METHOD OF TEST FOR DETERMINATION OF PERCENT PARTICLES WITH TWO OR MORE CRUSHED FACES AND UNCRUSHED PARTICLES IN PROCESSED COARSE AGGREGATE

1. SCOPE AND SIGNIFICANCE

1.1 This method covers the visual determination of the percent, by mass, of particles with two or more crushed faces and percent, by mass of uncrushed particles in a processed coarse aggregate.

1.2 The anticipated purpose of this test procedure is to assist in identifying those sources of crushed gravel that may be suitable for moderate high stability asphalt pavements. When sources have been approved the test would also be used to ensure consistent quality is achieved.

2. DEFINITION

2.1 A particle with two or more crushed faces is defined as a piece of coarse aggregate with at least two well-defined broken faces resulting from fracture. A well-defined face is one in which the area of the crushed face is at least about 20 percent of the total surface area. The face is surrounded by edges which are sharp or slightly rounded. In most cases such a particle will have fractured surfaces consisting of 50 percent or more of the total surface of the particle. The internal angle between the faces should be 150° or less. Particles with smooth faces and rounded edges, or with only small chips removed, are considered to be uncrushed particles.

3. APPARATUS

3.1 BALANCE: Of sufficient capacity and sensitive to 1 g or less.

4. PREPARATION OF TEST SAMPLE

4.1 Prepare the coarse aggregate in accordance with the Method for Preparation of Coarse Aggregate, MTO Method LS-600.

4.2 The test sample shall be prepared from coarse aggregate fractions representing at least 5 % or more of the submitted sample.

4.3 A sample shall be prepared to the approximate mass shown in Table 1.

Table 1

Coarse aggregate fraction		Approx. Mass, g
Pass	Retained	
37.5 mm	19 mm	200 Particles Minimum
19.0 mm	13.2 mm	1250
consisting of:		
19.0 mm	16.0 mm	750
16.0 mm	13.2 mm	500
13.2 mm	9.5 mm	750
9.5 mm	6.7 mm	200
6.7 mm	4.75 mm	75

5. TEST PROCEDURE

5.1 Weigh each fraction to the nearest 1 g. Record this mass (A).

5.2 Spread the sample on a clean, flat surface large enough to permit the particles to be visually inspected.

5.3 Separate the particles into portions containing two or more crushed faces, one crushed face and no crushed faces. (If cementations are present, they should be considered as uncrushed particles).

5.4 Weigh the portion of particles with two or more crushed faces, and the uncrushed portion of the sample, to the nearest 1 g. Do not weigh the portion of particles with one crushed face.

6. CALCULATION

6.1 Calculate the percentage of particles with two or more crushed faces in the test sample (to one decimal place), using the following formula:

$$\text{Percent particles with two or more crushed faces} = \frac{B}{A} \times 100$$

where A = mass of original sample

B = mass of particles with two or more crushed faces.

6.2 Calculate the percentage of uncrushed particles (to one decimal place), using the following formula:

$$\text{Percent uncrushed particles} = \frac{C}{A} \times 100$$

where A = mass of original sample

C = mass of uncrushed particles

6.3 When the test is performed on several test fractions or where the as-received sample contains less than 5 % on any size, a weighted average value shall be calculated as follows:

6.3.1 Multiply the percentage (based on the as-received coarse aggregate sample mass) on each fraction by the percent particles with two or more crushed faces for that fraction. The sum of those products divided by 100 is the weighted average percentage for the as-received sample. The same procedure is used for uncrushed particles.

6.3.2 For the purpose of calculating the weighted average consider any sizes (not tested) that contain less than 5 % of the as-received sample to have the same value as the average of the next smaller and the next larger size or if one of these sizes is missing, to have the same value as the next larger or smaller size, whichever is present.

7. REPORTING OF RESULTS

7.1 Report the weighted average particles with two or more crushed faces to the nearest whole percent.

7.2 Report the weighted average uncrushed particles to the nearest whole percent.

8. GENERAL NOTES

8.1 If a dirt or dust film makes it difficult to determine that the particles have well-defined fractured faces, it is permissible to wash the particles. However, the samples should be dried before weighing.

8.2 Material used in this test may be re-used if insufficient material is available for other required tests.

8.3 It is anticipated that results should be reported in the following manner:

% Particles with two or more crushed faces / % uncrushed particles = 55/5

This would mean that there were 55 % particles with two or more crushed faces and 5 % uncrushed particles.

8.4 From time to time it may be desired to measure the amount of totally crushed particles. In this case, paragraphs 4 to 6 of this procedure should be followed using the following definition:

"A totally crushed particle is defined as a piece of coarse aggregate which has no rounded surfaces and consists of well-defined broken faces resulting from fracture. Particles with smooth faces and rounded edges, or with only small chips removed, are considered to be uncrushed particles. Partly crushed particles are those which are neither totally crushed nor uncrushed particles".

8.5 When testing for the amount of totally crushed particles, it is anticipated that results should be reported in the following manner:

% totally crushed particles / % uncrushed particles = 40/10

This would mean that there were 40 % totally crushed particles and 10 % uncrushed particles

Laboratory sample No.	Sieve size	Mass of sample,g	Mass of particles with two or more crushed faces	Mass of uncrushed particles	Percent particles with two or more crushed faces	Percent uncrushed particles
Date: Operator: Remarks:						

Figure 1: Data Card for MTO LS-617 Percent Particles With Two or More Crushed Faces