



8-34.1 Sampling and Testing

Aggregate sampling techniques and minimum sample sizes must be in accordance with the appropriate sample method. Use of larger samples should be considered by the QC staff to increase the probability of obtaining a representative sample. When split samples are required by the provision, the field sample size shown in [CMM 8-50](#) needs to be doubled.

8-34.1.1 Sampling During Production or Before Placement

Retitle and revise 8-34.1.1 to include before-placement testing and update details for stockpile testing.

For production or **before-placement** sampling required by the provision, the contractor can obtain samples from the finished product conveyor belt or stockpile. Obtaining samples from the belt discharge is acceptable if the full production stream can be obtained with sufficient rapidity and safety.

Production samples are taken during aggregate crushing and stockpile operations and can only be conducted or witnessed by QC personal. Individual QMP provisions may allow for optional production testing as an alternative to in-place, stockpile or loadout samples before the beginning of a project. If production test results are submitted, documentation of random sampling must be provided.

Stockpile samples are taken after the contract is awarded, before placement and test results can be used for multiple projects within the QMP provision's specified timeframe. After aggregate placement begins, no additional stockpile samples are required for that project. Taking additional stockpile tests may be advisable depending on project circumstances. If a project is suspended and the aggregate source continues to be used on other non WisDOT projects or new material is added to the stockpile, taking a stockpile sample is advisable before resuming placement. If a project is suspended for over six months, taking an additional stockpile sample is advisable before resuming placement. Multiple stockpile tests for the same project and source are not required.

Selection of random sample locations must be in accordance with the QMP provision.

8-34.1.2 Sampling During Placement

Sampling from the roadbed must be performed according to the provision. Sampling must take place after blading and shaping but before beginning compaction. The intent is to obtain samples as near to the final placement location of the material as possible so as to truly represent the aggregate placed. Sampling from roadbed windrows should only be used when the subgrade is granular, and it would not be possible to differentiate the change in material between the crushed aggregate base course and the granular subgrade.

The quantity of materials for roadbed field sampling should be doubled since samples are needed for both quality control and department testing according to special provision requirements of the contract.

8-34.1.3 Sieve Analysis

Sieve analysis testing must follow AASHTO T11 and T27 as modified by WisDOT. This procedure is outlined in [CMM 8-60](#). The sample weights derived from this procedure are minimums. As has been pointed out for field sample sizes, the use of larger samples should be given careful consideration by the QC staff to increase the probability of obtaining a representative sample.

Test data and calculation results should be recorded on a copy of department form [DT1348](#), Sieve Analysis for Mixture of Fine and Coarse Aggregates. For consistency throughout the testing operations it is preferred the test mass be made in units of grams. [Figure 1](#) is an example of a completed test data sheet for a typical sample of aggregate base course material.

Figure 1 Example Sieve Analysis for Mixture of Fine and Coarse Aggregates, Form DT1348

SIEVE ANALYSIS FOR MIXTURE OF FINE AND COARSE AGGREGATES							Wisconsin Department of Transportation					
DT1348 2/2006												
Project Information							Project 1001-01-00		Contract		County Rock	
Deposit Identification							Contractor and/or Producer Brewers Stone		Sample No. 10T		Date 5/28/09	
<input checked="" type="checkbox"/> Crushed Stone <input type="checkbox"/> Crushed Gravel <input type="checkbox"/> Blend		<input checked="" type="checkbox"/> Base Course <input type="checkbox"/> Other		<input type="checkbox"/> 3/4 inch <input checked="" type="checkbox"/> 1 - 1/4 inches <input type="checkbox"/> 3 inches <input type="checkbox"/> Open Graded <input type="checkbox"/> Other			Sampled at 120 + 00, Top, 9' RT		Materials Accepted at		Time 3:20 pm	
MOISTURE CONTENT							Weight of Total Sample (dry, unwashed) 6513					
Weight of Sample (moist)			6788G		Weight of R4.75 mm (No. 4) dry, unwashed			3879 = 0. 596 (A)				
Weight of Sample (dry)			6513G		Weight of P4.75 mm (No. 4) dry, unwashed			2634 = 0. 404 (B)				
Moisture Loss			275G									
% Moisture			4.2%									
R-4.75 mm (R-4) MATERIAL				P-4.75 mm (P-4) MATERIAL			TOTAL MATERIALS (% Passing)					
				Wt. = 674 (Min. 500 g)								
Sieve	Weight Retained	% Retained	% Pass (C)	Weight Retained	% Retained	% Pass (D)	4.75 mm (R-4) (A)(C)	4.75 mm (P-4) (B)(D)	Washed Results	Spec		
75mm (3")	0	0	100	0	0	100	59.6	40.4	100			
37.5mm (1-1/2")	0	0	100	0	0	100	59.6	40.4	100			
32.5mm (1 1/4")	98	2.5	97.5	0	0	100	58.1	40.4	98.5			95-100
25 mm (1")	153	3.9	96.1	0	0	100	57.2	40.4	97.6			
19 mm (3/4")	1101	28.3	71.7	0	0	100	42.7	40.4	83.1			70-93
12.5 mm (1/2")	1798	46.3	53.7	0	0	100	32.0	40.4	72.6			
9.5 mm (3/8")	2471	64.2	35.8	0	0	100	21.3	40.4	61.7			42-80
4.75 mm (No. 4)	3738	96.4	3.6	0	0	100	2.1	40.4	42.5			25-63
2 mm (No. 10)	3796	97.9	2.1	233	34.6	65.4	1.3	26.4	27.7			16-48
425 µm (No. 40)	3800	98.0	2.0	415	61.6	38.4	1.2	15.5	16.7			8-28
75 µm (No. 200)	3813	98.3	1.7	531	78.8	21.2	1.0	8.6	9.6			2-12
In pan	19											
R-4.75 mm (R-4) FRACTURE COUNT				PLASTICITY CHECK			Can 425 µm (P-40) be rolled into 3.2 mm (1/8") thread when moist?					
Fracture Particles			30.2	<input type="checkbox"/> Yes <input type="checkbox"/> No			Mass/m ³ (Weight/c.y.) = _____					
Questionable Particles												
Total particles			413									
% Fracture			73									
NOTE: If test does not meet contract requirement notify Project Engineer and indicate the action taken.												
Sampled by Gormon Thomas				Date 5/28/09		Tested by Paul Molitor			Date 6/1/09			

Gradation of aggregate should be expressed in percent passing sieve sizes. Separate charts must be kept for 2", 1-1/2", 1", 3/4", 1/2", 3/8", #4, #8, #10, #16, #30, #40 #50, #100 and #200 (50mm, 37.5mm, 25mm, 19mm, 12.5mm, 9.5mm, 4.75mm, 2.36mm, 2.00mm, 1.18mm, 600µm, 425µm, 300µm, 150µm and 75µm). Control charts for only the sieve sizes specified by the applicable specification need to be produced.

8-34.1.4 Atterberg Limits

Record Atterberg Limits test results.

8-34.1.5 Fractured Particle Count

Fractured particle testing must be according to [CMM 8-60](#). The QC tester should make the required calculation. Fractured particle test results must be plotted on a control chart

8-34.2 Department Testing

Verification and independent assurance sampling and testing will be performed by the department or a department representative as described in the provision.

8-34.2.1 Verification Testing

Verification testing will be performed by an HTCP certified department representative on random samples collected independently of the contractor's samples. Testing of the material will be conducted in a separate laboratory and with separate equipment from the contractor's tests.

8-34.2.2 Independent Assurance Review

Independent assurance reviews will be conducted by a department representative in accordance with the provision and the department's Independent Assurance Program. These reviews will be made of the contractor's quality control and the department's verification sampling and testing equipment and personnel.

8-34.3 Dispute Resolution

Dispute resolution will be conducted according to the provision. The split samples of the material collected for QC testing can be used to help resolve conflicts. The use of these samples will be as agreed to by the contractor and the department.

8-34.4 Aggregate for Concrete Pavement

8-34.4.1 Sampling

Obtain aggregates using field sample sizes according to [CMM 8-50](#). The use of larger samples should be considered by the QC staff to increase the probability of obtaining a respective sample.

For the aggregate sampling required by the provision, the contractor can obtain samples from the finished product conveyor belt, holding bins, or stockpile. Obtaining samples from the belt discharge is excellent if the full production stream can be obtained with sufficient rapidity and safety.

Selection of random sample locations must be in accordance with the QMP provision.

8-34.4.2 Testing

Both the department and contractor must use the methods and frequencies for aggregate sampling and testing prescribed in the QMP provision.

8-34.4.2.1 Aggregate Sieve Analysis

The QMP provision allows for a portion of the gradation testing of coarse aggregates to be performed with an unwashed method. The procedures for unwashed (dry) sieve analysis are identical to those for washed (wet) sieve analysis except for references to washing operations. The processes for washed or unwashed sieve analysis testing must follow AASHTO T11 and AASHTO T27 as modified by WisDOT. Be aware that it is necessary to grade (sieve) all individual samples of both fine and coarse aggregates through the coarse and fine sieve series.

The sieve analysis test data sheet, and all subsequent use of the data should clearly indicate whether washed or unwashed testing was used. The tester must refer to [CMM 8-60](#) for instructions to determine whether dry sieving is acceptable or if wet sieving is required. While the QMP special provisions specify only every 10th sample of coarse aggregate is to be subjected to a washed analysis, the intention is that a dry analysis should be used only if it will provide reliable data. If, when comparing test results, sieve analysis comparisons are marginal or P/200 is above the warning limit, a washed sieve analysis must be performed on each sample until results by washed sieving meet the criteria.

8-34.4.2.2 Fineness Modulus

The fineness modulus of fine aggregate is required to be calculated by the special provision and is intended to be for information only. Fineness modulus must be calculated for the fine aggregate as outlined below. Fineness modulus is determined by adding the total percentages of material by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 then dividing by 100, as shown in the following example.

Example 1

Sieve No.	Spec. Percent Passing	Sample Percent Passing	Sample Percent Retained
4 (4.75mm)	90-100	98	2
8 (2.36mm)		80	20
16 (1.18mm)	45-80	60	40
30 (600µm)		32	68
50 (300µm)	10-30	20	80
100 (150µm)	2-10	8	92
		Total =	302

Fineness Modulus = $302/100 = 3.02$

8-34.4.3 Corrective Action

Corrective action must be implemented according to the provision.

8-34.4.4 Department Testing

Quality verification and independent assurance sampling and testing will be performed by the department or a department representative as described in the provision. Sampling and testing will be performed by a certified technician.

8-34.4.4.1 Verification Testing

Verification testing will be performed by an HTCP certified department representative on samples collected independently of the contractor's samples. Testing of the material will be conducted in a separate laboratory and with separate equipment from the contractor's tests.

With this provision, the contractor has two options for when the department's quality verification testing will be performed on the aggregate for concrete pavement.

1. For option 1:

Quality Verification testing is performed at the time of production.

2. For option 2:

Quality Verification testing is performed at the time the aggregate is being used or relocated.

Regardless of which option is used, the contractor is responsible for the product after it has been sampled, tested and accepted. Minimal segregation, contamination, and degradation must occur with relocation of the material. The engineer may require additional sampling and testing at the concrete plant site and use a statistically based Pooled T-Test to evaluate whether the quality of the material has been maintained. Follow procedure for the Pooled T-Test ([Attachment 1](#)).

8-34.4.4.2 Independent Assurance Review

Independent assurance reviews will be conducted by a department representative in accordance with the provision and the department's Independent Assurance Program. These reviews will be made of the contractor's Quality Control and the department's verification sampling and testing equipment and personnel.

8-34.4.4.3 Dispute Resolution

Dispute resolution must be conducted according to the provision.

List of Attachments

[Attachment 1](#) Pooled t-Test Procedure