

METHOD B14

THE DETERMINATION OF THE DRY BULK DENSITY, APPARENT RELATIVE DENSITY AND WATER ABSORPTION OF AGGREGATE RETAINED ON A 4,75 mm SIEVE

SCOPE

The dry bulk density and apparent relative density of the + 4,75 mm material, as defined below, are calculated from the loss in mass of the saturated surface-dry aggregate when it is submerged in water.

The water absorption is determined by calculating the mass of water absorbed after the 24-hour immersion in water of the oven-dried material .

Definition

Relative density is the ratio of the mass in air of a given volume of a material at a stated temperature to the mass in air of an equal volume of distilled water at the same temperature.

Bulk relative density is the ratio of the mass in air of a given volume of material (including the permeable and impermeable voids normal to the material) at a stated temperature to the mass in air of an equal volume of distilled water at the same temperature.

Apparent relative density is the ratio of the mass in air of a given volume of material (excluding the permeable voids but including the impermeable voids normal to the material) at a stated temperature to the mass in air of an equal volume of distilled water at the same temperature

2 APPARATUS

- 2.1 A balance with a capacity of 5 kg, accurate to 0,5 gram.
- 2.2 A wire basket, approximately 200mm in diameter and 200 mm high, manufactured from a 3,35 mm screen.
- 2.3 A suitable container with water for immersing the wire basket and a suitable arrangement for suspending the wire basket from the centre of the balance pan.
- 2.4 A thermometer measuring 0-100 EC.
- 2.5 A drying oven, thermostatically controlled and capable of maintaining a temperature of 105 to 110 E C.

3 METHOD

Quarter out approximately 3 kg of the material retained on the 4,75 mm sieve. Wash

the sample thoroughly to remove dust from the surfaces of the particles and soak for 24 hours in water. Remove the material from the water, drain off the free water for a few seconds and transfer it to a large absorbent cloth. In order to obtain the so-called saturated surface-dry condition, the sample is rolled in the cloth until all visible water has been absorbed, but the surfaces of the particles should still appear damp.

Large-aggregate particles may be wiped individually. As soon as the surface-dry condition is reached, weigh the sample, accurate to 0,5 gram, and transfer it to a wire basket that has previously been weighed in water. Weigh the basket with sample in water at 25 ± 1 EC taking care that no air is entrapped (see 5.1).

Remove the sample from the wire basket, allow the free water to drain off and then dry it to a constant mass in an oven at a temperature of 105 to 110EC.

Weigh the oven-dried sample.

This test must be done in duplicate.

4 CALCULATIONS

- 4.1 Calculate the dry bulk density and apparent relative density to the nearest 0,001 from the following formulae:

$$\text{Dry bulk density (25/25 EC)} = \frac{A}{B - C}$$

$$\text{Apparent relative density (25/25 E C)} = \frac{A}{A - C}$$

where :

- A = mass of oven-dry sample in air
B = mass of saturated surface-dry sample in air
C = mass of saturated sample in water at 25 E C

Duplicate results should agree within $\pm 0,005$ or be repeated.

- 4.2 Calculate the percentage of water absorbed to the nearest 0,1 from the following formula:

$$\text{Water absorption m/m} = \frac{(B - A)}{A} \times 100$$

Report relative density to the nearest 0,001 and water absorption to the nearest 0,1.

5 NOTES

- 5.1 The standard temperature is taken as 25 EC. If the test is done at any other temperature, this should be stated or the RD should be adjusted for a temperature of 25 EC.
- 5.2 The relative density of material retained on the 4,75 mm sieve can also be determined by using a pycnometer (see Method B15). The volume of the pycnometer should then be between 1000 and 3 000 ml.
- 5.3 Samples containing material passing and retained on the 4,75 mm sieve must be divided by means of this sieve and the appropriate test method used on the separate samples. The relative density of the total material must then be calculated as follows:

$$\text{Relative density of the total material} = \frac{100}{\frac{P1}{G1} + \frac{P2}{G2}}$$

Where :

- P1 = percentage of material passing the 4,75 mm sieve
P2 = percentage of material retained on the 4,75 mm sieve
G1 = relative density of the material passing the 4,75 mm sieve
G2 = relative density of the material retained on the 4,75 mm sieve

- 5.4 When only the apparent relative density is required, the determination of the saturated surface-dry mass of the sample in air is not required.

REFERENCES

ASTM Designation C127-73 and D854-58
AASHTO Designation T85-70
SABS Method 843 and 844