DETERMINATION OF PERCENT FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE
                                                                                 LS-608 R33

1. SCOPE
1.1 This method covers the determination of the percentage of flat and elongated particles in processed coarse aggregate, retained on the 4.75 mm sieve by measurement of individual particles.

3. DEFINITION
3.1 FLAT AND ELONGATED pieces shall be those particles whose greatest dimension in the longitudinal axis, compared to the least dimension in a plane perpendicular to the longitudinal axis, exceeds a ratio of 4:1.

4. APPARATUS
4.1 BALANCE: A balance having a capacity of 5000 g and readable to 1.0 g or less.........................

4.2 CALIPERS: Proportional (figure-of-eight) calipers or other suitable devices in which the ratio of the opening at one end to the other is 4:1..

Note 1: The proportional calipers must be checked periodically to ensure that the 4:1 ratio is maintained throughout the range of opening.

5. PREPARATION OF TEST SAMPLE
5.1 Prepare the coarse aggregate according to LS-600. NO further crushing of the test sample is required..

5.2 Dry the sample sufficiently to obtain a clean separation of particles on the 4.75 mm sieve.....

5.3 Separate the sample by sieving according to LS-602 into one or more of the individual fractions indicated in Table 1..

5.4 Prepare the test sample from each coarse aggregate fraction representing at least 5% or more of the submitted sample according to the minimum masses shown in Table 1..

Note 2: The test sample only needs to be prepared from those coarse aggregate fractions representing at least 5% or more of the submitted sample. Maintain each fraction of the test sample in separate sizes.

5.5 When the test sample contains a mixture of natural aggregate, recovered crushed concrete, recovered asphaltic material, glass and/or ceramic material, the size of test sample shall be increased so that the amount of natural aggregate and recovered crushed concrete in the test sample meets the requirements of Table 1...

Table 1 - Sample Preparation

Coarse Aggregate Fraction		Mass (minimum), g
Passing	Retained	
37.5 mm	26.5 mm	3000
26.5 mm	19.0 mm	2000
19.0 mm	13.2 mm	1250
13.2 mm	9.5 mm	500
9.5 mm	6.7 mm	200
6.7 mm	4.75 mm	75

DETERMINATION OF PERCENT FLAT AND ELONGATED PARTICLES
IN COARSE AGGREGATE   LS-608 R33

5.6 Weigh and record the mass of material of each fraction to the nearest 1 g............................. _____

6. TEST PROCEDURE
6.1 Spread each test fraction on a clean, flat surface large enough to permit individual particles to be easily inspected.. _____
6.2 For each fraction, separate the particles of each test fraction by means of calipers into:
(i) flat and elongated.. _____
(ii) cubical particles... _____
Set the caliper on the maximum particle length, and then check whether the least particle dimension will completely pass through the opening at the small end of the caliper...................................... _____
6.3 Weigh and record the mass of each flat and elongated and cubical portion of the fraction to the nearest 1 g.. _____
Table 2 in the LS is a laboratory worksheet for recording test data and calculations..................... _____

7. CALCULATION
7.1 Calculate the per cent of flat and elongated particles in each test fraction (to one decimal place) as follows: .... _____

$$\% \text{ Flat \& Elongated} = \frac{A}{A+B} \times 100$$

Where:
A = mass of flat and elongated particles
B = mass of cubical particles

7.2 Compute the percent of each fraction specified in Table 1 using the gradation test (LS-602) of the coarse aggregate portion of the as-received sample. The computation shall be based on the total mass of material retained on the 4.75 mm sieve.. _____
Note 3: DO NOT use the required minimum mass for the test to compute the percent of each fraction.
7.3 Calculate the percent of flat and elongated particles weighted average value for each fraction as follows: Multiply the percentage of each fraction calculated in Section 7.2 and the percent flat and elongated particles for that fraction.. _____
7.4 Calculate the percent of flat and elongated particles of the test sample as the sum of the weighted average value for each fraction divided by 100.. _____
7.5 For the purpose of calculating the weighted average, consider any fraction (not tested) containing less then 5% of the test sample to have a value equal to the average of the next smaller and the next larger fractions.. _____
If one of these sizes is missing, assign the same value as the next larger or smaller fraction, whichever is present... _____

DETERMINATION OF PERCENT FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE
LS-608 R33

8. REPORTING OF RESULTS

8.1 Report the percent flat and elongated of each fraction of the test sample to the nearest whole percent.. _____

8.2 Report the weighted average percent flat and elongated of the test sample to the nearest whole percent…... _____

9. GENERAL NOTES

9.1 Material used in this test may be reused if insufficient material is available for all the required tests…..._____

COMMENTS