DETERMINING THE AMOUNT OF SHALE IN FINE AGGREGATE

SCOPE

This test method covers the procedure for the approximate determination of the shale content in fine aggregate. This test method is the field procedure for Laboratory Test Method 209.

PROCEDURE

A. Apparatus

1. Balance having a capacity of not less than 1000 g and sensitive to at least 0.1 g

2. A strainer with openings smaller than #16 sieve (1.18 mm)

3. Two bowls of sufficient capacity

4. A solution of zinc chloride ($ZnCl_2$) having a specific gravity between 1.950 and 1.999 at 70°F (21°C)

   NOTE: To prepare one gallon of solution, slowly add 12.5 lb. (5670 g) of technical grade zinc chloride to 4.75 pt. (2248 g) of water with constant stirring. The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 70°F (21°C) and measure specific gravity with a hydrometer. If the sp. gr. is below 1.95, add zinc chloride in 0.5 lb. (227 g) increments until the sp. gr. of the solution is at least 1.95 at 70°F (21°C). It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

   CAUTION: There is no particular hazard from the fumes of the zinc chloride solution, but protective clothing should be worn. This includes gloves, goggles, and face shield. Mix in a well-ventilated area.

5. Drying oven or hot plate

6. Mixing spoon

B. Sample Preparation

1. Select a representative sample by appropriate methods detailed in Materials IM 301 and 336. The weight of the representative sample shall be large enough to yield at least 500 grams of dry material passing the #4 (4.75mm) sieve.

2. Sieve the representative sample over the #4 (4.75mm) sieve unless the material is Fine Aggregate for use in PC Concrete. In this case, any material retained on the #4 (4.75mm) sieve is also part of the test sample.

3. Dry the test sample to a constant weight, allow to cool, weigh, and record as the Original Dry Weight of the Test Sample.

4. Sieve the test sample over the #16 (1.18mm) sieve. Discard the material passing this sieve and subject the test sample to the test procedure.

   NOTE: The test sample may be accumulated from a completed sieve analysis. This would include the material retained on the #8 (2.36mm) and #16 (1.18mm) sieves, as well as any material retained on the #4 (4.75mm) sieve if the intended use is PC Concrete.

   The Original Dry weight of the test sample would then be the difference between the Original Dry Weight of the sieve analysis sample and the total of the weights retained on and above the #4 (4.75mm sieve). (The test sample weight of Fine Aggregate for PC Concrete would be the Original Dry weight of the sieve analysis sample.)

C. Test Procedure

1. Pour the zinc chloride solution into a mixing bowl until the volume of the liquid is at least 3 times the absolute volume of aggregate.

2. Stir the fine aggregate sample into the solution until all particles are coated.

3. Pour the liquid off into a second container, passing it through the strainer. Make sure that only the floating pieces are poured off and that none of the fine aggregate is decanted onto the skimmer.

4. Return to the first container the liquid that has been collected in the second container and after further agitation of the sample by stirring, repeat the decanting process just described until the sample is free of floating pieces.

5. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant weight (mass) in an oven at a temperature of 230 ± 9°F (110 ± 5°C) or on a hot plate at a low heat setting. Weigh to the nearest 0.1 g.

D. Calculations

1. Calculate the percentage of shale (and other low specific gravity materials) by the following formula:

$$\% \text{ Shale} = \frac{\text{Dry Mass (Weight) of Washed Decanted Particles (Shale)}}{\text{* Dry Mass (Weight) of Original Sieve Analysis Sample}} \text{ x } 100$$

*This mass (weight) includes the material passing the #16 sieve (1.18 mm) and represents the total sample mass (weight) of the fine aggregate. Report the result to the nearest 0.1 percent.