

4. FLAKINESS & ELONGATION INDEX TEST(SHAPE TEST).

(IS : 2386 – PART – 1)

INTRODUCTION:

The particle shape of aggregates is determined by the percentages of flaky and elongated particles contained in it. For base course and construction of bituminous and cement concrete types, the presence of flaky and elongated particles are considered undesirable as they may cause inherent weakness with possibilities of breaking down under heavy loads. The angularity number i.e., flaky and elongation has considerable importance in the gradation requirements of various types of mixes such as bituminous concrete, cement concrete and soil aggregate mixes.

Object:

To determine the flakiness and elongation of the aggregates by standard flakiness gauge and elongation gauges.

Apparatus:

a) Flakiness gauge (Thickness gauge): The Flakiness index of aggregates is the percentages by weight of particles whose least dimension is less than three-fifths (0.6) of their mean dimension. The test is not applicable to sizes smaller than 6.3mm. The apparatus consists of a standard thickness gauge of IS sieve sizes 63, 50, 40, 31.5, 25, 20, 16, 12.5, 10 and 6.3mm and a balance to weigh the samples.

b) Elongation gauge (Length gauge): The elongation index of aggregate is the percentage by weight of particles whose greatest dimension (length) is greater than one and four fifth times (1.8) their mean dimension. The elongation test is not applicable to sizes smaller than 6.3mm. The apparatus consists of a standard length gauge of IS sieve sizes 50, 40, 31.5, 25, 20, 16, 12.5, 10 and 6.3mm.

Procedure:

a) Flakiness Index: The sample is sieved with the sieves mentioned in above. A minimum of 200 pieces of each fraction to be tested is taken and weighed. In order to separate flaky materials, each fraction is then gauged for thickness on a thickness gauge. The amount of flaky material passing the gauge is weighed to an accuracy of at least 0.1 percent of the test sample.

Calculation:

In order to calculate the flakiness index of the entire sample of aggregates first the weight of each fraction of aggregate passing and retained on the specified set of sieves is noted (X1, X2, X3... etc). Each of the particle from this fraction of aggregate is tried to be passed through the slot of the specified thickness of the thickness gauge are found and



Flakiness Gauge



Elongation gauge

weighed ($x_1, x_2, x_3 \dots$ etc). 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.

$$\text{Flakiness Index} = \frac{(x_1 + x_2 + x_3 + \dots)}{(X_1 + X_2 + X_3 + \dots)} \times 100$$

b) Elongation Index: The sample is sieved through the IS sieves specified as above. A minimum of 200 pieces of each fraction is taken and weighed. In order to separate elongated material, each fraction is then gauged individually for length in a length gauge. The pieces of aggregates from each fraction tested which could not pass through the specified gauge length with its long side are elongated particles and are collected separately to find the total weight of aggregates retained on the length gauge from each fraction. The total amount of elongated material retained by the length gauge is weighed to an accuracy of at least 0.1 percent of the weight of the sample.

Calculation:

In order to calculate the Elongation index of the entire sample of aggregates first the weight of each fraction of aggregate passing and retained on the specified set of sieves is noted ($Y_1, Y_2, Y_3 \dots$ etc). Each piece of these are tried to be passed through the specified length of the gauge length with its longest side and those elongated pieces which do not pass the gauge are separated and weighed ($y_1, y_2, y_3 \dots$). Then 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.

$$\text{Elongation Index} = \frac{(y_1 + y_2 + y_3 + \dots)}{(Y_1 + Y_2 + Y_3 + \dots)} \times 100$$

Combined Flakiness & Elongation Index: To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particle is separated out from the remaining (non flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

Limits:

- (i) Flakiness Index for Bituminous and Non-bituminous Mixes = Max. 15%
- (ii) Elongation Index for Bituminous and Non-bituminous mixes = Max. 15%
- (iii) Combined Flakiness and Elongation Index for Bituminous and Non-bituminous mixes = Max.30%
- (iv) Flakiness Index for Concrete mixes = Max.35%

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Punjab State Road Sector Project
PWD B&R Branch, Govt. of Punjab
 Punjab Roads & Bridges Development Board

FLAKINESS AND ELONGATION INDEX
 (IS 2386 Part 1)

Source of Material: _____ Date Sampled: _____
 Description: _____ Date Tested: _____

Sieve Size (mm)	Total Wt. of Aggregates Retained (g)	Wt. Retained on Flakiness Gauge (g)	Wt. Passing on Flakiness Gauge (g)
63 - 50			
50 - 40			
40 - 31.5			
31.5 - 25			
25 - 20			
20 - 16			
16 - 12.5			
12.5 - 10			
10 - 6.3			
Total			

Percentage of Flakiness Index:
 (Total Wt. of Agg. Ret. on Flakiness Ga./Wt. Passing on Flakiness Ga.)(100) = _____

Sieve Size (mm)	Total Wt. of Aggregates Retained (g)	Wt. Retained on Elongation Gauge (g)	Wt. Passing on Elongation Gauge (g)
50 - 40			
40 - 25			
25 - 20			
20 - 16			
16 - 12.5			
12.5 - 10			
10 - 6.3			
Total			

Percentage of Elongation Index Value:
 (Total Wt. Ret. On Elongation Ga./Total Wt. Passing on Elongation Ga.)(100) = _____

COMBINED PERCENTAGE OF FLAKINESS & ELONGATION = _____

Remarks : _____
 Approved/Not Approved: _____

Contractor's Representative

Materials Engineer
Consultant

Resident Engineer
Consultant