7.6 Aggregate Impact Value

7.6.1 Scope. The aggregate impact value gives a relative measure of the resistance of the aggregate to sudden shock or impact.

The particular purpose which an aggregate is meant to serve requires the aggregate to have a particular strength which is usually stated in the specification. This test provides a method for measuring this strength.

7.6.2 Method outline. A test specimen, of chosen fractions, is compacted in a standardised manner, into an open steel cup. The specimen is then subjected to a number of standard impacts from a dropping weight. The impacts break the aggregate to a degree which is dependent on the aggregate’s impact resistance. This degree is assessed by a sieving test on the impacted specimen and is taken as the aggregate impact value.

7.6.3 Sampling. The sample used for this test shall be taken in accordance with Chapter 2.

7.6.4 Equipment

7.6.4.1 Impact testing machine. The machine shall be of the general form shown in Figure 7.6.1, have a total mass of between 45 kg and 60 kg and shall have the following parts:

a) A circular metal base, with a mass of between 22 kg and 30 kg, with a plane lower surface of not less than 300 mm diameter and shall be supported on a level and plane concrete or stone block floor at least 450 mm thick. The machine shall be prevented from rocking during operation of the machine.

b) A cylindrical steel cup, having an internal diameter of 102 mm plus or minus 0.5 mm and an internal depth of 50 mm plus or minus 0.25 mm. The walls shall be not less than 6 mm thick and the inner surfaces shall be case hardened. The cup shall be rigidly fastened at the centre of the base and be easily removed for emptying.

c) A metal hammer, with a mass of between 13.5 kg and 14.0 kg, the lower end of which shall be cylindrical in shape, 100.0 mm plus or minus 0.5 mm diameter and 50 mm plus or minus 0.15 mm long, with a 1.5 mm chamfer at the lower edge, and case hardened. The hammer shall slide freely between vertical guides so arranged that the lower part of the hammer is above and concentric with the cup.

d) Means for raising the hammer, and allowing it to fall freely between the vertical guides from a height of 380 mm plus or minus 5 mm on to the test sample in the cup, and means for adjusting the height of fall within 5 mm.

e) Means for supporting the hammer whilst fastening or removing the cup.

7.6.4.2 Square-hole perforated plate test sieves, of sizes 14.0 mm and 10.0 mm and a woven-wire 2.36mm test sieve.

7.6.4.3 A cylindrical metal measure, of sufficient rigidity to retain its form under rough usage and with an internal diameter of 75 mm plus or minus 1 mm and an internal depth of 50 mm plus or minus 1 mm.

7.6.4.4 A tamping rod, made out of straight iron or steel bar of circular cross section, 16 mm plus or minus 1 mm diameter and 600 mm plus or minus 5 mm long, with both ends hemispherical.

7.6.4.5 A balance, of capacity not less than 500 g and accurate to 0.1 g.

7.6.4.6 A ventilated oven, thermostatically controlled at a temperature of 105°C plus or minus 5°C.
Figure 7.6.1 Aggregate impact test machine

All linear dimensions are in millimetres.
7.6.4.7 A rubber mallet, a metal tray of known mass and large enough to contain 1 kg of aggregate and a brush with stiff bristles.

7.6.4.8 Additional equipment for testing aggregate in a soaked condition.

a) Drying cloths or absorbent paper, for the surface drying of the aggregate.
b) One or more wire-mesh baskets, with apertures greater than 6.5 mm.
c) A stout watertight container in which the basket may be immersed.

7.6.5 Preparation of test portions and specimens

7.6.5.1 Test portions. Reduce laboratory samples to test portions of sufficient mass to produce 3 specimens of 14 mm to 10 mm size fraction.

Table 7.6.1. Guide to minimum mass of test portions required to obtain a suitable mass of material to determine the aggregate impact value

<table>
<thead>
<tr>
<th>Grade of the aggregate</th>
<th>Minimum mass of test portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-in aggregate 40 mm max. size</td>
<td>20 kg</td>
</tr>
<tr>
<td>All-in aggregate 20 mm max. size</td>
<td>15 kg</td>
</tr>
<tr>
<td>Graded aggregate 40 to 5 mm</td>
<td>12 kg</td>
</tr>
<tr>
<td>Graded aggregate 20 to 5 mm</td>
<td>8 kg</td>
</tr>
<tr>
<td>Graded aggregate 14 to 5 mm</td>
<td>5 kg</td>
</tr>
</tbody>
</table>

7.6.5.2 Test specimen in a dry condition

a) Sieve the entire dried test portion on the 14 mm and the 10 mm test sieve to remove the oversize and undersize fraction. Divide the resulting 14 mm to 10 mm size fractions to produce 3 test specimens each of sufficient mass to fill the measure when it is filled by the procedure in 7.6.5.2(c).

b) Dry the test specimens by heating at a temperature of 105°C plus or minus 5°C for a period of not more than 4 h. Cool to room temperature before testing.

c) Fill the measure to overflowing with the aggregate using a scoop. Tamp the aggregate with 25 blows of the rounded end of the tamping rod, each blow being given by allowing the tamping rod to fall freely from a height of about 50 mm above the surface of the aggregate and the blows being distributed evenly over the surface.

Remove the surplus aggregate by rolling the tamping rod across, and in contact with, the top of the container. Remove by hand any aggregate that impedes its progress and fill any obvious depressions with added aggregate. Record the net mass of aggregate in the measure and use the same mass for the second test specimen.

7.6.5.3 Test specimens in a soaked condition

a) Prepare the test portion as in 7.6.5.1 except that the test portion is tested in the as-received condition and not oven-dried. Place test specimen in a wire basket and immerse it in the water in the container with a cover at least 50 mm of water above the top of the basket. Remove entrapped air by lifting the basket 25 mm above the base of the container and allowing it to drop 25 times at a rate of approximately once per second. Keep the aggregate completely immersed in water at all times and for the next 24 h plus or minus 2 h and maintain the water temperature at 20°C plus or minus 5°C.
Chapter 7  
Tests For Aggregates And Bricks

b) After soaking, remove from the water and blot the free water from the surface using the absorbent cloths. Prepare for testing as described in 7.6.5.2 immediately after this operation.

7.6.6 Aggregate impact value

7.6.6.1 Procedure

a) Test specimens in a dry condition

(i) Fix the cup firmly in position on the base of the impact machine and place the whole of the specimen in it and then compact by 25 strokes of the tamping rod. Adjust the height of the hammer so that its lower face is 380 mm plus or minus 5 mm above the aggregate in the cup and then allow it to fall freely on to the aggregate. Subject the test specimen to 15 such blows each blow being delivered at an interval not less than 1 s.

(ii) Remove the crushed aggregate by holding the cup over a clean tray and hammering on the outside with the rubber mallet until the crushed aggregate falls freely on to the tray.

Transfer fine particle adhering to the inside of the cup and to the surface of the hammer to the tray by means of the stiff bristle brush. Weigh the tray and the aggregate and record the mass of the aggregate to the nearest 0.1 g (M₁).

(iii) Sieve the whole of the specimen on the 2.36 mm test sieve until no further significant amount passes during a further period of 1 min. Weigh and record the mass of the fractions passing and retained on the sieve to the nearest 0.1 g (M₂ and M₃) respectively and if the total mass (M₂ + M₃) differs from the initial mass (M₁) by more than 1 g, discard the result and test a further specimen.

(iv) Repeat the procedure from (i) to (iii) above inclusive using a second specimen of the same mass as the first specimen.

b) Test specimens in a soaked condition

(i) Follow the test procedure described in 7.6.6.1(a) except that the number of blows of the hammer to which the aggregate is subjected, is the number of blows which will yield between 5% and 20% of fines when this value is calculated using procedure in 7.6.6.2.

(ii) Remove the crushed specimen from the cup and dry it in the oven at a temperature of 105°C plus or minus 5°C either to constant mass or for a minimum period of 12 h. Allow to cool and weigh to the nearest 1 g and record this mass M₁. Complete the procedure described in (ii) of 7.6.6.1(a) starting at the stage where the specimen is sieved on the 2.36mm test sieve.

7.6.6.2 Calculation and expression of result

a) Calculate the aggregate impact value (AIV) expressed as a percentage to the first decimal place for each test specimen from the following expression.

\[(AIV) = 100 \times \frac{M_2}{M_1} \]

Where,

M₁ is the mass of the test specimen in grams.
M₂ is the mass of the material passing the 2.36mm test sieve in grams.

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b) Aggregate in the soaked condition.

(i) Calculate the mass of fines, m, expressed as a percentage of the total mass for each test specimen from the following expression.

\[ M = 100 \times \frac{M_2}{M_1} \]

Where,

- \( M_1 \) is the mass of the oven-dried test specimen in grams.
- \( M_2 \) is the mass of the oven-dried material passing the 2.36mm test sieve in grams.

(ii) Calculate the AIV expressed as a percentage to the first decimal place for each test specimen from the following expression.

\[ (AIV) = 15 \times \frac{m}{n} \]

Where, \( n \) is the number of hammer blows to which the specimen is subjected.

### 7.6.7.3 Results

Calculate the mean of the two values determined in (a) or (b) of 7.6.6.2 to the nearest whole number. Report the mean as the aggregate impact value, unless the individual results differ by more than 0.15 times the mean value. In this case repeat the test on two further specimens, calculate the median of the four results to the nearest whole number and report the median as the aggregate impact value.

A data sheet is given in Form 7.6.1.
### AGGREGATE IMPACT VALUE

<table>
<thead>
<tr>
<th>Name of testing agent</th>
<th>Client</th>
<th>Contractor's name</th>
<th>Contract</th>
<th>Description of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC Ltd.</td>
<td>ABC Ltd</td>
<td></td>
<td></td>
<td>Crushed overburned bricks (Drainage layer)</td>
</tr>
</tbody>
</table>

#### DRY CONDITION

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Weight of dry sample $M_1$ (g)</th>
<th>Weight of sample passing 2.36 mm test sieve $M_2$ (g)</th>
<th>A/V Dry Condition $M_2/M_1 \times 100$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>230.97</td>
<td>68.82</td>
<td>29.80</td>
</tr>
<tr>
<td>2</td>
<td>230.38</td>
<td>65.85</td>
<td>28.63</td>
</tr>
<tr>
<td>3</td>
<td>231.56</td>
<td>59.30</td>
<td>25.61</td>
</tr>
</tbody>
</table>

#### SOAKED CONDITION

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Weight of oven-dried sample $M_1$ (g)</th>
<th>Weight of oven-dried sample passing 2.36 mm test sieve, $M_2$ (g)</th>
<th>$m$</th>
<th>Blows $n$</th>
<th>A/V Soaked Condition $15 m / n$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date tested</th>
<th>Date reported</th>
<th>Name and designation of tester</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

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