate and filter paper removed after draining		
28. Mass of specimen determined		
Penetration Test		
29. Penetration piston seated after one surcharge weight has been placed on the specimen		
30. Piston seated with 44 N (10 lb) load		
31. The remainder of surcharge weights, equal to that used during soaking, placed on the specimen		
32. Penetration dial indicator and load indicators set to zero		
33. Loads applied to the piston so the penetration rate is uniform at 1.3 mm (0.05 in.) per minute		
34. Loads recorded at penetrations of 0.64, 1.27, 1.91, 2.54, 5.08 and 7.62 mm (0.025, 0.050, 0.075, 0.100, 0.150, 0.200, and 0.300 in.		
35. If using a soaked CBR, the water content of upper 25 mm (1 in.) of the sample determined, according to T 99 or T 180, weighs at least 100 g for fine-grained soils or 500g for coarse-grained soils		
36. Stress-strain curve prepared		
37. CBR values obtained in percent by dividing corrected load values at 2.54 and 5.08 mm (0.10 and 0.20 in.) by the standard loads of 1000 and 1500 psi (6.9 and 10.3 MPa), respectively, and multiplying those ratios by 100 If CBR is greater at 5.08 mm (0.20 in.) than at 2.54 mm (0.10 in.) penetration, is test rerun		
38. If check test gives similar results, the ratio at 5.08 mm (0.20 in.) penetration used		

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

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

Comments:

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