ND T 176 – PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST

SCOPE

This test is intended to serve as a rapid field test to show the relative proportions of fine dust or claylike material in soils or graded aggregates.

For equipment specification details, consult the current edition of AASHTO.

REFERENCED DOCUMENTS

ND T 2 and AASHTO T 2, Sampling of Aggregates
AASHTO T 176, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
ND T 248 and AASHTO T 248, Reducing Samples of Aggregate to Testing Size

APPARATUS

Pan
Trowel
Damp cloth
Plastic splitting cloth
3-oz. sample tins
Spatula or straightedge
Graduated plastic cylinder
Stock calcium chloride solution
Funnel
Clock or stop watch
Rubber stopper
Mechanical sand equivalent
Shaker
Irrigation tube
Weighted foot assembly
No. 4 sieve (4.75 mm)

TEST SPECIMEN

Obtain a sample according to ND T 2. Thoroughly mix and reduce according to ND T 248. Dry the sample according to ND T 255 at a temperature of 230 ± 9°F (110 ± 5°C).

Test specimen should be approximately 1000 to 1500 g of unwashed soil or graded aggregate that passes the No. 4 sieve. All aggregations of fine grained soil should be pulverized to pass the sieve and all fines shall be cleaned from the particles retained on the sieve and then included with the material passing.

SAMPLE PREPARATION

Place oven-dried sample in the pan and use a trowel to mix. Add just enough water so that when a small portion of the sample is squeezed tightly a cast is formed. If the cast can be carefully handled without breaking, the correct moisture has been obtained. If the cast crumbles it will be necessary to add water and remix. If free water is visible the sample is too wet and must be drained and air dried.

Cover the sample with a damp cloth and let stand for a minimum of 15 minutes. Do not allow the cloth to touch the material.

If the original sample allows a cast without adding water, you may omit the 15 minute standing period and proceed with the test.

After the standing period, place the sample on a splitting cloth and mix by alternately lifting each corner of the cloth and pulling it over the sample toward the diagonally opposite corner, causing the material to be rolled. When the material appears homogeneous, finish the mixing with the sample in a pile near the center of the cloth.

Using one hand, push the 3-oz. tin through the base of the pile. Hold the other hand on the opposite side of the pile to cause the material to fill the tin. Press firmly with the palm to compact the maximum amount into the tin. Strike off the top of the tin with a spatula or straightedge to create a level surface. Cover the sample.

Mix the remaining material on the splitting cloth as previously mixed, and again finish the mixing with the sample in a pile near the center of the cloth. Obtain a second sample using the same procedure as used to obtain the first sample.

Siphon 4 ± 0.1" (101.6 ± 2.5 mm) of calcium chloride solution into the graduated cylinder.

PROCEDURE

Record all information on SFN 51730. Record readings to 0.1.

The complete procedure will be run twice. The results of each test will be averaged. The average is reported as the sand equivalent.

Using a funnel, pour the sample from the tin into the cylinder. Tap the bottom of the cylinder sharply with the heel of the hand several times to remove air bubbles. Allow the wetted specimen to stand undisturbed for 10 ± 1 minutes.

Stopper the cylinder and shake gently to loosen the material. This can be achieved by partially inverting the cylinder and shaking it simultaneously. After loosening the material, place the cylinder in a mechanical shaker for 45 ± 1 seconds.

Following the shaking, set the cylinder upright and remove the stopper. Using the irrigation tube, rinse material on the cylinder wall down with the calcium chloride solution as the irrigation tube is being lowered in the cylinder. Force the irrigation tube through the material to the bottom of the cylinder using a gentle stabbing and twisting motion. Continue to gently stab and twist the irrigation tube until the calcium chloride solution approaches the 15" (381 mm) mark. Then raise the irrigation tube slowly at a rate that maintains the liquid level at about the 15" (381 mm) mark as the irrigation tube is being removed. Stop the flow of the calcium chloride solution just before the irrigation tube is entirely withdrawn. Adjust the calcium chloride solution level to 15".

Allow the cylinder to sit undisturbed for 20 minutes ± 15 seconds. Read the level of the top of the clay suspension. This is referred as the clay reading. If no clear line is visible, allow the sample to stand for up to 10 more minutes. If the line is still not clear, discard the sample and rerun the test with three samples from the same material. Read and record the clay column height requiring the shortest sedimentation period only.

Next determine the sand reading. This is done by gently lowering the weighted foot into the cylinder until it comes to rest. Take the reading of the extreme top edge of the indicator and subtract 10" from this value to obtain the sand reading. Record this as the sand reading.

Report the clay and sand readings to the nearest 0.1 of an inch. If the reading falls between the 0.1 of an inch graduations, report to the next higher reading.

Repeat this process for the second sample obtained and record the clay and sand readings.

CALCULATIONS

Calculate the sand equivalent by dividing the sand reading by the clay reading and multiply the results by 100. The equation is as follows:

Sand Equivalent = (Sand reading/Clay reading) x 100

Complete the calculations for both tests. If the calculated sand equivalent is not a whole number, round up to the next higher whole number.

REPORT

Average the two test results. If the average is not a whole number, raise it to the next whole number.

NOTES

A one-gallon bottle of calcium chloride solution shall be placed on a shelf 36 ± 1" above the work surface.

Prepare the calcium chloride solution by diluting one measuring tin (85 ± 5 mL) of stock calcium chloride to 1 gal. (3.8 L) of distilled or demineralized water. The working solution has a maximum shelf life of 30 days.

The temperature of the calcium chloride solution should be maintained at 72 ± 5°F (22 ± 3°C).

CALIBRATION

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