

1210**LOS ANGELES RATTLER**
AASHTO Designation T 96
Refer to ASTM Designation C131 or C535**1210.1** SCOPE

This method covers the procedure for testing crushed rock, slag and gravel and uncrushed gravel for resistance to abrasion using the Los Angeles testing machine.

1210.2 SUMMARY OF METHOD

The Los Angeles Rattler test is a measure of degradation of mineral aggregates of standard gradings resulting from a combination of actions including abrasion or attrition, impact, and grinding in a rotating steel drum containing a specified number of steel spheres (dependent upon the test sample's grading). As the drum rotates, a shelf plate picks up the sample and the steel spheres, carrying them around until they are dropped to the opposite side of the drum, causing an impact-crushing effect. The contents then roll within the drum with an abrading and grinding action until the shelf plate impacts and the cycle is repeated. After the prescribed number of revolutions, the contents are removed from the drum and the aggregate portion is sieved to measure the degradation as percent loss.

1212.3 APPARATUS

- A. Los Angeles Abrasion Machine - See AASHTO T 96 specifications.
- B. Sieves - Standard, 300mm (12") dia., 4.75mm (#4) and a 1.70mm (#12) sieves conforming to the requirements of AASHTO M 92.
- C. Balance - Conforming to the requirements of AASHTO Designation M 231 (Class G5 or better) with a readability and sensitivity of 1 gram and an accuracy of 1 gram or 0.1%.
- D. Oven - For drying samples capable of maintaining a temperature of 110 ± 5 °C (230 ± 9 °F).
- E. Charge - Shall consist of steel spheres averaging approx. 46.8mm (1 27/32") in diameter and each weighing between 390 and 445g.

NOTE 1: Steel ball bearings 46.0mm (1 13/16") and 47.6mm (1 7/8") in diameter, weighing approximately 400 and 440g each, respectively, are readily available. The charge may consist of a mixture of these three sizes provided that the individual spheres conform to the 395 - 445g limits and that the total charge conforms to the requirements in Section 1210.4.

1210.4 TEST SAMPLE

The test sample shall be selected from washed aggregate, dried to a constant weight at 110 ± 5 °C (230 ± 9 °F). The tests samples shall be separated into individual size fractions and recombined to the grading shown in Table 1 below, **most nearly corresponding to the range of sizes in the aggregate furnished for the work.** The weight of the sample prior to the test shall be recorded to the nearest 1g.

TABLE 1 - Grading of Test Samples

SIEVE SIZE, mm (in.)		WEIGHT & GRADING OF TEST SAMPLE, grams						
PASSING	RETAINED ON	A	B	C	D	E	F	G
75 (3)	63 (2 1/2)	---	---	---	---	2500 ± 50	---	---
63 (2 1/2)	50 (2)	---	---	---	---	2500 ± 50	---	---
50 (2)	37.5 (1 1/2)	---	---	---	---	5000 ± 50	5000 ± 50	---
37.5 (1 1/2)	25.0 (1)	1250 ± 25	---	---	---	---	5000 ± 25	5000 ± 25
25.0 (1)	19.0 (3/4)	1250 ± 25	---	---	---	---	---	5000 ± 25
19.0 (3/4)	12.5 (1/2)	1250 ± 10	2500 ± 10	---	---	---	---	---
12.5 (1/2)	9.5 (3/8)	1250 ± 10	2500 ± 10	---	---	---	---	---
9.5 (3/8)	6.3 (1/4)	---	---	2500 ± 10	---	---	---	---
6.3 (1/4)	4.75 (#4)	---	---	2500 ± 10	---	---	---	---
4.75 (#4)	2.36 (#8)	---	---	---	5000 ± 10	---	---	---
TOTAL		5000 ± 10	5000 ± 10	5000 ± 10		10000 ± 100	10000 ± 75	10000 ± 50

1210.5 ABRASIVE CHARGE & REVOLUTIONS

The abrasive charge, depending upon the grading of the test sample as described in Section 1210.4, shall be in accordance with Table 2 below. The number of revolutions shall also conform to Table 2.

TABLE 2 - Charge & Revolutions

GRADING	NUMBER of SPHERES	WEIGHT of CHARGE, g	NUMBER of REVOLUTIONS
A	12	5000 ± 25	500
B	11	4584 ± 25	500
C	8	3330 ± 20	500
D	6	2500 ± 15	500
E	12	5000 ± 25	1000
F	12	5000 ± 25	1000
G	12	5000 ± 25	1000

NOTE 2: Gradings E, F & G are ASTM procedures used by Mn/DOT for railroad ballast. The ASTM method (1000 revolutions) has no known consistent relationship to results obtained using the method prescribed for gradings A, B, C & D.

1210.6 PROCEDURE

Place the test sample and the abrasive charge in the Los Angeles testing machine and rotate the machine at a speed of 30 to 33 rpm for the prescribed number as shown in Table 2 above. A revolution counter with an automatic shutoff attached to the machine is an appropriate way to control the revolutions.

After the prescribed number of revolutions the material shall be discharged from the machine and a preliminary separation of the sample made on a 4.75mm (#4) sieve. Sieve the finer portion on a 1.70mm (#12) sieve. Wash the material (See Note 3, below.) coarser than the 1.70mm (#12) sieve, oven-dry to a constant weight at 110 ± 5 °C (230 ± 9 °F), and weigh to the nearest gram.

NOTE 3: Washing the material over a 1.70mm (#12) sieve and re-drying will only be required when the percent loss is within 2% of the specification limit. If the aggregate is essentially free of adherent coatings and dust the elimination of washing will seldom reduce the measured loss by more than 0.2% of the original sample weight.

1210.7 CALCULATION & REPORT

Express the loss (difference between the original weight and the final weight of the test sample) as a percentage of the original weight of the test sample. In the example (See Section 1210.9) the calculation is as follows where:

X = The weight of the sample in grams before testing.

Y = The weight of the sample after testing (that portion retained on the 1.70mm (#12) sieve).

Z = The weight loss in grams (A - B).

$$\text{Percent Loss} = \frac{Z}{X} \times 100 \quad \text{or} \quad \frac{1246}{5000} \times 100 = 24.9\%$$

Report the grading size from Table 1 used for the test; i.e. A, B, C or D and the percent loss by abrasion to the nearest 1% by mass (25%).

1210.8 MAINTENANCE OF SHELF

The shelf of the abrasion machine is subject to severe wear from the impact of the aggregate and charge. The working surface of the shelf is peened by the steel spheres and tends to develop a ridge of metal parallel to and about 32mm (1 1/4") from the junction of the shelf and the drum. The shelf may also become bent.

The shelf should be inspected periodically to determine if the above conditions exist and repaired or replaced as needed. The ridge should be ground off if its height exceeds 2mm (0.1").

1210.9 EXAMPLE - L.A.R. WORK SHEET

Mn/DOT TP-02445-02 (4-92)

Quality Test Work Sheet

Lab. No. CA93XXX

Test	Litho. <u>(L.A.R.)</u> Shale	Comp. <u>A,B,C,</u> -4 +4	Crush Str. - Str.	Ing. Mag. Sul.	Soft R. F & T	Limetstone Sp. G. & Abs.
Size	1 1/2+	1-3/4		<u>1/2-3/8</u> 3/8-#3		3-4
	1 1/2 - 1	3/4-1/2				

L.A.R. TEST

Wt. before	<u>5000</u>	No. balls	_____
Wt. after	<u>3754</u>	Rev. start	_____
Wt. loss	<u>1246</u>	Rev. end	_____
% Loss	<u>24.9%</u>	Diff.	_____

SHALE TEST

Org. wt.	_____
Shale	_____
% Shale	_____

% CRUSHING COUNT

Crushed	_____
Non crushed	_____
TOTAL	_____

LITHOLOGICAL COUNT

Shale	_____	Clay balls	_____
Iron oxide	_____	Distint. R.	_____
Unsound chert.	_____	Sandstone	_____
Ochre	_____	Igneous	_____
Paint Rock	_____	Thin or Elong.	_____
Argillite	_____	Soft Rock	_____
Limestone	_____	Other rock	_____
Schist	_____	TOTAL	_____
Slate	_____		

PREPARED BY MH TESTED BY OR DATE 1/1/93

Limestone _____

24.9% would be rounded and reported to the nearest whole number i.e. 25%.