

## 5-692.100 SAMPLING

### A. Rate of Sampling

The Schedule of Materials Control outlines the minimum sampling and testing required for most materials used in highway construction. Tab. A 5-692.100 is an example of the Grading and Base section of the Schedule.

The rate of sampling and testing may change from year to year. Always use the Schedule included in your contract documents or the most current approved Schedule.

Where there is unusual variation of the material, additional samples should be taken to assure quality and uniformity.

The vast majority of samples taken by the Agency should be for project acceptance of materials only. All samples taken on a project for the quality control of the work are an essential part of the record of the work. Samples should not be taken for the sole purpose of obtaining additional data or for satisfying the curiosity of the inspector or the contractor.

If an informational sample is absolutely necessary, it should be obtained from a stockpile or from material not yet incorporated into the work. If this sample is submitted to the District or Central laboratory, it should be indicated on the sample identification card as "Informational". Unless a sample is so identified at the time it is submitted to the laboratory, the sample will be treated as a project acceptance sample.

Sample test results should be available at all times for review by qualified personnel. Under the Random Sampling Test Method, the contractor will be entitled to view only the average of the four random sampled test results.

### B. Sampling for Field Tests

Sample size and method of sampling for the various field tests are included with the individual test method.

### C. Samples to be submitted to the Laboratory

#### 1. Samples of Base, Surface and Shoulder Aggregates

Obtain a minimum 15 kg (25 lb.) sample from the road at a time when the material is ready for compaction. See section 5-692.211 for instructions on sampling.

#### 2. Embankment Construction

In order to obtain a meaningful check on the work being performed in the field, large samples should be taken and quartered, with one half submitted to the laboratory and the other half tested in the field. The textural classification and moisture density relationship should be compared to field results as a check on the field work. The group index should be used as a guide in soil selection.

### D. Origin of Field and Laboratory Samples

All samples should be taken from the roadway; except for classes 1, 2 and 7 shoulder surfacing aggregate sampled under Specification 3138.3 and samples taken for bituminous extraction, percent of crushing and quality tests, which may be taken from a source pit or stockpile.

SCHEDULE OF MATERIALS CONTROL

I. GRADING AND BASE CONSTRUCTION ITEMS ([www.mrr.dot.state.mn.us/pavement/GradingandBase/gradingandbase.asp](http://www.mrr.dot.state.mn.us/pavement/GradingandBase/gradingandbase.asp))

Please contact the Mn/DOT District Independent Assurance Inspector when project starts to provide servicing of your project.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
1. GRADATION(5-692-210) (a) Aggregate Surfacing (2118) (b) Aggregate Base (2211) (c) Aggregate Shoulders (2221) (d) Bituminous Treated Base (2204)	3138 & Special Provisions	Random Sampling Gradation Acceptance Method (See Spec. 2211.3F) & (5-692.700)	02115-03, 02154-02 & 24346-02	None except (See Note 1)	10-15 kg (25 lb.)
(c) Stabilizing Aggregate (2105)	3149 & Special Provisions				
(f) Permeable Aggregate Open Graded Aggregate Base (OGAB)	Special Provisions	1/1000 t, or 1/600 m <sup>3</sup> (LV), or 1/460 m <sup>3</sup> (CV) or 1/1000 ton, or 1/714 CuYd (LV) or 1/550 CuYd (CV)	21760-03a, 21760-03a & 24346-02	1 per source	10-15 kg (25 lb.)
(g) Binder Soil (3138.2B)	3146	2 per source (See Note 1)		1 per source	5 kg (10 lb.)
(h) Granular Borrow Select Granular Borrow (2105)	3149 & Special Provisions	0-65,000 m <sup>3</sup> (LV) – minimum of 1/5,000 m <sup>3</sup> (LV) or 7, which ever is less 66,000-130,000 m <sup>3</sup> (LV) – minimum 10 required 131,000-260,000 m <sup>3</sup> (LV) – minimum 15 required 261,000 m <sup>3</sup> (LV) or more – minimum 1/20,000 m <sup>3</sup> (LV)  0-50,000 m <sup>3</sup> (CV) – minimum of 1/4,000 m <sup>3</sup> or 7, which ever is less 51,000-100,000 m <sup>3</sup> (CV) – minimum 10 required 101,000-200,000 m <sup>3</sup> (CV) – minimum 15 required 201,000 m <sup>3</sup> (CV) or more – minimum 1/15,000 m <sup>3</sup> (CV)  1 m <sup>3</sup> (LV) = 1.31 CuYd (LV) 1 m <sup>3</sup> (CV) = 1.31 CuYd (CV) (See Note 1)		1 per source	10-15 kg (25 lb.)
(i) Granular Filter	3601 & Special Provisions	1 per source (See Note 1)			

SCHEDULE OF MATERIALS CONTROL

I. GRADING AND BASE CONSTRUCTION ITEMS (Cont'd)

Please contact the Mn/DOT District Independent Assurance Inspector when project starts to provide servicing of your project.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
(j) Granular Backfill (2451) (k) Aggregate Backfill (2451) (l) Granular Bedding (2451) (m) Aggregate Bedding (2451) (n) Coarse Filter (2451) (o) Fine Filter (2502) (p) Sand Cover (2206)	3149	1 per source (See Note 1)	02115-03, 21760-03a & 24346-02	1 per source	10-15 kg (25 lb.)
(q) Embankment Soil (Excavation and Borrow)	2105	None	02115-03 & 21760-03a	1 per major soil for Identification (Specified Density Only)	5 kg (10 lb.)

NOTE 1: No laboratory samples for 1,000 metric ton [1,000 ton] or 600 m<sup>3</sup> (LV) [714 CuYd (LV)] or 460 m<sup>3</sup> (CV) [550 CuYd (CV)] or less. First laboratory samples shall be taken within the first 3,000 metric ton [3,000 ton] and shall have a field companion sample.

LV = Loose Volume  
CV = Compacted Volume

If salvaged bituminous is used, submit a companion to the first Random Sampled gradation for a bituminous extraction gradation.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
2. "ONE POINT DENSITY" (5-692.583) (a) Bituminous Stabilized Subgrade	2207	1/1,500 m <sup>3</sup> (LV) or 1/1,200 m <sup>3</sup> (CV) or [1/2,000 CuYd (LV) or 1/1,500 Cu Yd (CV)]	24587-01 Retain in Field	None	
3. MOISTURE-DENSITY TEST* (5-592.222) (a) Aggregate Base	2211	1/40,000 t/source or	24587-01 Retain in Field	One sample minimum and additional samples as required	25-30 kg (50 lb.)
(b) Aggregate Shoulder	2221	[1/40,000 ton/source]			
(c) Soil – Cement Base	2206	1/350 m <sup>3</sup> (LV) or 1/1,270 m <sup>3</sup> (CV) or [1/450 CuYd (LV) or 1/350 Cu Yd (CV)]		None	
(d) Embankment Soil	2105	1 per major soil.		Two samples per project and additional samples as required	

\*When Specified Density is Required.

SCHEDULE OF MATERIALS CONTROL

I. GRADING AND BASE CONSTRUCTION ITEMS (Cont'd)

Please contact the Mn/DOT District Independent Assurance Inspector when project starts to provide servicing of your project.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>4. RELATIVE DENSITY TEST* (5-692.251)</b>			02115-03 & 21760-03b	None	
(a) Aggregate Base	2211	1/1,800 t, 1/1,000 m <sup>3</sup> (LV) or 1/800 m <sup>3</sup> (CV)			
(b) Aggregate Shoulder	2221	or [1/1,800 ton,			
(c) Bituminous Stabilized Subgrade	2207	1/1,300CuYd (LV), or 1/1000 CuYd (CV)]			
<b>*When Specific Density is Required.</b>					
(d) Soil – Cement Base	2206	1/350 m <sup>3</sup> (LV) or 1/270 m <sup>3</sup> (CV) or [1 per 450 CuYd (LV) or 1/350 CuYd (CV)]			
(e) Embankment Soil (Excavation and Borrow)	2105 & Special Provisions	1/3,000 m <sup>3</sup> (LV) or 1/2,300 m <sup>3</sup> (CV) or [1 /4,000 CuYd (LV) or 1/3,000 CuYd (CV)]			
<b>4a. PENETRATION INDEX METHOD (Procedures**)</b>			02115-03 & 2170-02	None	
Aggregate Base/Shouldering Classes 5, 6, and 7	2211	2 DCP***tests/1,800 t, or 800 m <sup>3</sup> (CV) or [2DCP tests/1,800 ton, or 1,000 CuYd (CV)]			
**Dynamic Cone Penetrometer – Procedure @ <a href="http://www.mnr.dot.state.mn.us/pavement/GradingandBase/gradingandbase.asp">www.mnr.dot.state.mn.us/pavement/GradingandBase/gradingandbase.asp</a>					
<b>5. RELATIVE MOISTURE TEST BEFORE PRIMING (5-692.253)</b>			21760-03b	None	
(a) Aggregate (2211)	2321 & 2358 Special Provisions	Upper 75 mm (3 in) 1/350 m <sup>3</sup> (LV) or 1/270 m <sup>3</sup> (CV)			
(b) Aggregate Shoulder (2221)		or [1/450 CuYd (LV) or 1,350 CuYd (CV)]			

SCHEDULE OF MATERIALS CONTROL

I. GRADING AND BASE CONSTRUCTION ITEMS (Cont'd)

Please contact the Mn/DOT District Independent Assurance Inspector when project starts to provide servicing of your project.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>6. RELATIVE MOISTURE TEST* AT TIME OF COMPACTION (5-692.253)</b> (a) Aggregate Base (b) Aggregate Shoulder *When Specific Density or Penetration Index Method is Required	2211  2221	1/1,800 t, 1/1,000 m <sup>3</sup> (LV) or 1/800 m <sup>3</sup> (CV) or [1/1,800 ton, 1/1,300 CuYd (LV), or 1/1000 CuYd (CV)]	02115-03 & 21760-03b	None	
(c) Bituminous Stabilized Subgrade (5-692.582) SS-1 Mixture	2207	1/1,000 m <sup>3</sup> (LV) or 1/800 m <sup>3</sup> (CV) or [1/1,800 ton, 1/1,300 CuYd (LV), or 1/1000 CuYd (CV)]	21760-03b	None	
(d) Soil - Cement Base	2206	1/350 m <sup>3</sup> (LV) or 1/270 m <sup>3</sup> (CV) or [1 per 450 CuYd (LV) or 1/350 CuYd (CV)]	21760-03b	None	
(e) Embankment Soil (Excavation and Borrow) (5-692.253)	2105	1/2,000 m <sup>3</sup> (LV) or 1/1,500 m <sup>3</sup> (CV) or [1/2,600 CuYd (LV) or 1/2,000 CuYd (CV)]	21760-03b	None	
<b>7. PULVERIZATION TEST (5-692.260)</b> (a) Binder Soil (3138)	3146	1 per day	21760-03b	None	
(b) Soil - Cement Base	2206	1/350 m <sup>3</sup> (LV) or 1/270 m <sup>3</sup> (CV) or [1 per 450 CuYd (LV) or 1/350 CuYd (CV)] 1/hour if plant mixed			
<b>8. PERCENT CRUSHING</b> (a) Belt Samples (5-692.203)	3138 & 3149 & Special Provisions	Once each day	24346-02	None	
(b) Particle Count (5-692.204)		One per Project	02463 Retain in Field		

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SCHEDULE OF MATERIALS CONTROL

1. GRADING AND BASE CONSTRUCTION ITEMS (Cont'd)

Please contact the Mn/DOT District Independent Assurance Inspector when project starts to provide servicing of your project.

Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
9. AGGREGATE (Quality Tests)	3138 & Special Provisions	None	24346-02	Submit sample of aggregate retained on the 4.75 mm (#4) sieve from each source	25 kg (50 lb.)
				1 per source (Total Sample)	10-15 kg (25 lb.)

EXAMPLE

## 5-692.101

## SAMPLE IDENTIFICATION CARD

- A. Samples submitted to the laboratory must contain a sample identification card properly protected against moisture and soiling. Complete information is necessary so that analysis of the sample can be expedited in either the Central or District Laboratory.
- B. The illustration that follows is an example of a properly completed identification card:
1. "Field Identification"  
In the example, 15-3 indicates that this is representative of the same material as field test no. 15-3.
  2. "Spec."  
Include both specification number and class of material.
  3. "S.P."  
Submit all samples under the lowest project number.
  4. "Submitted by"  
Enter the name of the person submitting the sample. If the sample is submitted as an Independent Assurance Sample, include the visiting IAS Inspector's name and state "Independent Assurance Sample."
  5. "Proj. Engr."  
Enter the name of the project engineer.
  6. "Type of material and use"  
Enter what the material is to be used for and the specification.  
Example:  
Base (2211)  
Shouldering (2221)  
Subgrade Soil (2105)
  7. "Mix Proportions"  
If the Contractor is using a combination of crushed quarry rock and natural gravel, report the % crushed rock so that the gradation requirement is clear.
  8. "Pit No."  
Give Pit No. or owner's name.
  9. "Source"  
Usually not required for grading or base work.
  10. "Location"  
Location of pit (either geographic, as in illustration, or legal description with Section, Town, and Range).
  11. "Sample taken from"  
Windrow, compacted base, belt, borrow pit, etc. Also, give stationing, if applicable.
  12. "Tests required"  
Example:  
Gradation  
Shale  
Proctor  
LA Rattler
  13. "Remarks"  
If field test results are available at the time the sample is submitted, include the results. (Most sample cards submitted should include this companion information). Also, include any observations or information that would assist in evaluating the test results of the sample. Include the gradation specification requirements of material.

Mn/DOT TP-02410-02 <b>LAB I.D. NUMBER</b>	Minnesota Department of Transportation <b>Sample Identification Card</b> Date Sampled: <u>9-21-00</u> Field I.D.: <u>15-3</u> Spec No./Type: <u>3188-5</u> Spec Yr.: <u>2000</u> Mix Design Report #: _____
<input checked="" type="checkbox"/> S.P.    Proj. No. <u>2710-05</u> Br. No.: <u>27007</u> <input type="checkbox"/> S.A.P.    Submitted By: <u>Frank Lee</u> Tel. No.: <u>(651) 779-5608</u> <input checked="" type="checkbox"/> Co./City    Proj. Eng.: <u>Bob Cott</u> Fax No.: <u>(651) 779-5616</u> <input type="checkbox"/> Maint.    County/City: <u>Hennepin</u> District No.: <u>MW</u> T.H. No.: <u>169</u> Type of Material and Use: <u>Base + Shouldering (2211 - 2221)</u> Mix Proportions %: _____ Pit No./Name: <u>T.H.E. Pits 16909</u> Legal Description: _____ Manufacturer/Contractor: _____ Location: _____    Lot No.: _____ Sample Taken From: <u>Window</u> Tests Required: <u>Gradation, Shale + Proctor</u> Remarks: <u>For check of field</u> Date Received: _____ <u>companion sample</u>	

PERCENT PASSING		
	Field Result No. <u>15-3</u>	Job Mix/Spec. Required
50mm(2")		
37.5mm (1 1/2")		
31.5mm(1 1/4")		
25.0mm (1")	<u>100</u>	<u>100</u>
19.0mm(3/4")	<u>97.6</u>	<u>90-100</u>
16.0mm(5/8")		
12.5mm(1/2")		
9.5mm(3/8")	<u>73.3</u>	<u>50-90</u>
4.7mm(#4)	<u>45.0</u>	<u>35-80</u>
3.35mm(#6)		
2.36mm(#8)		
2.00mm(#10)	<u>38.9</u>	<u>20-65</u>
1.18mm(#16)		
850 μm (#20)		
600 μm (#30)		
425 μm (#40)	<u>26.2</u>	<u>10-35</u>
300 μm (#50)		
180 μm (#80)		
150 μm (#100)		
75 μm (#200)	<u>6.3</u>	<u>3-10</u>
W.M. / F.M.		
200/1" Ratio (75 μm/25mm)		
Remarks:		

Mn/DOT Aggregate Sample Card (Front)  
 Percent Passing (Back)  
 Fig. 1 5-692.101

**5-692.110 INDEPENDENT ASSURANCE SAMPLING & TESTING**

Independent Assurance sampling and testing is required on all Federal Aid, State Funds and County Federal Aid Projects. Assurance sampling is the direct responsibility of the District Materials Engineer. The district materials office will notify each project engineer on Form 24121 of the items and number of Independent Assurance samples required. (Fig. 1 5-692.110)

The purpose of this sampling is to verify the inspector's sampling and testing procedures. The testing equipment being used is also checked during Independent Assurance sampling. The project personnel are required to notify the district materials office when any work requiring Independent Assurance sampling has begun. It is necessary for scheduling that some lead time be given in the notifications. It is the responsibility of the project personnel to keep a record of Independent Assurance contacts so that a sufficient number of timely contacts can be made. Independent Assurance sampling is not a materials acceptance requirement; it is for the benefit of the project engineer and assures him that equipment and procedures meet requirements so that his quality control testing is accurate.

Procedure:

The District Assurance Inspector is required to review testing and procedure and to obtain laboratory samples. He will record his findings on Form 24139. (See Fig. 2 5-692.110).

To obtain the maximum benefit from the effort required to obtain Independent Assurance samples of grading and base items, the following procedures are recommended.

- A. Any Independent Assurance test or sampling procedures should be performed by the project personnel assigned to that particular phase of the work.
- B. The equipment used and procedures followed during Independent Assurance sampling and testing should be the same as the equipment used and the procedures followed during the routine sampling and testing requirement on the job.
- C. If the procedure followed or equipment used does not conform to the applicable standard, note the fact on the report (Form 24139) and advise the inspector of the corrections required for subsequent tests.
- D. Independent Assurance gradation test samples must be companion samples of field gradation tests so that field and lab results can be compared.
- E. If an Independent Assurance relative density test is observed and the density does not meet requirements, report the test result and the action taken by the inspector.
- F. If it becomes evident that a required Independent Assurance test or sample cannot be obtained, use Form 24139 to report the type of construction, sample, and standard involved and the reasons for not obtaining the test or sample.

It is assumed that the Independent Assurance samples and tests are fair representatives of the materials sampling and testing procedures and workmanship on each S.P., so any substantial deviation between an Independent Assurance sample or test and a companion sample or test must be investigated.

TP-24-121-04 (11/2000)



### Project Summary of Independent Assurance Testing

S.P.	T.H.	Fed. No.	Date Started	Date Completed	Engineer
Location					
GRADING & BASE					
Grading	Aggregate Base			Remarks	
	Densities Required	Densities Required	Inspector Name		
Date Issued:				Independent Assurance Tester:	

BITUMINOUS											
Agency					Contractor						
Extract/Grad Gradations Required	Mix. Prop. Required	Densities Required	Nuc./Obsrv Mix Sampling	Inspector Name	Mix Sampling	Extract/Grad Gradations Required	Mix Prop. Required	Nuc./Spec. Densities Required	Mix Prop. Required	Bituminous Plant Name	Inspector's Name
										Nuc./Gauge	

CONCRETE											
Agency					Contractor						
Grad./Plant Required	Air Tests Required	Slumps Required	Cylinders Required	Inspector Name	Concrete Plant	Gradations Required	Air Tests Required	Gradations Required	Slumps Required	Cylinders Required	Inspector's Name

Fig. 1 5-692.110



Minnesota Department of Transportation  
Office of Materials and Road Research

TP 24139-03 (1/2001)

### Report of Independent Assurance Sampling And Testing for Grading and Base Items

To: Project Engineer  
District Materials Engineer

Date Sampled \_\_\_\_\_

From: \_\_\_\_\_ Independent Assurance Inspector

S.P. \_\_\_\_\_ T.H. \_\_\_\_\_ Fed. No. \_\_\_\_\_

Location \_\_\_\_\_

#### GRADING

Independent Assurance Density Tests	Location	Depth Below Grade	Maximum Density	Density kg/m <sup>3</sup> (lb/ft <sup>3</sup> )	Relative Density	Test Performed By

#### BASE AND SHOULDERING

Independent Assurance Gradation Samples	Class	Location	Pit No.	Sampled By		

  

Independent Assurance Density Tests	Class	Location	Maximum Density	Density kg/m <sup>3</sup> (lb/ft <sup>3</sup> )	Relative Density/ DCP Penetration	Test Performed By

- Was the observed sampling and splitting for the gradation testing conducted according to the procedures in the Grading and Base Manual? Yes\_\_\_\_ No\_\_\_\_
- Was the observed field testing conducted according to the procedures in the Grading and Base Manual? Yes\_\_\_\_ No\_\_\_\_

Note: If the answer to questions No. 1 and/or No. 2 is "No", please explain under remarks.

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_