

Method of Test for
ABRASION OF LIGHTWEIGHT COURSE AGGREGATE
DOTD Designation: TR 111

I. Scope

- A. This method covers the procedure for testing lightweight coarse aggregate for resistance to abrasion in the Los Angeles testing machine with an abrasive charge.
- B. Reference Documents
 - 1. AASHTO M 92 – Standard Specification for Wire-Cloth Sieves for Testing Purposes
 - 2. AASHTO T 19 – Bulk Density (Unit Weight) and Voids in Aggregate
 - 3. AASHTO M 96 – Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - 4. DOTD TR 113 – Sieve Analysis of Fine and Coarse Aggregate

II. Apparatus

- A. The apparatus for this test shall be as described in AASHTO T-96.
- B. Balance or Scale – accurate to 0.01% of test load over the range required for this test.
- C. Sieves – wire sieves as specified on Table 1, confirming to the requirements of AASHTO M 92.
- D. Aggregate Test Report – DOTD 03-22-0745
- E. Lightweight Coarse Aggregate Worksheet – Figure 1

III. Abrasive Change

The abrasive charge shall be as required in AASHTO T-96.

IV. Health Precautions

Proper equipment and precautions are to be taken whenever hot materials or equipment must be handled. Use container holders or gloves while handling hot containers. Wear eye protection while stirring and weighing materials.

V. Sample

- A. Weight of Test Sample Determination
 - 1. Dry the entire clean aggregate sample in an oven at a temperature not exceeding 235°F to a constant weight.
 - 2. To determine the amount of material to use as the test sample first determine the loose unit weight of the lightweight coarse aggregate sample as received in accordance with the procedure described in AASHOT 19.
 - 3. Determine the weight of material be used as the test sample using the following equation:

$$\text{Weight of test sample} = \text{Unit Wt. of Aggregate (lbs/cu.ft.)} \times 51.55$$

Example:

Unit Weight of Course Aggregate = 35 lbs/cu.ft.

Weight of test sample = 35 x 51.55 = 1804 grams

B. Test Specimen Preparation

1. Using fresh material that was not used for the unit weight determination, separate the aggregate into individual size fractions by running over the sieves listed in Table 1.
2. Determine the appropriate grade by noting which sieves have material retained. The grade listed at the top of the column will correspond to a certain set of sieves represented.

Example:

If 1804 grams produced a grading as follows

- 0 grams retained on the 1" sieve
- 64 grams retained on the the 3/4" sieve
- 923 grams retained on the 1/2" sieve
- 700 grams retained on the 3/8" sieve
- 117 grams retained on the 1/7 sieve

Then the lightweight aggregate would be considered a Grade B.

3. Separate portions of the individual size fractions obtained in V.B.1 of each size fraction needed for the previously determined Grade and recombine into one test specimen using the weight percentages listed in Table 1.

Example:

Since the sample is a Grade B, from Table 1, the test specimen will consist of 50% material retained on the 1/2" sieve and 50% retained on the 3/8" sieve.

4. Record the weight of the test specimen prior to testing to the nearest gram on the worksheet (Figure 1).

TABLE 1 – GRADINGS OF TEST SPECIMEN

SIEVE SIZE (SQUARE OPENINGS)		PERCENT OF MASS FOR GRADING OF TEST SPECIMEN		
Passing	Retained On	A	B	C
1 1/2 in.	1 in.	25%	----	----
1 in.	3/4 in.	25%	----	----
3/4 in.	1/2 in.	25%	50%	----
1/2 in.	3/8 in.	25%	50%	----
3/8 in.	1/4 in.	----	----	50%
1/4 in.	No. 4	----	----	50%

VI. Procedure

- A. Place the abrasive charge in the Los Angeles abrasion testing machine drum.
- B. Place the test specimen in the drum and secure the cover.
- C. Rotate the machine at a range of speed from 30 to 33 rpm. The machine shall be rotated for 100 revolutions for all grading's.
- D. Remove the abrasive charge from the drum. Then discharge the material from the machine and sieve on a No.4 sieve in a manner confirming to Section V.A. of DOTD TR 113.
- E. Wash the material coarser than the No.4 sieve by placing in a pan larger enough to contain the plus No.4 material.
- F. Fill the pan with water completely covering the material. Stir or agitate until any dust present is in suspension.
- G. Remove wash water by pouring over a No. 4 sieve. Repeat the process until the wash water is clear.
- H. Dry to constant mass in an oven at a temperature not exceeding 235°F.
- I. Record mass to the nearest gram on the worksheet (Figure 1).

VII. Calculations

- A. Calculating the portions of the test specimen for its appropriate Grade aggregate:

Example:

For the previous Grade B aggregate with the specimen total mass of 1804g:

$$\begin{aligned}WT &= 1804g \\W_{1/2} &= 1804g \times 50\% = 902g \\W_{3/8} &= 1804g \times 50\% = 902g\end{aligned}$$

Where:

- WT = Total mass of the test specimen
- $W_{1/2}$ = Mass of specimen from portion retained on 1/2" sieve
- $W_{3/8}$ = Mass of specimen from portion retained on 3/8" sieve

The difference between the original weight and the final weight of the test sample shall be expressed as a percentage of the original mass of the test sample. This value shall be reported as the percentage of wear, L.

- B. Calculate the amount of material passing the No.4 after testing as follows:

$$C = A - B$$

Where:

- A = Dry mass of graded sample prior to testing
- B = Dry mass of graded sample after testing
- C = Weight of sample passing No.4 sieve after washing

- C. Calculate the percentage of wear , L. as follows:

$$L = \frac{C}{A} \times 100$$

A = Dry weight of graded sample prior to testing
B = Dry weight of washed sample after testing
C = Weight of sample passing No.4 sieve (A-B)

Example:

A = 1804g

B = 1503g

C = 301g (1804 – 1503)g

$$L = \frac{301}{1804} \times 100$$

$$L = 0.1669 \times 100$$

$$L = 16.7$$

VIII. Report

Report the percent loss to the nearest 0.1%.

IX. Normal Reporting Time

Normal reporting time is approximately four days.

TEST FOR ABRASION OF LIGHTWEIGHT COARSE AGGREGATE TR 111 - 09

DATE 1-29-10 LABORATORY NO. 22-733349

SAMPLE SPLIT NO. 682-H NAME OF MATERIAL Expanded Clay

GRADING B NO. OF SPHERES 11 NO. OF REVOLUTIONS 100

A = DRY WEIGHT OF GRADED SAMPLE PRIOR TO TESTING, GRAMS, 1804

B = DRY WEIGHT OF WASHED SAMPLE AFTER TESTING, GRAMS, 1503

C = WEIGHT OF SAMPLE PASSING #4 SIEVE (A-B), GRAMS, 301

$C \div A \times 100 =$ ACTUAL PERCENTAGE LOSS (NEAREST 0.1 %) 16.7

ACTUAL PERCENTAGE LOSS (NEAREST WHOLE %) 17

REMARKS Results are within acceptable Limits

TESTED BY GPC PASS/FAIL Pass

LOOSE UNIT WEIGHT OF AGGREGATE 35.00 CALCULATION FACTOR 51.55

SAMPLE SIZE CALCULATION

LOOSE UNIT WEIGHT OF AGGREGATE 35.00 X 51.55 = 1804 = TOTAL SAMPLE WEIGHT

TOTAL SAMPLE WEIGHT / 4 = _____ TOTAL SAMPLE WEIGHT / 2 = 902

FOR GRADING A DIVIDE TOTAL SAMPLE WEIGHT BY 4 TO REPRESENT THE FOUR SIZES AVAILABLE 1, 3/8, 3/8 INCH
 FOR GRADING B DIVIDE TOTAL SAMPLE WEIGHT BY 2 TO REPRESENT THE TWO SIZES AVAILABLE 3/8, 3/8 INCH
 FOR GRADING C DIVIDE TOTAL SAMPLE WEIGHT BY 2 TO REPRESENT THE TWO SIZES AVAILABLE No. 3, No. 4

GRADING A = 12 SPHERES GRADING B = 11 SPHERES GRADING C = 8 SPHERES STANDARD NO. OF
 REVOLUTIONS IS 100.

Figure 1