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 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 1,000 mL to 1,500 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 sieve assembly (Figures 3 and 4).

9. Balance, with a capacity of 12,000 g and sensitive to 0.1.

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 – Chemical Lab).

SAMPLING

Obtain a representative sample per Test Method Nev. T200.

SAMPLE PREPARATION

1. 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)	20,000 ± 1000	1,500 ± 10
37.5mm x 19.0mm (1 ½ in x ¾ in) Size No. 4 aggregate	10,000 ± 500	1,250 ± 10
25 mm x 4.75 mm (1 in x No. 4) Size No. 57 aggregate Size No. 67 aggregate	2,500 ± 125	1,000 ± 5
12.5 mm Max. (½ in. Max.) CHIPS	1,000 ± 50	500 ± 3

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

3. Cool sample to room temperature.

4. 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) (Size No. 4 aggregate)

   a. Divide the sample into portions weighing approximately 2,500 g each.

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

f. Retain each of the portions in separate containers.

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

No further preparation is required.

Pit-Run Aggregate

a. Divide the sample into portions weighting approximately 2,500 g each.

b. Place one of the portions on the 4.75 mm (No. 4) rocker and box sieve assembly and "rock" the material 10 cycles in 12 seconds. One complete cycle is a back and forth motion with the stops on each end of the rocker and box sieve assembly, 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 on the 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) (Size No. 57 aggregate & Size No. 67 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 and pour into the graduated plastic beaker.

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 wash vessel.

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

c. Discard the washed aggregate particle and repeat the procedure until all aggregate 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 wash vessel.

f. Stir the wash water vigorously to bring the fines into suspension and pour the dirty wash water from the collection pot into the graduated plastic beaker and adjust the volume to 1,500 ± 10 mL with fresh water.

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

a. Place one of the 2,500 g portions into the wash vessel.

b. Add the measured amount of wash water, clamp the lid in place, 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, remove the wash vessel from the agitator and remove the lid.

e. Bring the fines into suspension by holding the wash 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 wash 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 wash vessel.

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

i. Pour the wash water from the collection pot into a graduated plastic beaker and adjust the volume to 1,250 ± 10 mL with fresh water.

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

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

l. After washing the last portion of the test specimen and pouring it over the nested sieves into the collection pot, stir the wash water vigorously to bring the fines into suspension and pour the dirty wash water into the graduated plastic beaker. Use a small amount of fresh water to rinse the remaining fines from the collection pot. Adjust the volume of wash water to 1,250 ± 10 mL with fresh water.

Aggregates having a maximum nominal size of 25 mm (1 in.) or less (1 in. x No.4) & (1/2 in.)

a. Place the sample into the wash vessel.

b. Add the measured amount of wash water, clamp the lid in place, 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 2 min ± 10 s.

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

e. Bring the fines into suspension by holding the wash 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 wash 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 wash 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. Stir the wash water vigorously to bring the fines into suspension and pour the dirty wash water from the collection pot into the graduated plastic beaker. Use a small amount of fresh water to rinse the remaining fines from the collection pot.

l. Adjust the volume of wash water per Table 1 with fresh water.

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

2. Stir the wash water in the collection pot 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.

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

4. 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 (equals one inversion).

5. 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.

6. 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 performed 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 (up or down) 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:

    37.5 mm x 19.0 mm (1 ½ in. x ¾ in.) aggregate
    C.V. = 91%
    91% x 0.40 = 36.4%

    25 mm x 4.75 mm (1 in. x No. 4) aggregate
    C.V. = 89%
    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:

    63 mm x 37.5 mm (2 ½ in. x 1 ½ in.) aggregate
    C.V. = 84%
    84% x 0.30 = 25.2%

    37.5 mm x 19.0 mm (1 ½ in. x ¾ in.) aggregate
    C.V. = 77%
    77% x 0.30 = 23.1%

    25 mm x 4.75 mm (1 in. x No. 4) aggregate
    C.V. = 91%
    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.

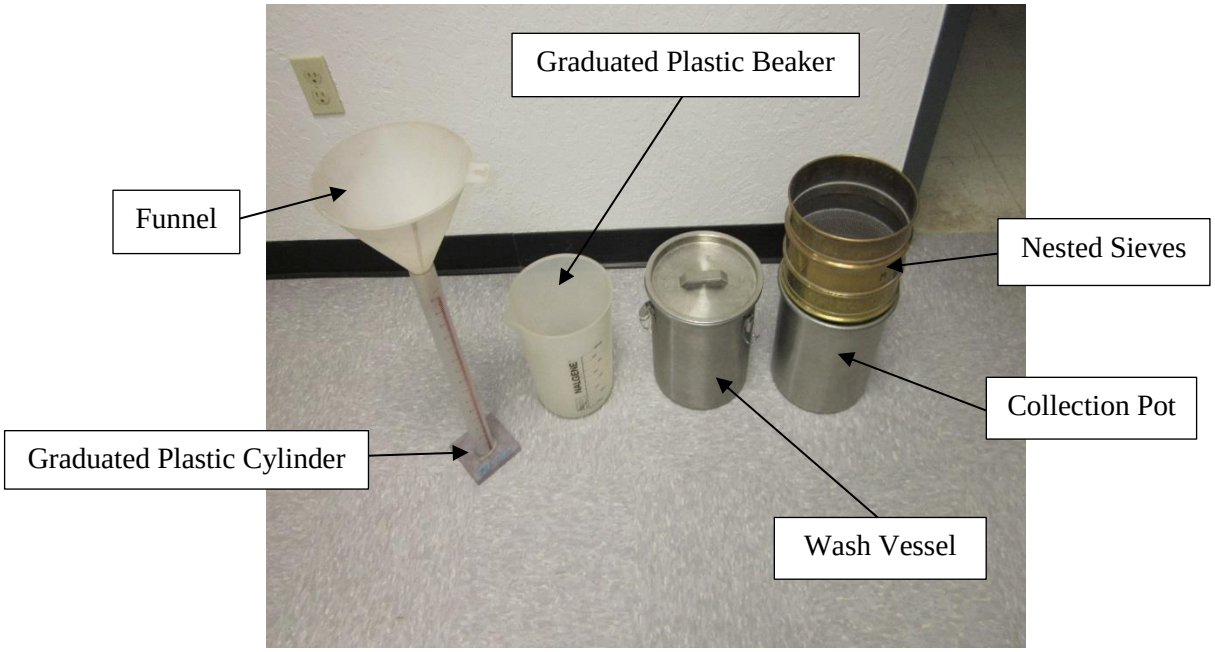

Figure 1

Figure 2
Agitator and Wash Vessel

Figure 3
Rocker and Box Sieve Assembly

Figure 4
Rocker and Box Sieve Assembly