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**ENGINEERING SERVICE CENTER**  
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## METHOD OF TEST FOR ABRASION OF COARSE AGGREGATE BY USE OF THE LOS ANGELES RATTLER MACHINE

**CAUTION:** Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section G of this method. It is the responsibility of the user of 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 method which is a modification of AASHTO Designation T 96, is used to determine the resistance of coarse aggregate to impact in a rotating cylinder containing metallic spheres. This test is known as the Los Angeles Rattler Test.

### B. APPARATUS

1. Los Angeles Machine. The Los Angeles Abrasion Testing Machine shall conform to the essential design characteristics in Figure 1 and the narrative below.

The testing machine shall consist of a hollow steel cylinder, closed at both ends, having an inside diameter of  $710 \pm 5$  mm and an inside length of  $510 \pm 5$  mm. The steel cylinder shall be mounted on stub shafts attached to the ends of the cylinder but not entering it, and shall be mounted in such a manner that it may be rotated about its axis in a horizontal position. An opening in the cylinder shall be provided for the introduction of the test sample. The opening shall be closed with a dust-tight cover that is easily removed. The cover shall be so designed as to maintain the cylindrical contour of the interior surface

unless the shelf is so located that the charge will not fall on the cover, or come in contact with it during the test. A removable steel shelf, projecting radially  $90 \pm 2$  mm into the cylinder and extending its full length, shall be mounted along one element of the interior surface of the cylinder. The shelf shall be of such thickness and so mounted, by bolts or other approved means, as to be firm and rigid. The position of the shelf shall be such that the distance from the shelf to the opening, measured along the circumference of the cylinder in the direction of rotation, shall not be less than 1270 mm.

The shelf may also be mounted on the inside of the cover plate as shown in Figure 1. The shelf shall be made of wear-resistant steel and shall be rectangular in cross-section. The Los Angeles Machine shall be so driven and so counterbalanced as to maintain 100 revolutions in  $190 \pm 10$  s. It is desirable to have the machine equipped with an adjustable automatic counter which can be set to stop the machine at the required number of revolutions.

2. Balance. The balance shall have a capacity of at least 5500 g and a sensitivity of 1 g or less.

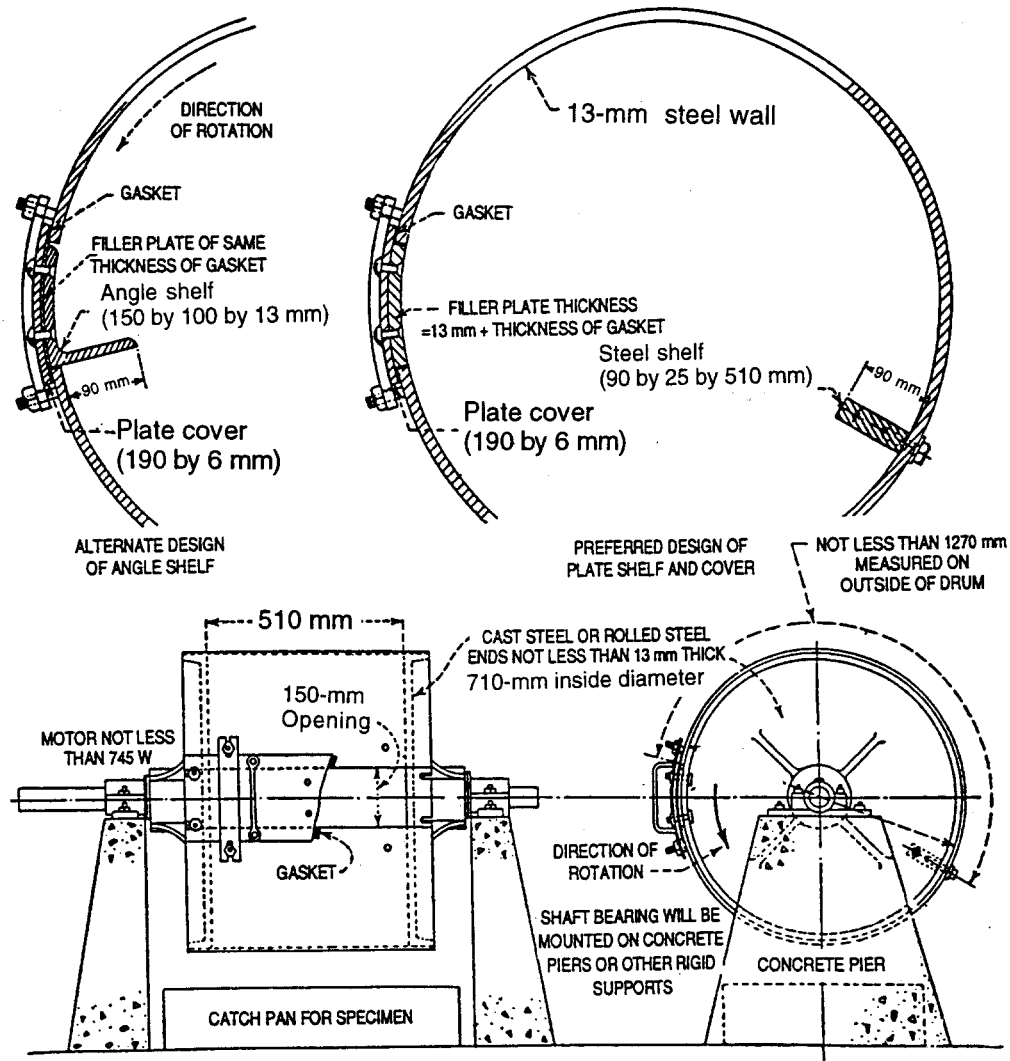


FIGURE 1 - LOS ANGELES ABRASION TESTING MACHINE

3. Sieves. Standard 4.75 and 1.70-mm woven wire sieves shall conform to AASHTO Designation: M 92. These sieves should be at least 300 mm in diameter.
4. Abrasive Charge.
  - a. Each abrasive charge shall consist of a solid, steel sphere having a mass between 390 and 445 g. A solid, steel sphere with a diameter of  $46.5 \pm 0.5$  mm will typically meet this requirement.
  - b. The abrasive charge, depending upon the grading of the test specimen, as described under C, Preparation of Test Specimen, shall be as follows:

Test Specimen Grading	Number of Spheres	Mass of Charge, in g
A .....	12	5000 ± 25
B .....	11	4584 ± 25
C .....	8	3330 ± 20
D .....	6	2500 ± 15

**C. PREPARATION OF TEST SPECIMEN**

1. Prepare the sample as prescribed in California Test 201. When necessary, blend the natural material and the product obtained from crushing the oversized particle as prescribed in Section G, Adjusting Grading of Samples, of California Test 201.
2. Dirty or coated aggregate shall be washed, dried to constant mass at 110 ± 5°C, and cooled to room temperature before preparing the test specimen.
3. Select the grading from Table 1 most nearly representative of the aggregate furnished for the work, separate the aggregate on the required sieve sizes, and prepare the test specimen using the mass of each sieve size fraction specified for the grading selected. Determine and record the mass of the prepared test specimen to the nearest 1 g.

If the coarse aggregate has been separated into two or more bin sizes, select the grading from Table 1 most nearly representative of the combined aggregate mix to be furnished.

**TABLE 1**

**GRADINGS FOR TEST SPECIMENS**

Sieve Size		Mass For Each Grading, in g			
Passing	Retained	A	B	C	D
37.5 mm	25.0 mm	1250 ± 25			
25.0 mm	19.0 mm	1250 ± 25			
19.0 mm	12.5 mm	1250 ± 10	2500 ± 10		
12.5 mm	9.5 mm	1250 ± 10	2500 ± 10		
9.5 mm	6.3 mm			2500 ± 10	
6.3 mm	4.75 mm			2500 ± 10	
4.75 mm	2.36 mm				5000 ± 10
Total Mass =		5000 ± 10	5000 ± 10	5000 ± 10	5000 ± 10

**D. TEST PROCEDURE**

1. Place the test specimen and abrasive charge in the Los Angeles Abrasive Testing Machine and close the opening with the dust-tight cover.
2. Start the testing machine and allow to operate for the required number of revolutions.
3. When the testing machine has completed rotating the required number of revolutions, remove the cover and carefully empty the entire contents into a pan. Remove the abrasive charge from the pan.
4. Separate the test specimen on the 4.75-mm sieve, then sieve the passing 4.75-mm material on the 1.70-mm sieve. Combine the material retained on the 4.75 and 1.70-mm sieves. Weigh and record these values to the nearest 1 g.
5. If the mass of material retained on the 1.70-mm sieve was determined after 100 revolutions, return the entire test specimen, including the material passing the 1.70-mm sieve, to the testing machine. Close the opening in the testing machine and operate for the required number of additional revolutions, then repeat Step 3 and 4 above.

**E. CALCULATION AND REPORTING**

1. Calculate the "Percent Wear" to the nearest % using the following equation:

$$\text{Percent Wear} = [(A - B)/A] \times 100$$

Where:

- A = Mass of original test specimen, to the nearest 1 g
- B = Mass retained on the 1.70-mm sieve after the specified number of revolutions, to the nearest 1 g

2. Report the grading of the test specimen and the percent wear at the number of revolutions tested.

#### F. PRECAUTIONS

1. It is essential that the entire test specimen, including the passing 1.70-mm sieve portion, be returned to the testing machine after determining the loss at 100 revolutions. Loss of fines during this phase of the operation will generally cause a higher than normal percent wear at 500 revolutions.
2. Backlash or slip in the driving mechanism is very likely to result in erroneous test results. Occasionally, check machine for worn gears, improperly tensioned belts, worn bearings, etc., to reduce possibility of improper operations.
3. The shelf of the Los Angeles Machine should be inspected periodically for wear and distortion. If the shelf is bent, either lengthwise or from its normal radial position with respect to the cylinder, it should be repaired or replaced before further abrasion tests are made. If a ridge develops on the working surface of the shelf, it should be ground off if its height exceeds 2.54 mm.

#### G. SAFETY AND HEALTH

Soils and aggregates may contain bacteria and/or organisms which can be harmful to one's health. Dust masks and protective gloves are required when handling materials.

Heat resistant gloves/mitts or pot holders are required for removing materials samples

and other objects from hot ovens.

Dust, noise, lifting and the operation of equipment are encountered in this testing procedure. It is not possible to completely eliminate these risks, but steps should be taken to minimize them as much as possible.

Dust collection units and the spraying of work room floors with dust palliatives are effective methods of reducing dust conditions.

Ear plugs or ear muffs is recommended when operating noisy equipment. Enclosures built around noisy equipment can eliminate much of the noise. The use of sound deadening material should be utilized when appropriate.

Guards or shields should be provided around dangerously exposed moving parts of machinery. Also, personnel should be instructed in the proper operation of each machine and in proper lifting methods. The use of back support braces and table-height carts to move materials can eliminate much of the lifting.

Prior to handling, testing or disposing of any materials, testers are required to read 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:

California Test 201  
AASHTO Designations: T 96 and M 92

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