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Aggregate Impact Test

INTRODUCTION

Toughness is the property of a material to resist impact. Due to traffic loads, the road stones are subjected to the pounding action or impact and there is possibility of stones breaking into smaller pieces. The road stones should therefore be tough enough to resist fracture under impact. A test designed to evaluate the tougness of stones i.e., the resistance of the stones to fracture under repeated impacts may be called an impact test for road stones.

Impact test may either be carried out on cylindrical stone specimens as in *Page Impact* test or on stone aggregates as in Aggregate Impact test. The Page Impact test is not carried out now-a-days and has also been omitted from the revised British Standards for testing mineral aggregates. The Aggregate Impact test has been standardised by the British Standard Institution and the Indian Standard Institution.

The aggregate impact value indicates a relative measure of the resistance of aggregate to a sudden shock or an impact, which in some aggregates differs from its resistance to a slow compressive load. The method of test covers the procedure for determining the aggregate impact value of coarse aggregates.

Apparatus

The apparatus consists of an impact testing machine, a cylindrical measure tamping rod, IS sieve balance and oven.

(a) Impact testing machine : The machine consists of a metal base with a plane lower surface supported well on a firm floor, without rocking A detachable cylindrical steel cup of internal diameter 10.2 cm and depth 5 cm is rigidly fastened centrally to the base plate A metal hammer of weight between 13.5 and 14.0 kg having the lower end cylindrical in shape, 10 cm in diameter and 5 cm long, with 2 mm chamber at the lower edge is capable of sliding freely between vertical guides, and fall concentric over the cup. There is an arrangement for raising the hammer and allowing it to fall freely between vertical guides from a height of 38 cm on the test sample in the cup, the height of fall being adjustable upto 0.5 cm. A key is provided for supporting the hammer while fastening or removing the cup. Refer Figure 12.1.

(b) Measure : A cylindrical metal measure having internal diameter 7.5 cm and depth 5 cm for measuring aggregates.

(c) Tamping rod : A straight metal tamping rod of circular cross section, 1 cm in diameter and 23 cm long, rounded at one end.

(d) Sieve : IS sieve of sizes 12.5 mm, 10 mm and 2.36 mm for sieving the aggregates.

(e) Balance : A balance of capacity not less than 500 g to weigh accurate upto 0.1 g.

(f) Oven : A thermostatically controlled drying oven capable of maintaining constant temperature between 100°C and 110°C.

Procedure

The test sample consists of aggregates passing 12.5 mm sieve and retained on 10 mm sieve and dried in

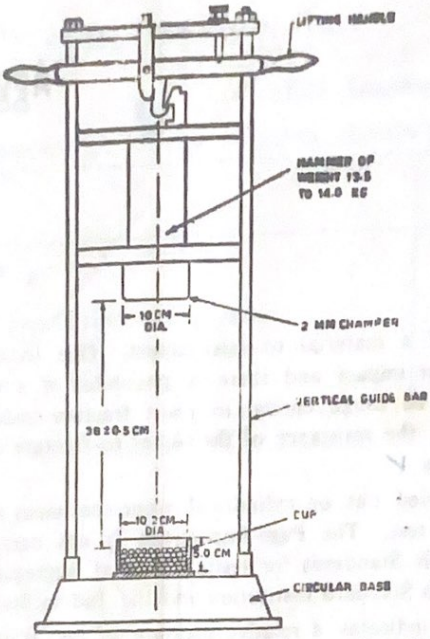

Figure 12.1 Aggregate Impact Testing Machine

an oven for four hours at a temperature 100°C to 110°C and cooled. The aggregates are filled upto about one-third full in the cylindrical measure and tamped 25 times with rounded end of the tamping rod. Further quantity of aggregates is then added upto about two-third full in the cylinder and 25 strokes of the tamping rod are given. The measure is now filled with the aggregates to over flow, tamped 25 times. The surplus aggregates are struck off using the tamping rod as straight edge. The net weight of the aggregates in the measure is determined to the nearest gram and this weight of the aggregates is used for carrying out duplicate test on the same material. The impact machine is placed with its bottom plate flat on the floor so that the hammer guide columns are vertical. The cup is fixed firmly in position on the base of the machine and the whole of the test sample from the cylindrical measure is transferred to the cup and compacted by tamping with 25 strokes.

The hammer is raised until its lower face is 38 cm above the upper surface of the aggregates in the cup, and allowed to fall freely on the aggregates. The test sample is subjected to a total of 15 such blows, each being delivered at an interval of not less than one second. The crushed aggregate is then removed from the cup and the whole of it sieved on the 2.36 mm sieve until no further significant amount passes. The fraction passing the sieve is weighed accurate to 0.1 g. The fraction retained on the sieve is also weighed and if the total weight of the fractions passing and retained on the sieve is added, it should not be less than the original weight of the specimen by more than one gram; if the total weight is less than the original by over one gram, the result should be discarded and a fresh test made.

The above test is repeated on fresh aggregate sample.

Calculation

The aggregate impact value is expressed as the percentage of the fines formed in terms of the total weight of the sample.

Let the original weight of the oven dry sample be W_1 g and the weight of fraction passing 2.36 mm IS sieve be W_2 g.

Aggregate impact value $= \frac{100\ W_2}{W_1}$ percent.

This is recorded correct to the first decimal place

Results

The mean of the two results is reported as the aggregate impact value of the specimen to the nearest whole number.

Aggregate impact value is to classify the stones in respect of their toughness property as indicated below :

Aggregate impac: values

$< 10\%$	Exceptionally strong :	10—20%	Strong.
10—30%	Satisfactorily for road surfacing ;	$> 35\%$	Weak for road surfacing

Discussion

Chief advantage of aggregate impact test is that test equipment and the test procedure are quite simple and it determines the resistance to impact of stones simulating field condition. The test can be performed in a short time even at construction site or at stone quarry, as the apparatus is simple and portable.

Well shaped cubical stones provide higher resistance to impact when compared with flaky and elongated stones.

It is essential that the first specimen to be tested from each sample of aggregate is equal in volume; this is ensured by taking the specimen in the measuring cylinder in the specified manner by tamping in three layers. If all the test specimens to be tested in the aggregate impact testing mould are of equal volume, the height of these specimens will also be equal and hence the height of fall of the impact rammer on the specimens will be equal. On the other hand, if equal weight of different aggregate samples are taken, their volume and height may vary depending upon the specific gravity of the aggregates and their shape factors.

There is no definite reason why the specified rate of application of the blows of the impact rammer should be maintained.

Applications of Aggregate Impact Value

The aggregate impact test is considered to be an important test to assess the suitability of aggregates as regards the toughness for use in pavement construction. It has been found that for majority of aggregates, the aggregate crushing and aggregate impact values are numerically similar within close limits. But in the case of fine grained highly siliceous aggregate which are less resistant to impact than to crushing the aggregate impact values are higher (on the average, by about 5) than the aggregate crushing values.

Various agencies have specified the maximum permissible aggregate impact values for the different types of pavements, those recommended by the Indian Roads congress are given in Table 12.1.

For deciding the suitability of soft aggregates in base course construction, this test has been commonly used. A modified impact test is also often carried out in the case of soft aggregates to find the wet impact value after soaking the test sample. The recommendations given in Table 12.2 based on work reported by different agencies; have been made to assess the suitability of soft aggregate for road construction.