AGGREGATE IMPACT TEST

The aggregates to sudden shock of impact. The apparatus for the standard aggregate impact test as per IS 2386 – 1963 (part IV) consists of the following.

- A testing machine weighing 45 to 60 kg and having a metal base with a plane lower surface of not less than 30 cm in diameter. It is supported on level and plane concrete floor of minimum 45 cm thickness. The machine should also have provisions for fixing its base.

- A cylindrical steel cup of internal diameter 102mm, depth 50mm and minimum thickness 6.3mm.

- A metal hammer or tube weighing 13.5 to 14kg with lower end in cylindrical shape is 50mm long, 100mm diameter with a 2mm chamfer at the lower edge and case hardened. The hammer should slide freely between vertical guides and be concentric with the cup.

- A cylindrical metal measure having internal diameter of 75mm and depth 50mm for measuring aggregates.

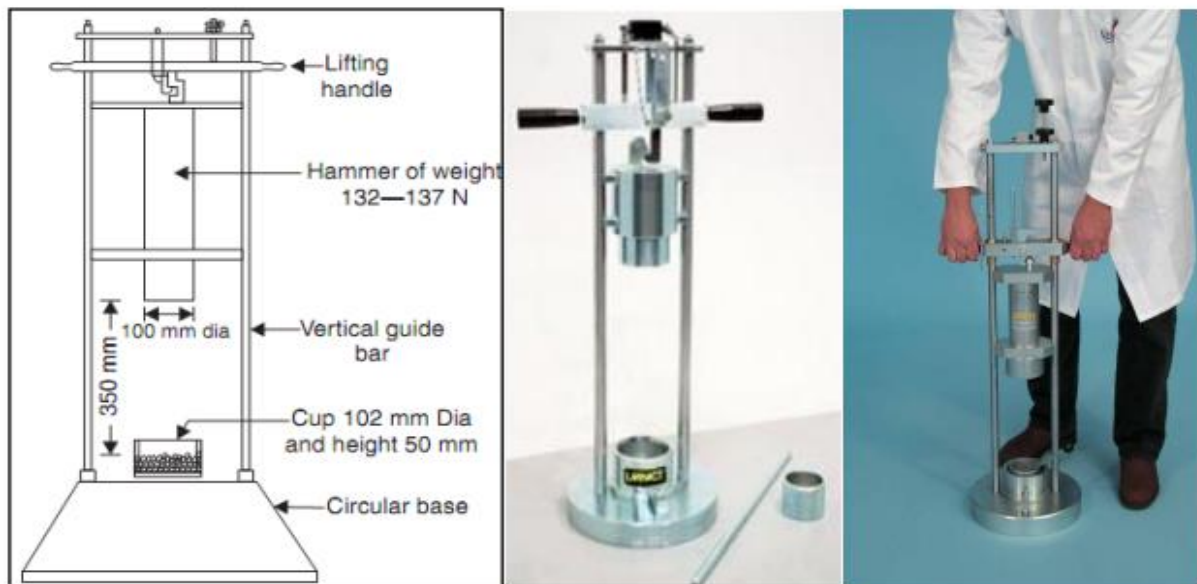- A balance of capacity not less than 500gm, readable and accurate up to 0.1g

FIG. 11 AGGREGATE IMPACT TEST APPARATUS

Procedure:

- The test sample: It consists of aggregates sized 10mm to 12.5mm. The aggregates should be dried by heating at 100 – 110˚c periods of 4 hours and cooled.

- The material is sieved through 12.5mm and 10mm IS sieves. The aggregates passing through 12.5mm sieve and retained on 10mm sieve comprises the test material.

- The aggregate is poured to fill about just one – third depth of measuring cylinder.

- The material is compacted by giving 25 gentle blows with the rounded end of the tamping rod.

- Two more layers are added in similar manned, so that cylinder is full.

- The surplus aggregates are strike off.

- The net weight of the aggregates is determined to the nearest gram (w1)

- The impact machine is brought to rest without wedging or packing upon the level plate, block or floor so that it is rigid and the hammed guide columns are vertical.

The cup is fixed firmly in position on the base of the machine and plate whole of the test sample in it and compact by giving 25 gentle strokes with taming rod.

- The hammer is raised until its lower face is 380mm above surface of the aggregate sample in the cup and allows it to fall freely on the aggregate sample. Give 15 such blows at an interval of not less than one second between successive falls.

- The crushed aggregates is removed from the cup and sieve it through 2.36mm IS sieves until no further significant amount passes in one minute.

- The fraction passing the sieve is weighed to an accuracy of 1gm (w2). Also the fraction retained in the sieve is weighed.

- The observations are noted down and the aggregate impact value is computed. The mean of two observations, rounded to nearest whole number is reported as the 'Aggregate Impact Value.

TABLE 10 AGGREGATE IMPACT TEST

Observations	Sample I	Sample II
Total weight of dry sample taken (W_1 gm)		
Weight of portion passing 2.36mm Sieve (W_2 gm)		
Aggregate Impact Value (%) =(W_2/W_1)X 100		

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

TABLE 11 AGGREGATE IMPACT VALUES

Aggregate Impact Value	Classification
10 %	Exceptionally strong
10 – 20 %	Strong
20 – 30 %	Satisfactory for road surfacing
35 %	Weak for road surfacing

SHAPE TEST FOR AGGREGATES

Flakiness Index: The flakiness index of aggregate is the percentage by weight of particles in it whose least dimension (thickness) is less than 0.6 times of their mean dimension. The test is not applicable to sizes smaller than 6.3 mm. Elongation Index The elongation index of aggregate is the percentage by weight of particles in it whose greatest dimension (length) is greater than 1.8 times their mean dimension. The elongation index is not applicable to sizes smaller than 6.3 mm.

Angularity Number: The shape of aggregate can be expressed by a parameter

called Angularity Index which depends on Angularity number. If the void is 33% the angularity of such aggregate is considered zero. If the void is 44% the angularity number of such aggregate is considered as 11. Angularity number zero represents the most practicable rounded aggregates and the angularity number 11 indicates the most angular aggregates that could be tolerated for making concrete.

Apparatus Required: Balance to weigh coarse aggregate with cylinder,

Cylinder of 3 liters Capacity. Thickness gauge, Length gauge, I.S. sieve - 63 mm, 50 mm, 40 mm, 31.5 mm, 25 mm, 20 mm, 16 mm, 12.5 mm, 10 mm and 6.3 mm.

Procedure Flakiness Index

- Weight of each fraction of aggregate passing and retained on the specified set of sieves is noted.

- 200 pieces of the aggregate passing 63mm sieve and retained on 50mm sieve be =w1 g.

- Each of the particles from this fraction of aggregate is tried to be passing through the slot of the specified thickness of the thickness gauge.

- The weight of the flaky material passing this gauge is w1 g. Similarly the weights of the fractions passing and retained the specified sieves,

  W1, W2, W3 etc. are weighed and the total weight W1 + W2 + W3 +… = W g is found.

- Also the weights of material passing each of the specified thickness gauges are found = w1, w2, w3… and the total weight of material passing the different thickness gauges = w1 + w2 + w3 + …= w g. is found.

- Then the flakiness index is the total weight of the flaky material passing the various thickness gauges expressed as a percentage of the total weight of the sample gauged. Flakiness Index = (w1 + w2 + w3 + …)/ (W1 + W2 + W3 +…) x 100 percent.
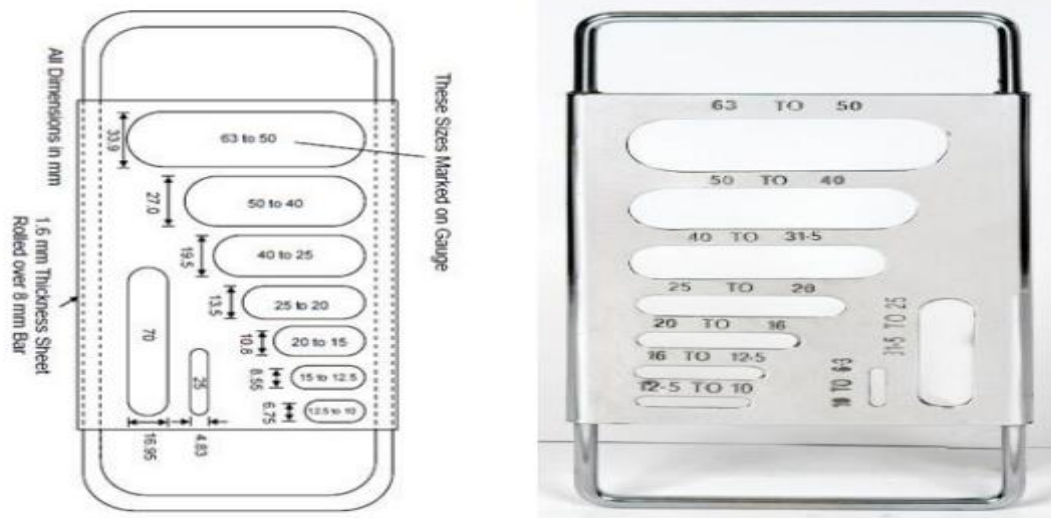
FIG. 13 AGGREGATE FLAKINESS TEST GAUGE

Tabulation for flakiness Index According to IS: 2386 (Part I) - 1963.

TABLE 12 AGGREGATE FLAKINESS TEST VALUES

S. No.	Size of aggregates, mm		Thickness gauge (mm)	Wt. of aggregates taken, gm (W)	Wt. of aggregates passing on Thickness gauge, gm (w)
	Passing	Retained			
1	63	50	33.90		
2	50	40	27.00		
3	40	31.5	19.50		
4	31.5	25	16.95		
5	25	20	13.50		
6	20	16	10.80		
7	16	12.5	08.55		
8	12.5	10	06.75		
9	10	6.3	04.89		

Elongation Index

o The weight of the aggregates which is retained on the specified gauge length from each fraction is noted.

o 200 pieces of the aggregate passing 50mm sieve and retained 40mm sieve weight W_1 g.

o Each piece of these are tried to be passed through the specified gauge length with its longest side and those elongated pieces which do not pass the gauge are separated and the total weight determined = w_1 g. Similarly the weight of each

fraction of aggregate passing and the retained on specified sieves sizes are found, W1, W2, W3 ….

And the total weight of the sample determined = W1 + W2 + W3 + … = W g.

o Also the weight of material from the each fraction retained on the specified gauge length is found = x1, x2, x3…. and the total weight of the retained determined = x1 + x2 + x3 + …and the total weight retained determined = x1 + x2 + x3 + …=X g. · The elongation index is the total weight of the material retained on the various length gauges, expressed as a percentage of the total weight of the sample gauged. Elongation Index = (x1 + x2 + x3 + …)/(W1 + W2 + W3 + …) x 100 percent

FIG. 14 ELONGATION LENGTH GAUGE

TABLE 13 ELONGATION INDEX VALUE

TABLE 13 ELONGATION INDEX VALUE

S. No.	Size of aggregates, mm		ngth gauge, mm	Wt. of aggregates taken, gm (W)	Wt. of aggregates retained on Thickness gauge, gm (w)
	Passing	Retained			
1	50	40	81.0		
2	40	25	58.5		
3	25	20	40.5		
4	20	16	32.4		
5	16	12.5	25.9		
6	12.5	10	20.2		
7	10	6.3	14.7		

Ref According to IS: 2386 (part I) – 1963

Angularity Number:

- The sample of single sized aggregate retained between the specified pair of sieves is dried in an oven at a temperature 100o C to 110o C for 24 hours
- The aggregate are filled in the cylinder.
- The aggregate in the cylinder are subjected to 100 blows of the tamping rod at a rate of about 2 blows per second.
- The 100 blows must be distributed evenly over the surface to the aggregates
- The aggregate with cylinder is then weighed to the nearest 5 g. The separate determinations are made and the mean weight of the aggregate in the cylinder is calculated.

TABLE 14 ANGULARITY VALUE OF AGGREGATES

Particulars	Trial Number			
	1	2	3	4
Weight of aggregate filling the cylinder to the nearest five grams, g (W)				
Weight of water filling the cylinder, g (C)				

Ref According to IS: 2386 (part I) – 1963 Angularity Number = 67 – 100W/CG Flakiness index of aggregate to be used in road construction should not exceed 25 %. It is preferred if it is kept below 15 %. Value of elongation index should also not exceed 15 % for a good aggregate and normally must not exceed 25 %. Angularity number of a good aggregate should lie between 0 and 10.

LOS ANGELES ABRASION TEST:

The principle of the Los Angeles abrasion test is to find the percentage wear due to the relative rubbing action between the aggregate and the steel balls used as abrasive charge. Pounding action of these balls also exist during the test and the resistance to wear and impact is evaluated. Apparatus Required Los Angeles machine.

Abrasive charge Machine Description:

The Los Angeles machine consists of a hollow cylinder closed at both ends, having inside diameter 70 cm and length 50 cm and mounted so as to rotate about its horizontal axis.

The abrasive charge consists of cast iron spheres of approximate diameter 4.8 cm and each of weight 390 to 445 g. The number of spheres to be used as abrasive charge and their total weight have been specified based on grading of the aggregate sample.
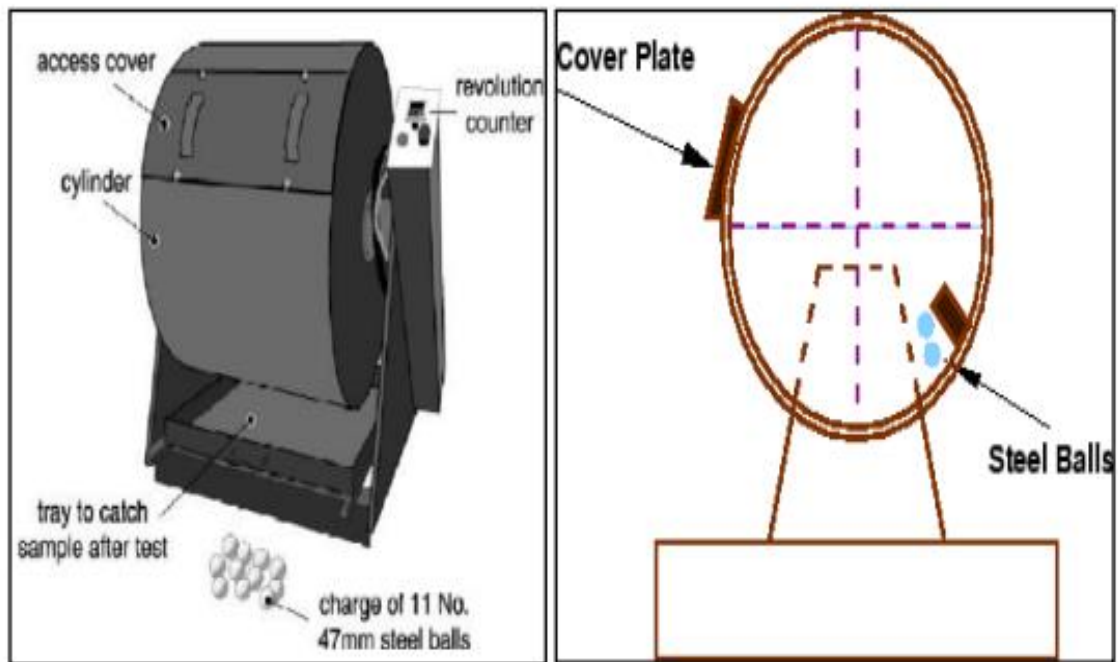
FIG.16 LOS ANGELES ABRASION TEST APPARATUS

FIG.17 LOS ANGELES ABRASION TEST APPARATUS

Procedure:

- The specified weight of the aggregate specimen (5 to 10 kg) is placed in the machine along with the abrasive charge.

- The machine is rotated at a speed of 30 to 33 rpm for the specified number of revolutions (500 to 1000 depending on the grading of the specimen).

- The abraded aggregate is then sieved on 1.7 mm IS sieve and the weight of the powdered aggregate passing this sieve is found.

- The abrasive value is the percentage passing 1.7 mm sieve expressed in terms of

the original weight of the sample.

FIG.18 ABRASION OF AGGREGATES BEFORE AND AFTER ABRATION TEST

Observation:

Initial weight of aggregate sample, W1 gm = Weight of the aggregate passing thro' 1.7mm IS sieve, W2 gm = Formula Used % Percentage wear or abrasive value = W2 X 100 According to ISI, acceptable aggregate for cement concrete should have abrasive value of 16 %. For aggregate to be used in bituminous mixes, this value may be allowed up to 30% for quality surface courses and 50% for base courses of bitumen bound macadam.