

## Determination of Relative Density and Water Absorption of Aggregate between 40mm and 5mm

Lab Test Reference

British Standard Reference

### **BS 1097- 6: 2000 Tests for mechanical and physical properties of aggregates – Part 6: Determination of particle density and water absorption**

Principal Apparatus as follows:

- (i) Riffle Boxes, 63mm, 50mm, 40mm, 14mm gaps should be at hand and available for use depending on the nominal size of aggregate being tested. Type as shown in **BS EN 933-1:1996 Tests for geometrical properties of aggregates - Part 2: Determination of particle size distribution: Test sieves, nominal size of apertures**
- (ii) A ventilated drying oven controlled to maintain a temperature of 105+/-5 deg C.
- (iii) Electronic Balance to weight at least 30 kg to 0.1 gram.
- (iv) Two gas jars of 1.0 to 1.5 litre capacity with flat ground lips and two plane ground discs of plate glass for covers.
- (v) A 5.00 mm Test Sieve with a yellow label.
- (vi) Two Dry Soft Absorbent Cloths or a box of Paper Tissues.
- (vii) Clean Square Trays sufficiently large to completely contain the sample.
- (viii) An airtight container large enough to completely contain the sample.
- (ix) A supply of distilled water or alternatively deionised water. General laboratory ware.

#### 1. Preliminaries

- 1.1 A designated area will be used to perform this test and a clear area of bench must first be allotted before this test proceeds.
- 1.2 Ensure that the Sample Number and Test Schedule correspond.
- 1.3 Obtain the Test Worksheet No. xxx from the Cabinet.
- 1.4 All equipment to be used in this test must first be checked.
- 1.5 Check the calibration status of the oven and balance.
- 1.6 Check the sieves are required on receipt. If any splits, dents or tears are present on the mesh, they will be taken out of service.
- 1 Ensure that the glass jars and plates are undamaged.
- 2 Standard Test Method

- 2.1 Sample Preparation.
  - 2.2 The aggregate used in this test will have been obtained from a bulk sample that was initially taken and prepared in the manner described in BS 812: 1985 Part 102. The test will be performed in duplicate on the portion of about 1kg.
  - 2.3 As a rule samples that have been oven dried should not be used. If they are then it should be stated on the test report
  - 2.4.1 The sample will then be thoroughly washed through the 5.0 test sieve to remove any clay and silt and dust. After washing drain the bulk of the water from the sample leaving it just wetted but taking care not to lose any of the aggregate.
- 1 Test Procedure
  - 3.1 The sample is split into two approximately equal sub samples and each of the samples will be placed into the gas jars that have previously been half filled with distilled water.
  - 3.2 Keep the sample immersed in the water in the gas jars for 24+/- 0.5 hrs with the water temperature being maintained at 20+/- 5 deg C. The gas jars may be stood partly immersed in a cube tank which are always maintained within this above range. Record the date that the sample was immersed in Box 1, the time that the sample was immersed in Box 2 and the temperature at the time of immersion in Boxes 4 and 5.
  - 3.3 Soon after immersion and again at the end of the soaking period, remove any entrapped air or bubbles on the surface of the aggregate by gentle agitation. This may be achieved by rapid rotation of the vessel in a clockwise and anticlockwise direction between the operators hands. Record the time that the sample was removed from immersion in Box 3 and the temperature in Boxes 6 and 7.
  - 3.4 Overfill the gas jars with distilled water, take the temperature and record the value in Boxes 9 and 10. Record the time immersed in Box 8. Slide the ground glass plate over the mouth of the jar so that air is not trapped beneath the plate.
  - 3.5 Dry the outside of the gas jar and weigh to the nearest 0.1 grm recording the weight on the test sheet as (mass B). Empty the aggregate onto the 5.0mm sieve that is resting in a metal tray and allow to drain.
  - 3.6 Refill the gas jar with water as before, take the temperature of the water and record the result in Boxes 11 and 12. The difference in temperature of the water during the first and second weighing shall not exceed 2°C.
  - 3.7 Replace the plate ensuring that no air is trapped beneath the plate or on the walls of the jar. Dry the outside of the jar and weight, recording the weight on the test form as (mass C).
  - 3.8 Remove the aggregate from the sieve and place on a dry cloth. Replace any particles that have passed through the sieve and place them with main the sample on the dry cloth. Gently surface dry the sample with the cloth transferring it to a second dry cloth when the first will remove no further water. Spread out the sample not more than one stone deep on the second cloth and leave it exposed to the atmosphere away from direct sunlight and any other source of heat until all visible forms of water are removed but the aggregate still has a damp appearance.
  - 3.9 Weigh a shallow sample tray and record the weight as (W1) in Boxes 13 and 14. Place the sample in the tray and weigh the tray and sample, record the weight in Boxes 15 and 16 as (W2). The difference between

W1 and W2 is recorded as (mass A).

- 3.10 Place the sample and tray in an oven that has reached a constant operating temperature of 105+/-5 deg C. Leave the sample in the oven for 24+/-0.5 hrs. Record the time that the sample was placed in the oven in Box 17.
- 3.11 Weigh an airtight container and record the weight as (W3) in Boxes 19 and 20.
- 3.12 Record the time that the sample was removed from the oven in Box 18.
- 3.13 Place the sample in the airtight container replace the lid and allow to cool. When the sample is cool weigh the container and sample and record the weight as (W4) in Boxes 21 and 22. The difference between W3 and W4 is recorded as (mass D).

4. Calculations

4.1

Relative Density, Oven-Dried	<u>  D  </u>
	A - (B-C)
Relative Density Saturated Surface Dry	A
	A - (B-C)
Apparent Relative Density	D
	D - (B-C)
Water Absorption % Dry Mass	100 * (A - D)
	D

- A** is the mass of the saturated surface dry sample in air (g)
- B** is the mass of the vessel containing sample and filled with water (g)
- C** is the mass of vessel containing water only (g)
- D** is the mass of the oven dry sample in air (g)

5. Test Report

- 5.1 The mean result of the two tests will be reported for each of the relative densities recorded to the nearest 0.01.
- 5.2 The size of the aggregate tested.
- 5.3 Whether it has been artificially heated before the start of the test.
- 5.4 The water absorption will be reported to the nearest 0.1%.