

ND T 113 – LIGHTWEIGHT PIECES IN AGGREGATE

Conduct this procedure according to ND T 113.

The AASHTO standard test procedure uses saturated surface dry material. The NDDOT modification uses material that is dried to a constant weight.

AASHTO uses material for the fine aggregate that passes the No. 4 and is retained on the No. 50 sieve. NDDOT uses material for the fine aggregate that passes the No. 4 and is retained on the No. 30 sieve.

AASHTO uses a heavy liquid with a specific gravity of 2.00 ± 0.01 . NDDOT uses a heavy liquid with a specific gravity of 1.95 ± 0.01 .

AASHTO does not indicate a time period for stirring and resting the sample. NDDOT agitates the fine aggregate sample for 15 seconds and then allows resting for 30 seconds before removing the lightweight pieces. This is done a maximum of three times.

Consult the current edition of AASHTO for procedure in its entirety and equipment specification details.

SCOPE

This test method determines the percentage of lightweight pieces in aggregate by means of sink-float separation in a heavy liquid with a specific gravity of 1.95 ± 0.01 . This test is performed separately on the coarse and fine portions of aggregate. The No. 4 sieve is designated as the division between the fine and coarse aggregate.

REFERENCED DOCUMENTS

ND T 2 and AASHTO T 2, Sampling Aggregates
ND T 27 and AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregate
AASHTO T 113, Lightweight Pieces in Aggregate
ND T 248 and AASHTO T 248, Reducing Samples of Aggregate to Testing Size
ND T 255 and AASHTO T 255, Total Evaporable Moisture Content of Aggregate by Drying

APPARATUS

Balance
 Sieves: No. 4 (4.75 mm) and No. 30 (600 μ m)
 Specific gravity hydrometer
 Zinc chloride
 Enamel pans
 Glass beaker
 Fine strainer
 Spoon
 Oven

TEST SPECIMEN

Obtain a sample according to ND T 2 and reduce according to ND T 248.

Test specimen shall be a representative sample determined from the following table:

Nominal Maximum Size of Aggregate	Minimum Mass of Sample
No. 4 (4.74 mm)	200 g
3/4" (19.0 mm)	3000 g
1½" (37.5 mm)	5000 g
3" (75 mm)	10,000 g

If the nominal maximum size of the aggregate to be tested is not listed above, use the next larger size to determine the sample size.

Dry the sample according to ND T 255 at a temperature of $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$). Cover the sample and cool to room temperature.

Perform sieve analysis according to ND T 27. The material retained on the No. 4 sieve will be used for the coarse aggregate portion. The material passing the No. 4 and retained on the No. 30 sieve will be used for the fine aggregate portion.

PROCEDURE

Record all information on SFN 9987. All weights are recorded to the nearest 0.1 g.

Coarse Aggregate:

Weigh the sample and record as weight of Plus No. 4 material.

Place the coarse portion into the zinc chloride solution. The volume of the liquid should be three times the volume of the aggregate.

Using the strainer, skim off floating particles and place the lightweight pieces into a pan. Repeatedly agitate, rest, and remove the floating particles from the sample until no additional particles float to the surface.

Use hot water to wash the zinc chloride solution from the lightweight pieces. Dry according to ND T 255 at a temperature of $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$). Weigh and record as weight of lightweight pieces in Plus No. 4 material.

Fine Aggregate:

Weigh the sample and record as weight of Minus No. 4 Plus No. 30 material.

Place the fine aggregate portion in a nonabsorbent container, preferably a glass beaker. Pour zinc chloride solution in with the sample. The volume of liquid should be three times the volume of the aggregate.

Agitate to bring all particles into suspension by stirring for a period of 15 seconds. Allow the sample to rest for 30 seconds.

After the rest period, decant the floating lightweight pieces onto a No. 30 sieve or smaller. Repeatedly agitate, rest, and remove the floating particles from the sample until no additional particles float to the surface. This process may be completed up to a maximum of three times.

Use hot water to wash the zinc chloride solution off the lightweight pieces. Dry according to ND T 255 at a temperature of $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$). Weigh and record as weight of lightweight pieces Minus No. 4 Plus No. 30 material.

CALCULATIONS

Coarse Aggregate:

- To calculate the percent of lightweight pieces in the coarse aggregate portion, divide the weight of material that floats by the weight of the Plus No. 4 material.

The equation is as follows:

$$A = (B/C) \times 100$$

A = Percent of lightweight pieces in the coarse aggregate

B = Weight of coarse lightweight pieces

C = Weight of sample of the coarse aggregate

- To determine the percent of coarse lightweight pieces in the total sample, multiply the percent of lightweight pieces in the coarse portion times the percent of the total sample retained on the No. 4 sieve. Multiply this result by 100.

The equation is as follows:

$$D = (A \times E)/100$$

D = Percent coarse lightweight pieces, total sample

A = Percent of lightweight pieces in the coarse aggregate

E = Percent of total sample retained on the No. 4

Fine Aggregate:

- To calculate the percent of lightweight pieces in the fine aggregate portion, divide the weight of material that floats by the total weight of the fine portion. Multiply this result by 100.

The equation is as follows:

$$F = (G/H) \times 100$$

F = Percent of lightweight pieces in fine aggregate

G = Weight of fine lightweight pieces

H = Weight of sample of the fine aggregate

- To determine the percent of fine lightweight pieces in the total sample, multiply the percent of lightweight pieces in the fine portion times the result of the percent of the total sample passing the No. 4 sieve minus the percent passing the No. 30 total sample. Multiply this result by 100.

The equation is as follows:

$$I = (F \times J)/100$$

I = Percent fine lightweight pieces, total sample

F = Percent of lightweight pieces in fine aggregate

J = Result of the percent passing No. 4 minus the percent passing No. 30 total sample

Report individual results to the nearest 0.01%.

Lightweight Pieces Total Sample:

- To determine the lightweight pieces in total sample combine the percent fine lightweight pieces total sample and percent coarse lightweight pieces total sample.

The equation is as follows:

$$H = D + I$$

H = Percent lightweight pieces total sample

D = Percent coarse lightweight pieces, total sample

I = Percent fine lightweight pieces, total sample

Report to the nearest 0.1%.

NOTES

Zinc chloride is a poison. Handle and store accordingly. Avoid zinc chloride dust or vapor from the solution by wearing an appropriate mask or work under a vent hood. The zinc chloride solution is corrosive to skin and clothing. Use safety goggles, rubber gloves, and a rubberized apron to avoid contact with skin or clothing.

To prepare a zinc chloride solution, mix zinc chloride with water at room temperature at a rate of approximately 3 parts zinc chloride to 1 part water. This would be a mix proportion of about 2800 g of zinc chloride to about 1100 mL of water. During mixing the solution heats up considerably so allow time for the solution to cool to room temperature. Use a specific gravity hydrometer to adjust the specific gravity to 1.95 ± 0.01 by adding water or zinc chloride in small quantities. Adding an additional amount of zinc chloride will increase the specific gravity or adding water will decrease the specific gravity.

To reuse the zinc chloride solution, check the specific gravity and adjust before each use.

CALIBRATION

A calibration check of the equipment should be performed annually as a minimum, or whenever damage or repair occurs.