

DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
 Transportation Laboratory
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**METHOD FOR DETERMINING PERCENTAGE
OF CRUSHED PARTICLES**

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section H of this method. It is the responsibility of whoever uses this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. SCOPE

This test describes a procedure for determining the percent, by mass, of particles which, by visual inspection, have the characteristics of crushed aggregate.

more of the submitted sample, split a representative portion to within 10 % of the mass specified in Table 1.

B. APPARATUS

1. Balance: A balance or scale shall have a minimum capacity of 6 kg, sensitive to 1 g or less.
2. Sieves: Standard sieves shall be of the woven-wire type with square openings and shall conform to AASHTO Designation: M 92.
3. Splitter: Any device may be used which will divide the sample into representative portions. However, the riffle-type splitting method is preferred to the hand-quartering method.
4. Spatula: A spatula or similar small tool is required to sort aggregates.

C. PREPARATION OF SAMPLE

1. Prepare the sample as described in California Test 201. From each coarse aggregate fraction representing 5 % or

TABLE 1

Coarse Aggregate Fraction		Test Sample Mass, in g
(Passing by Retained)		(± 10 %)
50 mm	by 37.5 mm	6000
37.5 mm	by 25.0 mm	3000
25.0 mm	by 19.0 mm	1500
19.0 mm	by 12.5 mm	1000
12.5 mm	by 9.5 mm	500
9.5 mm	by 6.3 mm	250
6.3 mm	by 4.75 mm	100
* If 12.5-mm and/or 6.3-mm sieves are not required, use the following:		
19.0 mm	by 0.5 mm	1200
9.5 mm	by 0.75 mm	300

2. If the percent of crushed particles for the portion passing the 4.75-mm sieve and retained on the 2.36-mm sieve material is required (i.e., when stated in specifications or when determination of percentage of crushed particles is not limited to the material retained on the 4.75-mm sieve and the 4.75 by 2.36-mm aggregate fraction represents more than 5 % of the submitted sample), split a representative portion of the material

passing the 4.75-mm sieve large enough to yield 100 ± 10 g of material retained on the 2.36-mm sieve. Waste the fraction passing the 2.36-mm sieve.

D. TEST PROCEDURE

1. Weigh each test sample to the nearest g and record as "Test Sample Mass."
2. Spread one of the test samples on a clean flat surface large enough to permit the material to be spread thinly for inspection.
3. Use the knife edge of a large spatula or similar tool to separate crushed particles from uncrushed particles. Any particle appearing to have one or more fractured faces, shall be considered a crushed particle.
4. When the separation is complete, weigh the crushed particles and record as "Mass of Crushed Particles."
5. Repeat the above procedure on each test sample representing an individual size fraction.

E. CALCULATIONS

1. Calculate the percent of crushed particles in each respective test sample using the following formula:

$$\text{Percent of Crushed Particles} = \frac{[\text{Mass of Crushed Particles}]}{[\text{Test Sample Mass}]} \times 100$$

2. Calculate the percent of crushed particles in the whole or in the coarse portion of the as-received sample by the weighted average method as follows:

Multiply the percent of each size fraction to be included in the weighted average by its respective percent of crushed particles (use the total mass of the as-received sample). The sum of these products divided by the sum of the percent of each of the included size fractions (based on the total mass of the as-received sample) gives the weighted average percent of crushed particles for

that group of fractions included in the calculation. The following example illustrates a typical calculation for the coarse (retained 4.75-mm sieve) portion of a sample:

Size Fractions (Passing by Retained)	A Percent of As-received Sample	B Percent of Crushed Particles	C Products of Columns A & B
50.0 mm by 37.5 mm	3*	—	
37.5 mm by 2.5 mm	20	87	= 1740
25.0 mm by 19.0 mm	7	89	= 623
19.0 mm by 9.5 mm	19	93	= 1767
9.5 mm by 4.75 mm	<u>16</u>	95	= <u>1520</u>
	62		5650

* Less than 5 % of fraction in As-received Sample—no test. Weighted Average Percent of Crushed Particles in the Retained 4.75-mm sieve fractions = $5650/62 = 91\%$.

F. PRECAUTION

If a dust film obscures the surface and makes it difficult to detect fractured particle faces, wash and oven-dry the aggregate sample.

G. REPORTING OF RESULTS

Report the weighted average test results to the nearest 1 %.

H. SAFETY AND HEALTH

Aggregates may contain bacteria and/or organisms which can be harmful to one's health. The wearing of dust masks and protective gloves when handling materials is advised.

Prior to handling, testing or disposing of any materials, testers are required to read the following portions of Caltrans Laboratory Safety Manual: Part A, Section 5.0, Hazards and Employee Exposure; Part B, Sections: 5.0, Safe Laboratory Practices; 6.0, Chemical Procurement Distribution and Storage; and 10.0, Personal Protective Apparel and Equipment; and Part C, Section 1.0, Safe Laboratory Practices. Users of this method do so at their own risk.

REFERENCES: AASHTO Designation: M 92 California Test 201

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