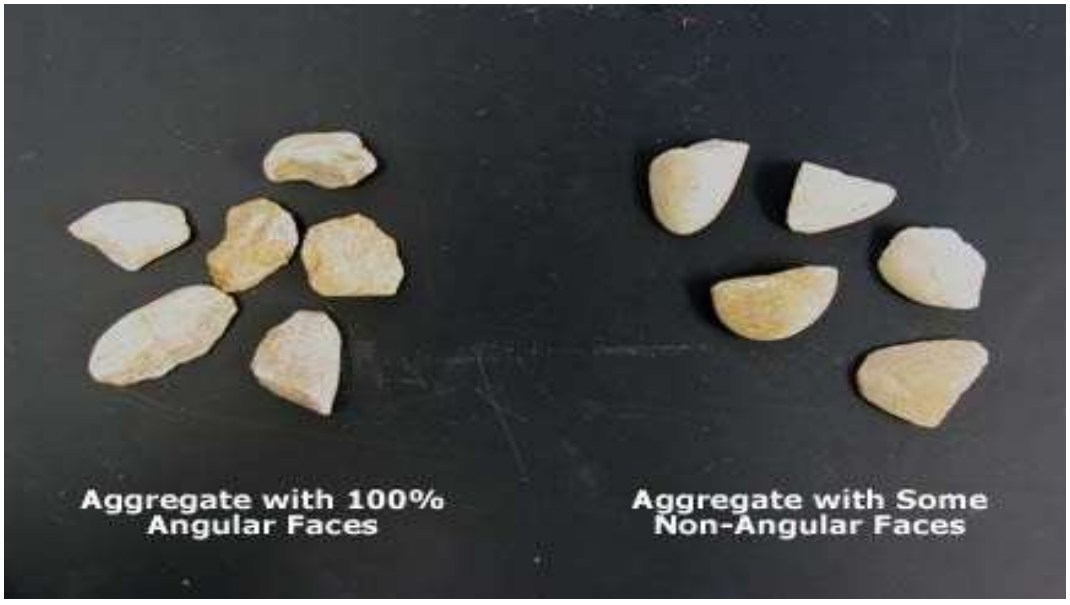
EXPERIMENT NO: 03

DETERMINATION OF ANGULARITY NUMBER

(BS: 812: 1975 (PART 1, 2, 3))





6.1 GENERAL

The angularity number is determined from the proportion of voids in a sample of aggregate after compaction in the specified manner. This property is used mainly in the design of mix proportions and in research.

Angularity or absence of rounding of the particles of an aggregate is a property which is of importance because it affects the ease of handling of a mixture of aggregate and binder (e.g. the workability of concrete) or the stability of mixtures that rely on the interlocking of the particles. The least angular (most rounded) aggregates are found to have about 33% voids and the angularity number is defined as the amount by which the percentage of voids exceeds 33. The angularity number ranges from 0 to about 12.

Since considerably more compactive effort is used than in the test for bulk density and voids (see 6.1 of part 2) the percentage of voids will be different. Weaker aggregates may be crushed during compaction and the results will be anomalous if this method is applied to any aggregate which breaks down during the test.

6.2 SAMPLING

The sample for this test shall be taken in accordance with clause 5 of this part of this standard.

6.3 APPARATUS

The following apparatus is required:

6.3.1 A metal cylinder closed at one end , of about 0.003 m^3 volume, the diameter and height of which should be approximately equal (e.g. 150 mm and 150 mm).

The cylinder shall be made from metal of a thickness not less than 3 mm and shall be of sufficient rigidity to retain its shape under rough usage.

6.3.2 A straight metal tamping rod of circular cross section 16 mm in diameter and 600 mm long rounded at one end.

6.3.3 A balance or scale of capacity 10 kg, accurate to 1 g.

6.3.4 A metal scoop approximately 200 mm x 120 mm x. 50 mm (i.e. about 1 liter heaped capacity).

6.3.5 BS perforated plate test sieves from 20.0 mm to 5.0 mm aperture size (but see note to section 3.5.5(a)).

6.4 CALIBRATION OF THE CYLINDER

The cylinder shall be calibrated by determining to the nearest mass of water (gm) at $20^0 \pm 2^0$C required to fill it up so that no meniscus is present above the rim of the container (mass C).

6.5 PREPARATION OF THE TEST SAMPLE

The sets sample shall be prepared as follows.

a) The amount of aggregate available shall be sufficient to provide, after separation on the appropriate pair of sieves, at least 10 kg of the predominant size as determined by sieve analysis on the BS test sieves.

The test sample shall consist of aggregate retained between the appropriate pair of BS test sieves from the following list:

20.0 mm and 14.0 mm; 14.0 mm and 10.0 mm; 10.0 mm and 6.3 mm; 6.3 mm and 5.0 mm.

Note: In testing aggregates larger than 20.0 mm the volume of the cylinder should be greater than 0.003 m^3, but for aggregates smaller than 5.0 mm a smaller cylinder may be used. The procedures should be the same as with the 0.003 m^3 cylinder, except that the amount of compactive effort (mass) should be proportioned to the volume of the cylinder used.

b) The aggregate to be tested shall be dried for at least 24 hr in shallow trays in a well-ventilated oven at a temperature of 105 ± 5^0C, cooled in an air tight container and tested.

6.6 TEST PROCEDURE

Fill the scoop and heap it to overflowing with the aggregate, which shall be placed in the cylinder by allowing it to slide gently off the scoop from the least height possible.

Subject the aggregate in the cylinder to 100 blows of the tamping rod at a rate of about two blows per second. Apply each blow by holding the rod vertical with its rounded end 50 mm above the surface of the aggregate and releasing it so that it falls freely. Do not apply any force to the rod. Evenly distribute the 100 blows over the surface of the aggregate.

Repeat the process of filling and tamping exactly as described above with a second and third layer of aggregate; the third layer shall contain just sufficient aggregate to fill the cylinder level with the top edge before tamping.

After the third layer of aggregate has been tamped, fill the cylinder to overflowing, and strike off the aggregate level with the top, using the tamping rod as a straight-edge.

Then add individual pieces of aggregate and roll them in, to the surface by rolling the tamping rod across the upper edge of the cylinder, and continue this finishing process as, long as the aggregate does not lift the rod off the edge of the cylinder on either side. Do not push in or otherwise force down the aggregate, and apply no downward pressure to the tamping rod, which shall roll in contact with the metal on both sides of the cylinder. Then weigh the aggregate in the cylinder to the nearest 5 gm.

Make three separate determinations and calculate the mean mass of aggregate in the cylinder (mass M). If the result of any one determination differs from the mean by more than 25 g, three additional determinations shall immediately be made on the same material, and the determinations calculated (mass M).

6.7 CALCULATIONS

The angularity number of the aggregate shall be calculated from the equation:

$$\text{Angularity number} = 67 - \frac{100\,M}{CG}$$

Where,

M is the mean mass of aggregate in the cylinder (gm);
C is the mass of water required to fill the cylinder (gm);
G is the relative density on an oven-dried basis of the aggregate determined in accordance with clause 5 of part 2 of this standard.

6.8 REPORTING OF RESULTS

The angularity number shall be reported to the nearest whole number.