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**DIVISION OF ENGINEERING SERVICES**  
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## **METHOD OF TEST FOR ABRASION OF COARSE AGGREGATE BY USE OF THE LOS ANGELES ABRASION TESTING MACHINE**

### **A. SCOPE**

This test method describes the procedure used to determine the resistance of coarse aggregate to impact in a rotating cylinder containing metallic spheres. This test is also known as the Los Angeles Rattler Test.

### **B. REFERENCES**

California Test 201 – Soil and Aggregate Sample Preparation  
California Test 202 – Sieve Analysis of Fine and Coarse Aggregates  
AASHTO M 92 – Wire-Cloth Sieves for Testing Purposes  
AASHTO T 96 – Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine  
ASTM C 131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

### **C. APPARATUS**

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

The testing machine must consist of a hollow steel cylinder, closed at both ends, with an inside diameter of 28 in.  $\pm$  0.2 in. and an inside length of 20 in.  $\pm$  0.2 in. The steel cylinder must be mounted on stub shafts attached to the ends of the cylinder but not entering it, and must be mounted in such a manner that it may be rotated about its axis in a horizontal position. An opening in the cylinder must be provided for the introduction of the test sample. The opening must be closed with a dust-tight cover that is easily removed. The cover must 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 3.5 in.  $\pm$  0.1 in. into the cylinder and extending its full length must be mounted along one element of the interior surface of the cylinder. The shelf must be of such thickness and be mounted, by bolts or other approved means, so as to be firm and rigid. The position of the shelf must be such that the distance from the shelf to the opening, measured along the circumference of the cylinder in the direction of rotation, is not less than 50 in.

The shelf may also be mounted on the inside of the cover plate (Figure 1). The shelf must be made of wear-resistant steel and must be rectangular in cross-section. The Los Angeles Abrasion Testing Machine must be driven and counter balanced so as to maintain 100 revolutions in 190 s  $\pm$  10 s. The machine must be equipped with an adjustable counter, which can be set to stop the machine at the required number of revolutions.

2. Balance: a balance having a capacity of at least 5500 g sensitive to 0.1 g or less.
3. Sieves: No. 4 and No. 12 woven wire sieves conforming to AASHTO M 92. These sieves should be at least 12 in. in diameter.
4. Abrasive Charge:
  - a. Each abrasive charge must consist of a solid, steel sphere having a weight between 390 g and 445 g. A solid, steel sphere with a diameter of  $1\frac{3}{4}$  in.  $\pm$   $\frac{1}{16}$  in. typically meets this requirement.
  - b. The abrasive charge, depending upon the grading of the test specimen as described under Section D, must be as follows:

Grading	Number Of Spheres	Weight of Charge, grams
A	12	5000 $\pm$ 25
B	11	4584 $\pm$ 25
C	8	3330 $\pm$ 20
D	6	2500 $\pm$ 15

#### D. PREPARATION OF TEST SPECIMEN

1. Prepare the sample in accordance with California Test 201. When necessary, blend the natural material and the material obtained from crushing the oversized particles in accordance with California Test 201, Section H.
2. Wash dirty or coated aggregate and dry to constant weight in accordance with California Test 226 at 230°F  $\pm$  9°F. Cool the aggregate 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. Prepare the test specimen using the weight of each sieve size fraction specified for the grading selected. Determine and record the weight of the prepared test specimen to the nearest 1 g.

If the coarse aggregate has been separated into 2 or more sieve 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		Weight in Grams for Each Grading			
Passing	Retained on	A	B	C	D
1 ½ in.	1 in.	1250 $\pm$ 25			
1 in.	¾ in.	1250 $\pm$ 25			
¾ in.	½ in.	1250 $\pm$ 10	2500 $\pm$ 10		
½ in.	⅜ in.	1250 $\pm$ 10	2500 $\pm$ 10		
⅜ in.	¼ in.			2500 $\pm$ 10	
¼ in.	No. 4			2500 $\pm$ 10	
No. 4	No. 8				5000 $\pm$ 10
Total Weight		5000 $\pm$ 10	5000 $\pm$ 10	5000 $\pm$ 10	5000 $\pm$ 10

**E. 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 run it for the required number of revolutions.
3. When the testing machine has completed 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 No. 4 sieve and sieve the passing No. 4 material on the No. 12 sieve. Combine the material retained on the No. 4 and No. 12 sieves in accordance with California Test 202. Weigh and record these values to the nearest 1 g.
5. If the weight of material retained on the No. 12 sieve was determined after 100 revolutions, return the entire test specimen, including the material passing the No. 12 sieve, to the testing machine. Close the opening in the testing machine and operate for the required number of additional revolutions, then repeat Steps 3 and 4.

**F. CALCULATION**

Calculate the "Percent Wear" to the nearest percent using the following equation:

$$\text{Percent Wear} = \frac{(A - B)}{A} \times 100$$

Where:

A = Weight of original test specimen to the nearest 1 g

B = Weight retained on the No. 12 sieve after the specified number of revolutions to the nearest 1 g

**G. REPORTING RESULTS**

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

**H. PRECAUTIONS**

1. It is essential that the entire test specimen, including the passing No. 12 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 Abrasion Testing 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 0.1 in.

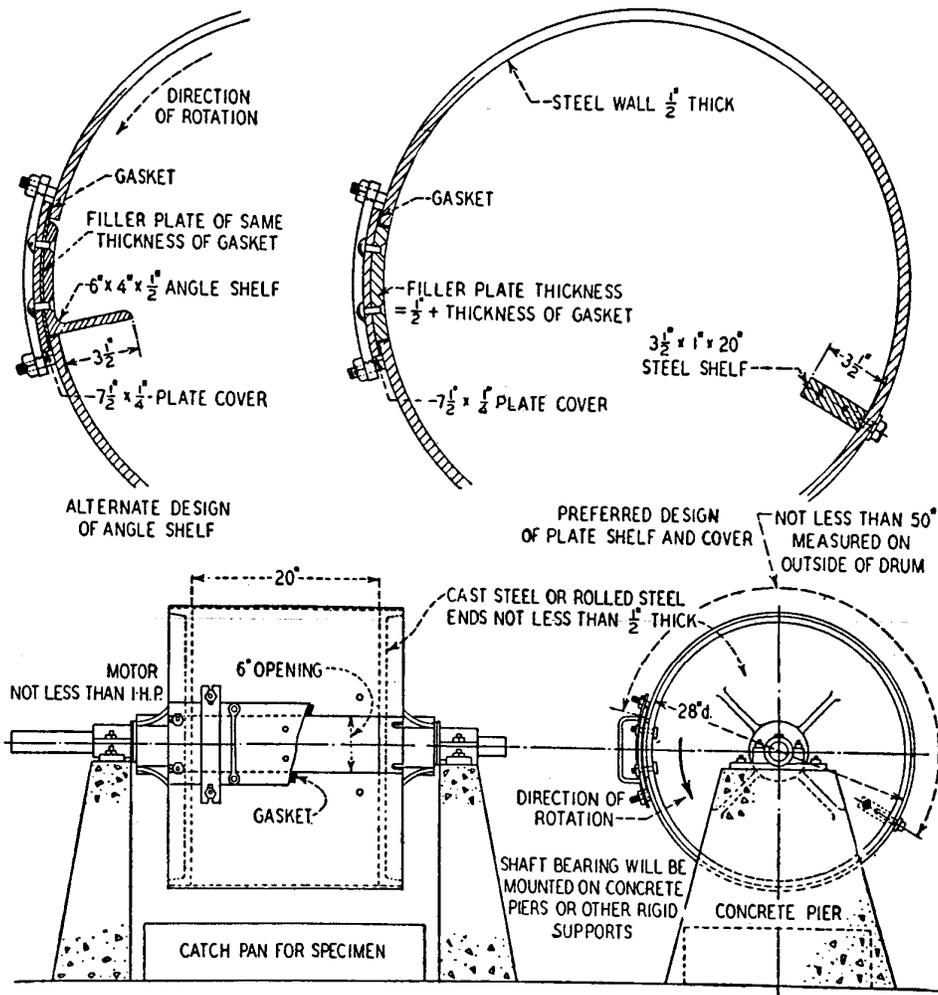
**I. HEALTH AND SAFETY**

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

[http://www.dot.ca.gov/hq/esc/ctms/pdf/lab\\_safety\\_manual.pdf](http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf)

**End of Text  
(California Test 211 contains 5 Pages)**



**FIGURE 1. Los Angeles Abrasion Testing Machine**