

Method of Test for Density (Unit Weight) of Concrete

1. Scope:

This test is for determining the density (unit weight) of freshly mixed concrete

2. Apparatus:

- 2.1 Scale or balance having the capacity to weigh any sample which may be tested utilizing this procedure and readable to the nearest 0.1 lb.
- 2.2 Tamping rod. A round, smooth, straight 5/8 in. diameter steel rod with the tamping end or both ends rounded to a hemispherical tip of 5/8 in. diameter. The minimum length will be 18 in.
- 2.3 Measure. A cylindrical rigid metal measure with a capacity of approximately 0.5 ft.³ or the measuring bowl of the air meter may be used (SD 403).
- 2.4 Mallet. A mallet (with a rubber or rawhide head) having a mass of 1.25 +/- 0.50 lb.
- 2.5 Scoop. A scoop of a size large enough so a representative amount of concrete is obtained and small enough that concrete is not spilled during placement in the measure.
- 2.6 Strike-Off Plate. A flat rectangular metal plate at least 1/4 in. thick or a glass or acrylic plate at least 1/2 in. thick with a length and width at least 2 in. greater than the diameter of the measure with which it is to be used. The edges of the plate will be straight and smooth within a tolerance of 1/16 in.

3. Procedure:

- 3.1 Calibrate the measure as described in SD 205, paragraph 3.3 C to determine the volume of the measure to the nearest 0.001 ft³.
- 3.2 Obtain a sample of concrete in accordance with SD 402.

NOTE: Samples of volumetric mixed low slump dense concrete will be placed in a covered container for 5 minutes prior to testing.

- 3.3 Dampen the interior of the empty measure and remove any standing water from the bottom. Weigh the empty measure to the nearest 0.1 lb. Place the measure on a flat, level and firm surface.
- 3.4 Fill the measure with concrete in 3 approximately equal layers. Rod each layer 25 times. Distribute the strokes uniformly over the cross section of the layer being rodded.

Rod the lower layer its total depth, but the rod will not forcibly strike the bottom of the measure so as to cause excessive vibration. Rod the second and third layers with the rod penetrating slightly (Approximately 1 inch) into the layer below.

Add concrete to the final layer in a manner to avoid excessive overfilling. Add additional concrete as required to keep the surface above the measure as it is rodded.

After each layer is rodded, tap the outside of the measure 10 to 15 times with the mallet. Tap with enough force to close any voids left by rodding and to release any large air bubbles that may have been trapped. For concrete with a slump of less than 2", the number of taps can be increased to achieve consolidation.

- 3.5 After consolidation of the concrete, strike off the top surface of the concrete and finish it smoothly using the strike-off plate, so the measure is level full.

Press the strike-off plate on top of the measure to cover approximately 2/3 of the measure. Withdraw the strike-off plate with a sawing motion. Place the strike-off plate on the measure in the original position to cover the same 2/3 of the measure. Advance the strike-off plate with downward pressure and a sawing motion until it slides completely off the measure. Finish the surface with several strokes of the strike-off plate at an inclined angle

- 3.6 Clean all excess concrete from the measure and weigh to the nearest 0.1 lb.

4. Report:

- 4.1 Calculations.

A. Subtract the weight of the empty measure from the total weight to determine the weight of the concrete to fill the measure.

B. Density (unit weight) of concrete $\text{lb./ft}^3 = \text{Weight of the concrete to fill the measure divided by the volume of the measure.}$

Example:

Total weight of measure & fresh concrete (0.1 lb.)		Weight of empty measure (0.1 lb.)		Weight of fresh concrete (0.1 lb.)
44.3 lb.	-	8.0 lb.	=	36.3 lb.

Volume of measure = 0.251 ft^3

Density (unit weight) of concrete = $36.3 \text{ lb.} / 0.251 \text{ ft}^3 = 144.6 \text{ lb./ft}^3$

Report to the nearest 0.1 lb./ft³ on a DOT-23.

5. References:

DOT-23
SD 205
SD 402
SD 403