State of Nevada
Department of Transportation
Materials Division

METHOD OF TEST FOR EVALUATING CLEANNESS OF COARSE AGGREGATE

SCOPE

The cleanness test provides an indication of the relative proportions of clay–sized material clinging to coarse aggregates or screenings.

APPARATUS

1. Agitator (Figure 2), mechanical device designed to hold the wash vessel in an upright position while subjecting it to a lateral reciprocating motion at a rate of 285 ± 10 complete cycles per minute.

2. Wash vessel (Figure 2), flat–bottom, straight sided, cylindrical vessel with a capacity of 7.5L.

3. Collection pot (Figure 1), round pan or container with vertical sides and equipped to hold the wire mesh of a standard 203 mm (8.0 in) diameter sieve at least 76 mm (3.0 in) above the bottom.

4. Graduated plastic beaker (Figure 1), with a capacity of 1000 mL to 1500 mL.

5. Graduated plastic cylinder (Figure 1), sand equivalent test cylinder with a rubber stopper.

6. Funnel (Figure 1), wide–mouthed funnel suitable for directing water into the graduated plastic cylinder.

7. Sieves (Figure 1), 2.36 mm (No. 8) and 75µm (No. 200), standard 203 mm (8 in) diameter, full height.

8. Rocker and box assembly (Figure 3 and 4), 4.75 mm (No. 4) and 25.0 mm (1 in). (See Figure 4 and Figure 5)

9. Balance, with a capacity of 12,000 g and sensitive to 0.19.

10. Oven, capable of maintaining a temperature of 110 ± 5ºC (230 ± 9ºF).

11. Stop watch, in minutes and seconds

12. Brass or steel wire brush.

13. Stock calcium chloride solution. (Obtain from Materials Division – Chemistry Lab)

SAMPLE PREPARATION

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

2. Reduce the sample per Test Method Nev. T203. Obtain the proper amount of aggregate and wash water per Table 1.

TABLE 1

PRIMARY AGGREGATE NOMINAL SIZE	OVEN-DRY MASS (g)	VOLUME OF WASH WATER (mL)
63mm x 37.5mm (2 ½ in x 1 ½ in)	20000 ± 1000	1500 ± 15
37.5mm x 19.0mm (1 ½ in x ¾ in) #4	10000 ± 500	1250 ± 12
25 mm x 4.75 mm (1 in x No. 4) #57 & #67	2500 ± 125	1000 ± 5
12.5 mm Max. (½" Max.) CHIPS	1000 ± 50	500 ± 3

3. Dry sample to a constant weight at 110 ± 5ºC (230 ± 9ºF).

4. Cool sample to room temperature.

5. Complete the sample preparation according to the **primary aggregate nominal size**.

63 mm x 37.5 mm (2 ½ in x 1 ½ in) AND 37.5 mm x 19.0 mm (1 ½ in x ¾ in) (No. 4 aggregate)

a. Divide the sample into portions weighting approximately 2500g each.

b. Place one of the portions on the rocker box assembly and sieve and “rock” the material on the 4.75 mm (No. 4) rocker box assembly and sieve 10 cycles in 12 seconds. One complete cycle is a back and forth motion with the stops on each end of the rocker box assembly and sieve bumping the floor before the motion is reversed.

c. Repeat for each divided portion.

d. Discard material that passes the 4.75 mm (No. 4) sieve.

e. Save the material retained 4.75 mm (No. 4) for the test.

f. Retain each of the four portions in separate containers.

25 mm x 4.75 mm (1 in. x No. 4) (#67 & #57 aggregate)

No further preparation is required.

Pit-Run Aggregate

a. Divide the sample into portions weighting approximately 2500g each.

b. Place one of the portions on the rocker box assembly and sieve and "rock" the material on the 4.75 mm (No. 4) rocker box assembly and sieve 10 cycles in 12 seconds. One complete cycle is a back and forth motion with the stops on each end of the rocker box assembly and sieve bumping the floor before the motion is reversed.

c. Repeat for each divided portion.

d. Discard material that passes the 4.75 mm (No. 4) sieve.

e. Save the material retained 4.75 mm (No. 4) for the test.

f. Split or quarter out a test specimen conforming to the mass requirements for **25 mm x 4.75 mm (1 in. x No. 4)** aggregate on Table 1.

12.5 mm (½ in. Max.) maximum size aggregates (Screenings/Chips)

No further preparation is required.

PROCEDURE

1. Measure out the appropriate volume of water for the test specimen according to Table 1.

2. Wash the prepared test specimen according to the appropriate procedure below:

63 mm x 37.5 mm (2 ½ in. x 1 ½ in.)

a. Pour the wash water into the washing pan.

b. Submerge each aggregate particle individually in the wash water and remove the fines by scrubbing with a stiff fiber brush.

c. Discard the washed particle and repeat the procedure until all particles have been washed. Take care to avoid loss of wash water or fines.

d. Stir the wash water vigorously to bring the fines into suspension and pour the dirty wash water and accumulated fines through the 75 µm (No. 200) sieve into the collection pot.

e. Use a small amount of fresh water to rinse any remaining fines from the washing pan.

f. Pour the wash water into a graduated plastic beaker and adjust the volume to 1500 ± 10 mL with fresh water. Return the wash water to the collection pot taking care to include all water and fines.

37.5 mm x 19.0 mm (1 ½ in. x ¾ in.) (No. 4 aggregate)

a. Place one of the 2500 g portions in the wash vessel.

b. Add the measured amount of wash water, clamp the lid in place, and secure the wash vessel in the agitator and let it sit for 1 min ± 10 s.

c. Start the agitator and agitate the wash vessel for a period of 1 minute ± 10 s.

d. Immediately following the agitation period, take the vessel from the agitator, and remove the lid.

e. Bring the fines into suspension by holding the vessel in an upright position and moving it vigorously in a horizontal circular motion 5 or 6 times to cause the contents to swirl inside.

f. Immediately pour all of the contents of the vessel into the 2.36 mm (No. 8) and 75 µm (No. 200) sieves nested over the collection pot.

g. Discard the material retained on the 2.36 mm (No. 8) sieve.

h. Pour the wash water from the collection pot into a graduated plastic beaker, and adjust the volume to 1250 ± 10 mL with fresh water.

i. Place the second portion of the test specimen in the washing vessel, add the same wash water, and wash according to the above procedures.

j. Repeat this procedure with each of the four portions of the test specimen.

k. After washing the last portion and pouring it into the nested sieves, use a small amount of fresh water to rinse the remaining fines from the washing vessel.

l. Adjust the volume of wash water to 1250 ± 10 mL with fresh water. Return the wash water to the collection pot taking care to include all water and fines.

Aggregates having a maximum nominal size of 25 mm (1 in.) or less

a. Place the sample in the washing vessel.

b. Add the measured amount of wash water, clamp the lid in place, and secure the wash vessel in the agitator and let it sit for 1 min ± 10 s.

c. Start the agitator and agitate the vessel for a period of 2 min ± 10 s.

d. Immediately following the agitation period, take the vessel from the agitator, and remove the lid.

e. Bring the fines into suspension by holding the vessel in an upright position and moving it in a horizontal circular motion 5 or 6 times to cause the contents to swirl inside.

f. Immediately pour all of the contents of the vessel into the 2.36 mm (No. 8) and 75 µm (No. 200) sieves nested over the collection pot.

g. Use a small amount of fresh water to rinse the remaining fines from the washing vessel.

h. Discard the material retained on the 2.36 mm (No. 8) sieve.

i. If a concentration of material is retained on the 75 µm (No. 200) sieve, re–rinse the fine material by pouring the wash water through the sieve again, using the following procedure:

    1. Allow the wash water to stand undisturbed in the collection pot for a few moments to permit the heavier particles to settle to the bottom.

    2. Set the 75 µm (No. 200) sieve aside and pour the upper portion of the wash water into a separate container.

    3. Place the 75 µm (No. 200) sieve back on the collection pot, and pour the water back through the material on the 75 µm (No. 200) sieve. (If two collection pots are available, the specimen may be rinsed by alternately placing the sieve on one and then the other while pouring the wash water through the material on the sieve. Before each rinsing, allow the heavier particles to settle to the bottom, and pour only the upper portion of the water through the material.)

    4. Repeat this procedure as necessary until all of the 75 µm (No. 200) material has been washed through the sieve. When the material has been rinsed sufficiently, the material on the sieve will be free of visible streaks of clay, and the wash water will flow freely through the sieve and accumulated material.

j. Discard the material retained on the 75 µm (No. 200) sieve.

k. Pour the wash water into a graduated plastic beaker and adjust the volume to the original measure amount with fresh water. Return the wash water to the collection pot taking care to include all water and fines.

3. Fill the graduated plastic cylinder to the 3 unit mark with stock calcium chloride solution, and place the funnel on the graduated plastic cylinder.

4. Stir the wash water vigorously with one hand until all fines are in suspension. Use a circular motion allowing the fingers to rub the sides and bottom of the collection pot.

5. Immediately fill the graduated plastic cylinder to the 150 unit mark with the turbulent wash water.

6. Stopper the cylinder and thoroughly mix the wash water and calcium chloride solution by inverting the cylinder 20 times in approximately 35 seconds. Allow the air bubble to completely traverse the length of the cylinder each time, this counts as one inversion.

7. Immediately place the cylinder on a work bench or table free of vibrations, remove the stopper, and allow it to stand undisturbed for 20 min ± 10 s.

8. At the end of the 20 minute period, read the top of the sediment column to the nearest 1 unit mark.

    a. If a clearly defined line of demarcation does not form between the sediment and the liquid above it in the specified 20 minute period and the test was done with distilled or deionized water, allow the cylinder to stand undisturbed until the clear line of demarcation does form, then immediately read and record the time and the height of the column. If tap water was used, retest an untested portion of the same material using distilled or deionized water. If after 20 minutes there is no defined line of demarcation, consider the test invalid and a retest must be completed.

    b. If the liquid immediately above the line of demarcation is still darkly clouded at the end of 20 minutes, and the line of demarcation, although distinct, appears to be in the sediment column itself, read and record the level of this line at the end of the specified 20-minute period. If tap water was used, retest an untested portion of the sample using distilled or deionized water.

CALCULATIONS

Sediment height to the nearest unit on the graduated plastic cylinder equals the % C.V. (Example: 4 units = 89% C.V.)

CLEANNESS VALUES (C.V.) FOR 0 TO 150 UNITS SEDIMENT HEIGHT READINGS (H)

SEDIMENT HEIGHT (UNITS)	C.V. (%)	SEDIMENT HEIGHT (UNITS)	C.V. (%)	SEDIMENT HEIGHT (UNITS)	C.V. (%)	SEDIMENT HEIGHT (UNITS)	C.V. (%)	SEDIMENT HEIGHT (UNITS)	C.V. (%)
0	100	31	45	62	23	93	12	124	4
1	97	32	44	63	23	94	11	125	4
2	94	33	43	64	22	95	11	126	4
3	91	34	42	65	22	96	11	127	4
4	89	35	41	66	21	97	11	128	4
5	86	36	40	67	21	98	10	129	3
6	84	37	40	68	21	99	10	130	3
7	81	38	39	69	20	100	10	131	3
8	79	39	38	70	20	101	9	132	3
9	77	40	37	71	19	102	9	133	3
10	75	41	36	72	19	103	9	134	3
11	73	42	36	73	18	104	9	135	2
12	71	43	35	74	18	105	8	136	2
13	69	44	34	75	17	106	8	137	2
14	68	45	33	76	17	107	8	138	2
15	66	46	33	77	17	108	8	139	2
16	64	47	32	78	16	109	7	140	2
17	63	48	32	79	16	110	7	141	1
18	61	49	31	80	15	111	7	142	1
19	60	50	30	81	15	112	7	143	1
20	58	51	29	82	15	113	7	144	1
21	57	52	29	83	15	114	6	145	1
22	56	53	28	84	14	115	6	146	1
23	54	54	28	85	14	116	6	147	0
24	53	55	27	86	14	117	6	148	0
25	52	56	26	87	13	118	6	149	0
26	51	57	26	88	13	119	5	150	0
27	49	58	25	89	13	120	5		
28	48	59	25	90	13	121	5		
29	47	60	24	91	12	122	5		
30	46	61	24	92	12	123	5		

1. When two or more primary sizes of coarse aggregate are combined in a mix, determine the weighted-average Cleanness Value for the mix. For Portland cement concrete mixes, calculate the weighted-average Cleanness Value using the combinations shown below regardless of the actual proportions to be used on the project.

    a. 37.5 mm (1 ½ in.) maximum aggregate mix:

    37.5 mm x 19.0 mm (1 ½ in. x ¾ in.) … 40%
    25 mm x 4.75 mm (1 in. x No. 4) … 60%

    Example:
    (For ¾ in. aggregate) 91 x 0.40 = 36.4
    (For No. 4 aggregate) 89 x 0.60 = 53.4
    36.4 + 53.4 = 89.8 = 90% C.V.

    b. 63 mm (2 ½ in.) maximum aggregate mix:

    63 mm x 37.5 mm (2 ½ in. x 1 ½ in.) … 30%
    37.5 mm x 19.0 mm (1 ½ in. x ¾ in.) … 30%
    25 mm x 4.75 mm (1 in. x No. 4) … 40%

    Example:
    (For 1 ½ in. aggregate) 84 x 0.30 = 25.2
    (For ¾ in. aggregate) 77 x 0.30 = 23.1
    (For No. 4 aggregate) 91 x 0.40 = 36.4
    25.2 + 23.1 + 36.4 = 84.7 = 85% C.V.

REPORT:

Report the Cleanness Value to the nearest whole number and record on NDOT form 040-035.

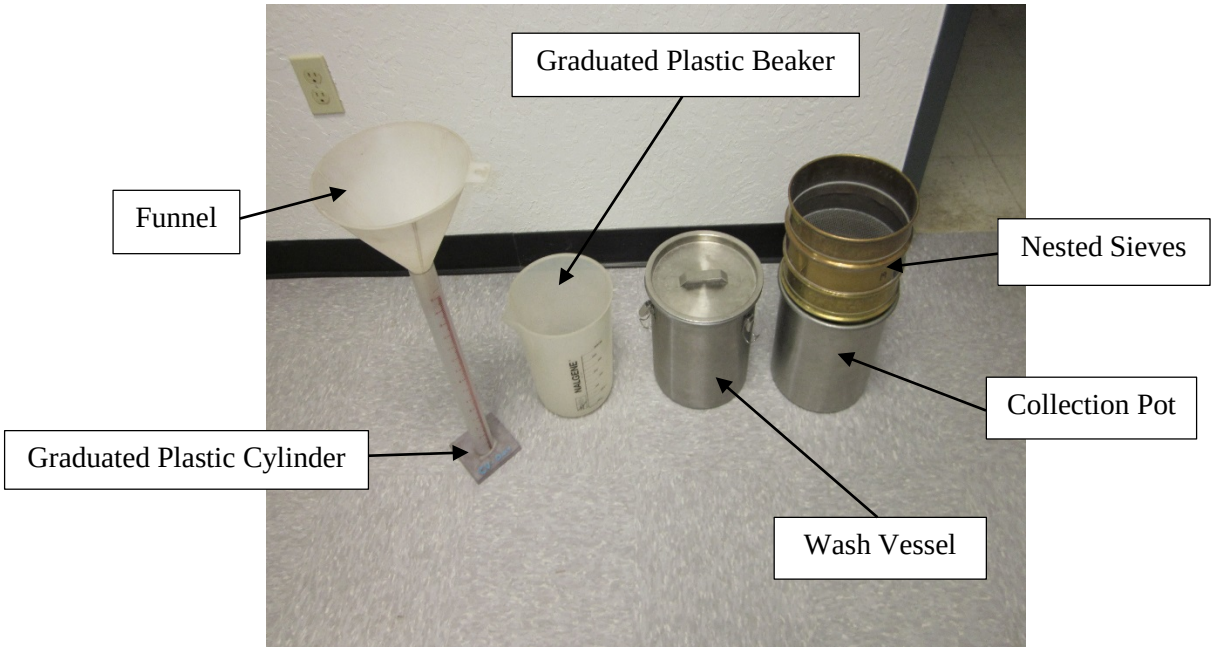

Figure 1

Figure 2
Agitator and Wash Vessel

Figure 3
Rocker and Box Sieve Assembly

Figure 4
Rocker and Box Sieve Assembly