

1202**COARSE AGGREGATE SIEVE ANALYSIS**
AASHTO Designation T 27 (Mn/DOT Modified)**1202.1 GENERAL**

This method of test covers a procedure for the determination of the particle size distribution of granular materials using sieves with square openings. It is not intended for use in the sieve analysis of aggregates recovered from bituminous mixtures or for the sieve analysis on mineral fillers.

1202.2 APPARATUS

- A. **BALANCE** - Shall conform to AASHTO M 231, CLASS G20, having a capacity of over 5kg thru 20kg (44 lbs.) with a readability & sensitivity of 5 grams (0.01 lbs.), and an accuracy of 5 grams (0.01 lbs.) or 0.1%.
- B. **SIEVES** - The sieves with square openings shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. The woven wire cloth sieves shall conform to AASHTO M 92. Suitable sieve sizes shall be selected to furnish the information required by the specifications covering the material to be tested.
- C. **SHAKER** - The mechanical shaker shall lock the screens in place and shall be equipped with a timer capable of turning off the shaker when the pre-set, required time limit has been achieved. The sieving action shall be such that the criterion of 1202.4B is met in a reasonable time period.
- D. **OVEN** - The oven shall be capable of maintaining a uniform temperature of 110 ± 5 °C (230 ± 9 °F).
- E. **SAMPLE SPLITTER** - The sample splitter openings should be 50mm (2"), with at least three pans.
- F. **MISCELLANEOUS** - Necessary bowls, pans or pails.

1202.3 TEST SAMPLES - (See Section 1201 - SAMPLE PREPARATION)

Wet samples shall be air dried before weighing. Samples too large to test, shall be reduced to test sample size as described in Section 1002.

1202.4 PROCEDURE

- A. After sample has been air-dried, weigh the sample to the nearest 5 grams (0.01 lb.) and record the weight (Mn/DOT Form #2429).
- B. Discharge entire sample onto the top sieve on the mechanical sieving apparatus (shaker) and sieve. Sieving shall be continued until not more than 0.5 percent by weight of the total sample passes any sieve during one minute of hand sieving (see Note 1). In no case shall fragments in the sample be turned or manipulated through the sieve by hand.
- Note 1:** Shaking time shall be determined for each mechanical shaker by a calibration procedure. For information purposes only the existing Mn/DOT Central Laboratory equipment (Gilson Models TS-1 & TM-3), satisfactory results can be obtained by sieving for a minimum of 7 minutes.
- C. Weigh, individually, the amount retained on each sieve and record on gradation form. When material is retained on the largest sieve it shall be checked for larger size material. (See Notes #3 and #4).
- D. When additional tests are required, such as LITHOLOGICAL or Los Angeles Rattler (LAR) tests, the material retained after being weighed from each individual sieve may be put into pans according to the sieve sizes needed for that test. (See Note #4)
- E. When all the sieves have been weighed including the bottom pan, the total weight **MUST CHECK WITH THE ORIGINAL WEIGHT WITHIN $\pm 0.3\%$** . If not the entire sample shall be weighed again and steps B, C, & D above shall be repeated.
- F. After completing the sample and preparing samples for other tests from the +4.75mm (#4) material, such as LITHOLOGICAL OR LAR tests, the minus 4.75mm (#4) material shall be split down to 450-600 grams for the FINE SIEVE ANALYSIS TEST and 200-300 grams of the minus 4.75mm (#4) material for a shale test, if a shale test is required. The balance of all material shall be returned to the sample sack(s) and tagged with the laboratory number. This material can be used for re-checks. In the case of failing tests, additional tests **MUST** be run. The 450-600 grams of minus 4.75mm (#4) material shall be placed in an oven and dried to a constant weight. Oven temperature shall be 110 ± 5 °C (230 ± 9 °F). **See Section 1203.6 for special instructions on drying aggregate samples containing salvaged asphalt pavement.**
- Note 2:** It has been found useful to split out an additional 1500-1800 grams of material passing the 4.75mm (#4) sieve at this time and retain it as a file sample in case re-checks are needed.

Note 3: Should the material on any of the coarse sieves have finer material clinging to the particles, or contain clay balls, the rock particles shall be cleaned before weighing. In the case of coarse aggregate for CONCRETE or BITUMINOUS, clay balls shall be hand-picked, dried and weighed. The total sample shall be dried and weighed and the percent of clay balls calculated.

For GRAVEL SURFACING or PROSPECT SAMPLES, hand-push all the clay balls through the 9.5mm (3/8") sieve and onto the 4.75mm (#4) sieve. The material retained on the 4.75mm (#4) sieve shall be added to the material passing the 4.75mm (#4) sieve (bottom pan) and then thoroughly mixed. A representative sample of approximately 600-750 grams is split out for fine sieve analysis.

Note 4: On coarse aggregate samples for CONCRETE (Lab samples, Source samples & Assurance samples), that require LITHOLOGICAL tests, the +4.75mm (#4) material shall be saved after the gradation test and separated into 37.5 - 25.0, 25.0 - 12.5, 12.5 - 4.75mm (1 1/2"-1", 1"-1/2", 1/2"-#4) sieve sizes. When an LAR test is required on the +4.75mm (#4) material it shall be separated into an "A", "B", "C" or "D" LAR (SEE TABLE IN SECTION 1202.5)

1202.5 WEIGHTS for SIZES (LAR)

SIEVE SIZE (mm)	SIEVE SIZE	"A" RATTLER	"B" RATTLER	"C" RATTLER	"D" RATTLER
37.5 – 25.0	1 1/2 - 1"	1370g			
25.0 – 19.0	1 - 3/4"	1370g			
19.0 – 12.5	3/4 - 1/2"	1370g	2750g		
12.5 – 9.5	1/2 - 3/8"	1370g	2750g		
9.5 – 6.3	3/8 - 1/4"			2750g	
6.3 - 4.75	1/4" - #4			2750g	
4.75 – 2.36	#4 - #8				5500g

Note 5: Use the LAR sample, which is most representative of the materials being tested.

1202.6 SPECIAL REQUIREMENTS FOR PROSPECT SAMPLES (PS)

When testing Prospect Samples (PS) the requirements of 1202 apply, except all samples from the same pit shall be saved and separated into samples for QUALITY and LAR TESTS. Accumulated samples from the same source shall have two LAR tests and at least one LITHOLOGICAL test. On large pits run one set of tests per 40 bags of material. During the gradation process, the material shall be separated into the following sieve sizes:

37.5 - 25.0; 25.0 - 19.0; 19.0 - 12.5; 12.5 - 9.5; 9.5 - 4.75; and minus 4.75mm
(1 1/2" - 1"; 1" - 3/4"; 3/4" - 1/2"; 1/2" - 3/8"; 3/8" - #4; and minus #4).

Material from above and below water shall be separated and run as separate samples. (For sample sizes see Section 1201 - SAMPLE PREPARATION).

Note 6: Material for the -4.75mm (#4) shale tests shall come from the same sample sets. Accumulate an approximately equal amount of -4.75mm (#4) from each sample. Thoroughly mix all the individual portions and, using an approved sample splitter, split the combined sample down to the required test size.

1202.7 CALCULATIONS FOR COARSE GRADATION.

$$\% \text{ Passing} = \frac{\text{Total Weight Passing Any Sieve}}{\text{Total Weight of Material Retained On All Sieves Plus Bottom Pan (Check Total)}} \times 100$$

The results for the coarse sieve analysis shall be reported to the nearest whole percent.

Note 7: See Section 1209 for LITHOLOGICAL calculations.

1202.8 FAILURES

For non-verification samples, ie. a sample without a companion specimen follow the following procedure (Does not apply to bituminous quality tests):

- 1) If the sample passes, report result and report as "Meets Requirements".
- 2) If the sample fails, and there is enough material to perform a retest, retest the sample.
- 3) If there is not enough material available for a retest, do report result and report as "unable to verify spec., not enough material for a retest".
- 4) If the retest passes, and is within interlab tolerance, see tables 1003 A-C, column 2, report result and report as "Meets Requirements".
- 5) If the retest fails and the retest result is within interlab tolerance, see tables 1003 A-C, column 2, then report the first test result and report as "Does Not Meet Requirements".
- 6) If the retest and the original test both fail and the tests are not within interlab tolerance perform a second retest.
- 7) If there is not enough material available for a second retest, do not report results and report as "Unable to Verify Spec., Not Enough Material for a Retest".
- 8) If the second retest passes, and is within interlab tolerance with one of the first two tests, see tables 1003 A-C, column 3, report result and report as "Meets Requirements".
- 9) If the second retest fails and the second retest result is within interlab tolerance, see tables 1003 A-C, column 3, with either of the first two tests, then report the first test result and report as "Does Not Meet Requirements".
- 10) If the second retest result is not within the parameters of column 3 of table 1003 A-C, then report as "unable to verify Spec".

Note 8: For samples with a companion specimen: See Section 1003 for Lab-Field Tolerance Procedures.