

1201 Sample Preparation- AASHTO Designation T 248 (Mn/DOT Modified)**1201.1 General**

This procedure is to standardize the preparation of samples for the tests performed in the aggregate sections of Mn/DOT's laboratories so that the tested sample is representative of the original.

1201.2 Equipment

Equipment shall consist of the following:

1. Assorted balances, meeting or exceeding the requirements in TABLE 2 of AASHTO M 231 that are appropriate for the specific use.
2. Sieves conforming to AASHTO M 92 including the 31.5, 25.0, 19.0, 16.0, 12.5, 9.5 and 4.75mm (1-1/4", 1", 3/4", 5/8", 1/2", 3/8" and #4) sieves.
3. Miscellaneous boxes, pans, and pails for holding prepared samples until tested.
4. Shovel, garden rake, push broom, and counter brush.
5. Sample splitters with openings of 12.5, 25.0 and 50mm (1/2", 1", and 2").

1201.3 Sample Selection from Larger Samples

One of the following methods will be used to secure a representative sample for laboratory testing whenever the original sample is larger than can be used:

A. Sample Splitters

1. 50mm (2") splitter for material up to 37.5mm (1 1/2") in size.
2. 25.0mm (1") splitter for material up to 19.0mm (3/4") in size.
3. 12.5mm (1/2") splitter for material finer than 9.5mm (3/8").

B. Quartering (for a test sample 1/2 to 1/4 of the original sample weight and usually for a test sample with a high moisture content).

C. Quartering on a Canvas Blanket (more than 90 kilograms of material in the original sample.)

Note 1: Refer to Section 1002 for specific sample size reduction procedures.

1201.4 Sample Preparation Procedure**A. Routine Samples****1. Sample Size**

BA, CA (3/4"+) and GS:	10 - 15kg (22 - 33 lbs.)
CA (3/4"-)	5 - 7kg (11 - 15 lbs.)
CA 70 and sand	5kg (11 lbs.)

If the sample is oversize it shall be reduced to proper size for testing by the appropriate method listed in Section 1201.3 and described in Section 1002.

2. The prepared sample shall be processed in accordance with Section 1202 for coarse (+4.75mm [#4]) aggregate and 1203 for fine (-4.75mm [#4]) aggregate.

B. Prospect Samples

1. PS shall be processed in accordance with Section 1202 for coarse (+4.75mm [#4]) aggregate and 1203 for fine (-4.75mm [#4]) aggregate. In addition, there are special Litho and -4.74 mm (#4) Shale Test requirements; refer to Sections 1202.6.

C. Bituminous Mix Design**1. Sample Preparation**

- a. Determine if the material is suitable for sieving. A surface-dry state is preferable. If the sample is too wet spread it out on a clean surface to air dry (fans may be used). As the sample is drying use a rake to move the material around so the sample dries evenly to a surface-dry state. If the sample is too dry spread it out on a clean surface, sprinkle it with water and mix with a rake until the sample is at a surface-dry state.
- b. At this point follow a suitable method described in Section 1002 and place approximately 15 kilograms (30 pounds) of material in 20 liter (5 gallon) plastic pails.
- c. Weigh the material in each pail to the nearest gram and record the weights.
- d. Sieve each pail separately in accordance with Section 1202. The reported gradation results are from the total weights of **ALL** the pails.
- e. Thoroughly mix all +4.75mm (#4) material and fill one Mix Design pan 3/4 full with representative material and put the remainder in sample sack(s). Label both the Mix Design pan and sample sack(s) with the date, sample ID number and size (+4.75mm [#4]).

- f. Thoroughly mix all -4.75mm (#4) material and split out (as described in Section 1201.3) representative samples for fine sieve analysis and a shale test. A second, approximate 1000g sample may be taken at this time for use in any necessary re-checks. Then fill one Mix Design pan 3/4 full with representative material and put the remainder in sample sack(s). Label both the Mix Design pan and sample sack(s) with the date, sample ID number and size (-4.75mm [#4]).
- g. An accompanying sample of +4.75mm (#4) material is normally submitted for quality tests. Representative samples for the quality indicated on the work sheet shall be prepared. (See Table 1 for sample size). The excess material shall be bagged and tagged with the proper laboratory sample number and saved until testing is completed.
- h. Frequently, Mix Design samples arrive graded and split by the submitter. If this is the situation, it is only necessary to mix the material thoroughly; fill two Mix Design pans 3/4 full of +4.75mm (#4) and -4.75mm (#4) material, respectively; extract a sample for the shale test; re-bag the remaining material; and label the pans and bags.
- i. If quality tests are needed and no separate +4.75mm (#4) material was submitted it will be necessary to acquire a representative sample from the material intended for Mix Design. Get a sample sufficient for a Litho. Due to the large amount of material needed for a LAR, it may be necessary to wait until Trial Mix testing is finished before commencing with the LAR.

D. Unit Weight Samples (Central Laboratory only)

1. Sample preparation

- a. If field gradations are submitted with the material, the sample does not need a laboratory gradation test. If no gradations are submitted, a representative sample for gradation shall be prepared in accordance with Section 1201.3B and 1002.5. From this gradation the weights of the different sizes of aggregate required to prepare the unit weight sample shall be calculated. Representative samples of the total material shall be sieved until enough material of each size is obtained to make up the unit weight sample (total weight 70kg [150 lbs.]). See Section 1201, Table 2 for an example of the calculations.

E. Moisture - Density Sample (Proctor)

1. Sample Preparation

- a. When a sample requires gradation and proctor, the sample shall be split according to Section 1201.3A and 1002.4, prior to grading. One-half of the sample shall be used for a gradation. The other half of the sample shall be used for the moisture - density (proctor) test and shall be a minimum of 5400g.

F. Fine Sieve, File Sample, Color Plate, -4.75mm (#4) Shale, Structural Strength, Specific Gravity and Absorption on -4.75mm (#4) material.

1. Sample Preparation

- a. The Color Plate sample shall be air-dried.
- b. The Specific Gravity and Absorption shall be tested in accordance with AASHTO Specification T 84.
- c. These samples shall be prepared by splitting the -4.75 mm (#4) material according to Section 1201.3A and 1002.4 until the desired size is reached. Should the sample material be too wet to flow through the sample splitter, Section 1201.3B or C (modified for preparing a smaller sample on a table top) may be used. See Table 1 for the required sample size. The Fine Sieve, shale, and Structural Strength samples shall be dried to a constant weight at a temperature of 110 ± 5 °C (230 ± 9 °F).
- d. Do not wash the material for these tests.

G. Los Angeles Rattler, Magnesium Sulfate, Percent Crushed Particles Lithological Count, +4.75mm (#4) Shale, Specific Gravity and Absorption on +4.75mm (#4) material and Insoluble Residue.

1. Preparation of Samples

- a. The entire sample shall be divided, by sieving, into the various sizes required for testing according to Section 1202. The work sheet will indicate which quality tests to prepare and any special instructions peculiar to the sample. The amount and size of material needed for each test is noted on Table #1.

Note 2: See Section 1221.3 for Insoluble Residue.

- b. The LAR and Mag. Sulfate samples shall be washed and dried to a constant weight at a temperature of 110 ± 5 °C (230 ± 9 °F).
- c. The +4.75mm (#4) Shale and Litho samples may be washed using only as much water as needed to clean the fine particles clinging to the coarse aggregate. **Do not agitate the sample and do not use a mechanical washing device.** If the aggregate is already fairly clean washing is not necessary. Dry the sample to a constant weight at a temperature of 110 ± 5 °C (230 ± 9 °F) regardless if the sample was washed or not.
- d. The Specific Gravity and Absorption sample shall be tested in accordance with AASHTO Specification T 85.
- e. Refer to Section 1214 for data on Percentage of Crushed Particles.

H. Special Requirements for Recycled Asphalt Pavements (RAP)

1. Sample Preparation

- a.** The entire sample shall be transferred into large, flat pans (Approximately 15,000 – 18,000 grams) and then placed in a 110 ± 5 °C (230 ± 9 °F) oven. Heat for 30 minutes until softened.
- b.** Remove from the oven and then break up the large conglomerations of RAP by carefully chopping with a blade.
- c.** As the old asphalt cement is being reactivated blend the RAP by mixing the freshly chopped material with the fines in the pan.
- d.** Continue this heating and re-mixing process until the RAP sample is homogeneous.
- e.** Once the sample reaches a homogeneous state allow the sample to cool and as it cools continue to separate and re-mix the RAP. Try to keep the RAP from hardening back into a large mass.
- f.** At this point place the prepared RAP into a hopper or pan and uniformly pour it through a sample splitter (1 or 2” chutes). Thoroughly mix the RAP by repeating this process a couple of times. Try to achieve a representative blend. See Section 1002.4

2. Prepared RAP Sample

- a.** Once the RAP is prepared split out any required test sample portions (i.e., an extraction/gradation or “Rice Test”) using a sample splitter or a rotary riffle splitter.
- b.** For a Bituminous Mix Design process the RAP in accordance with Section 1202. Separate the RAP into +19.0mm (3/4”), 19.0mm (3/4”) to 4.75mm (#4) and – 4.75mm (#4) size fractions. See Section 1801.5.

Note 3: Representative portions for tests such as Aggregate Specific Gravity, Lithological Counts and/or Lightweight Pieces in Aggregates shall initially be split out from the entire prepared sample (See Step 2a above) and then chemically extracted. Refer to Section 1801.5.

I. Special Requirements for Seal Coat Aggregates

1. Sample Preparation

- a.** Using Section 1002, split out the amount needed to run a gradation in the fine sieve area ($1000 \pm$ grams to be run on MaryAnn or equivalent shaker using 12” diameter sieves).

- b. Oven dry the remaining material and split out the amount needed for Unit Weight Determination, Section 1211. Use the Shoveling procedure. A 1/10th ft.³ Unit Weight container may be used.
- c. Take the remaining material and set up a specific gravity most nearly corresponding to the range of sizes in aggregate furnished for the work.

Note 4: Specific Gravity samples designations include -#4, +#8 and a +#4. If the sample contains a substantial quantity of material finer than the #4 sieve but coarser than the #8 sieve (such as pea rock) set up and run a +8 coarse specific gravity. Run Specific Gravity tests in accordance with Sections 1204 or 1205 as applicable.

- d. Wash and dry the gradation material in accordance with Section 1203.
- e. Run 1203 gradation and include a 1/4" sieve in the stack.
- f. Set up a -#4 shale sample if the material is from a natural gravel source. This is not necessary if the material is from a quarry.
- g. Save the material retained on the 3/8", 1/4" and #4 sieves; place into separate containers for Flakiness Index Test (Section 1223). A minimum of 4% of the total sample must be retained on an individual sieve to be tested.

J. Special Requirements for Shingles (RAS)

1. Sample Preparation

- a. The entire sample is transferred into a large flat pan and air dried to a constant weight.

2. Prepared RAS Sample

- a. Once the RAS is prepared, split out any required test sample portions using a sample splitter or a rotary riffle splitter.

Sample size is 500-700 grams each:

For a chemical extraction

For a shredded gradation (1/2" & #4 sieves)

For an "extraneous waste" litho

- b. For a Bituminous Mix Design there is no additional processing of the RAS. The remaining RAS material will be added as is during the mixing process.

Table 1 – Sample Sizes

Los Angeles Rattler (See Note #5)					Shale Test (See Note #6)				
Aggregate Size (mm)	Aggregate Size	Sample Size (g)			Aggregate Size	Sample Size			
		A	B	C					
37.5 – 25.0	1 1/2 - 1"	1370	-	-	-4.75mm (#4)	Shale Cup 200 – 300g			
25.0 – 19.0	1 - 3/4"	1370	-	-	+4.75mm (#4)	2500 – 4500g			
19.0 – 12.5	3/4 - 1/2"	1370	2750	-					
12.5 – 9.5	1/2 - 3/8"	1370	2750	-					
9.5 – 6.3	3/8 - 1/4"	-	-	2750					
6.3 – 4.75	1/4" - #4	-	-	2750					
Set up 1 test per sample Note: See Section 1202.5 for "D" Rattler					Specific Gravity & Absorption (See Note #7)				
Lithological Count (See Note #6)					Aggregate Size (mm)	Aggregate Size	No. of Pans	Sample Size (g)	For
Aggregate Size (mm)	Aggregate Size	Sample Size (Grams)			37.5	1 1/2"+	3	2500	CA
25.0+	1"+	1500 – 9000			37.5 – 19.0	1 1/2 - 3/4"	3	2500	CA
25.0 – 12.5	1 – 1/2"	1500 – 4500			19.0 – 9.5	3/4 - 3/8"	3	2500	CA
12.5 – 4.75	1/2 - #4	900 – 1100			9.5 – 4.75	3/8" - #4	3	1500	CA
4.75 only	3/8" - #4 (Pea Rock)	300			- 4.75 Sand	- #4 Sand	2*	1500	CA or BA
Note: Weights are for guidance <u>only</u> . In no case shall the number of particles examined in any fraction be less than 150.					+4.75	+ #4	3	2500	BA
					+2.36	+ #8	3	1500	CA or BA
					*Set up three tests, run two and use the third as a backup				
Color Plate					Structural Strength				
Minus 4.75mm (#4) material - 400 – 500g					2 Pans @ 5500 grams each				
Fine Sieve					Magnesium Sulfate (See Note #5)				
Minus 4.75mm (#4) material - 450 – 600g Minus 9.5mm (3/8") material - 600 - 750g					Aggregate Size (mm)	Aggregate Size	Sample Size (g)		
Order of Work BA - Grading, fine sieve, file sample, tests circled BA (Fines) - Hand sieve through the 9.5mm (3/8") sieve, Fine sieve, file sample, tests circled CA (Rock) - Grading, tests circled CA (Sand) - Hand sieve through the 9.5mm (3/8") sieve, Fine sieve, file sample, tests circled GS - Grading, fine sieve, file sample, tests circled					63.0 – 50.0	2 1/2 – 2"	3500		
					50.0 – 37.5	2 - 1 1/2"	2500		
					37.5 – 25.0	1 1/2 - 1"	1500		
					25.0 – 19.0	1 - 3/4"	1000		
					19.0 – 12.5	3/4 - 1/2"	1000		
					12.5 – 9.5	1/2 - 3/8"	600		
					9.5 – 4.75	3/8 - #4	600		

Table 1 – Sample Sizes (Continued)

Percentage of Crushed Particles Refer to Section 1214	Prospect Sample Fine Sieve, representative shale sample, grade, save all rock, tests circled
File Sample Minus 4.75mm (#4) material - 1500 – 1800g	Proctor Grading, fine sieve, file sample, split out + 4.75mm (#4), send -4.75mm (#4) & +4.75mm (#4) to the Soils Lab

Note 5: These weights are for sample set-up/submittal. The actual weights used in the test can be found in Section 1210.4, Table 1 for the LAR test or Section 1219.2H for the Magnesium Sulfate test.

Note 6: Should the sample contain less than 5% of either +4 or –4 material, that portion shall not be tested for lithological count or shale.

Note 7: Should the sample contain less than 15% of either +4 or –4 material, that portion shall not be tested for Specific Gravity.

Note 8: If the sample contains a limited amount of material, set up the tests in the following order to maximize the usage of material for as many tests as possible:

- 1) Specific Gravity/Absorption
- 2) Lithological Count
- 3) Magnesium Sulfate
- 4) Los Angeles Rattler

Table 2 – Calculations, Unit Weight Samples

Lab ID No.	CO-CA99-0001	CO-CA99-00001	Composite
Fraction	+19.0mm (3/4")	-19.0mm (3/4")	
Proportions	30%	70%	100%
Sieve Size	Percent Retained	Percent Retained	Percent Retained
37.5mm (1 1/2")	0.2	0.0	0.1
19.0mm (3/4")	83.6	0.5	25.4
9.5mm (3/8")	99.6	48.9	64.1
4.75mm (#4)	99.8	90.2	93.1
Pan	100	100	100

TABLE 2 – Calculations, Unit Weight Samples (Continued)

Aggregate Size (mm)	Aggregate Size	Percent of Total +19.0mm (3/4")	Weight of Aggregate in kg (Pounds) +19.0mm (3/4")	Percent of Total -19.0mm (3/4")	Weight of Aggregate in kg (Pounds) 19.0mm (3/4")	Composite Weight of Aggregate On kg (Pounds)
+37.5	+1 1/2	0.2	0.04 (0.1)	0.0	0.00 (0.0)	0.05 (0.1)
37.5 – 19.0	1 1/2 – 3/4"	83.4	17.02 (37.5)	0.5	0.24 (0.5)	17.24 (38.0)
19.0 – 9.5	3/4 - 3/8"	16.0	3.27 (7.2)	48.4	23.05 (50.8)	26.31 (58.0)
9.5 – 4.75	3/8" - #4	0.2	0.04 (0.1)	41.3	19.67 (43.4)	19.73 (43.5)
-4.75	-#4	0.2	0.04 (0.1)	9.8	4.67 (10.3)	4.72 (10.4)
Total			20.41 (45.0)		47.63 (105.0)	68.04 (150.0)

Calculations:

A) Percent of Total = The % retained on a sieve **minus** the percent retained on the next larger sieve.
[i.e., % ret. on the 19.0mm (3/4") sieve - % ret. on the 37.5mm (1 1/2")]

or $83.6 - 0.2 = 83.4$

B) Weight of Agg. = The percent of total **x** the total weight. [i.e., the weight of the 37.5 - 19.0mm (1 1/2 - 3/4") size in the +19.0mm (+3/4") fraction]

or $83.4\% \times 20.41 = 17.02\text{kg}$