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# 5

## MODIFIED ACCEPTANCE PROGRAM

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### Modified Acceptance Program Control Plan

#### Open Graded Coarse and Fine Aggregates

Aggregate Producers shall be responsible for controlling their product for gradation and Atterberg Limits, in accordance with the plan outlined herein, when producing any type aggregate, other than Type I Select Material or any type subbase or base dense graded, central-mixed aggregates specified respectively in Secs. 207 and 208 of the Road and Bridge Specifications. Approval of the Producer's Quality Control (QC) Plan shall in no way relieve the Producer or Contractor of responsibility for complying with all of the requirements of the contract or specifications. The QC Plan shall meet the following specific requirements.

#### Sampling Rate

The QC sampling rate shall be one sample per 1000 tons per size of material produced. It is recognized that due to production schedules, past performance and perhaps other factors, this rate may be changed for a particular operation. Therefore, the actual rate for a specific location shall be at the discretion of the District Materials Engineer.

#### Sampling Method

With the requirements of quality assurance and Producer certification of aggregate, the method of obtaining aggregate samples for grading tests becomes more critical. Therefore, the only way statistics will be meaningful is for the sampling, by both the Department and the Producer, to be performed in a similar manner.

Samples shall be obtained from each size material produced. These samples shall be selected from barges, conveyor belts, or stockpiles or as approved by the Engineer. Sampling and testing shall be performed by qualified personnel.

Sampling of aggregate shall follow the procedures outlined in AASHTO T2 as modified herein. The shovel used for sampling of aggregates shall be a square nose shovel of spade design with slightly built up edges and back, capable of penetrating full depth into the stockpile. A short handle with butt handle grip is needed to obtain the leverage to remove the sample from the stockpile. The sample size should be as noted on page 5-5.

For source approval sampling, segregation of the individual particles is not important, for they will be recombined into the testing sizes needed in the laboratory. Therefore, for coarse aggregate, a sample of approximately 40 lbs. (20 kg) each of No. 8 and No. 57, if available, will generally be sufficient to conduct quality tests. For fine aggregate, a single 40 lb (20 kg) is sufficient.

To determine gradation compliance, the sampler shall take care to follow the procedures outlined above exactly. When safe to do so, samples shall be taken at a point other than in stockpiles to reduce the error inherent with stockpile segregation. A sample of approximately 10 lbs. (5 kg) is typically sufficient for fine aggregate and one of 30 lbs. (15 kg) for coarse aggregate. Open-graded aggregates and Grade A fine aggregate shall be tested for minus 200 material by washing prior to the dry gradation being performed.

All verification samples shall be packed and marked in accordance with Sec. 203 of the Manual of Instructions (MOI), using Form TL-10, as outlined in Sec. 800 of the MOI. Special care shall be taken to ship the aggregate in a secure container or sample bag free of contaminants.

Five types of sampling are permitted; truck bed sampling, belt sampling, stockpile sampling, miniature stockpile sampling and tube sampling. See Chapter 2 of this manual for details.

The importance of sampling is equivalent to the importance of good quality control. The primary concern of sampling is to take samples that will represent the stockpile as closely as possible and will determine as accurately as practical the properties of the complete stockpile.

## Acceptance of Materials

Materials which fail to meet the specification requirements shall not be shipped to State projects or for State uses under any circumstances.

All materials meeting the applicable specification requirements may be shipped as accepted based on the Producer's certification, which, among other things, shall state that the required tests by the Producer have been performed and have met the specification requirements of the material. See Section 204 of the Manual of Instructions and the Road and Bridge Specification.

The Producer shall furnish to the Department a copy of the test results for each size material produced.

The Producer shall keep all records pertinent to the production for a period of one year and they shall be available for review by the Engineer.

## Verification

The Department through the District Materials Engineer will visually inspect stockpiles of produced materials. When deemed necessary by the Department, verification testing may be performed to verify the adequacy and accuracy of the Producer's quality control plan. When requested by the Materials Representative, samples shall be taken by the Producer in the presence of the Materials Representative, and then either quartered or introduced through a sample splitter with each party conducting the test on their half. Verification tests shall be conducted in the VDOT Laboratory or by AMRL-accredited consultant laboratories. The verification test results shall be compared to the Producer's test results.

The verification test results shall no way be used to judge acceptance. The Producer's half of the verification sample may serve as its production sample for that 1000-ton lot. If the comparisons indicate verification test results are not in relatively close agreement with the Producer's results, an investigation shall be made to determine the reason for the difference. In the event it is determined that the Producer's test results are not representative of the product, the Producer shall take corrective action to alleviate any problems identified. If corrective action is not performed in a timely manner or does not alleviate problems identified, the Department may withdraw approval of the Producer's QC plan.

## **General**

The Producer's quality control plan shall include a system by which the District Materials Engineer shall be advised as to the amount and size of material shipped to each project or order. If the Producer's quality control plan is found to be unsatisfactory, the Department may withdraw approval of the program.

**Dry Riprap** - Contractors shall furnish and place the class of dry riprap specified on the plans. Although dry riprap is primarily mechanically sized during production as other aggregates are, the acceptance of riprap relies primarily on visual inspection for size and percentages to meet the Department's specifications. Thus to avoid project delays and minimize material rejections the Project Inspector is to use the following procedures:

**Stockpiled Dry Riprap** - Verify the size and acceptability of the material at the quarry prior to shipment.

Dry Riprap to be shipped as it is produced - Establish by visual inspection with the Contractor and the Producer the size and percentages required to meet the Department's specifications.

The Contractor shall furnish samples of the minimum and maximum size riprap at the project site to be used for visual comparison of riprap delivered to the project and a sample should be maintained at the quarry for the Producer's benefit. In event a shipment is questionable as to specification conformance, the District Materials Engineer shall make the final determination as to acceptability.

## **Sizes No. 1, No. 2, No. 3 and Gabion Stone**

Except for use in hydraulic cement concrete, aggregate size No. 1, No. 2, No. 3 and Gabion Stone shall be inspected visually for size, cleanliness and general conformance to the specified gradation. Gradation testing shall be performed by the Department in the event of dispute.

## Aggregate Gradation

As previously stated in Chapter 3 the grading of an aggregate is determined by a sieve analysis in which the particles are divided into various sizes by sieves. The sieves for grading coarse aggregate are:

<b>COURSE AGGREGATE SIEVES</b>	<b>FINE AGGREGATE SIEVES</b>
150 mm (6 in.)	4.75 mm (No. 4)
75 mm (3 in.)	2.36 mm (No. 8)
37.5 mm (1 1/2 in.)	1.18 mm (No. 16)
19.0 mm (3/4 in.)	600 µm (No. 30)
9.5 mm (3/8 in.)	300 µm (No. 50)
4.75 mm (No. 4)	150 µm (No. 100)
	75 µm (No. 200)

For any test to be valid, it should be run on a sample that is representative of the total material to be used or, as it is in concrete, the total stockpile. The method of obtaining a representative sample for aggregate gradations has been previously explained in Chapter 3.

The representative sample must now be reduced to the proper size for testing by either the quartering method, or by use of a sample splitter. Both methods reduce the sample to approximately half the size each time it is used.

The sample size is determined by the size of the aggregate as shown below.

<b>Nominal Maximum Size Aggregate</b>	<b>Minimum Test Sample Size (grams)</b>
No. 8 (2.36 mm)	300
No. 4 (4.75 mm)	300
No. 3/8 (9.5 mm)	1,000
½ in. (12.5 mm)	2,000
3/4 in. (19.0 mm)	5,000
1 in. (25.0 mm)	10,000
1 ½ in. (37.5 mm)	15,000
2 in. (50.0 mm)	20,000

In a sieve analysis, a nest of sieves is placed in a mechanical vibrator with the smallest openings on the bottom and largest on top. A dry representative sample of aggregate is weighed and placed in the top sieve and the nest of sieves are vibrated until all particles are separated.

The fraction of material retained on each sieve is weighed cumulatively, and the cumulative percent retained and percent passed each screen is calculated. The results are compared with the gradation range of the specification to determine if the aggregate meets gradation requirements.

(Note: In a fine aggregate sieve analysis, the test sample is washed over the No. 200 (75  $\mu$ m) sieve and the portion retained on the No. 200 (75  $\mu$ m) is dried and the loss recorded.)

## Grading a Sand

### Sieve Analysis Example

The following sieve analysis is for a sample of natural sand not subject to abrasion and meets Virginia Department of Transportation requirements for Grading "A" Sand.

In this example, the cumulative weight retained on each sieve was determined in the sieve analysis. The first step is to calculate the cumulative percent retained on each sieve. Divide the cumulative weight retained by the total weight of the sample, and multiply the answer by 100 (converts decimal to percent).

Sieve Size	Cumulative Grams Retained	Cumulative % Retained	% Passing	VDOT Specs. (% Passing)
9.5mm (3/8 in.)	0.0	0.0	100	100
4.75mm (No. 4)	6.2	1.0	99	95-100
2.36mm ( No. 8)	108.5	18.1	82	80-100
1.18mm (No. 16)	228.7	38.2	62	50-85
600 $\mu$ m (No. 30)	355.5	59.4	41	25-60
300 $\mu$ m (No. 50)	476.3	79.6	20	5-30
150 $\mu$ m (No. 100)	551.9	92.2	8	0-10
75 $\mu$ m (No. 200)	583.6	97.5	2.5	0-5
Total Wt.	598.7	100.0		

For Example:

4.75 mm (No. 4) sieve cumulative % retained =

Cumulative weight retained: 6.2 grams = 0.0103 X 100 = 1.0%

Total weight of sample: 598.7 grams

After finding the cumulative percent retained on each sieve, we subtract the cumulative percentage retained on each standard sieve from 100 to obtain the percent passing, as illustrated below:

9.5 mm (No. 3/8 in.) sieve: 100.0 - 0.0 = 100%

4.75 mm (No. 4) sieve: 100.0 - 1.0 = 99%

The percent passing is compared to the VDOT specification range to determine if the sample passes.  
Road & Bridge Spec. - Section 202.02

TABLE II-1  
Fine Aggregate

Grading	Amounts Finer Than Each Laboratory Sieve (Square Openings) ( % by Mass)							
	3/8 in. 9.5 mm	No. 4 4.75 mm	No. 8 2.36 mm	No. 16 1.18 mm	No. 30 600 μm	No. 50 300 μm	No. 100 150 μm	No. 200 75 μm
A	Min. 100	95-100	80-100	50-85	25-60	5-30	Max. 10	
B	Min. 100	94-100					Max. 10	
C	Min. 100	94-100				Max. 25		

- (e) **Deleterious Material:** The amount of deleterious material in sands shall be not more than the following:

Material	% by Weight	Test Method
Clay lumps	0.25	T112
Shale, mica, coated grains, soft or flaky particles	1.0	T113
Organic material	0	T21
Total material passing No. 200 sieve by washing <sup>1</sup>		T11 and T27
For use in concrete subject to abrasion	3	
For other concrete	5	

<sup>1</sup>In the case of stone sand, if the material passing the No. 200 sieve is dust of fracture essentially free from clay or shale, the percentages shown for use in concrete subject to abrasion and in other concrete may be increased to 5.0% and 7.0%, respectively.

**Example: No.57 Sieve Analysis**

Sieve Size	Grams Retained	% Retained	% Passing	VDOT Specs. (% Passing)
37.5 mm (1 1/2 in.)	0.0	0.0	100	100
25.0 mm (1 in.)	97.7	1.0	99	95 - 100
19.0 mm (3/4 in.)	1087.8	10.8	88	
12.5 mm (1/2 in.)	4269.8	42.5	46	25 - 60
9.5 mm (3/8 in.)	2286.3	22.8	23	
4.75 mm (No. 4)	1805.2	18.0	5	0 - 10
2.36 mm (No. 8)	210.7	2.1	3	0 - 5
Total Wt.	10037.5			

25.0 mm (1 in.) sieve % retained =

Weight retained: 97.7 grams =  $0.0097 \times 100 = 1.0\%$

Total weight of sample: 10037.5 grams

After finding the percent retained on each sieve, we subtract the percentage retained on each standard sieve from 100 to obtain the percent passing, as illustrated below:

37.5 mm (1 1/2 in.) sieve  $100.0 - 0.0 = 100\%$

25.0 mm (1 in.) sieve  $100.0 - 1.0 = 99\%$

The percent passing is compared to the VDOT specification range to determine if the sample passes.

## Crusher Run

- (a) Grading - Grading shall conform to the following when tested in accordance with the requirements of AASHTO T27:

### % by Mass of Materials Passing Sieve

Size No.	63 mm 2 ½ in.	50 mm 2 in.	37.5 mm 1 ½ in.	25.0 mm 1 in.	19.0 mm ¾ in.	4.75 mm No. 4
24	Min. 100	95±5				32±18
25			Min. 100	95±5		32±18
26				Min. 100	95±5	38±22

- (b) Atterberg Limits - The liquid limit shall be not more than 25. The plasticity index shall be not more than 3. Tests will be performed in accordance with the requirements of VTM-7.
- (c) Soundness Loss - Soundness loss shall conform to the requirements of Table II-4 for aggregate bases. Tests will be performed in accordance with the requirements of AASHTO T103 or T104.
- (d) Abrasion Loss - Abrasion Loss shall be not more than 45 percent. Tests will be performed in accordance with the requirements of AASHTO T96. (c) Soundness Loss - Soundness loss shall conform to the requirements of Table II-4 for aggregate bases. Tests will be performed in accordance with the requirements of AASHTO T103 or T104.

Table II-3  
SIZES OF OPEN GRADED COURSE AGGREGATES

V.A. Size No.	Amounts Finer Than Each Laboratory Sieve (Square Openings) (% by Weight)															
	4 in. 100 mm	3 1/2 in. 87.5 mm	3 in. 75 mm	2 1/2 in. 62.5 mm	2 in. 50 mm	1 1/2 in. 37.5 mm	1 in. 25 mm	3/4 in. 19 mm	1/2 in. 12.5 mm	3/8 in. 9.5 mm	No. 4 4.75 mm	No. 8 2.36 mm	No. 16 1.18 mm	No. 50 300 μm	No. 100 150 μm	
1	Min. 100	90-100		25-60		Max. 15		Max. 5								
2			Min. 100	90-100	35-70	Max. 15		Max. 5								
3				Min. 100	90-100	35-70	0-15		Max. 5							
357				Min. 100	95-100		35-70		10-30		Max. 5					
5						Min. 100	90-100	20-55	Max. 10	Max. 5						
56						Min. 100	90-100	40-85	10-40	Max. 15	Max. 5					
57						Min. 100	95-100		25-60		Max. 10	Max. 5				
67							Min. 100	90-100		20-55	Max. 10	Max. 5				
68							Min. 100	90-100		30-65	5-25	Max. 10	Max. 5			
7							Min. 100	90-100	40-70	Max. 15	Max. 5					
78							Min. 100	90-100	40-75	5-25	Max. 10	Max. 5				
8							Min. 100	90-100	85-100	10-30	Max. 10	Max. 5				
8P							Min. 100	90-100	75-100	5-30	Max. 5					
9							Min. 100	90-100	85-100	10-40	Max. 10	Max. 5				
10							Min. 100	90-100	85-100							10-30

## Knowledge Check

### Chapter 5 Modified Acceptance

1. What is the rate of sampling under the Modified Acceptance Plan for Open Graded Aggregates?
  - A. one per 500 tons
  - B. one per 1000 tons
  - C. one per 1500 tons
  - D. one per 2000 tons
  
2. The sample taken for open graded aggregates accepted under the Modified Acceptance Plan is taken from:
  - A. Conveyor Belt
  - B. Stockpile
  - C. Barge
  - D. All of the above
  
3. Does the Quality Control Technician have to be certified?
  - A. Yes
  - B. No
  
4. All Open-Graded Aggregates must have a job-mix submitted before production can start.
  - A. True
  - B. False

**Problem No. 1 Sieve Analysis**

**Open Graded Aggregates**

Check the following sieve analysis of a sample of natural sand for use in concrete not subject to abrasion and determine if it meets Virginia Department of Transportation requirements for Grading "A" Sand. Circle the sieve(s) not passing, if any.

Sieve Size	Cumulative Grams Retained	Cumulative % Retained	% Passing	VDOT Specs. (% Passing)
9.5 mm (3/8 in.)	0.0			
4.75 mm (No. 4)	16.6			
2.36 mm ( No. 8)	64.5			
1.18 mm (No. 16)	214.1			
600 $\mu\text{m}$ (No. 30)	389.2			
300 $\mu\text{m}$ (No. 50)	483.0			
150 $\mu\text{m}$ (No. 100)	543.4			
75 $\mu\text{m}$ (No. 200)	565.0			
Total Wt.	573.0			

Does this sample pass?      Yes \_\_\_\_\_ No \_\_\_\_\_

**Problem No. 2 Sieve Analysis****Open Graded Aggregates**

Check the following sieve analysis of a sample of 57s and determine if it meets Virginia Department of Transportation requirements. Circle the sieve(s) not passing, if any.

Sieve Size	Grams Retained	% Retained	% Passing	VDOT Specs. (% Passing)
37.5 mm (1 1/2 in.)	0.0			
25.0 mm (1 in.)	0.0			
19.0 mm (3/4 in.)	703.2			
12.5 mm (1/2 in.)	4544.7			
9.5 mm (3/8 in.)	2247.8			
4.75 mm (No. 4)	2250.6			
2.36 mm (No. 8)	116.1			
Total Wt.	10120.7			

Does this sample pass?      Yes\_\_\_\_\_ No\_\_\_\_\_

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