State of Nevada
Department of Transportation
Materials Division

METHOD OF TEST FOR SAND EQUIVALENT

SCOPE

This test method is intended to determine the proportion of detrimental fines (dust or clay size material) in the portion passing the 4.75 mm (No. 4) sieve of soils or graded aggregates.

APPARATUS

1. Sand Equivalent Apparatus (Figure 1), graduated plastic cylinders, rubber stopper, irrigator tube, weighted foot assembly and siphon assembly fitted to a glass 4 L (1 gal.) bottle placed on a shelf 915 ± 25 mm (36 in. ± 1 in.) above the work surface.

2. Measure, tin measure having a capacity of 85 ± 5 mL (3 oz.) approximately 57 mm (2.25 in.) in diameter.

3. Balance, having a capacity of 12,000 g and sensitive to 0.1 g.

4. Funnel, wide-mouth funnel approximately 100 mm (4 in.) in diameter at the largest side of the funnel.

5. Stop watch, accurate to the nearest 0.1 seconds.

6. Shaker,

   Mechanical Shaker (Figure 2) – with a throw of 203 mm ± 1 mm (8 in. ± 0.04 in.) and operating at 175 ± 2 cycles per minute.

   Manual Shaker (Figure 3) – capable of producing an oscillating motion at the rate of 100 complete cycles in 45 ± 5 seconds with a hand assisted half stroke length of 127 mm ± 5 mm (5 in. ± 0.2 in.) and a C-clamp to latch to counter top.

7. Working Calcium Chloride Solution, produced by adding 85 mL ± 5 mL of Stock Calcium Chloride Solution to a 1-gallon jar and then fill with distilled or demineralized water to make a total of 1-gallon Working Calcium Chloride solution. Stock Calcium Chloride Solution is obtained from the Materials Division – Chemical Lab. Dispose of Stock Calcium Chloride Solution that has been mixed with water when growth is present in the mixture.

8. Oven, capable of maintaining a temperature of 110 ± 5°C (230 ± 9°F).

9. Sieve, 4.75 mm (No. 4).

10. Mini riffle splitter, chute width – 3 mm (1/8 in.).

SAMPLING

1. Obtain a representative sample per Test Method Nev. T200.

2. Obtain a representative portion of the sample per Test Method Nev. T203.

SAMPLE PREPARATION

1. Thoroughly hand sieve the material over the 4.75 mm (No. 4) sieve. While sieving, ensure that all the fines are cleaned from the material retained on the 4.75 mm (No. 4) sieve and included with the material passing the 4.75 mm (No. 4) sieve. Retain all the material passing the 4.75 mm (No. 4) sieve. The sample size should be approximately 500 g to 1,000 g. Oven dry the sample at 60 ± 3ºC (140 ± 5ºF) or air dry sufficiently until a complete separation of the course and fine material within the passing 4.75 mm (No. 4) sample can be achieved. However, not so dry as to lose particles of the fines while splitting the material through the mini riffle splitter (damp material).

2. Dampen the dried – 4.75 mm (– No. 4) material, so the fines are not lost during the splitting process through the mini riffle splitter. Split the damp – 4.75 mm (– No. 4) material into four quarters using the mini riffle splitter and fill each one of the four 85 mL (3 oz.) tins to within 4.76 mm (3/16 in.) of the brim, tapping the bottom of the tin on the counter to cause consolidation of the material and allowing the maximum amount to be placed in the tin without overflowing. **STRIKING OFF THE TIN MEASURE LEVEL IS NOT ALLOWED.** Adjustments are usually required to provide the desired test sample size. However, make these adjustments before the sample is reduced below a volume equal to four tin measures or approximately 450 g for material of average specific gravity.

   NOTE: Use extreme care in the sand equivalent test sample preparation to obtain a truly representative sample. Experiments show that as the amount of material being reduced by splitting or quartering is decreased, the accuracy of providing representative portions is decreased. For this reason, it is imperative that the sand equivalent test sample, which is already relatively small, be split carefully. When it appears necessary, dampen the material to avoid segregation or loss of fines.

3. After obtaining the four 85 mL (3 oz.) tins of material, dry the test samples in an oven to a constant mass at 60 ± 3ºC (140 ± 5ºF) and cool before testing.

PROCEDURE

1. Siphon 101.6 mm ± 2.5 mm (4 in. ± 0.1 in.) of Working Calcium Chloride solution into each of the four graduated plastic cylinders.

2. Place the funnel on top of the graduated plastic cylinder and pour a tin of material into one of the graduated plastic cylinders. Cover the opening of the graduated plastic cylinder while tapping the bottom of the cylinder sharply on the heel of the hand several times to release any air bubbles and to promote thorough wetting of the sample.

3. Allow the saturated sample to stand undisturbed for 10 minutes ± 1 minute. After the 10 minute time period, stopper the graduated plastic cylinder and loosen the sample from the bottom by partially inverting the cylinder while shaking it simultaneously.

4. After loosening the material from the bottom of the graduated plastic cylinder, shake the cylinder and contents by one of the following methods:

   Mechanical Shaker Method (Figure 2) – The mechanical shaker shall be bolted to the counter or shelf it is on. Secure the stoppered graduated plastic cylinder in the mechanical shaker and allow the mechanical shaker to shake the sample for 45 seconds ± 1 second.

   Manual Shaker Method (Figure 3) – Secure the manual shaker to the counter with a C-Clamp. Secure the stoppered graduated plastic cylinder to the spring clamps on the manual shaker and reset the stroke counter to zero. Stand directly in front of the manual shaker. With the fingers of the right hand placed on the vertical steel strap, force the pointer towards the counter maintaining a smooth oscillating motion. Continue the shaking process for 100 strokes. Make sure the gradations are facing up so as not to render the marks illegible.

5. Once shaking is complete, remove the graduated plastic cylinder from the clamps and swirl as much of the material to the bottom of the graduated plastic cylinder as possible. Set the graduated plastic cylinder on the counter and remove the stopper.

6. Insert the irrigator tube into the graduated plastic cylinder, unclamp the irrigator tube and rinse any material left on the stopper and the walls of the graduated plastic cylinder as the irrigator is lowered. Force the irrigator tube through the sample to the bottom of the graduated plastic cylinder by applying a gentle stabbing and twisting action. This flushes the fines into suspension above the coarser particles. Continue the stabbing twisting action until the working solution reaches the 381 mm (15 in.) mark on the graduated plastic cylinder.

7. Let the graduated plastic cylinder stand undisturbed for 20 minutes ± 15 seconds. Start the timer as soon as the irrigator tube has been removed from the graduated plastic cylinder.

8. At the end of the 20 minute sedimentation period, read the level of the top of the clay suspension. This is referred to as the clay reading. If no line of demarcation has formed at the end of the specified period, allow the sample to stand undisturbed until a clay reading can be obtained or for a maximum of 30 minutes. If the total sedimentation time exceeds 30 minutes, rerun the test with one of the other four samples of the same material.

9. Gently place the weighted foot assembly into the graduated plastic cylinder and keep the sand reading indicator in contact with the graduated plastic cylinder wall as it is lowered towards the sand. Once the weighted foot comes to rest on the sand, ensure the sand reading indicator is in contact with the graduated plastic cylinder wall and read the level of the sand reading indicator. Subtract 254 mm (10 in.) from the

sand reading (Ex. 13.5 – 10 = 3.5). This is referred to as the sand reading.

NOTE: If the clay or sand reading falls between two graduations on the graduated plastic cylinder, record the higher graduation as the reading. For example, a clay reading of 3.75 would be recorded at 3.8, and a sand reading of 3.22 would be recorded as 3.3.

10. Steps 1 through 9 shall be repeated for all four tin samples.

CALCULATIONS

1. Calculate the sand equivalent (S.E.) to the nearest 0.1 using the following formula.

   (Sand Reading / Clay Reading) x 100 = S.E.

   If the calculated number is not a whole number, report it as the next higher whole number.

   EX. (3.3 / 3.5) x 100 = 94.3 = 95

2. Use the three individual S.E. values that are the closest together to calculate the S.E. value. Each of the three sand equivalent values must be within ± 4 points from the average of these values. If this tolerance is not met, re–run the test using material retained from the original sample.

3. Average the 3 sand equivalent whole numbers:

   (S.E. + S.E. + S.E.) / 3 = S.E. Average

   If the calculated average is not a whole number, report it as the next higher whole number.

   EX. (93 + 94 + 96) / 3 = 94.3 = 95

REPORT

Report the average Sand Equivalent to the whole number.

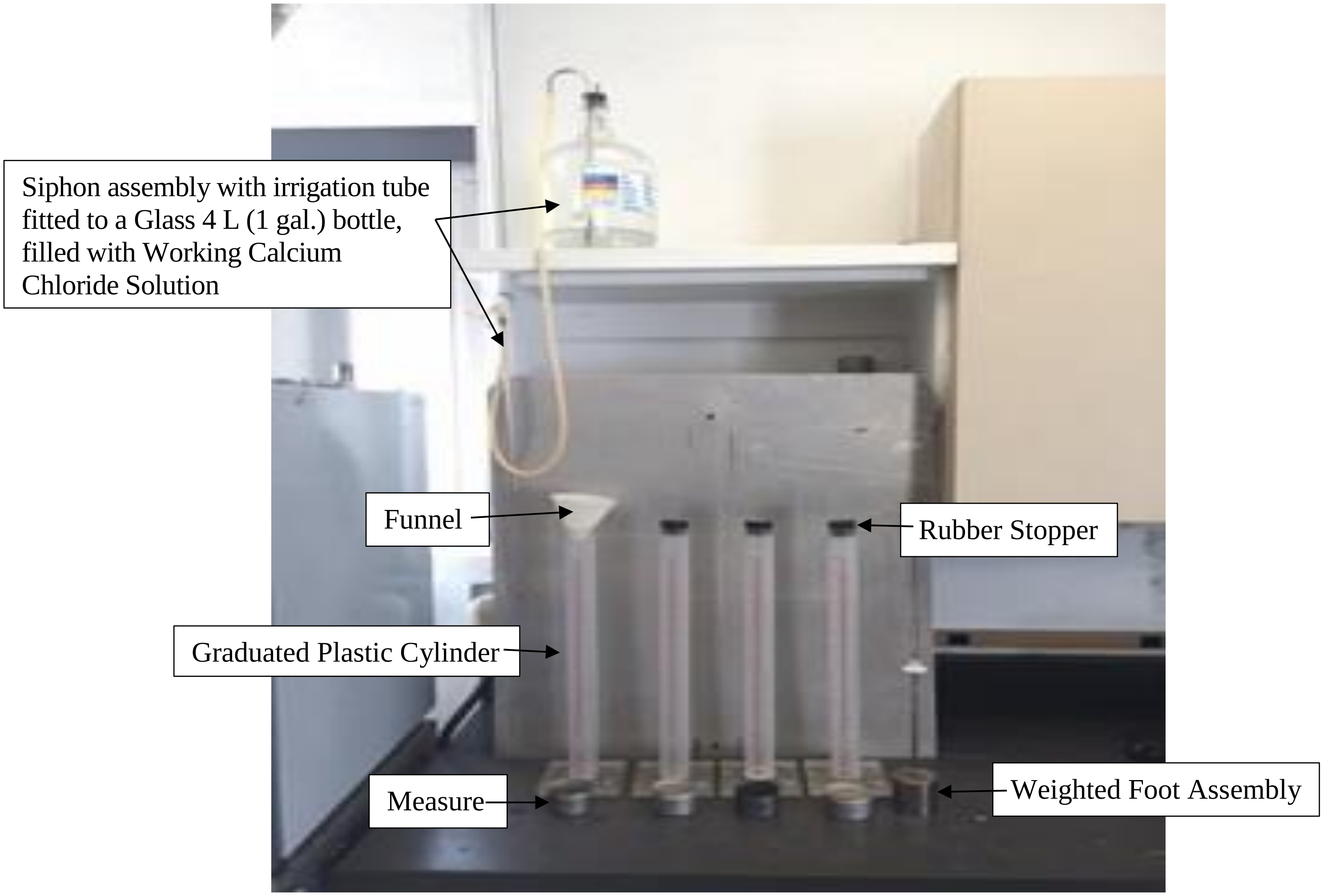
Siphon assembly with irrigation tube fitted to a Glass 4 L (1 gal.) bottle, filled with Working Calcium Chloride Solution
Funnel
Rubber Stopper
Graduated Plastic Cylinder
Measure
Weighted Foot Assembly

Figure 1

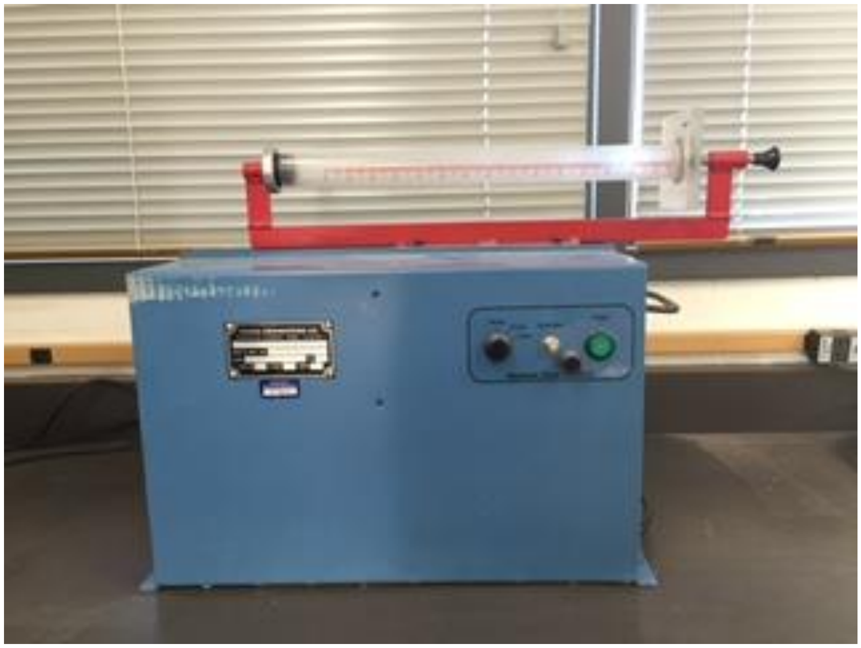

Figure 2
Mechanical – S.E. Shaker

Figure 3
Manual – S.E. Shaker