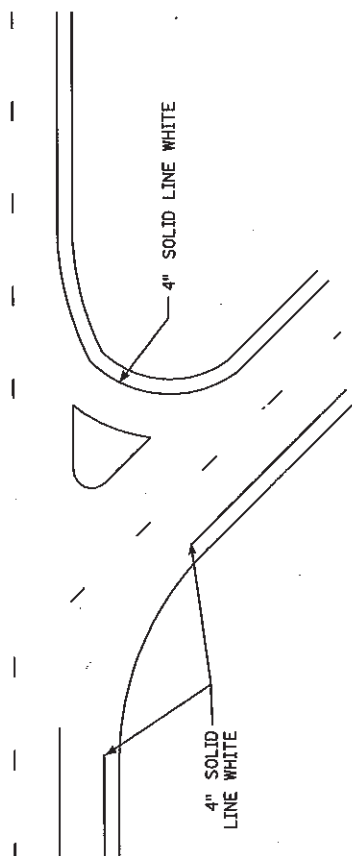
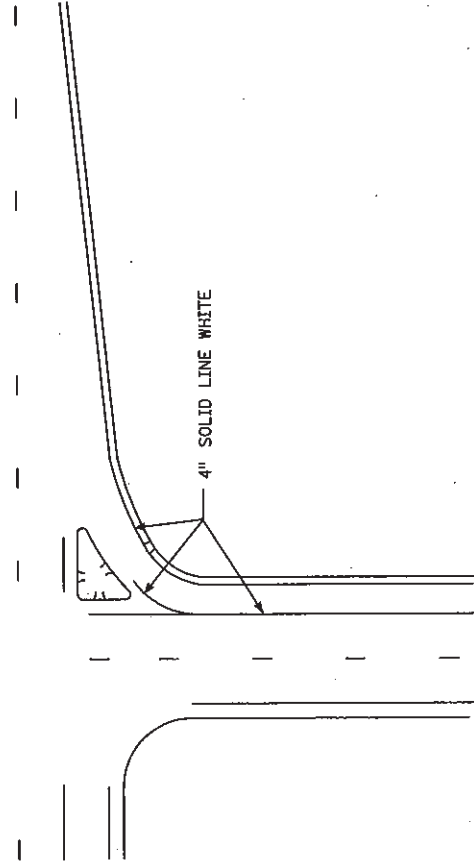




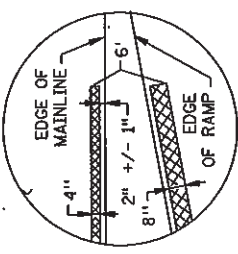
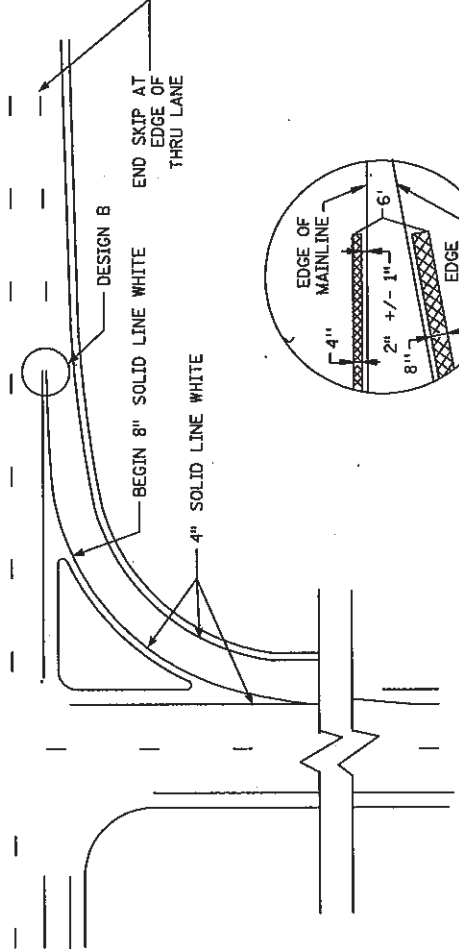
**FREE RIGHT STOP CONDITION**



**FREE RIGHT YIELD CONDITION**



**FREE RIGHT MERGE CONDITION**



**DESIGN B**

I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

ENGINEER *James A. White* L.I.C. NO. 26405



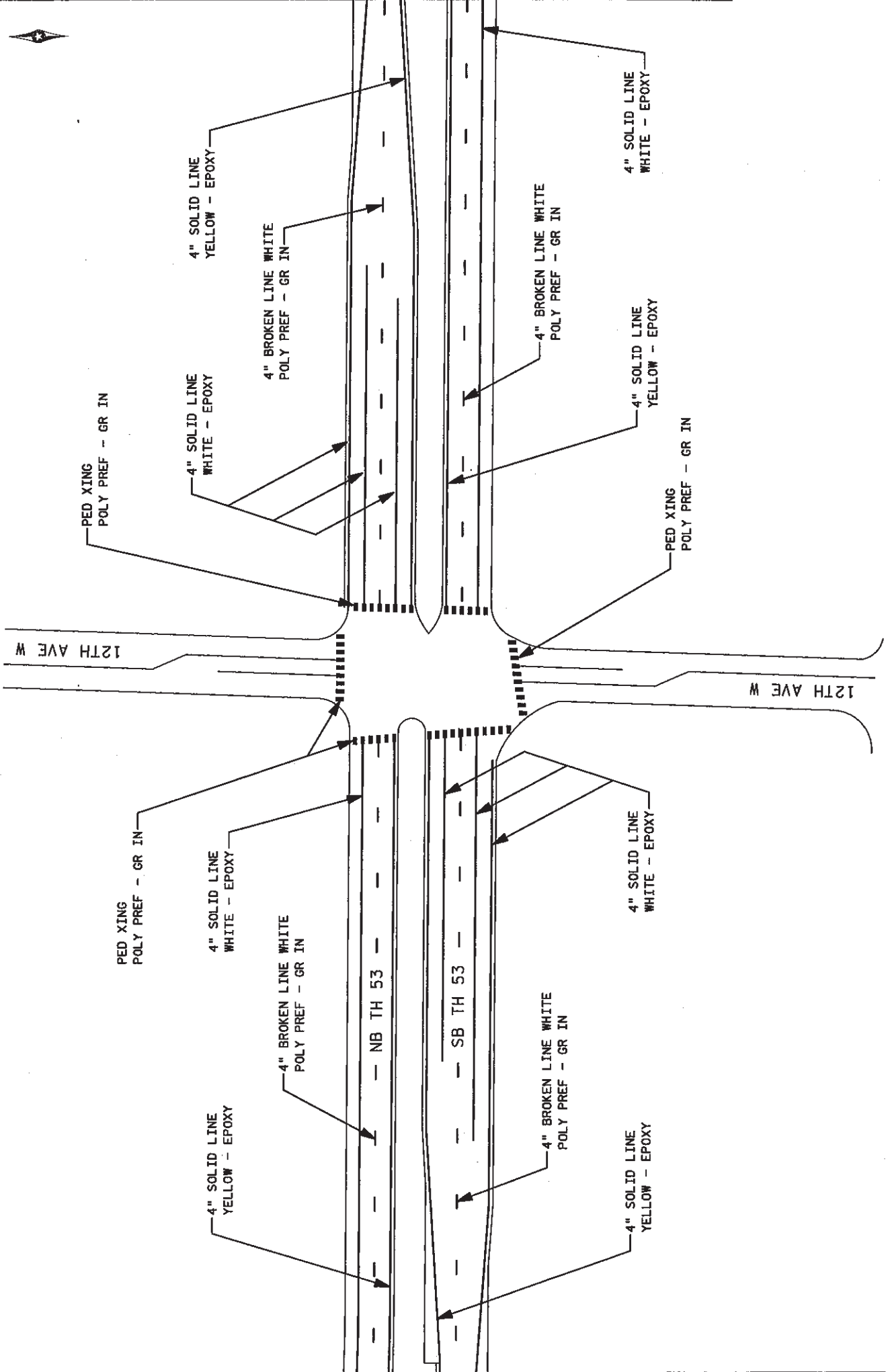
District 1

IPLOT NAME:  
PATH & FILENAME:

1882177\_pml16-25  
R:\TH 053\882177\Plan\882177\_pml.dgn

PLOTTED AND/OR REVISED:

18-JUN-2008



I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

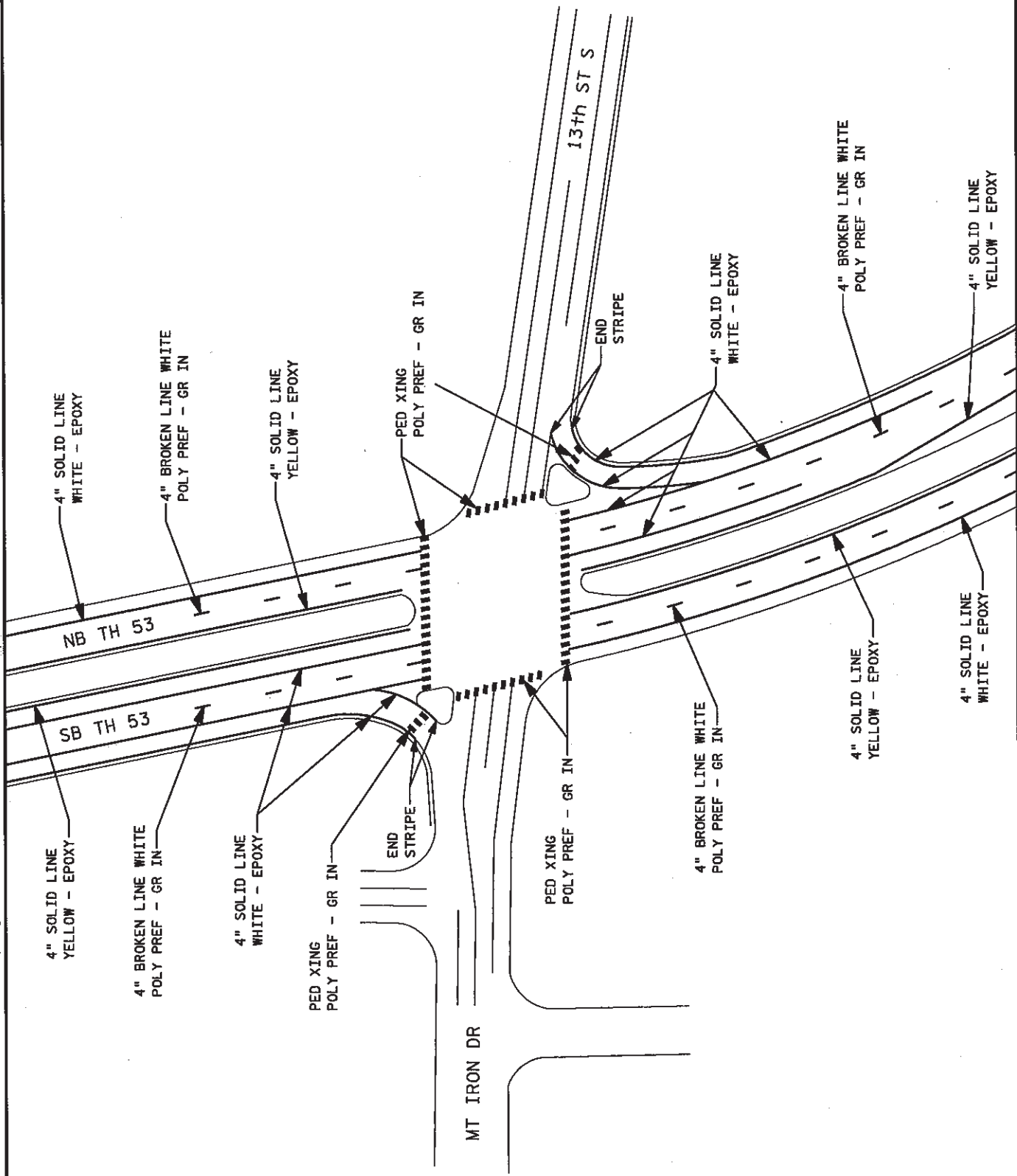
ENGINEER James A. Miska L.C. NO. 26405

S.P. 8821-177 (TH 53)

PAVEMENT MARKING DETAILS - TH 53 & 12TH AVE W

SHEET 25 OF 31 SHEETS





I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

ENGINEER *James A. Miska* LIC. NO. 26405  
 STATE OF MINN.

PAVEMENT MARKING DETAILS - TH 53 & 13TH ST S

S.P. 8821-177 (TH 53)

SHEET 26 OF 31 SHEETS



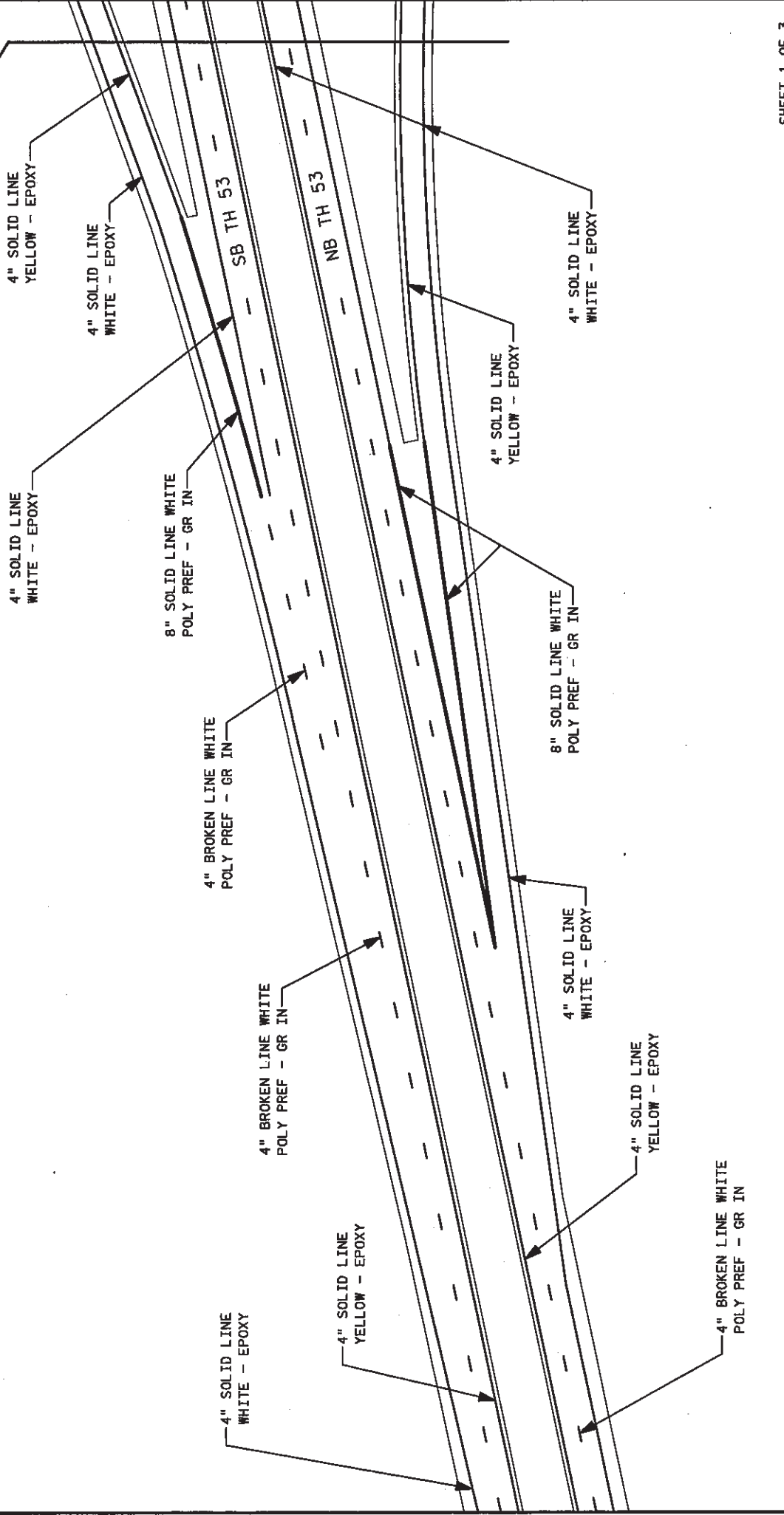
District 1  
PLOT NAME: 1882177\_pml2-27  
PATH & FILENAME: R:\TH\_053\882177\Plan\882177\_pml.dgn

PLOTTED AND/OR REVISED:

18-JUN-2008



MATCHLINE A



SHEET 1 OF 3

I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A FULLY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

ENGINEER James A. Mabe LIC. NO. 26405  
JAMES A. MABE

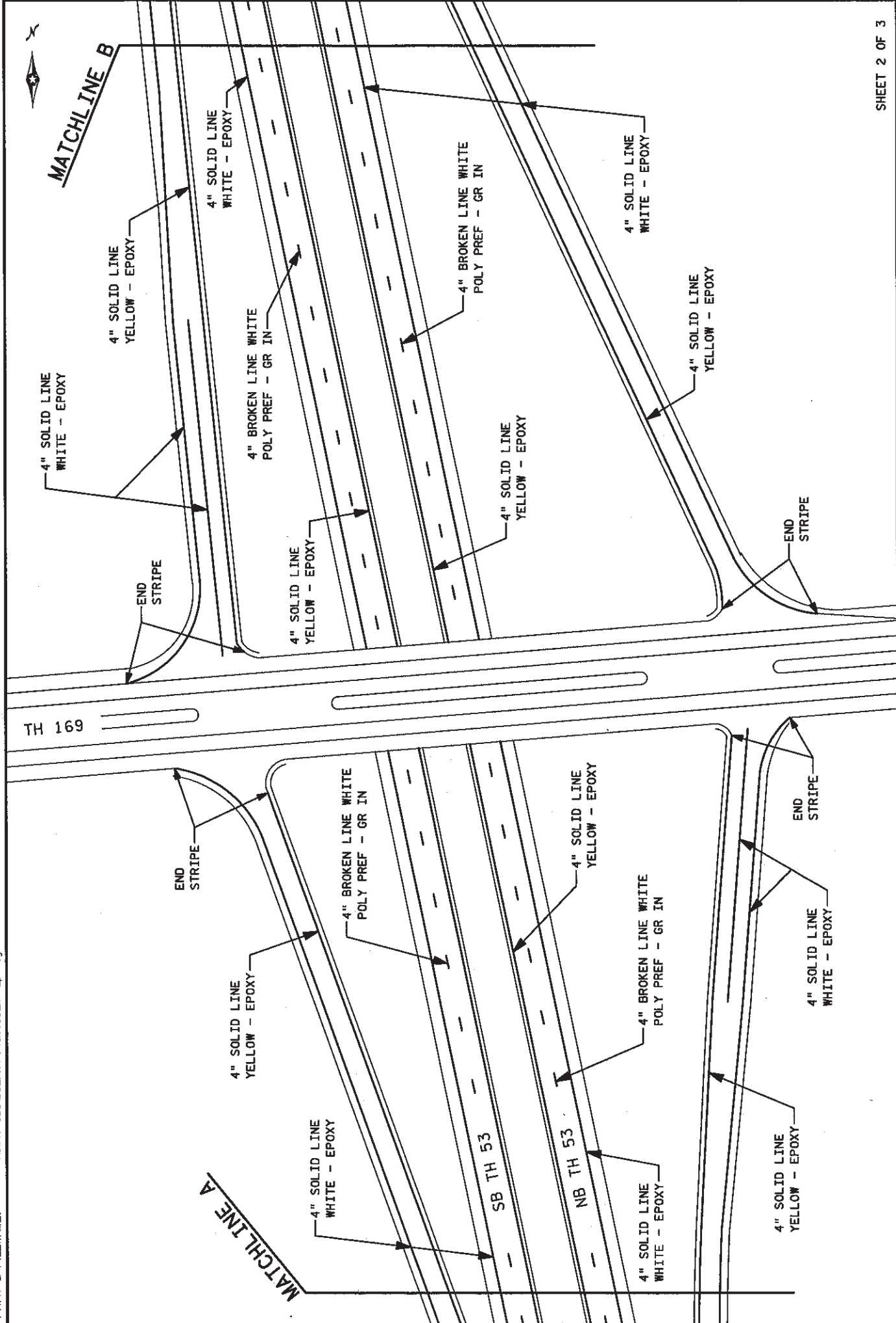
PAVEMENT MARKING DETAILS - TH 53 & TH 169

S.P. 8821-177 (TH 53)

SHEET 27 OF 31 SHEETS





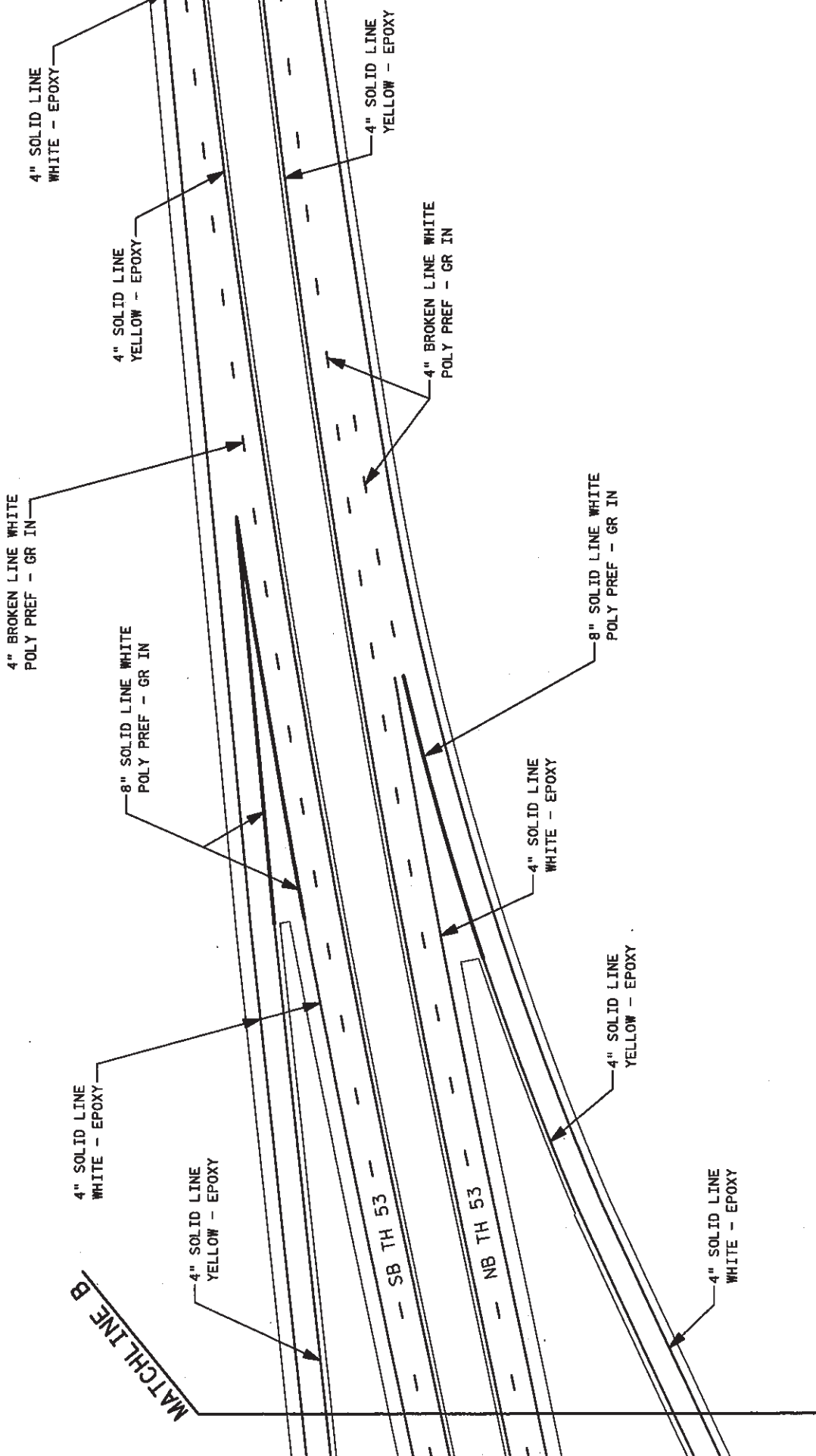


I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.



District 1  
PLOT NAME: 1882177\_pml4-29  
PATH & FILENAME: RATH\_053882177\_PlanV882177\_pml.dgn

18-JUN-2008  
PLOTTED AND/OR REVISED:



SHEET 3 OF 3

I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

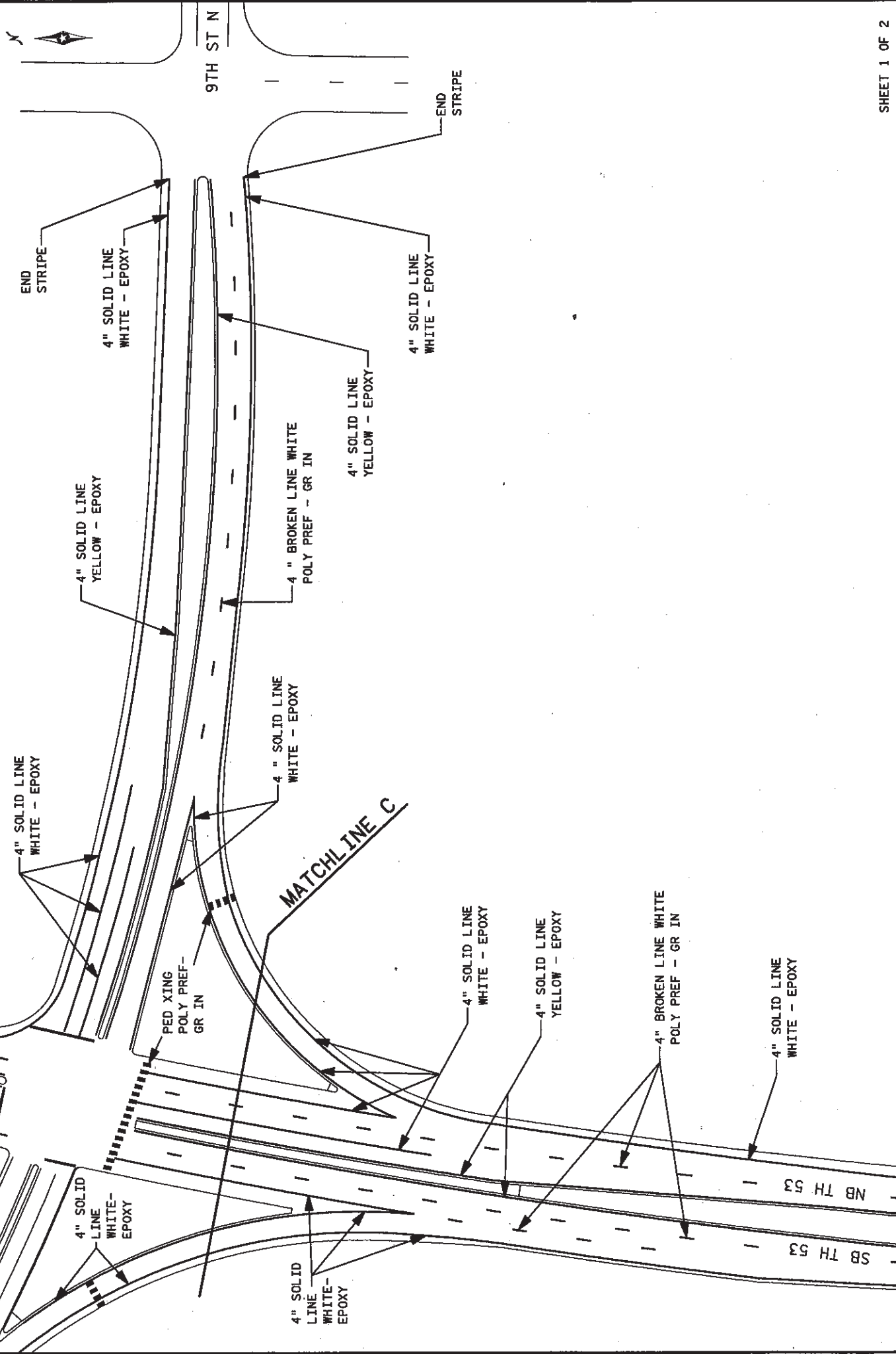
ENGINEER James A. Mills LIC. NO. 26405

PAVEMENT MARKING DETAILS - TH 53 & TH 169

S.P. 8821-177 (TH 53)

SHEET 29 OF 31 SHEETS







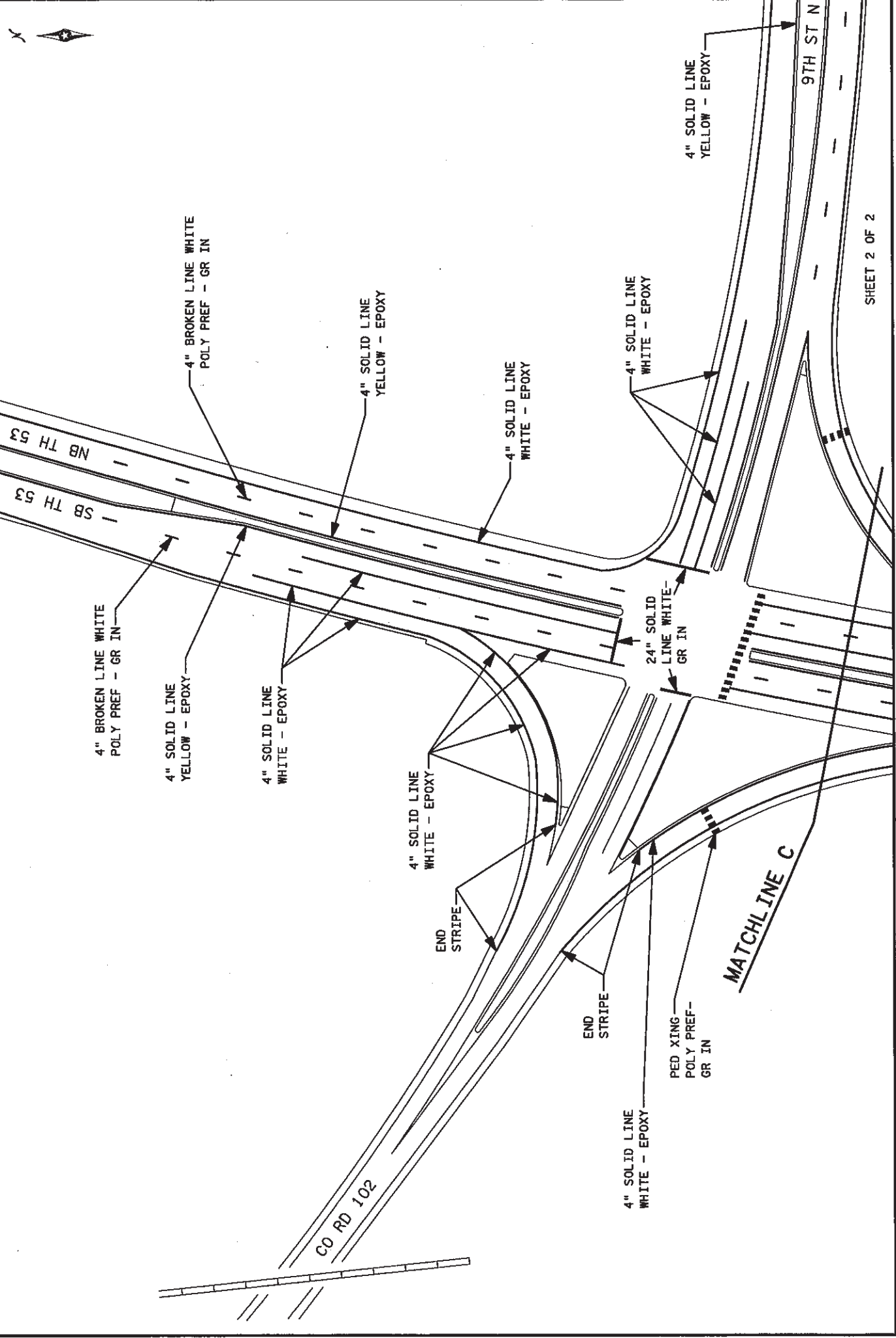
District 1

IPLOT NAME: 1882177\_pml17-31

PATH & FILENAME: RATH\_053882177\_Plan\882177\_pml.dgn

PLOTTED AND/OR REVISED:

18-JUN-2008



SHEET 2 OF 2

I HEREBY CERTIFY THAT THIS PLAN SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

ENGINEER  
*James A. Mabe*  
 L.I.C. NO. 26405

PAVEMENT MARKING DETAILS

S.P. 8821-177 (TH 53)

SHEET 31 OF 31 SHEETS





**(1910) FUEL ESCALATION CLAUSE**

The provisions set forth in Mn/DOT 1910 are hereby deleted, and the following is substituted therefore:

These provisions provide for compensation adjustments in the cost of motor fuels (diesel and gasoline) consumed in prosecuting the Contract work. The Engineer will calculate the Fuel Cost Adjustments. Payments or credits will be applied to partial and final payments for work items set forth herein.

For this purpose, the Department will establish a Base Fuel Index (BFI) for fuel to be used on the Project. The Base Fuel Index will be the average of the high and low rack prices shown for No. 2 ultra low sulfur fuel oil in the "OPIS Energy Group" tabulation titled "RackFax, Minneapolis, MN, OPIS Direct Gross No. 2 Distillate Fuels" *for the day of the Contract letting*.

A Current Fuel Index (CFI) in cents per gallon will be established for each month. The CFI will be the average of the high and low rack prices shown for No. 2 ultra low sulfur fuel oil in the "OPIS Energy Group" tabulation titled "RackFax, Minneapolis, MN, OPIS Direct Gross No. 2 Distillate Fuels" averaged for the beginning and ending dates of the monthly period being adjusted.

The Engineer will compute the ratio of the Current Fuel Index to the Base Fuel Index (CFI/BFI) each month. If that ratio falls between 0.75 and 1.25, no fuel adjustment will be made that month. If the ratio is less than 0.75, a credit to the Department will be computed. If the ratio is greater than 1.25, additional payment to the Contractor will be computed.

Credit or additional payment will be computed as follows:

- (1) The Engineer will estimate the quantity of work done in that month under each of the Contract items listed below.
- (2) The Engineer will compute the gallons of fuel used in that month for each of the Contract items listed below by applying the unit fuel usage factors shown.
- (3) The Engineer will summarize the total gallons (Q) of fuel used in that month for the applicable items.
- (4) The Engineer will determine the Fuel Cost Adjustment (FCA) from the following formulas:

If the Current Fuel Index (CFI) is greater than the Base Fuel Index (BFI), the following formula shall be used to determine the amount of Fuel Cost Adjustment to be paid to the Contractor.

$$FCA = [(CFI/BFI) - 1.25] \times Q \times BFI$$

If the Current Fuel Index (CFI) is less than the Base Fuel Index (BFI), the following formula shall be used to determine the amount of Fuel Cost Adjustment to be credited to the Department.

$$FCA = [(CFI/BFI) - 0.75] \times Q \times BFI$$

Where FCA = Fuel Cost Adjustment (cents)  
 CFI = Current Fuel Index (cents per gallon)  
 BFI = Base Fuel Index (cents per gallon)  
 Q = Monthly total gallons of fuel

Basis of Payment

A Fuel Cost Adjustment payment to the Contractor will be made as a lump sum each payment period based on the last published CFI. A Fuel Cost Adjustment credit to the Department will be deducted as a lump sum each payment period from any monies due the Contractor. Upon completion of the work under the Contract, any difference between the estimated quantities previously paid and the final quantities will be determined. The CFI in effect on the day of completion of the Contract will be applied to the quantity differences in accordance with the procedures set forth above.

Schedule of Work Items

(Only items shown will be considered for compensation adjustments.)

Item	Unit	Gallons of Fuel per Unit	Unit	Gallons of Fuel per Unit
(1) Earthwork:				
2105.501	Common Excavation	Cu. Yd	0.17	m <sup>3</sup> 0.22
2105.503	Rock Excavation	Cu. Yd	0.27	m <sup>3</sup> 0.35
2105.505	Muck Excavation	Cu. Yd	0.17	m <sup>3</sup> 0.22
2105.507	Subgrade Excavation	Cu. Yd	0.17	m <sup>3</sup> 0.22
2105.515	Unclassified Excavation	Cu. Yd	0.23	m <sup>3</sup> 0.30
2105.521	Granular Borrow (EV)	Cu. Yd	0.17	m <sup>3</sup> 0.22
	Granular Borrow (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
	Granular Borrow (LV)	Cu. Yd	0.14	m <sup>3</sup> 0.18
2105.522	Select Granular Borrow (EV)	Cu. Yd	0.17	m <sup>3</sup> 0.22
	Select Granular Borrow (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
	Select Granular Borrow (LV)	Cu. Yd	0.14	m <sup>3</sup> 0.18
2105.523	Common Borrow (EV)	Cu. Yd	0.17	m <sup>3</sup> 0.22
	Common Borrow (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
	Common Borrow (LV)	Cu. Yd	0.14	m <sup>3</sup> 0.18
2105.535	Topsoil Borrow (EV)	Cu. Yd	0.17	m <sup>3</sup> 0.22
	Topsoil Borrow (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
	Topsoil Borrow (LV)	Cu. Yd	0.14	m <sup>3</sup> 0.18
2106.607	Topsoil Embankment (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
2106.607	Common Embankment (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
2106.607	Granular Embankment (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
2106.607	Select Granular Embankment(CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
2106.607	Select Granular Embankment Modified (___ %) (CV)	Cu. Yd	0.19	m <sup>3</sup> 0.25
2106.607	Excavation – Rock	Cu. Yd	0.27	m <sup>3</sup> 0.35
2106.607	Excavation – Muck	Cu. Yd	0.17	m <sup>3</sup> 0.22

Item	Unit	Gallons of Fuel per Unit	Unit	Gallons of Fuel per Unit	
(2) Aggregate Base:					
2211.501	Aggregate Base	Ton	0.55	t	0.61
2211.502	Aggregate Base (LV)	Cu. Yd	0.77	m <sup>3</sup>	1.01
2211.503	Aggregate Base (CV)	Cu. Yd	0.99	m <sup>3</sup>	1.29
(3) Aggregate Shouldering:					
2221.501	Aggregate Shouldering	Ton	0.55	t	0.61
2221.502	Aggregate Shouldering (LV)	Cu. Yd	0.77	m <sup>3</sup>	1.01
2221.503	Aggregate Shouldering (CV)	Cu. Yd	0.99	m <sup>3</sup>	1.29
(4) Concrete Pavements:					
2301.511	Structural Concrete	Cu. Yd	0.98	m <sup>3</sup>	1.28
2301.513	Structural Concrete HE	Cu. Yd	0.98	m <sup>3</sup>	1.28
(5) Bituminous Pavements:					
2350.501	Type ( ) Wearing Course Mixture ( )	Ton	0.90	t	0.99
2350.502	Type ( ) Non-Wearing Course Mixture ( )	Ton	0.90	t	0.99
2350.503	Type ( ) ( ) Course ( , ) (t)" Thick	Sq. Yd	0.051*t		
2350.503	Type ( ) ( ) Course ( , ) (t) mm Thick			m <sup>2</sup>	0.0024*t
2360.501	Type SP ( ) Wearing Course Mixture ( )	Ton	0.90	t	0.99
2360.502	Type SP ( ) Non-Wearing Course Mixture ( , )	Ton	0.90	t	0.99
2360.503	Type SP ( ) ( ) Course ( , ) (t)" thick	Sq. Yd	0.051*t		
2360.503	Type SP ( ) ( ) Course ( , ) (t) mm thick			m <sup>2</sup>	0.0024*t

*t* = thickness

**NOTE:** No price adjustments will be made on fuel used for drying and heating aggregates.



# Guidelines for Approval of Computer Generated Schedule of Prices

The *American Association of State Highway and Transportation Officials (AASHTO)* “**Expedite**” is an approved program that can be used to produce Computer Generated Schedule of Prices for submittal to Mn/DOT. This program and the required EBS files can be found on the “Bid Express” Web site ([www.bidx.com](http://www.bidx.com)).

If programs other than “**Expedite**” are used for this purpose, they must conform to the following requirements.

## Administrative Requirements

1. The Department may grant approval to individual contractors for locally developed systems; or to software developers for programs produced for use by bidders.
2. The Department will furnish, after review, written approval or denial of proposed forms or software systems.
3. Failure of a bidder to comply with the requirements of these guidelines may be cause for a proposal to be considered irregular.

## Formatting Requirements

1. The forms shall be printed on good quality 8-1/2" X 11" white paper.
2. Printing shall be in the "Portrait" format; i.e. pages shall be 8-1/2" wide and 11" high.
3. Printing shall be dark enough to produce legible copies.
4. Unit prices and extensions thereof may be written in ink or typed in the respective columns if left blank by the computer printing. This will not be considered an alteration or erasure.
5. Vertical spacing shall be so aligned so that 80 lines are printed within ten inches.
6. Horizontal spacing shall be ten to twelve characters per inch.
7. Printed copy shall be aligned a minimum of 3 inch from the left paper edge.
8. Printed pages shall be separated, placed in correct sequence and securely stapled together in the upper left corner.

9. The entire computer generated Schedule of Prices shall be firmly attached to the back cover of the proposal.

### **Data Requirements**

1. The general appearance shall approximate the Schedule of Prices in the proposal.
2. Headings and section headers shall be included.
3. Page numbers shall be printed in the same approximate location as in the Schedule of Prices in the proposal. Page sequence number shall be included in page numbering.
4. Horizontal and vertical alignment of the various columns shall approximate those used in the Schedule of Prices in the proposal.
5. The items on each page and subtotals (where applicable) shall match those on the Schedule of Prices in the proposal, and the sequence shall be the same.
6. The page number shall match that of the Schedule of Prices in the proposal.
7. Extensions shall be rounded to the nearest cent, with a half-cent being rounded upward.
8. The computer generated Schedule of Prices shall include a title page which shall list the letting date, the State project number, the description of the project, name of the bidding firm with address and telephone number, and shall be signed by an authorized firm representative.
9. A Total Bid amount shall be printed on the last page of the schedule.

Any further additions to the schedule such as revision numbers shall not be included, and will not be approved.

**For further information on guidelines for the substitute bid schedule, contact Nancy Worline, telephone No. (651) 366-4243.**

# MN/DOT INDIAN EMPLOYMENT TRACKING FORM

Mn/DOT Form 21861 (06/07)

<b>Prime Contractor:</b>	State Project (SP) Number(s):
<b>Address:</b>	Reporting Period _____ To _____

<u>Employee Name</u>	<u>Contractor</u>	<u>Trade Classification</u>	<u>Tribal ID #</u>	<u>Date of Hire</u>	<u># Of hrs on project</u>	<u>Current Status: Seasonal/Permanent/Laid-off</u>
1.						
2.						
3.						
4.						
5.						
6.						
7.						

**Please provide the reason for lay-off/termination for any of the employees listed above:**

**CONTRACTOR:**  
*The undersigned contractor hereby certifies that the listed information is true and correct as required by the Mn/DOT Special Provision for Indian Employment.*

\_\_\_\_\_ Date  
 Contractor Signature/Title





**Minnesota Department of Transportation Office of Materials Schedule of Materials Control**

**Federal Aid, State Funds, County/Municipal Federal Aid Projects and State Aid Projects**

This schedule outlines the minimum sampling and testing required for most materials used in highway construction. Some items that are rarely used or materials of recent development are often covered by special provisions and may not be shown on the schedule. For more information regarding contract requirements for testing, please reference the "Standard Specifications for Construction", Specification 1603 Materials: Specifications, Samples, Tests, and Acceptance. When sample sizes required for testing exceed 35 pounds, please submit multiple containers of the material with no individual container weighing more than 35 pounds.

Small quantities of materials may be accepted without sampling and testing. A small quantity is defined as any total quantity, for the whole project, of one material, which is smaller than the minimum quantity required for testing unless modified by the individual material items. These materials shall be from known, reliable sources, perform satisfactorily and meet the requirements for purpose intended. The inspection report (Form 02415) should include a statement to this effect and show the source. Form 2403 may be used to report small quantities of diverse materials from different sources. Form 02415 and Form 2403 (or approved revisions) are referenced in the Schedule of Materials Control for project record documentation and are required to be maintained in the project file.

Where items of small quantity are used in a critical location or significantly influence the safety, performance, strength or durability of major construction items, prior approval for their use without testing must be obtained.

Previously approved materials transferred from another project should be reported on Form 02415. The report should include: type of material, quantities involved, source, and supplier of materials. Whenever possible, include the project number for which the material was originally approved.

"If Forms 2415 and 2403 are referenced by form number within the Materials Control Schedule for materials or products received from pre-approved sources, where the field responsibility for acceptance is visual inspection and all information required to complete these forms is contained in other documents in the project file, the use of these forms becomes optional. If these forms are completed and sent to the Project Engineer by off-site inspection personnel from the district or the Office of Materials, they must be retained in the project file."

A TELEPHONE INDEX is included with the Schedule giving the numbers of contact persons if further information is required regarding the various materials. A form index is also included.

A website ([www.dot.state.mn.us/materials.html](http://www.dot.state.mn.us/materials.html)) has been established for the Office of Materials. The contributing units to the Materials Control Schedule from the Pavement Engineering Section are the Bituminous Engineering Unit, the Concrete Engineering Unit, and the Grading & Base Unit. The Materials Engineering Unit contains the Approved Products and the Certified Products and Services List, as well as, the Materials Control Schedule.

Products manufactured offsite may be pre-approved, however, final acceptance will be made at the point of incorporation, based upon review of documentation and inspection for shipping or other damage.

**PLEASE CONTACT THE Mn/DOT DISTRICT INDEPENDENT ASSURANCE INSPECTOR WHEN PROJECT STARTS TO PROVIDE THE PROPER SERVICING OF YOUR PROJECT.**

## SCHEDULE OF MATERIALS CONTROL

## INDEX

<b>Section</b>	<b>Page(s)</b>
<b>I. Grading and Base Construction Items</b>	<b>1 thru 4</b>
<b>II. Bituminous Construction Items for Specification 2360</b>	<b>5 thru 10</b>
<b>III. Sealcoat Construction Items for Specification 2356</b>	<b>11 thru 13</b>
<b>IV. Concrete Construction Items</b>	<b>14 thru 27</b>
<b>V. Landscaping and Erosion Control</b>	<b>28 thru 31</b>
<b>VI. Chemical Items</b>	<b>32 and 33</b>
<b>VII. Metallic Materials and Metal Products</b>	<b>34 and 36</b>
<b>VIII. Miscellaneous Materials</b>	<b>37</b>
<b>IX. Geosynthetics, Pipe, Tile, and Precast/Prestressed Concrete</b>	<b>38 thru 41</b>
<b>X. Brick, Stone, and Masonry Units</b>	<b>42</b>
<b>XI. Electrical and Signal Construction Items</b>	<b>43 and 44</b>

## SCHEDULE OF MATERIALS CONTROL

## TELEPHONE INDEX FOR SCHEDULE OF MATERIALS CONTROL

Section	Page	Section Name	Contact	Phone
Part I	Page 1	Grading & Base	Tim Andersen Cary Efta Rebecca Embacher	(651) 366-5455 (651) 366-5421 (651) 366-5525
Website: <a href="http://www.dot.state.mn.us/materials/gradingandbase.html">www.dot.state.mn.us/materials/gradingandbase.html</a>				
Part II Part II B 4	Page 5 Page 7	Bituminous - Spec. 2360 Asphalt Binder	John Garrity Jim McGraw Jason Szondy	(651) 366-5577 (651) 366-5548 (651) 366-5549
Website: <a href="http://www.dot.state.mn.us/materials/bituminous.html">www.dot.state.mn.us/materials/bituminous.html</a>				
Part III	Page 11	Seal Coating – Spec 2356	Erland Lukanen Jerry Geib	(651) 366-5460 (651) 366-5496
Part IV	Page 15	Concrete – Aggregates and Mix Design Concrete – Certified Ready Mix Concrete – Paving Concrete – Bridges	Wendy Garr Wendy Garr Maria Masten Ron Mulvaney	(651) 366-5423 (651) 366-5423 (651) 366-5572 (651) 366-5575
Website: <a href="http://www.dot.state.mn.us/materials/concrete.html">www.dot.state.mn.us/materials/concrete.html</a>				
<b>Changed Title of Agricultural Items to Landscaping and Erosion Control Items</b>				
Part V	Page 28	Landscaping and Erosion Control Items Erosion Control Landscaping Wood Chips	Lori Belz Scott Bradley Paul Walvatne	(651) 366-3607 (651) 366-4612 (651) 366-3632
Part VI	Page 32	Chemical Items	Jim McGraw Dave Iverson	(651) 366-5548 (651) 366-5550
Part VII	Page 34	Metallic Materials and Metal Products Sampling Test Results Bridge Structural Metals	Terry Beaudry Laboratory Todd Niemann Barry Glassman	(651) 366-5456 (651) 366-5560 (651) 366-4567 (651) 366-4568
Part VIII	Page 36	Miscellaneous Materials Sections 1 thru 3 Section 4  Test Results	Terry Beaudry Todd Nieman Barry Glassman Laboratory	(651) 366-5456 (651) 366-4567 (651) 366-4568 (651) 366-5560
Part IX	Page 37	Geosynthetics, Pipe, Tile, and Precast/Prestressed Concrete Sections 1 thru 5 and 8 thru 11 Sections 6, 7 Section 12 Section 13 Test Results	Steve Grover Terry Beaudry Randy Tilseth Lori Belz Laboratory	(651) 366-5540 (651) 366-5456 (651) 366-5451 (651) 366-3607 (651) 366-5560
Part X	Page 41	Brick, Stone and Masonry Units/ Modular Retaining Wall Blocks Sections 1, 2A & 4 Section 2B Section 3 Test Results	Terry Beaudry Blake Nelson Steve Grover Laboratory	(651) 366-5456 (651) 366-5599 (651) 366-5540 (651) 366-5561
Part XI	Page 42	Electrical & Signal Sections 1, 8-11 Section 2 Section 3 Sections 4-7 Test Results	Susan Zarling Steve Grover Wendy Garr Terry Beaudry Laboratory	(651) 234-7052 (651) 366-5540 (651) 366-5423 (651) 366-5456 (651) 366-5560

## SCHEDULE OF MATERIALS CONTROL

## Form Index

<b>Grading and Base</b>	
<b>Form No.</b>	<b>Form Name</b>
02115-03	Grading & Base Report
02154-02	Random Sampling Gradations
2170-02	Penetration Index Method - Aggregate Base & Edge Drains
02402-03	Work Sheet for Sieve Analysis of Granular Material
02463	Percent Crushing Report
24346-02	Certificate of Aggregates & Granular Materials
24587-01	Calculation for Moisture - Density Relationships in Subgrade Soils and Aggregate Base and Shoulders
<b>Concrete</b>	
<b>Form No.</b>	<b>Form Name</b>
2152	Concrete Batching Report
2162	Concrete Test Beam Data
2409	ID Card Concrete Test Cylinder
2448	Weekly Concrete Report
2449	Weekly Concrete Aggregate Report (QC/QA)
21412	Weekly Report of "Low Slump Concrete"
21764	Concrete Aggregate Worksheet JMF
24143	Weekly Certified Ready-Mix Plant Report (Verification)
24300	ID Card Cement Samples
24308	ID Card Fly Ash Samples
	Microwave Oven Worksheet
<b>Bituminous</b>	
<b>Form No.</b>	<b>Form Name</b>
2413	Asphalt Sample Identification Card
24327	Field Core Report
<b>Miscellaneous</b>	
<b>Form No.</b>	<b>Form Name</b>
2410	Sample ID Card
02415	Inspection Report on..... (May be used for documentation or use another method to capture required documentation)
2403	Inspection Report for Small Quantities (May be used for documentation or use another method to capture required documentation)

## SCHEDULE OF MATERIALS CONTROL

I. GRADING AND BASE CONSTRUCTION ITEMS ([www.dot.state.mn.us/materials/gradingandbase.html](http://www.dot.state.mn.us/materials/gradingandbase.html))

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

Material	Spec. No.	Form No. (See Note 5)	Minimum Required Contractor Quality Control Testing (QC Production Testing Rate)		Minimum Required Agency Acceptance Testing (Field Testing Rate)		Minimum Required Laboratory Testing (See Note 1)	Sample Size for Testing (See Note 6)	
			Metric	English	Metric	English		Metric	English
1. GRADATION (a) Aggregate Surfacing (2118) (b) Aggregate Base (2211) (c) Aggregate Shoulders (2221)	3138 & Special Provisions	02115-03, 02154-02, & 24346-02	1/1,000 t or 1/460 m <sup>3</sup> (CV)	1/1,000 ton or 1/550 yd <sup>3</sup> (CV)	< 500 t (See Note 2) 500 t to <4,000 t 1/1,000 t	<500 tons (See Note 2) 500 tons to <4,000 tons 1/1,000 tons	1 per source (Salvage Bit. See Note 3)	10-15 kg.	25 lb.
(d) Stabilizing Aggregate (2105)	3149 & Special Provisions				4,000 t to 10,000 t 4 tests	4,000 tons to 10,000 tons 4 tests			
(e) Open Graded Aggregate Base (OGAB)	Special Provisions	02115-03, 24346-02, & 02402-03	1 per source before placing on project  Contractor is encouraged to perform additional tests for process control.		1/1,000 t or 1/460 m <sup>3</sup> (CV) (See Note 2)	1/1,000 ton or 1/550 yd <sup>3</sup> (CV) (See Note 2)	1 per source	10-15 kg	25 lb.
(f) Granular Borrow Select Granular Borrow	3149 & Special Provisions				Less than 115,000 m <sup>3</sup> (CV) 1/8,000 m <sup>3</sup>  115,000 m <sup>3</sup> (CV) or more 1/15,000 m <sup>3</sup> (See Note 2)	Less than 150,000 yd <sup>3</sup> (CV) 1/10,000 yd <sup>3</sup>  150,000 yd <sup>3</sup> (CV) or more 1/20,000 yd <sup>3</sup> (See Note 2)	1 per source (Salvage Bit. See Note 3)	10-15 kg	25 lb.
(g) Full Depth Reclamation	Special Provision	02115-03 & 02402-03	1/5,000 m <sup>2</sup>	1/6,000 yd <sup>2</sup>	1/10,000 m <sup>2</sup>	1/12,000 yd <sup>2</sup>	None	None	
(h) Granular Filter	3601 & Special Provisions	02115-03, 24346-02, & 02402-03	1 per source before placing on project  Contractor is encouraged to perform additional tests for process control.		1 per source (See Note 2)		1 per source	10-15 kg	25 lb.

## 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.	Form No. (See Note 5)	Minimum Required Contractor Quality Control Testing (QC Production Testing Rate)		Minimum Required Agency Acceptance Testing (Field Testing Rate)		Minimum Required Laboratory Testing (See Note 1)	Sample Size for Testing (See Note 6)	
			Metric	English	Metric	English		Metric	English
(i) Granular Backfill (2451) (j) Aggregate Backfill (2451) (k) Granular Bedding (2451) (l) Aggregate Bedding (2451) (m) Coarse Filter (2451) (n) Fine Filter (2502) (o) Sand Cover (2206)	3149	02115-03, 24346-02 & 02402-03	1 per source before placing on project  Contractor is encouraged to perform additional tests for process control.		1 per source  (See Note 2)		1 per source (Salvage Bit. See Note 3)  1 per source	10-15 kg	25lb
2. MOISTURE-DENSITY TEST (Required for Specified Density) (Proctor) (a) Aggregate Base (b) Aggregate Shoulder  (c) Embankment Soil (Excavation & Borrow)	2211 2221 2105	24587-01	Contractor is encouraged to perform proctor tests for process control.		1/40,000 t or 1/18,000 m <sup>3</sup> (per source)	1/40,000 ton or 1/22,000 yd <sup>3</sup> (per source)	One sample minimum and additional samples as required  Two samples per project and additional samples as required	25-30 kg	50 lb.
3. RELATIVE DENSITY TEST (Required for Specified Density) (a) Aggregate Base (b) Aggregate Shoulder  (c) Embankment Soil (Excavation & Borrow)	2211 2221 2105 & Special Provisions	02115-03 & 02140-03	Contractor is encouraged to perform density tests for process control.		1/1,800 t or 1/800 m <sup>3</sup> (CV)	1/1,800 ton or 1/1,000 yd <sup>3</sup> (CV)	None	None	
4. Penetration Index Method (DCP) (a) Aggregate Base (b) Aggregate shoulders	2211 2221	02115-03 & 02170-02	Contractor is encouraged to perform DCP tests for process control.		2 DCP tests/ 1,800 t or 800 m <sup>3</sup> (CV)	2 DCP tests/ 1,800 ton or 1,000 yd <sup>3</sup> (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.	Form No. (See Note 5)	Minimum Required Contractor Quality Control Testing (QC Production Testing Rate)		Minimum Required Agency Acceptance Testing (Field Testing Rate)		Minimum Required Laboratory Testing (See Note 1)	Sample Size for Testing (See Note 6)	
			Metric	English	Metric	English		Metric	English
(Continued) 4. Penetration Index Method (DCP) (c) Full Depth Reclamation	Special Provisions	02115-03 & 02170-02	Contractor is encouraged to perform DCP tests for process control.		2 DCP tests/ 5,000 m <sup>2</sup>	2 DCP tests/ 6,000 yd <sup>2</sup>	None	None	
(d) Fine Filter Aggregate (Edge Drains)	2331 & Special Provisions				See Special Provisions				
5. Modified Penetration Index Method (DCP) (Special Provisions) (a) Aggregate Base (b) Aggregate Shoulder	2211 2221	02115-03 & Special Provisions	Contractor is encouraged to perform moisture tests for process control.		2 DCP tests/ 1,800 t or 800m <sup>3</sup> (CV)	2 DCP tests/ 1,800 ton or 1/1,000 yd <sup>3</sup> (CV)			
(c) Granular Borrow Select Granular Borrow	2105 & 3149				2 DCP tests/ 3,000 m <sup>3</sup> (CV)	2 DCP tests/ 4,000 yd <sup>3</sup> (CV)			
6. Relative Moisture (Required for Specified Density) (a) Aggregate Base (b) Aggregate Shoulder	2211 2221	02115-03 & 21850-02	Contractor is encouraged to perform moisture tests for process control.		1/1,800 t or 1/800m <sup>3</sup> or 10 tests whichever is less	1/1,800 ton or 1/1,000 yd <sup>3</sup> or 10 tests whichever is less			
(c) Embankment Soil (Excavation & Borrow)	2105				1/ 7,500 m <sup>3</sup> (CV)	1/ 10,000 yd <sup>3</sup> (CV)			
7. Moisture Content, (Dry Weight) (Required for Quality Compaction, Penetration Index Method, & Modified Penetration Method) (a) Aggregate Base (b) Aggregate Shoulder	2211 2221		Contractor is encouraged to perform moisture tests for process control.		1/1,800 t or 1/800m <sup>3</sup> or 10 tests whichever is less	1/1,800 ton or 1/1,000 yd <sup>3</sup> or 10 tests whichever is less			
(c) Full Depth Reclamation	Special Provisions				1/5,000 m <sup>2</sup>	1/6,000 yd <sup>2</sup>			



**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.	Form No. (See Note 5)	Minimum Required Contractor Quality Control Testing (QC Production Testing Rate)		Minimum Required Agency Acceptance Testing (Field Testing Rate)		Minimum Required Laboratory Testing (See Note 1)	Sample Size for Testing (See Note 6)	
			Metric	English	Metric	English		Metric	English
8. Percent Crushing (a) Belt Samples	3138, 3149, & Special Provisions	02463 & 24346-02	One Per Day (See Note #7)		None				
(b) Particle Count			None		One Per Source (See Note #7)				
9. Aggregate (Quality Tests)	3138 & Special Provisions		Contractor is encouraged to perform aggregate quality tests for process control.		None		1 per source	10-15 kg (See Note 4)	25 lb. (See Note 4)

**NOTE 1:** Laboratory samples are not required for 1,000 metric ton [1,000ton] or less. Conversion Factors are listed in the Mn/DOT Grading & Base Manual under "Conversion Factors in Grading and Base Work".

The first laboratory sample shall be taken within the first 3,000 metric ton [3,000 ton] and all laboratory samples shall have a field companion sample. The field sample results must be included with the laboratory sample.

Field-lab tolerances are in the Mn/DOT Grading & Base Manual at:

Sieve Analysis Procedure (Gradation)  
Sampling for Moisture-Density Test (Proctor)

The laboratory sample shall be twice the size used for testing (i.e. 25 lb. gradation test sample + 25 lb. companion sample = 50 lb. laboratory sample).

**NOTE 2:** Samples are not required for 500 ton or less. Report small quantities on form 02415 or 2403.

**NOTE 3:** Submit a laboratory companion to the first Acceptance Gradation sample for a bituminous extraction. Full Depth Reclamation samples are not required.

**NOTE 4:** Carbonate aggregate materials require 25-30 kg. (50 lbs.) for the lab.

**NOTE 5:** Forms are available on the Grading & Base website at:

[www.dot.state.mn.us/materials/gradingandbase.html](http://www.dot.state.mn.us/materials/gradingandbase.html)

**NOTE 6:** Sample size needed for each test performed. (i.e.; 25 lb Gradation Test Sample + 25 lb Companion Sample = 50 lb Field Sample).

**NOTE 7:** Percent crushing test will not be required when the material is crushed from a source meeting the requirements of class A or class B in 3137.2B or 3139.2A2.

## SCHEDULE OF MATERIALS CONTROL

### II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1)

(All bituminous mixtures are from Certified Plants) ([www.dot.state.mn.us/materialsbituminous.html](http://www.dot.state.mn.us/materialsbituminous.html))

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

#### DEFINITIONS

SAMPLE TYPE	DESCRIPTION	SAMPLE LOCATION DETERMINED BY	SAMPLE TAKEN BY	SAMPLE TESTED BY
QC	Quality Control Testing performed by Contractor. Also known as Process Control Testing.	Contractor	Contractor	Contractor
QA	Quality Assurance Testing performed by the Agency. This test is performed on a companion sample to the Contractor's QC sample.	Contractor	Contractor	Agency
Verification	A sample to assure compliance of the Contractor's Quality Control program. The results shall be included as part of the QA Testing Program.	Agency	Agency	Agency
Verification Companion	A companion sample to the Agency's Verification sample provided to the Contractor. The Contractor <u>is required</u> to test this sample. The results <u>shall be used</u> as part of the QC program.	Agency	Agency	Contractor
IAST	The <u>I</u> ndependent <u>A</u> ssurance <u>S</u> ampling and <u>T</u> esting assures testers are sampling and testing properly and that equipment is calibrated correctly.	Agency	Contractor or Agency	Contractor or Agency

### A. PRE-PRODUCTION SAMPLING AND TESTING for Specification 2360

**SAMPLE SIZE:** 35 kg (75 lb.) - plus #4 aggregate sample for quality testing and Percent Crushing

15 kg (35 lb.) - minus #4 aggregate for quality testing

18 kg (40 lb.) - bituminous mixture plus 3 Marshall specimens for volumetric testing (Marshall)

33 kg (70 lb.) - bituminous mixture plus 2 Gyratory specimens for volumetric testing (Gyratory)

35 kg (75 lb.) - bituminous mixture for TSR testing (option A)

8 kg (18 lb.) - bituminous mixture for TSR testing plus 9 Marshall specimens (option B) (Marshall)

8 kg (18 lb.) - bituminous mixture for TSR testing plus 6 Gyratory specimens (option B) (Gyratory)

1 kg (2 lb.) - for mineral filler.

## SCHEDULE OF MATERIALS CONTROL

### II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1) (Part A, cont'd)

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

<p>1. Bituminous Mix Design (QC/QA)</p> <p><u>QC Testing</u> REMARKS: Mix Design for Spec. 2360 is Contractor's responsibility with review by Mn/DOT.</p> <p><u>QA Testing</u> For Marshall Design, Option 1- Laboratory Mix Design: In addition to reviewing the Trial Mix data (JMF), test Contractor's 3 Marshall specimens and uncompacted mixture (specimens and mixture submitted at optimum asphalt content). Also, evaluate TSR per 2360.3 B3. For option 2, Modified Mix Design, review Trial Mix data only.</p> <p>For Gyratory Design, Option 1- Laboratory Mix Design: In addition to reviewing the Trial Mix data (JMF), test Contractor's 2 Gyratory specimens and uncompacted mixture (specimens and mixture submitted at optimum asphalt content). Also, evaluate TSR per 2360.3 B3. For option 2, Modified Mix Design, review Trial Mix data only.</p>
<p>2. Aggregate Quality Testing (QA Only)</p> <p><u>QA Testing</u> Contractor shall provide 24 hour notice of intent to sample aggregates for quality testing. Agency has the option to monitor sampling.</p> <p>Contractor submits to the Bituminous Engineer or the District Materials Engineer one (1) sample of each non-asphaltic aggregate type or class per source per year. Contractor shall also submit the asphaltic aggregate material (RAP) when the mixture contains RAP. Quality testing will be performed as directed by the Bituminous Engineer or the District Materials Engineer. When aggregate qualities approach specification limits or when material variation is observed, take additional field samples.</p>
<p>3. Mineral Filler (QA Only)</p> <p><u>QA Testing</u> One (1) per shipment of 45 metric tons (50 tons) or less, unless previously inspected.</p>
<p>4. Additives (QA Only)</p> <p><u>QA Testing</u> 1 L (1 qt.) of blended asphalt binder and additive. Sample first shipment of each type of material, then submit one sample per 1,000 m<sup>3</sup> (250,000 gal.) (approximately 1,000 ton).</p>

### B. BITUMINOUS PRODUCTION for Specification 2360

- SAMPLE SIZE:** 15 kg (35 lb.) for Aggregate for Gradation (QC/QA)  
 35 kg (75 lb.) for each plus #4 Aggregate Type for Quality Testing  
 15 kg (35 lb.) for each minus #4 Aggregate Type for Quality Testing  
 20 kg (45 lb.) for Mixture Properties (QC/QA) 2 full 6" by 12" cylinder molds for QA (Marshall mixes)  
 30 kg (65 lb.) for Mixture Properties (QC/QA) 3 full 6" by 12" cylinder molds for QA (Gyratory mixes)  
 40 kg (90 lb.) for TSR (QC/QA) 4 full 6" by 12" cylinder molds for QA  
 40 kg (90 lb.) for Aggregate Specific Gravity (QC/QA)  
 1 L (1 qt) for Asphalt Binder (QA)  
 2 L (½ gal) for Asphalt Emulsion (QA)

<p>1. Plant Mix Aggregate Gradation Testing (QC/QA, Verification*)</p> <p><u>QC Testing</u> 1 per 900 metric tons (1000 tons) at start of production, for the first 1,800 metric tons (2,000 tons) of mixture produced, then 1 per 1,800 metric tons (2,000 tons) or portion thereof per mix blend as required by 2360.4E6          1 per 900 metric tons (1000 tons) when operating under corrective action.          Companion samples taken for agency.          REMARKS: See Note #2 &amp; Note #3. See Note #9 for Projects requiring the Adjusted AFT.</p> <p><u>QA Testing</u> Companions to QC samples set aside for 7 working days and tested as needed. The Agency representative observes QC testing as needed.</p>
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SCHEDULE OF MATERIALS CONTROL

II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1) (Cont'd)
(All bituminous mixtures are from Certified Plants)

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

B. BITUMINOUS PRODUCTION for Specification 2360 (cont.)

Table with 4 rows detailing testing procedures for Aggregate Percent Crushing, Aggregate Quality Testing, Asphalt Binder Content, and QA Testing. Includes sub-sections for QC Testing and QA Testing, and a list of methods for Asphalt Binder Content.

**SCHEDULE OF MATERIALS CONTROL**

**II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1) (Part B, Cont'd)**  
**(All bituminous mixtures are from Certified Plants)**

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

**B. BITUMINOUS PRODUCTION for Specification 2360 (cont.)**

5. Mixture Properties (QC/QA, Verification\*)

Maximum Specific Gravity, Marshall Bulk Specific Gravity - 3 Specimen Average, Gyratory Bulk Specific Gravity - 2 Specimen Average, air voids, VMA, asphalt binder content, and gradation.

REMARKS: See Note #8 Asphalt Film Thickness (AFT)

QC Testing

1 per 450 metric tons (500 tons) per mix blend, at the start of production, for first 1,800 metric tons (2,000 tons) of mixture produced.

Determine planned tonnage for each mixture to be produced during the production day. Divide the planned production by 1,000; round up to the next higher whole number. This number will be the number of production tests required for that mixture.

Verification Companion testing from Agency split sample is required to be performed and shall be used as a QC sample once per day.

REMARKS: See Note #2 & Note #3 Calibration factors shall be established regarding reheated samples.

QA Testing

Companion samples to QC samples set aside for 7 working days and tested as needed. The agency representative shall review QC operations on a daily basis. Review shall include but is not limited to monitoring QC summary sheets and comparing allowable tolerances for verification sample/verification companion sample test results. The Agency representative shall observe either 1 QC test per week (during production) or 1 QC test per 10,000 tons, whichever results in more frequent observations.

\*Verification Testing

Verification Companion testing from Agency split sample is required to be performed and shall be used as a QC sample once per day. The verification companion shall also be tested for CAA and FAA at a rate of 1 test per week, if the CAA and FAA exceed the requirements by 8% and 5% respectively, otherwise test daily.

An Agency representative will take 1 verification sample per mixture blend per day for Mn/DOT laboratory testing. A verification companion sample will be given to contractor for QC testing.

6. Core Density and Thickness

QC Testing

Production/lot testing rate requirements.

Daily Production		Lots
Metric Ton	English (ton)	
270* - 545	(300* - 600)	1
546 - 910	(601 - 1000)	2
911 - 1455	(1001 - 1600)	3
1456 - 3275	(1601 - 3600)	4
3276 - 4545	(3601 - 5000)	5
4546 +	(5001 +)	6

\*When mix production is less than 270 metric tons (300 tons), establish 1<sup>st</sup> lot when accumulative tonnage exceeds 270 metric tons (300 tons).

Core locations determined and marked by Agency. The Contractor shall schedule the approximate time of testing during normal project work hours so that the Agency may observe and record the saturated surface dry and immersed weight of the cores.

REMARKS: Sawing of cores into separate lifts is required. Contractor is required to have a saw capable of separating the core lifts without damaging the material.

QA Testing

1 companion core per lot. Core locations determined and marked by Agency. Agency representative observes all Contractor coring, sawing and testing, and takes possession of Mn/DOT cores after sawing. Agency cores shall be transported and tested at the Laboratory (Agency field or District/Division) as soon as possible to prevent damage due to improper handling or exposure to heat. A completed coring log shall be submitted to the Laboratory (Agency field or District/Division).

Remarks: See Note #6

7. Aggregate Specific Gravity (QC/QA)

QC Sampling: Sampled and tested by Contractor, if requested by District Materials Engineer.

QA Testing: Companion sample to QC sample shall be submitted to the District Materials Lab and tested as needed.

**SCHEDULE OF MATERIALS CONTROL**

**II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1) (Part B, Cont'd)**  
**(All bituminous mixtures are from Certified Plants)**

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

**B. BITUMINOUS PRODUCTION for Specification 2360 (cont.)**

8. Tensile Strength Ratio (T.S.R.) (QC/QA)  <u>QC Sampling</u> Sample as directed by the District Materials Engineer. If the District Materials Engineer requires the samples to be tested, both the Contractor and the Department will be required to test these samples within 72 hours after they are sampled.  <u>QA Testing</u> When QC sampling is required, the companion sample to QC sample shall be submitted to the District/Division Materials Lab and tested as needed.				
9. BITUMINOUS MATERIALS Only Bituminous Materials from Certified Sources are allowed for use. The most current list of Certified Sources can at <a href="http://www.dot.state.mn.us/products">http://www.dot.state.mn.us/products</a>  SAMPLE SIZE: 1 L (1 qt) for Asphalt Binder (QA)                      2 L (1/2 gal) for Asphalt Emulsion (QA)				
	<b>Spec. No.</b>	<b>Quality Control (QC)</b>	<b>Quality Assurance (QA)</b>	<b>Form No.</b>
Asphalt Binder	3151	QC testing is the responsibility of the bituminous material supplier. Random sampling is arranged by the Mn/DOT Chemical Laboratory.	State inspector observes contractor personnel taking sample. Sample first shipment of each grade of material at the start of a plant's production each year or after set-up of a portable plant. Thereafter, submit one sample per 1,000,000 liters (250,000 gal). Sample asphalt binder in clean one L (qt) steel container.	2413 Asphalt Sample Identification Card
Asphalt Emulsion			Sample first shipment, then submit one sample per 200 m <sup>3</sup> ((50,000 gal.). Sample asphalt emulsion in clean two L (2 qt.) plastic container with wide screw top and immediately send to Mn/DOT Chemical Lab within 7 days of sampling.	
Cutback Asphalt			Cutback Asphalt should only be used in cold temperature applications with the Engineer's approval. Contact Bituminous Office for cold temperature application guidelines. Pressure fit 1 L (1qt.) cans for cutback asphalt.	
10. Moisture Content in Mixture (QC only) <u>QC Testing</u> Sampling and testing shall be conducted by the Contractor on a daily basis unless exempted by the Engineer and tested according to the procedures in the Bituminous Manual (5-693.950). Moisture contents above 0.3% are not allowed.				

## SCHEDULE OF MATERIALS CONTROL

### II. BITUMINOUS CONSTRUCTION ITEMS FOR SPECIFICATION 2360 (Note #1) (Part B, Cont'd) (All bituminous mixtures are from Certified Plants)

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

**NOTE #1.** Projects with bituminous tonnage less than or equal to 272 metric tons (300 tons) per day may be accepted on a small quantity basis at the discretion of the Engineer. Retain Form 02415 or Form 2403 in Project File.

**NOTE #2.** All QA test samples shall be from split samples.

If a member of the monitoring team observes the Contractor Test, note and sign under remarks.

The Project Engineer is responsible for:

- 1.) Reviewing control charts & Test summary sheets for accuracy and completeness,
- 2.) Checking sampling and testing procedures,
- 3.) Discussing QC problems with the Contractor,
- 4.) Obtaining Verification Samples,
- 5.) When additional testing is necessary, collect QA samples which have been acquired and retained by the Contractor and/or additional verification samples.

**NOTE #3.** For process control testing, acceptance will be based on Contractor's test results as verified by Mn/DOT test results.

**NOTE #4.** Bituminous mixes composed entirely of Class A and/or Class B aggregates are not required to be tested for CAA (Coarse Aggregate Angularity).

**NOTE #5.** When the required sampling rate is one test per 500 tons, divide the bituminous mixture production planned for the day by 500, and round up to the next higher whole number; this will be the number of tests required for the day. When the required sampling rate is one test per 1000 tons, divide the bituminous mixture production planned for the day by 1000, and round up to the next higher whole number; this will be the number of tests required for the day. When the required sampling rate is one test per 2000 tons, divide the bituminous mixture production planned for the day by 2000, and round up to the next higher whole number; this will be the number of tests required for the day.

**NOTE #6.** Most Mn/DOT projects in the 2008 Construction season will require 2 companion cores per lot be obtained for QA Testing. The Department will select at least one of the two companion cores per lot to be tested. However, the Department may elect to test all companions to provide a direct verification of all individual and daily average test results. Agency representative observes all Contractor coring, sawing and testing, and takes possession of Mn/DOT cores after sawing. Agency cores shall be transported and tested at the Laboratory (Agency field or District/Division) as soon as possible to prevent damage due to improper handling or exposure to heat. A completed coring log shall be submitted to the Laboratory (Agency field or District/Division).

**NOTE #7.** Traffic Level 4 or 5 mixtures that contain shingles will require a minimum of one spot check per day in addition to the required method (b) or (c) used for % total AC. The spot checks will be used for the determination of new added asphalt binder.

**NOTE #8.** Most Mn/DOT projects in the 2008 Construction season will require the calculated Adjusted Asphalt Film Thickness (AFT). VMA will still be calculated for informational purposes, but will not be used for acceptance criteria. The adjusted AFT shall be calculated each time a gradation test is required.

**NOTE #9.** One gradation per 900 metric tons (1000 tons) or portion thereof, of mixture produced with a minimum of one test per day.

**NOTE #10.** One asphalt binder determination per 900 metric tons (1000 tons) or portion thereof, of mixture produced with a minimum of one test per day.

### SCHEDULE OF MATERIALS CONTROL

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

#### III. Seal Coat Construction Items For 2356 SPECIAL PROVISIONS

##### A. (2356) Bituminous Seal Coat

##### B. (2356) Micro-Surfacing

<b>DEFINITIONS</b>				
Sample Type	Description	Sample Location Determined By	Sample Taken By	Sample Tested By
	<i>Definitions from 23 CFR 637.203</i>			
QA Quality Assurance	All those planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality			
QC Quality Control	All contractor/vendor operational techniques and activities that are performed or conducted to fulfill the contract requirements.	Contractor	Contractor	Contractor
Verification sampling and testing	Sampling and testing performed to validate the quality of the product.	Agency	Agency	Agency
	<i>Mn/DOT Definition</i>			
IAST	The Independent Assurance Sampling and Testing assures testers are sampling and testing properly and that equipment is calibrated correctly.	Agency	Contractor or Agency	Contractor or Agency

**Should unique circumstances arise on a project which makes the quantities or rates of testing materials impractical, they may be revised prior to performing the work by contacting the Pavement Management Unit and obtaining their approval.**

**The testing rates shown are only minimums.**



**SCHEDULE OF MATERIALS CONTROL**

**III. Seal Coat Construction Items For 2356 SPECIAL PROVISIONS (cont'd)**

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

**A. (2356) BITUMINOUS SEAL COAT**

<b>SAMPLE SIZE:</b>		<b>Mix Design: 150 lbs.</b>		
<b>Test Type</b>	<b>Spec. No.</b>	<b>Quality Control (QC)</b>	<b>Verification</b>	<b>Form No.</b>
Seal Coat Mix Design	2356	One per source	Verify all QC results and review mix design.	
Gradation and Aggregate Qualities		Average gradation during production. % Shale Static Stripping Test Flakiness Index Los Angeles Rattler  Aggregate design application rate Bit. Material design application rate Loose unit mass (weight) of the aggregate Bulk specific gravity of the aggregate		
Seal Coat Aggregate		Test for gradation. One per day, or one per 1360t (1500 tons), whichever is greater. If a temporary stockpile is used, test at this location.	Test for gradation. One per day, or one per 1360t (1500 tons), whichever is greater. If a temporary stockpile is used, test at this location.	
Stockpile Production Gradation		Sample for gradation. One per day. Test if required by the Engineer. All samples shall be taken from chip spreader hopper.	Sample for gradation. One per day. Test if required by the Engineer. All samples shall be taken from chip spreader hopper.	
Construction				
Bituminous Material For Seal Coat		Use a Certified Source.	Sample first shipment, then submit one sample per 200 m <sup>3</sup> (50,000 gal.). Sample asphalt emulsion in plastic container with wide screw top and immediately send to Mn/DOT Chemical Lab.	
Quality		Verify the application rate daily by dividing the volume used by the area covered.		
Application rate		Use a certified source.		
For Fog Seal		Verify the application rate daily by dividing the volume used by the area covered.	One sample to test for dilution rate.	
Quality				
Application rate				

**SCHEDULE OF MATERIALS CONTROL**

**III. Seal Coat Construction Items For 2356 SPECIAL PROVISIONS (cont'd)**

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

**B. (2356) SEAL COAT - MICRO-SURFACING**

<b>SAMPLE SIZE: Mix Design: 150 lbs.</b>				
<b>Test Type</b>	<b>Spec. No.</b>	<b>Quality Control (QC)</b>	<b>Verification</b>	<b>Form No.</b>
Micro-surfacing Mix Design	2356	One per source	Verify all QC results and review mix design.	
Gradation and Aggregate Qualities		Average gradation during production. Sand Equivalent Abrasion Resistance Soundness		
Asphalt Emulsion Certified source		Residue after Distillation Softening Point Penetration at 25C (77F) Absolute Viscosity at 60C (140F)		
Mix Design		Wet Stripping Wet Track Abrasion Loss - one hour soak - six day soak Saturated Abrasion Compatibility Mix Time at 25C (77F) Mix Time at 37.4C (100F)		
Micro-surfacing Aggregate		Test for gradation. One per day, or one per 1360t (1500 tons), whichever is greater. If a temporary stockpile is used, test at this location.		
Stockpile Production				
Construction		Sample for gradation, sand equivalence and moisture content. One per 435.6 metric tons (500tons), minimum of one per day.	Test for gradation. One per 1360t (1500 tons), If a temporary stockpile is used, test at this location. Determine moisture content. One per day	
Asphalt Emulsion		Use a Certified Source.	Sample first shipment, then submit one sample per 200 m <sup>3</sup> (50,000 gal.). Sample asphalt emulsion in plastic container with wide screw top and immediately send to Mn/DOT Chemical Lab.	
Quality				
Quantity		Verify the quantity using equipment counter readings.		
For Fog Seal, when required				
Quality		Use a certified source.	One sample to test for dilution rate.	
Application rate		Verify the application rate daily by dividing the volume used by the area covered.		

## SCHEDULE OF MATERIALS CONTROL

### IV. CONCRETE CONSTRUCTION ITEMS ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

(All Ready Mix is from Certified Plants)

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

- The testing rates shown in this Schedule of Materials Control are minimums. All samples shall be taken in a random manner using an appropriate number generator. Take as many tests as necessary to ensure quality concrete.
- It is recommended that the Agency Plant Monitor be present during critical pours, such as superstructure or paving concrete (ie. 3Y33, 3Y36, 3Y46, 3A21).
- If any field test fails, reject the concrete or if the Producer makes adjustments to the load to meet requirements, record the adjustments on the Certificate of Compliance and the Weekly Concrete Report. Retest the load and record the adjusted test results. Make sure the next load is tested, before it gets into the work.
- If batching adjustments are made at the plant, test the adjusted load, before it gets into the work. Continue to test the concrete when test results are inconsistent or marginal.
- Material not meeting requirements shall not knowingly be placed in the work. If failing concrete inadvertently gets placed in the work, either the Mn/DOT Standard Specifications for Construction or the Schedule of Price Reductions for Concrete address penalties.
- It is recommended that the Agency representative continually monitor the progress of all concrete pours. (It is not a recommended practice to only perform minimum testing requirements and leave the project.)
- Should circumstances arise on a project, which makes the testing rate impractical, contact the Concrete Engineering Unit.

DEFINITIONS				
	Description	Sample Location Determined By	Sample Taken By	Sample Tested By
QC	Quality Control Testing performed by Contractor. Also known as Process Control Testing.	Contractor	Contractor	Contractor
QA	Quality Assurance Testing performed by the Agency. This test is performed on a companion sample to the Contractor's QC sample.	Contractor	Contractor	Agency
Verification	A sample to assure compliance of the Contractor's Quality Control program. The results shall be included as part of the QA Testing Program.	Agency	Agency	Agency
Verification Companion	A companion sample to the Agency's Verification sample provided to the Contractor. The Contractor is <u>required</u> to test this sample. The results shall be used as part of the QC program.	Agency	Agency	Contractor
IAST	The <u>I</u> ndependent <u>A</u> ssurance <u>S</u> ampling and <u>T</u> esting assures testers are sampling and testing properly and that equipment is calibrated correctly.	Agency	Contractor or Agency	Contractor or Agency

SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

**CERTIFIED READY-MIX CONCRETE**

These testing rates shall be used for all concrete except paving concrete, low slump concrete overlays, and CPR.

Refer to Concrete Construction Materials Section to determine if any field samples are required.

All QC and Verification gradation tests require companion samples. These samples are obtained from a larger sample that is reduced by splitting to obtain the sample sizes listed below for both the Producer/Contractor and the Agency. Samples taken at location identified on Contact Report located at plant.

**Gradation Sample Size:** 10 – 15 kg (25 lb.) for +19 mm (3/4" Plus) Coarse Aggregate  
 5 – 7 kg (10-15 lb.) for –19 mm (3/4" Minus) Coarse Aggregate  
 5 kg (10 lb.) for CA-70 and Sand

**Quality Sample Size:** 25 kg (50 lb.) Coarse Aggregate  
 15 kg (30 lb.) Fine Aggregate

**Moisture Sample Size:** 500 g (1.1 lb.) Fine Aggregate  
 2000 g (4.4 lb.) Coarse Aggregate

Test Type	Spec. No.	Producer/Contractor Testing	Agency Testing	Form No.
Gradation Testing (QC/QA) (5-694.145 and 5-694.148)	3126 3137	<p>When over 20 m<sup>3</sup> (yd<sup>3</sup>) of Agency concrete produced per day:                      Coarse: 1 per 100 m<sup>3</sup> (yd<sup>3</sup>)                      Fine: 1 per 200 m<sup>3</sup> (yd<sup>3</sup>)</p> <p>The Producer shall complete the initial aggregate gradations prior to the start of concrete production each day. The Producer may perform testing on representative material at the end of the most recent day of production. <b>The Producer must have a passing gradation each day, prior to beginning production.</b></p> <p>The Producer is not required to wash the fine aggregate gradation (QC) sample, if the result on the -75µm (#200) sieve of the unwashed sample is less than 1.0%.</p> <p>The Producer is responsible for holding QA (QC companion) samples until they are picked up by the Agency monitor. If not picked up, they may be discarded after one week.</p>	<p>The Agency is required to pick up all QA (QC companion) samples.</p> <p>The QA (QC companion) samples are tested by the Agency at a rate directed by the Project Engineer.</p> <p>As a check on field testing equipment when QA testing is performed in the field, send one split gradation sample per month to District Laboratory for comparison testing.</p>	2449 Weekly Concrete Aggregate Report (QC/QA)
Gradation Testing (Verification/ Verification Companion) (5-694.145 and 5-694.148)	3126 3137	<p>The Producer is required to test the Verification Companion sample. Test to be completed during the day on which the sample was taken.</p> <p>The Producer must wash all fine aggregate Verification Companion samples.</p>	<p>Coarse and Fine: 1 per day or 1 per 500 m<sup>3</sup> (yd<sup>3</sup>) whichever results in the lowest sampling rate with a minimum of 1 per week.</p> <p>A minimum of 2 Verification samples per week is required when Certified production is 3 or more days per week. Take more Verification samples when production problems exist.</p>	2449 Weekly Concrete Aggregate Report  24143 Weekly Certified Ready-Mix Plant Report

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

<b>CERTIFIED READY-MIX CONCRETE (Cont.)</b>				
<b>Test Type</b>	<b>Spec. No.</b>	<b>Producer/Contractor Testing</b>	<b>Agency Testing</b>	<b>Form No.</b>
Moisture Testing (QC) (5-694.142)		<p>When over 20 m<sup>3</sup> (yd<sup>3</sup>) of Agency concrete produced per day:</p> <p>Coarse and Fine: 1 per 200 m<sup>3</sup> (yd<sup>3</sup>) or completed every four hours, whichever results in the highest sampling rate.</p> <p>The Producer shall complete the initial moisture content and adjust the batch water prior to the start of concrete production each day.</p> <p>If weather conditions allow, the Producer may perform moisture testing on representative material at the end of production the prior evening. In this event, the four-hour rate will commence with the first pour of the day, regardless if it is placed in Agency or private work.</p>	None	2152 Concrete Batching Report
Quality Testing (Verification)	3126 3137	At Producer's/Contractor's Discretion	<p>1 per month sampled for acceptance Testing may be adjusted by contacting the Concrete Engineering Unit.</p> <p>Quality testing will be performed as directed by the Concrete Engineer.</p>	2410 Sample ID Card
Coarse Aggregate Testing on -75µm (#200) (Verification) (5-694.146)	3137	At Producer's/Contractor's Discretion	Testing rate for cleanliness of coarse aggregate as directed by the Engineer.	2410 Sample ID Card
Air Content (Verification) (5-694.541)	2461	None	Test first load each day per mix 1 per 100 m <sup>3</sup> (yd <sup>3</sup> )	2448 Weekly Concrete Report
Slump (Verification) (5-694.531)	2461	None	Test first load each day per mix 1 per 100 m <sup>3</sup> (yd <sup>3</sup> ), except 1 slump test per day for slip form placement.	2448 Weekly Concrete Report

**SCHEDULE OF MATERIALS CONTROL**

**IV. CONCRETE CONSTRUCTION ITEMS (Cont.) (www.dot.state.mn.us/materials/concrete.html)**

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

<b>CERTIFIED READY-MIX CONCRETE (Cont.)</b>				
<b>Test Type</b>	<b>Spec. No.</b>	<b>Producer/Contractor Testing</b>	<b>Agency Testing</b>	<b>Form No.</b>
Compressive Strength (Verification) (5-694.511)	2461	None	<p>1 cylinder per 100 m<sup>3</sup> (yd<sup>3</sup>)                      Minimum of 1 per day if production is more than 20 m<sup>3</sup> (yd<sup>3</sup>)</p> <p>For concrete meeting specification 2521 and 2531 (curb and gutter and sidewalks):                      1 per day or 1 per 500 m<sup>3</sup> (yd<sup>3</sup>), whichever results in the lowest sampling rate with a minimum of one per week. A minimum of 2 cylinders per week is required, when production is 3 or more days per week.</p> <p>Make additional control cylinders as necessary.</p> <p>Mn/DOT standard cylinder mold size is 100 x 200 mm (4 x 8inch). If aggregate has a maximum size greater the 31.5 mm (1-1/4 inch), use 150 x 300 mm (6 x 12 inch) molds.</p>	2409 ID Card Concrete Test Cylinder

<b>SMALL QUANTITIES</b>		
<p>There are certain items of concrete that are acceptable under a modified small quantity acceptance plan from a known and reliable source. The Project Engineer should document small quantities on Form 2403 or 02415 and retain in project file. Agency testing is required at a minimum of 1 gradation verification test per week per plant. The Producer is required to test Verification Companion samples.</p>		
<b>Test Type</b>	<b>Testing Requirements</b>	<b>Form No.</b>
FIELD TESTING	<p>1 air (if required), 1 slump and 1 cylinder test per day without plant testing per:                      20 m<sup>3</sup> (yd<sup>3</sup>) of general concrete work (pavement, curb and gutter, bridge footings, bridge concrete constructed above footings, median barrier, etc.)                      100 m<sup>3</sup> (yd<sup>3</sup>) of concrete of a non-critical nature (all Grade C concrete, Cast in Place pile fill, fencepost footings, etc.)</p>	02415 or 2403 Inspection Report
PLANT TESTING	1 delivery truckload of concrete may be accepted without field tests if all plant tests are performed, including batching and mixing inspection.	02415 or 2403 Inspection Report

**SCHEDULE OF MATERIALS CONTROL**

**IV. CONCRETE CONSTRUCTION ITEMS (Cont.) (www.dot.state.mn.us/materials/concrete.html)**

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

**PAVING CONCRETE SUPPLIED BY A PAVING PLANT**

Refer to Special Provisions of Contract for project specific testing rates.

**Definitions:**

1. Paving Concrete shall be understood to include concrete mainline, ramps, loops, integrant curb, and curb and gutter placed adjacent to the concrete mainline with the same mixture as used in paving.
2. A concrete plant shall be understood to mean a paving plant, when concrete is hauled in dump or agitator trucks.

Refer to Concrete Construction Materials Section to determine if any field samples are required.

All samples for testing shall be taken in a random manner. All gradation samples shall be taken in the presence of the Agency, unless otherwise authorized by the Engineer. All Contractor gradation tests require companion samples. These samples are obtained from a larger sample that is reduced by splitting to obtain the sample sizes listed below for both the Contractor and the Agency.

**Gradation Sample Size:** 10 – 15 kg (25 lb.) for +19 mm (3/4" Plus) Coarse Aggregate  
 5 – 7 kg (10-15 lb.) for -19 mm (3/4" Minus) Coarse Aggregate  
 5 kg (10 lb.) for CA-70 and Sand

**Quality Sample Size:** 25 kg (50 lb.) Coarse Aggregate  
 15 kg (30 lb.) Fine Aggregate

**Moisture Sample Size:** 500 g (1.1 lb.) Fine Aggregate  
 2000 g (4.4 lb.) Coarse Aggregate

Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Gradation Testing (QC/QA) (5-694.145 and 5-694.148)	3126 3137	When over 200 m <sup>3</sup> (250 yd <sup>3</sup> ) is produced per day: 1 per 750 m <sup>3</sup> (1000 yd <sup>3</sup> ) or completed every four hours, whichever results in the highest sampling rate.  Maximum of 5 per day  Split all samples for Agency  All sieve sizes specified in the Job Mix Formula (including fine sieves) will be required for the coarse gradations on the first day of production. The results of these tests shall be averaged on each sieve finer than the 9.5 mm [3/8 inch] for use in calculating the overall gradation.	1 per day  Gradation is run on randomly selected Contractor split sample. Test the first 4 samples of production each time the Contractor mobilizes the plant or changes aggregate sources.	21764 Concrete Aggregate Worksheet JMF
Coarse Aggregate Testing on -75 μm (#200) (QC/QA) (5-694.146)	3137	Test the first 4 samples of production each time the Contractor mobilizes the plant or changes aggregate sources.  If the Project Engineer determines that the cleanliness of the coarse aggregate has changed, the above procedure shall be repeated, otherwise, no additional fine sieve analysis on coarse aggregate shall be required.	Test the first 4 samples of production each time the Contractor mobilizes the plant or changes aggregate sources.  If the Project Engineer determines that the cleanliness of the coarse aggregate has changed, the above procedure shall be repeated, otherwise, no additional fine sieve analysis on coarse aggregate shall be required.	21764 Concrete Aggregate Worksheet JMF

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

PAVING CONCRETE SUPPLIED BY A PAVING PLANT (CONT.)				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Aggregate Moisture Testing (Verification) (5-694.142)		None	1 per 750 m <sup>3</sup> (1000 yd <sup>3</sup> ) or completed every four hours, whichever results in the highest sampling rate.  Maximum of 5 per day  Take and test initial sample after approximately ½ hour of production each day. Initial samples for moisture and microwave testing should be taken after batch ticket water has stabilized indicating that the aggregate moisture has also stabilized.	2152 Concrete Batching Report
Water Content Determination Test (Verification) (5-694.532)		None	1 per 750 m <sup>3</sup> (1000 yd <sup>3</sup> ) or completed every four hours, whichever results in the highest sampling rate.  Maximum of 5 per day  Take and test initial sample after approximately 1/2 hour of production each day. Initial samples for moisture and microwave testing should be taken after batch ticket water has stabilized indicating that the aggregate moisture has also stabilized.	Microwave Oven Worksheet
Quality Testing (Verification)	3126 3137	At Contractor's discretion	Test each fraction 1 per month. See Special Provisions to determine if additional testing is required.  Quality testing will be performed as directed by the Concrete Engineer.	2410 Sample ID Card
Air Content (QC/QA) (5-694.541)	2461	Test first load each day per mix 1 per 300 m <sup>3</sup> (300 yd <sup>3</sup> )	1 air test per day minimum	2448 Weekly Concrete Report
Air Content (Verification) (5-694.541)	2461		1 set of air tests per day minimum (1 test before the paver and 1 test after the paver for correlation)	2448 Weekly Concrete Report
Slump (QC/QA) (5-694.531)	2461	Test first load each day per mix 1 per 300 m <sup>3</sup> (300 yd <sup>3</sup> ) except 1 slump test per day for slip form paving	1 slump test per day minimum	2448 Weekly Concrete Report



## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

PAVING CONCRETE SUPPLIED BY A PAVING PLANT (CONT.)				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Flexural Strength (5-694.521)	2301	<p>1 beam (28-day) per day or 1 per 4000 m<sup>3</sup> (5000 yd<sup>3</sup>), whichever results in the lowest sampling rate with a minimum of 1 per week.</p> <p>A minimum of 2 beams per week is required, when production is 3 or more days per week.</p> <p>Make additional control beams as necessary</p> <p>The Contractor fabricates beams, delivers beams to curing site, and cleans beam boxes.</p>	Agency supplies beam boxes, cures, and tests beams.	2162 Concrete Test Beam Data
Thickness	2301	The Contractor drills concrete cores for thickness verification. In addition to coring, the Contractor may be required to probe the concrete at a rate specified in the Special Provisions of the contract.	Coring is performed at locations determined by the Agency using random numbers. The Agency initials pavement at core locations and re-initials the sides of specimens after coring to clearly verify their authenticity.	24327 Field Core Report
Surface Smoothness Ride Quality	2301	Contractor provides Mn/DOT certified Inertial Profiler Results.	If the Contractor's test results are in question, the Project Engineer may request that an Independent Source retest the entire project.	

**SCHEDULE OF MATERIALS CONTROL**

**IV. CONCRETE CONSTRUCTION ITEMS (Cont.) (www.dot.state.mn.us/materials/concrete.html)**

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

**PAVING CONCRETE SUPPLIED BY A CERTIFIED READY-MIX PLANT**

Refer to the Special Provisions of Contract for project specific testing rates.

**Definitions:**

1. Paving concrete shall be understood to include concrete mainline, ramps, loops, integrant curb, and curb and gutter placed adjacent to the concrete mainline with the same mixture as used in the paving.
2. A concrete plant shall be understood to mean a ready-mix plant when concrete is hauled in revolving drum agitator trucks or transit-mix trucks.

Refer to Concrete Construction Materials Section to determine if any field samples are required.

All QC and Verification gradation tests require companion samples. These samples are obtained from a larger sample that is reduced by splitting to obtain the sample sizes listed below for both the Producer/Contractor and the Agency.

**Gradation Sample Size:** 10 – 15 kg (25 lb.) for +19 mm (3/4” Plus) Coarse Aggregate  
 5 – 7 kg (10-15 lb.) for –19 mm (3/4” Minus) Coarse Aggregate  
 5 kg (10 lb.) for CA-70 and Sand

**Quality Sample Size:** 25 kg (50 lb.) Coarse Aggregate  
 15 kg (30 lb.) Fine Aggregate

**Moisture Sample Size:** 500 g (1.1 lb.) Fine Aggregate  
 2000 g (4.4 lb.) Coarse Aggregate

Test Type	Spec. No.	Producer/Contractor Testing	Agency Testing	Form No.
Gradation Testing (QC/QA) (5-694.145 and 5-694.148)	3126 3137	<p>1 per 200 m<sup>3</sup> (250 yd<sup>3</sup>) or completed every four hours, whichever results in the highest sampling rate.</p> <p>The Producer shall complete the initial aggregate gradations prior to the start of concrete production each day. The Producer may perform testing on representative material at the end of the most recent day of production. <b>The Producer must have a passing gradation each day prior to beginning production.</b></p> <p>The Producer is not required to wash the fine aggregate gradation (QC) sample, if the result on the -75µm (#200) sieve of the unwashed sample is less than 1.0%.</p> <p>The Producer is responsible for holding QA (QC companion) samples until they are picked up by the Agency monitor. If not picked up, they may be discarded after one week.</p>	<p>The Agency is required to pick up all QA (QC companion) samples.</p> <p>The QA (QC companion) samples are tested by the Agency at a rate directed by the Project Engineer.</p> <p>As a check on field testing equipment when QA testing is performed in the field, send one split gradation sample per month to District Laboratory for comparison testing.</p>	21764 Concrete Aggregate Worksheet JMF

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

PAVING CONCRETE SUPPLIED BY A CERTIFIED READY-MIX PLANT (CONT.)				
Test Type	Spec. No.	Producer/Contractor Testing	Agency Testing	Form No.
Gradation Testing (Verification/ Verification Companion) (5-694.145 and 5-694.148)	3126 3137	The Producer is required to test the Verification Companion sample. Test to be completed during the day on which the sample was taken.  The Producer must wash all fine aggregate Verification Companion samples.	Coarse and Fine: 1 per day or 1 per 500 m <sup>3</sup> (yd <sup>3</sup> ) whichever results in the lowest sampling rate with a minimum of 1 per week.  A minimum of 2 Verification samples per week is required when Certified production is 3 or more days per week. Take more Verification samples when production problems exist.	2449 Weekly Concrete Aggregate Report  24143 Weekly Certified Ready-Mix Plant Report
Moisture Testing (QC) (5-694.142)		1 per 200 m <sup>3</sup> (250 yd <sup>3</sup> ) or completed every four hours, whichever results in the highest sampling rate.	None	2152 Concrete Batching Report
Quality Testing (Verification)	3126 3137	At Producer's/Contractor's discretion	Test each fraction 1 per month. See Special Provisions to determine if additional testing is required.  Quality testing will be performed as directed by the Concrete Engineer.	2410 Sample ID Card
Coarse Aggregate Testing on -75µm (#200) (Verification) (5-694.146)	3137	At Producer's/Contractor's Discretion	Testing rate for cleanliness of coarse aggregate as directed by the Engineer.	2410 Sample ID Card
Air Content (QC/QA) (5-694.541)	2461	None	Test first load each day per mix 1 per 200 m <sup>3</sup> (250 yd <sup>3</sup> )  1 set of air tests per day minimum (1 test before the paver and 1 test after the paver for correlation)	2448 Weekly Concrete Report
Slump (QC/QA) (5-694.531)	2461	None	Test first load each day per mix 1 per 200 m <sup>3</sup> (250 yd <sup>3</sup> ) except 1 slump test per day for slip form paving	2448 Weekly Concrete Report
Flexural/ Compressive Strength (5-694.521 and 5-694.511)	2301	None	1 beam/cylinder (28-day) per day  Make additional control specimens as necessary	2162 Concrete Test Beam Data
Thickness	2301	The Contractor drills concrete cores for thickness verification. In addition to coring, the Contractor may be required to probe the concrete at a rate specified in the Special Provisions of the contract.	Coring is performed at locations determined by the Agency using random numbers. The Agency initials pavement at core locations and re-initials the sides of specimens after coring to clearly verify their authenticity.	24327 Field Core Report
Surface Smoothness Ride Quality	2301	Contractor provides Mn/DOT certified Inertial Profiler Results.	If the Contractor's test results are in question, the Project Engineer may request that an Independent Source retest the entire project.	

**SCHEDULE OF MATERIALS CONTROL**

**IV. CONCRETE CONSTRUCTION ITEMS (Cont.) (www.dot.state.mn.us/materials/concrete.html)**

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

<b>LOW SLUMP CONCRETE FOR BRIDGE DECK OVERLAYS</b>				
Refer to Concrete Construction Materials Section to determine if any field samples are required.				
<b>Gradation Sample Size:</b> 10 – 15 kg (25 lb.) for +19 mm (3/4" Plus) Coarse Aggregate 5 – 7 kg (10-15 lb.) for –19 mm (3/4" Minus) Coarse Aggregate 5 kg (10 lb.) for CA-70 and Sand				
<b>Quality Sample Size:</b> 25 kg (50 lb.) Coarse Aggregate 15 kg (30 lb.) Fine Aggregate				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Gradation Testing (Verification) (5-694.145 and 5-694.148)	3126 3137	None	1 per fraction prior to commencing operations and each time aggregate is delivered to the site	21412 Weekly Report of "Low Slump Concrete"
Quality Testing (Verification)	3126 3137	None	As directed by the Project Engineer.  Quality testing will be performed as directed by the Concrete Engineer.	
Air Content (Verification) (5-694.541)	2461	None	Test at beginning of pour each day. 1 per 15 m <sup>3</sup> (yd <sup>3</sup> )	
Slump (Verification) (5-694.531)	2461	None	Test at beginning of pour each day. 1 per 15 m <sup>3</sup> (yd <sup>3</sup> )  For low-slump concrete from a concrete-mobile, allow mix to hydrate 4 to 5 minutes before slump test to assure all cement is saturated.	
Compressive Strength (Verification) (5-694.511)	2461	None	1 cylinder per 30 m <sup>3</sup> (yd <sup>3</sup> ) Minimum of 1 per project	2409 ID Card Concrete Test Cylinder

SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) (www.dot.state.mn.us/materials/concrete.html)

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

<b>CONCRETE PAVEMENT REPAIR (CPR) FOR CONCRETE NOT SUPPLIED BY CERTIFIED READY-MIX</b>				
<p>Refer to Concrete Construction Materials Section to determine if any field samples are required.</p> <p><b>Gradation Sample Size:</b> 10 – 15 kg (25 lb.) for +19 mm (3/4" Plus) Coarse Aggregate                      5 – 7 kg (10-15 lb.) for -19 mm (3/4" Minus) Coarse Aggregate                      5 kg (10 lb.) for CA-70 and Sand and 3U18 bag mix.</p> <p><b>Quality Sample Size:</b> 25 kg (50 lb.) Coarse Aggregate                      15 kg (30 lb.) Fine Aggregate</p>				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Gradation Testing (Verification) (5-694.145 and 5-694.148)	3126 3137	None	1 per fraction prior to commencing operations and each time aggregate is delivered to the site.  When Bagged Portland Cement Concrete Patching Mix Grade 3U18 is supplied (any size bags) to the project, the dry blended mixture shall be sampled from the Contractor's field batching apparatus. The minimum sampling rate shall be 1 sample per shipment.  The samples shall be submitted to the Central Laboratory for testing. The samples shall be wet-washed through the 75µm (#200) sieve to remove the portland cement and the aggregate retained on the 75µm (#200) sieve shall be dried prior to performing gradation testing to verify compliance with 3105.2B.	2448 Weekly Concrete Report
Quality Testing (Verification)	3126 3137	None	1 per fraction prior to commencing operations and each time aggregate is delivered to the site.  Quality testing will be performed as directed by the Concrete Engineer.	
Air Content (Verification) (5-694.541)	2461	None	Test at beginning of pour each day. 1 per 15 m <sup>3</sup> (yd <sup>3</sup> )	
Slump (Verification) (5-694.531)	2461	None	Test at beginning of pour each day. 1 per 15 m <sup>3</sup> (yd <sup>3</sup> )	
Compressive Strength (Verification) (5-694.511)	2461	None	1 cylinder per 30 m <sup>3</sup> (yd <sup>3</sup> ) Minimum of 1 per project	

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

<b>DOWEL BAR RETROFIT MATERIAL</b>				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Compressive Strength (Verification) (5-694.511)	2461	None	<p>During the test operations: 1 set of 3 cylinders tested at 3 hours 1 set of 3 cylinders tested at 1 day Testing may need to be repeated if any problems with the dowel bar retrofit material are encountered.</p> <p>First day of production: 1 set of 3 cylinders tested at 3 hours 1 set of 3 cylinders tested at 1 day</p> <p>After the first day of production: 1 cylinder per day during production tested at rate determined by Engineer.</p>	2409 ID Card Concrete Test Cylinder

<b>CONTROLLED LOW STRENGTH MATERIAL (CLSM) OR CELLULAR CONCRETE</b>				
Test Type	Spec. No.	Contractor Testing	Agency Testing	Form No.
Compressive Strength (Verification) (5-694.511)	2461 2519	None	<p>1 set of 4 cylinders per day Minimum of 1 set of 4 per project</p> <p>4 x 8 cylinders shall be filled in two equal lifts, do not rod the concrete, lightly tap the sides, cover and move to area with minimal or no vibration. Do not disturb for 24 hours.</p>	2409 ID Card Concrete Test Cylinder

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

<b>CONCRETE CONSTRUCTION MATERIALS</b>					
Refer to Metallic Materials and Metal Products for sampling requirements for concrete reinforcement.					
<b>CEMENTITIOUS MATERIALS</b>					
All cementitious materials must come from certified sources. All certified sources must state so on the Bill of Lading. The most current approved list of certified sources can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a>					
Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Minimum Required Sampling Rate for Laboratory Testing	Sample Size	Form No.
Standard Portland High Early Portland Air Entraining Portland Air Entraining High-Early Portland	3101		The Producer obtains and stores the sample in a sealed container provided by the Agency, and includes the supplier's bill-of-lading from which the sample is obtained.	2 kg (5 lb)	24300 ID Card Cement Samples
Portland Pozzolan Blended Cement Ground Granulated Blast Furnace Slag (GGBFS)	3102 3103		Sample once per project or once every 3 months, whichever is less.	2 kg (5 lb)	24300 ID Card Cement Samples
Fly Ash	3115		<u>Take additional samples</u> as Concrete Engineer directs	2 kg (5 lb)	24308 ID Card Fly Ash Samples
<b>ADMIXTURES FOR CONCRETE</b>					
Only admixtures from approved sources are allowed for use. The most current lists of approved admixtures can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a>					
Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Minimum Required Sampling Rate for Laboratory Testing	Sample Size	Form No.
Accelerating, Retarding, Water-Reducing, Air-Entraining, etc.	3113		<u>For Concrete Pavement:</u> 1 sample for each shipment for each type, brand, and concentration (Minimum of 1 per project)  <u>For Other Concrete:</u> 1 sample once per month per plant or as production warrants	0.25 L (1/2 pt)  Producer obtains samples from dispensing tubes  Store samples in plastic container	2410 Sample ID Card
<b>WATER</b>					
Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Minimum Required Sampling Rate for Laboratory Testing	Sample Size	Form No.
	3906	Visual Inspection	1 sample from any questionable source	3.5 L (1 gal) Store sample in a clean glass or plastic container	2410 Sample ID Card

## SCHEDULE OF MATERIALS CONTROL

IV. CONCRETE CONSTRUCTION ITEMS (Cont.) ([www.dot.state.mn.us/materials/concrete.html](http://www.dot.state.mn.us/materials/concrete.html))

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

<b>CONCRETE CONSTRUCTION MATERIALS (CONT.)</b>					
<b>CURING MATERIALS</b>					
Only curing materials from approved sources are allowed. The most current list of approved curing membrane compounds can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a>					
Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Minimum Required Sampling Rate for Laboratory Testing	Sample Size	Form No.
Burlap	3751	Visual Inspection		1 m <sup>2</sup> (1 yd <sup>2</sup> )	2410 Sample ID Card
Paper	3752	Visual Inspection Must be white opaque		0.25 m <sup>2</sup> (2 ft <sup>2</sup> )	2410 Sample ID Card
Plastic	3756	Visual Inspection Must be white opaque  A Certificate of Compliance shall be submitted to the Project Engineer from the Manufacturer certifying that the plastic complies with AASHTO M171.		0.25 m <sup>2</sup> (2 ft <sup>2</sup> )	2410 Sample ID Card
Membrane Compound	3754 3754AMS 3755		Refer to the approved products list of curing compounds for pretested lots or call (651) 366-5556 before applying.	1 liter (1 qt)  Materials must be thoroughly stirred or agitated immediately prior to taking sample. Store sample in steel container. Cover sample immediately.	2410 Sample ID Card
<b>JOINT MATERIALS</b>					
Only joint materials from approved sources are allowed for use. The most current list of approved hot pour & silicone sealants can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a>					
Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Minimum Required Sampling Rate for Laboratory Testing	Sample Size	Form No.
Hot Poured Elastomeric Type	3719 3723 3725		1 per lot	5 kg (10 lb) Take samples from application wand	2410 Sample ID Card
Silicone Joint Sealer	3722		1 per lot	0.5 liter (1 pt) Store sample in steel container	2410 Sample ID Card
Preformed Elastomeric Type	3721	Visual Inspection	1 per lot	2 m (6 ft)	2410 Sample ID Card
Preformed	3702	Visual Inspection		0.25 m <sup>2</sup> (2 ft <sup>2</sup> )	2410 Sample ID Card



## SCHEDULE OF MATERIALS CONTROL

## V. LANDSCAPING AND EROSION CONTROL ITEMS

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
1. Plant Stock & Landscape Materials <sup>a</sup>	3861 and 2571.2A1	Field Inspection at Job Site, submit itemized report for each shipment. <sup>b</sup>			
<p><sup>a</sup> Preliminary inspection will not be done at the source. Material must be in accordance with the Inspection and Contract Administration Guidelines for Mn/DOT Landscape Projects.</p> <p><sup>b</sup> Utilize "Inspection and Contract Administration Guidelines for Mn/DOT Landscape Projects" to determine and measure minimum and maximum criteria thresholds. The following documentation must be provided as a condition for delivery and approval:</p> <ol style="list-style-type: none"> <li>1. A Mn/DOT Certificate of Compliance for Plant Stock, Landscape Materials, and Equipment</li> <li>2. A valid copy of a nursery stock (dealer or grower) certificate registered with the MN. Dept. of Agriculture and/or a current nursery certificate/license from a state or provincial Dept. of Agriculture for each plant stock supplier.</li> <li>3. A copy of the most recent Certificate of Nursery Inspection for each plant stock supplier.</li> <li>4. Plant material shipped from out-of-state nursery vendors subject to quarantines (Gypsy Moth and Japanese Beetle) must be accompanied by documentation certifying all plants shipped are free of regulated pests.</li> <li>5. Bills of lading (shipping documents) for all materials delivered.</li> <li>6. Invoices (billing statements) for all materials to be used.</li> <li>7. Each bundle, bale, or individual plant must be legibly and securely labeled with the name and size of each species or variety.</li> </ol>					
2. Fertilizer <sup>c</sup>	3881	Visual Inspection	None		
<p><sup>c</sup> BAGGED: Inspected on the basis of guaranteed analysis. Rate based on fertility analysis of slope dressing/topsoil. BULK: Inspector to obtain copy of invoice of blended material stating analysis. Check the type specified.</p>					
3. Agricultural Lime <sup>d</sup>	3879	One gradation test for each 180 Metric Ton (200 ton)	02415 or 2403	One sample per source for quantities of 90 metric ton (100 ton) or less	4.5 kg (10 lb.)
<p><sup>d</sup> Submit form 02415 or 2403. Small Quantity is 90 metric ton (100 ton) or less. Contractor must supply amount of ENP (Equivalent Neutralizing Power) for each shipment.</p>					
4. Topsoil Borrow, Select Topsoil Borrow, & Premium Topsoil Borrow <sup>e</sup> Salvaged Topsoil (stockpiled)	3877.2	None		From each source: One composite sample for the first 765 m <sup>3</sup> (1,000 Cu yd) or less. One composite sample for each additional 2,300 m <sup>3</sup> (3,000 Cu yd) or fraction thereof.	10 kg (20 lb.)
<p><sup>e</sup> Testing takes about three weeks after delivery of the sample to the Department Laboratory. Sampling shall be done once source is identified or existing topsoil is stockpiled. Check acceptance schedule Spec 2105 Table 2105-1. Small Quantity - 230 m<sup>3</sup> (300 Cu yd)</p>					

## SCHEDULE OF MATERIALS CONTROL

## V. LANDSCAPING AND EROSION CONTROL ITEMS (cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>5. Mulch Material</b>					
A. Type 3 Mulch - Certified Weed Free (Certified sources only) <sup>f</sup>	3882	Visual Inspection, Check if from Certified Vendor by Minnesota Crop Improvement Association. Must be tagged, grain straw only.			
<sup>f</sup> Certified mulch will be indicated by label.					
B. Type 6 Mulch - Woodchips	3882	Visual Inspection, gradation 1/750 m <sup>3</sup> (1/1000 yd <sup>3</sup> ) per supplier.		Gradation 1/3825 m <sup>3</sup> (1/5000 yd <sup>3</sup> ) per supplier.	
<b>6. Seeds</b>					
A. Seeds (Certified Vendors Only) (Mixes 100-299) <sup>g</sup>	3876	Check for guaranteed analysis labels. If materials are on hand and past the nine months, testing must be done.		Sampling only, if quantity used is more than 1800 kg. (4,000 lb.) Send to Brett Troyer M.S. 620	0.5 L (1 pint)
<sup>g</sup> Seed guaranteed as meeting the requirements is identified by official guaranteed analysis labels affixed to each container of seed in addition to the customary seed tag. Any moldy or insect contaminated seed must be rejected.					
B. Native Seed (Mixes 300-399) certified seed only <sup>h</sup>	3876	Check if from Certified Vendor by Minnesota Crop Improvement Association, Must be tagged. If materials are on hand and past the nine months, testing must be done.	None	Sample only if quantity used is more than 1800 kg. (4,000 lb.) Send to: Brett Troyer M.S 620	
<sup>h</sup> Certified seed will be indicated by label on containers.					
<b>7. Erosion Control Blanket</b> <sup>i</sup>	3885	Visual Inspection	None	Random - See Footnote <sup>i</sup>	1 m <sup>2</sup> (1 Sq yd)
<sup>i</sup> Periodic tests from approved sources to verify quality. Check approved products list					
<b>8. Erosion Control Netting</b> <sup>j</sup>	3883	Visual Inspection	None	Random - See Footnote <sup>j</sup>	1 m <sup>2</sup> (1 Sq yd)
<sup>j</sup> Periodic tests from approved sources to verify quality. Check approved products list					
<b>9. Peat Moss</b> <sup>k</sup>	3880	Final Inspection at Job Site	None	For material furnished in bulk; one sample for 100 m <sup>3</sup> (100 Cu. yd.) or less. An additional sample for each 200 m <sup>3</sup> or less, thereafter.	2-1/4 kg (5 lb.)
<sup>k</sup> Submit Samples in moisture proof bags. Materials furnished in packaged form may be accepted on the basis of guaranteed analysis.					
<b>10. Sod</b> <sup>l</sup>	3878	Final Visual Inspection at site.	None		
<sup>l</sup> A Certificate of Compliance must be furnished by the producer to the Engineer for the type of sod supplied showing correct grass varieties.					

## SCHEDULE OF MATERIALS CONTROL

## V. LANDSCAPING AND EROSION CONTROL ITEMS (cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
11. Silt Fence <sup>m</sup>	3886	Visual Inspection Check Product Label		For amounts 300m (1000 ft) or greater.	3 m (9 ft)
<sup>m</sup> Samples sent 21 days prior to use. Check Approved Products List of accepted geotextiles.					
12. Flotation Silt Curtain <sup>n</sup>	3887	Visual Inspection	None	Random - See Footnote <sup>n</sup>	1 m (1 yd)
<sup>n</sup> Accepted, based on manufacturers' guaranteed results. Check weight of fabric.					
13. Compost					
A. Compost Certified Source <sup>o</sup>	3890	Visual Inspection	None		12 kg (25 lb.)
<sup>o</sup> Accepted on the basis of certified test reports furnished to the Engineer by the supplier. Periodic sampling to verify quality. Check approved source list.					
B. Compost Non-Certified Source <sup>p</sup>				Must be sampled - One Sample per 300 m <sup>3</sup> (500 Cu Yd)	
<sup>p</sup> Submit samples six weeks before use. Small quantity 75 m <sup>3</sup> (100 Cu Yd) or less.					
14. Erosion Stabilization Mat <sup>q</sup>	3888	Visual Inspection	None	See Footnote <sup>q</sup>	1 m <sup>2</sup> (1 Sq yd)
<sup>q</sup> Periodic tests from approved sources to verify quality. Check Approved Products List					
15. Sediment Mat <sup>r</sup>	3894	Visual Inspection	None	See Footnote <sup>r</sup>	1 m <sup>2</sup> (1 Sq yd)
<sup>r</sup> Periodic tests from approved sources to verify quality.					
16. Fiber Log <sup>s</sup>	3895	Visual Inspection	None	See Footnote <sup>s</sup>	1 m <sup>2</sup> (1 Sq yd)
<sup>s</sup> Periodic tests from approved sources to verify quality.					
17. Inlet Protection <sup>t</sup>	3891	Visual Inspection	None		
<sup>t</sup> Periodic tests from approved sources to verify quality. Check approved products list and Specification.					
18. Hydraulic Soil Stabilizer <sup>u</sup>	3884	Slump Test for Type 8	None	None	
<sup>u</sup> Periodic tests from approved sources to verify quality. Check approved products list.					

**SCHEDULE OF MATERIALS CONTROL**

**V. LANDSCAPING AND EROSION CONTROL ITEMS (cont'd)**

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
19. Filter Logs <sup>v</sup>	3897	Visual Inspection	None	None	
<sup>v</sup> Periodic tests from approved sources to verify quality. Check approved products list.					
20. Flocculants <sup>w</sup>	3898	Visual Inspection	None	None	
<sup>w</sup> Periodic tests from approved sources to verify quality. Check approved products list.					

## SCHEDULE OF MATERIALS CONTROL

## VI. CHEMICAL ITEMS

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

CALL CHEMICAL LABORATORY (651) 366-5548

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
1. Asphalt Plank	3204	Visual Inspection	2410 Sample ID Card	1 per 1,000 plank or less of each thickness in each shipment	3 – 1 linear m (yd) pieces samples from different planks
2. Calcium Chloride	3911	Visual Inspection	2410 Sample ID Card	Liquid: 1 per 40,000 L (1 per 10,000 gal)	0.5 L (1 pint)
Magnesium Chloride	3912			Dry: 1 per shipment	0.5 kg (1 lb.) in Plastic Container
<b>3. Waterproofing Materials</b>					
Only waterproofing systems from approved sources are allowed for use. The most current list can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a>					
A. Membrane Waterproofing System	3757	Visual Inspection	2410 Sample ID Card	1 per shipment (Membrane Only)	0.1 m <sup>2</sup> (1 Sq Ft)
<b>Membrane Waterproofing System: The manufacturer shall submit a one square foot sample of the membrane along with a letter of Certification and test results stating that the membranes meet the requirements of this specification. Other components of the waterproofing system do not need to be sampled for testing. The manufacturer shall also submit detailed technical data sheets for all components of the membrane waterproofing system. Other components of the waterproofing system do not need to be sampled for testing.</b>					
B. Three Ply System	<b>Three Ply System, containers will be stamped if approved prior to shipment. CALL CHEMICAL LABORATORY (651) 366-5548</b>				
i. Asphalt Primer	3165	Visual Inspection	2410 Sample ID Card	1 per shipment	0.5 L (1 pt.) in steel container
ii. Waterproofing Asphalt	3166	Visual Inspection	2410 Sample ID Card	1 per shipment	0.5 L (1 pt.) in steel container
iii. Fabric	3201	Visual Inspection	2410 Sample ID Card	1 per shipment	1 m <sup>2</sup> (1 Sq yd)

## SCHEDULE OF MATERIALS CONTROL

## VI. CHEMICAL ITEMS (cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>4. Paints</b>					
A. Traffic Marking Paint	<b>Only traffic marking paints from Qualified Products List are allowed for use.</b>				
i. Waterborne Latex	3591	Visual Inspection	2410 Sample ID Card	1 per lot	0.5 L (1 pint)
ii. Epoxy Traffic Paint	3590	Visual Inspection	2410 Sample ID Card	1 Part A per lot 1 Catalyst Part B per lot	0.5 L (1 pint)
<b>Waterborne Latex and Epoxy Traffic Paint: The most current Qualified Products List can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a> Call Laboratory at (651) 366-5550 for pre-approved lots.</b>					
iii. Other	Special Provisions	Visual Inspection	2410 Sample ID Card	1 Part A per lot 1 Catalyst Part B per lot	0.5 L (1 pint)
<b>For traffic marking paints other than Waterborne Latex and Epoxy see Special Provision for Qualified Products List.</b>					
B. Non-Traffic Striping Paints	3500 Series	Visual Inspection	02415	For pre-approved paints submit Form 02415 listing batch number. Call Chemical Laboratory for pre-approved lots	0.5 L (1 pint)
<b>Only approved paints are allowed for use. For bridge coatings, see <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a> for the approved products list. For all others, see the Special Provisions. Send color sample to Chemical Laboratory for color matching.</b>					
<b>5. Drop-on Glass Beads</b>	3592	Visual Inspection	2410	1 per lot	1 L (qt.)
<b>Only glass beads from Qualified Products List are allowed for use. The most current Qualified Products List can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a> Call Laboratory at (651) 366-5550.</b>					
<b>6. Pavement Marking Tape</b>	3353 3354 3355 Special Provisions	Visual Inspection	2410 Sample ID Card	1 clean sample of each color per lot	3 m (3 yds.)
<b>Only pavement marking tape from Qualified Products List are allowed for use. The most current Qualified Products List can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a></b>					
<b>7. Signs and Markers</b>	3352	Visual Inspection	02415	None unless material suspect	
<b>Only SIGNS AND MARKERS from Qualified Products List are allowed for use. The most current Qualified Products List can be found at <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a></b>					

## SCHEDULE OF MATERIALS CONTROL

## VII. METALLIC MATERIALS AND METAL PRODUCTS

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>1. Guard Rail</b>					
A. Fittings - Splicers, Bolts, etc.	3381	Visual Inspection	02415 or 2403	Bolts: 2 Post bolts and 4 splice bolts with nuts for each 1,000 units or less.	
B. Cable	3381	Visual Inspection	Same	1 sample from each spool	1.2 m (4 ft)
C. Structural Plate Beam	3382	Visual Inspection	Same	One sample from one edge of each 200 rail sections or one sample of each 100 terminal sections	Full depth x 0.25 m (full depth x 10")
<p><b>REMARKS: Applicable to all Guardrail A, B, &amp; C. To be approved before use. Pre-tested or Inspected will carry "Inspected" tag. Not Pre-tested: Submit laboratory samples at required laboratory rate.</b></p> <p><b>For small quantities, lab samples not required, but document on Form 02415 or 2403 and maintain in project file.</b></p> <p style="text-align: center;"><b>SMALL QUANTITIES: Rail Sections - 20 or less      Terminals - 10 or less</b>  <b>Post Bolts - 100 or less                      Splice Bolts - 100 or less</b></p>					
<b>2. Steel Posts</b>					
A. Sign Posts	3401	Visual Inspection	02415 or 2403	Two posts per shipment of each MASS per UNIT LENGTH	Submit shortest full sized length of each weight, not a scrap piece.
B. Fence Posts, Top Rails and others	3403* 3406* 3379*	Visual Inspection	Same	Include all of the following, if used on the project: For posts and top rail, one sample per 500 pieces or less, but not less than two samples per shipment; Three each of the following fittings and hardware items (cups, caps, nuts and bolts, end clamp, tension bands, and truss rod tightener); Twelve hog rings; Six tie wires, One full tension stretcher bar; One truss rod, cut to 2-foot minimum to include treaded section.	Need full length for posts used in the ground (line, terminal, "C" and anchor posts), not scrap pieces. Need 5' length of top rail, and brace bar. <b>For others see column to the left ←.</b>
<p><b>REMARKS: * For 3403, 3406, &amp; 3379 submit Certificate of Compliance and certified mill analysis with sample.</b></p> <p><b>Note: For fence items, two additional samples are needed for a retest, therefore it is recommended that two additional samples be taken and retained for each sample sent in for lab testing. If the initial test passes, then the additional items should be returned to the Contractor.</b></p>					
<b>3. Fence Wire</b>					
A. Barbed	3376*	Visual Inspection	02415 or 2403	One sample per 50 spools or fraction thereof	1 m (3 ft)
B. Woven	3376*	Visual Inspection	Same	One full height sample per 50 rolls	1 m (3 ft)
C. Chain Link Fabric	3376*	Visual Inspection	Same	One sample for each 1,500 m (5,000 ft) of fencing	0.3 m (1 ft)
<p><b>REMARKS: * For 3376, submit Certificate of Compliance. Two additional samples are needed for a retest; see note above (VII, 2 B).</b></p>					
<b>4. Water Pipe and other Piping Materials</b>	3364, 3365, 3366 & Special Provisions		02415 or 2403		
<p><b>REMARKS: To be identified and tested if necessary <u>prior</u> to use. Retain Form 02415 or 2403 in project files. SEE SPECIAL PROVISIONS.</b></p>					

## SCHEDULE OF MATERIALS CONTROL

## VII. METALLIC MATERIALS AND METAL PRODUCTS (Cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>5. Reinforcing Steel</b>					
A. Bars					
i. Uncoated	3301	Visual Check for Size and Grade Marking	02415 or 2403	No Field Sample Necessary	
ii. Epoxy Coated	3301	Visual Check for Size and Grade Marking and "Inspected" tag (See Remarks)	Same	One sample (1 bar) of each size bar for each day's coating production	1 m (3 ft)
iii. Spirals	3305			One per shipment	1 m (3 ft)
<b>REMARKS: For Uncoated bars - Retain Certificate of Compliance and Certified Mill Analysis in Project File. For Epoxy-Coated bars, steel will be tagged "Inspected" when it has been sampled and tested by Mn/DOT prior to shipment, and it will be tagged "Sampled" when testing has not been completed prior to shipment. If the Epoxy-Coated bars are not tagged "Sampled" or "Inspected", submit samples, Certificate of Compliance, and Certified Mill Analysis.</b>					
B. Steel Fabric	3303	Visual Inspection		No Field Sample Necessary	
<b>REMARKS: Retain Certificate of Compliance in project file.</b>					
C. Dowel Bars	3302			One Dowel Bar from each shipment	Full Size Dowel Bars
<b>REMARKS: For all types of dowels – Each project shall have a Certificate of Compliance from the Manufacturer certifying that all materials used in fabrication of the dowel bars and baskets comply with all applicable specifications. The Manufacturer shall maintain all records necessary for certification by project. The Certificate of Compliance shall be submitted to the Project Engineer.</b>					
D. Prestressing Strand	3348			One sample (2 strands) from each heat	1.8 m (6 ft)
<b>REMARKS: Submit one copy of mill certificate and one copy of the stress-strain curve representative of the lot with the samples.</b>					
6. Drainage and Electrical Castings	3321 2471 2565	Visual Inspection*	02415 or 2403	ALL CASTINGS Two tensile bars to be cast with each heat at Foundry and submitted to the Laboratory by an approved Foundry*	
<b>* Call Maplewood Laboratory at 651-366-5540 for list of approved foundries, or see website.</b> <b>REMARKS: Inspect in the field and retain Form 02415 or 2403 in project file, showing NAME OF FOUNDRY AND QUANTITY</b>					
7. Anchor Rods and Bolts (Cast in Place)	3385	Pre Approved			
<b>Notes: Manufacturer must have one yearly passing test from the Department for each anchor rod or bolt type. Prior to installation, obtain copy of Mn/DOT passing test report from supplier. Specs 3385.2 A, B, &amp; C require anchor rod markings per ASTM F 1554 S3. The end of each anchor bolt intended to project from the concrete must be die stamped with the grade identification as follows: Grade 36 = AB36, Grade 55 = AB55, Grade 105 = AB105.</b>					
8. Anchorages (Drilled In)	Special Provisions	Visual Inspection		Three complete anchorages	
<b>Note: Before installation, verify that anchorages are on the qualified products list <a href="http://www.dot.state.mn.us/products">www.dot.state.mn.us/products</a></b>					



## SCHEDULE OF MATERIALS CONTROL

## VII. METALLIC MATERIALS AND METAL PRODUCTS (Cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>9. Structural Steel</b>					
A. For Concrete Girders-Diaphragms and sole plates	2471	Field inspection: Check for damage and defects. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply diaphragms and sole plates. A list of approved suppliers can be found on the Bridge Office internet site.</b>					
B. Steel Bearings	2471	Field inspection: Check for damage and defects. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply steel bearings. A list of approved suppliers can be found on the Bridge Office internet site.</b>					
C. Expansion joints	2471	Field inspection: Check for damage and defects. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply expansion joints. A list of approved suppliers can be found on the Bridge Office internet site.</b>					
D. Railing-Structural tube and ornamental	2471	Field inspection: Check for damage and defects, especially the coating. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply structural tube and ornamental railing. A list of approved suppliers can be found on the Bridge Office internet site.</b>					
E. Drainage Systems	2471	Field inspection: Check for damage and defects. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply drainage systems. A list of approved suppliers can be found on the Bridge Office internet site.</b>					
F. Protection Angles	2471	Field inspection: Check for damage and defects. Check dimensions for contract compliance.	2415 or 2403	None except suspect material quality	Entire lot
<b>Remarks: Only suppliers (fabricators, galvanizers, paint shops) with approved Quality Control Plans (QCP's) shall only be used to supply protection angles. A list of approved suppliers can be found on the Bridge Office internet site.</b>					

## SCHEDULE OF MATERIALS CONTROL

## VIII. MISCELLANEOUS MATERIALS

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
1. Timber, Lumber Piling & Posts	3412 to 3471 & 3491	Visual Inspection	02415 or 2403		
<b>REMARKS: Untreated materials shall be inspected in the field and the results reported on Form 02415 or 2403. Treated materials shall be Certified on the Invoice or Shipping Ticket. Material is inspected and stamped by an Independent Agency as per Specification 3491. Contact Laboratory for additional information.</b>					
2. Miscellaneous pieces and Hardware (Galvanized)	3392 3394		02415 or 2403	Three samples of each item per shipment. Sample critical items only. (Critical items are load bearing, structurally necessary items.)	Three of each type.
<b>REMARKS: Will carry "Inspected" tag if sampled and tested prior to shipment. No sample necessary if "Inspected".</b>					
3. Insulation Board	3760	Visual Inspection	02415 or 2403	None	
4. Elastomeric Bearing Pads	3741 and Special Provisions	Check dimensions Check repair of tested pad		One sample, with one or more internal plates annually from each manufacturer.	Full size pad
<b>REMARKS: Submit copy of Certificate of Compliance with pad. <u>DO NOT</u> USE ANY PADS THAT ARE NOT CERTIFIED</b>					

## SCHEDULE OF MATERIALS CONTROL

## IX. GEOSYNTHETICS, PIPE, TILE, AND PRECAST/PRESTRESSED CONCRETE

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>1. Corrugated Metal Products</b>					
A. Culvert Pipe Underdrains Erosion control Structures	3225 thru 3229, 3351, and 3399	Visual Inspection: Check for good construction, workmanship, finish requirements and shipping	02415 or 2403		
<b>REMARKS: Make certain pipe is Certified on Invoice</b>					
B. Structural Plate	3231	Visual Inspection: Invoice shall include notation that material described is in accordance with fabricator's Certificate and Guarantee	02415 or 2403		
C. Aluminum Structural Plate	3233				
<b>REMARKS: The Fabricator's Certificate and Guarantee shall be on file in the Mn/DOT Central Laboratory.</b>					
<b>2. Clay Pipe</b>	3251	No samples required for less than 100 pieces	02415 or 2403	1 sample per 200 pieces of each size.	Full Size Pipe
<b>REMARKS: To be sampled and inspected in the field.</b>					
<b>3. Concrete Pipe</b>					
A. Reinforced Pipe and Arches Precast Cattle Pass Units Sectional Manhole Units	3236	Field Inspection: Check for damage and defects. Check dimensions as required. Check for producer's "Certified" stamp and signature on the certification document.	2403 or 02415	1 "companion" cylinder per month per plant, or cylinder testing machine, whichever is greater. Call Precast Inspection Engineer at 651-366-5540 for additional information.	
B. Non-Reinforced Concrete Pipe	3253	Field Inspection: Check for damage and defects. Check dimensions as required. Check for producer's "Certified" stamp and signature on the certification document.	2403 or 02415	2 samples of each size from each source <u>unless inspected and stamped at source.</u>	Full Size Pipe
<b>REMARKS: For Concrete Pipe Both A &amp; B: Product will be certified by producer, only spot checks are done by plant inspector. Make certain the invoice or certification document is signed and the product has the required markings. Maintain Form 2403 or 02415 in project records, showing source of materials and type and quantity used</b>					

## SCHEDULE OF MATERIALS CONTROL

## IX. GEOSYNTHETICS, PIPE, TILE, AND PRECAST/PRESTRESSED CONCRETE (Cont'd)

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

Kind of Material	Spec. No.	Tests by Producers	Form No.	Tests by Mn/DOT	Sample Size
<b>4. Precast/Prestressed Concrete Structures</b>					
A. Reinforced Precast Box Culvert	3238	1 Air test per day (1st load), 2 cylinders per pour for positive slump concrete (1 for handling, 1 for shipping).	02415 or 2403		
				1 "companion" cylinder per month per plant, or cylinder testing machine, whichever is greater. Call Precast Inspection Engineer at 651-366-5540 for additional information.	
	3126 Fine Aggregate			1 quality test per month.	
	3137 Coarse Aggregate			1 quality test per month.	
				Field Inspection: Check for plant inspector's stamp. Check for shipping damage or defects. Check dimensions as needed.	
B. Precast/Prestressed Concrete Structure (beams, posts, etc.).	2405 3126 (Fine Gradation: Aggregate)	1 gradation per 150 m <sup>3</sup> (200 Cu. yd.) or fraction thereof. 1 per day of production or 3 per week, whichever is less.		1 gradation and 1 quality test per month from a split sample. Include producer's gradation results on sample card.	10 kg (25 lb.)
				1 "companion" cylinder per month per plant, or cylinder testing machine, whichever is greater. Call Precast Inspection Engineer at 651-366-5540 for additional information.	
		1 air test per day (1st load), 2 cylinders per pour for positive slump concrete (1 for handling, 1 for shipping).			
	3137 (Coarse Aggregate)	Gradation: 1 per 75 m <sup>3</sup> (100 Cu yd) or fraction thereof. 1 per day of production or 3 per week, whichever is less.		3134 Coarse Aggregate 1 gradation and 1 quality test per month from a split sample. Include producer's gradation results on sample card.	10 kg (25 lb.)
				Field Inspection: Check for plant inspector's stamp. Check for shipping damage or defects. Check dimensions as needed.	
<b>REMARKS: Precast/prestressed structures including boxes will be inspected and stamped at source. Only spot checks for dimensions are performed.</b>					

## SCHEDULE OF MATERIALS CONTROL

## IX. GEOSYNTHETICS, PIPE, TILE, AND PRECAST/PRESTRESSED CONCRETE (Cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>5. Manholes and Catch Basins (Construction)</b>	2506 3622	Field Inspection: Check for damage and defects. Check dimensions as required. Check for Producer's "Certified" stamp and signature on the certification document.	02415 or 2403		
<b>REMARKS:</b> Product will be certified by producer or inspected, tested and stamped at source. Only spot checks are done by plant inspector. Make certain the invoice or certification document is signed and the product has the required markings. Maintain Form 2403 or 02415 in project records, showing source of materials and type and quantity used (bricks, blocks, precast, or combination).					
<b>6. Drain Tile (Clay or Concrete)</b>	3276	Visual Inspection		2 samples of each size from each source	
<b>7. Thermoplastic (TP) Pipe ABS and PVC</b>	3245	Obtain Certificate of compliance. Check for approved marking printed on pipe. Field Inspect for damage or defects.	02415 or 2403		
<b>REMARKS:</b> See Spec. 2345 for specific AASHTO or ASTM Pipe types are approved under this specification. If perforated, holes should be 5mm - 10 mm (3/16 - 3/8 inch) diameter, two rows for 4", and four rows for 6" diameter; approximately 75 mm (3 inches) on center.					
<b>8. Corrugated Polyethylene Pipe</b>	3278	Check for markings (AASHTO M 252) Certificate of Compliance. Field Inspect for damage or defects.	02415 or 2403	No Laboratory tests required	
<b>9. Sewer Joint Sealing Compound</b>	3724			One per shipment	0.5 liter (1 pt.)
<b>10. Preformed Plastic Sealer for Pipe</b>	3726 Type b			One from each source	0.3 m (1 ft)
<b>11. Bituminous Mastic Joint Sealer for Pipe</b>	3728	Visual Inspection		Sample, if questionable	

## SCHEDULE OF MATERIALS CONTROL

## IX. GEOSYNTHETICS, PIPE, TILE, AND PRECAST/PRESTRESSED CONCRETE (Cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>12. Geotextile Fabric and Geogrid Reinforcement</b>	3733 and Special Provisions	Inspect for damage and uniformity of texture. Rolls of both geotextile and geotextile wrapped PE Tubing must be wrapped in UV protective plastic. (Usually Black). Obtain Certificate of Compliance (see Note 1).		(a) 1 per 15,000 m (50,000 LF) or fraction thereof for pipe wrap or trench lining for Permeable base designs. (b) 1 per 8000 m <sup>2</sup> (10,000 sq. yd.) or fraction thereof of each type fabric or geogrid for all other uses. (see Note 2). (c) Sewn seam, if required, 1 per project minimum, additional as appropriate.	(a) 3m (10 Lin. Ft.) (b) 3m <sup>2</sup> (4 sq. yd.)* (c) 3m (10 Lin. Ft.)**
<p><b>Note 1:</b> Certificate of Compliance shall state material identification (e.g. Propex 2002, Miragrid 8XT), and minimum average roll values (MARV) for all specified geotextile properties. MARV values must meet the Specification 3733 Types I through VI requirements for the specific application. Submit copy of Certificate with material samples sent to the Materials Laboratory.</p> <p><b>Note 2:</b> Submit additional sample(s), if the manufacturer or model of geotextile or geogrid used changes during construction.</p> <p><b>REMARKS:</b> Sampling shall be by random selection and no more than one sample shall be taken from an individual roll. For type VI applications (including geogrids), submit pages of Special Provisions that list required material properties. (Type VI requirements are job specific.) For Modular Block Walls or Reinforced Soil Slopes, submit page(s) of shop drawings that reference geogrid/geotextile to be used (product name) and/or required properties. Contact Randy Tilseth, Geotechnical Section, 651-366-5451 for large quantity sampling rates (greater than 40,000 sq. yd. of material on project), small quantity testing, and questions.</p> <p>* Do not sample first full turn of rolled product. For sample, cut 1 m (3ft) wide strip across width of roll {usually 3 - 4 m (12 - 14 ft)}.</p> <p>** Seam sample to include approximately 0.6 m (2 ft.) of geosynthetic material on each side of seam (in direction perpendicular to seam).</p>					
<b>13. Silt Fence</b>	3886	Visual Inspection Check Product Label		For amounts 300 m (1000 ft) or greater.	3 m (9 ft)
<p><b>REMARKS:</b> Samples sent 21 days prior to use. Check Approved Products List of accepted geotextiles</p>					
<b>14. EPS Geofoam</b>	Special Provisions	Visual Inspection Check for yellow aged material, uniformity and dimensions. Weigh 1'x1'x1' cut coupon to verify density every 200 m <sup>3</sup> (250 yd <sup>3</sup> )	02415 or 2403		

## SCHEDULE OF MATERIALS CONTROL

## X. BRICK, STONE, AND MASONRY UNITS

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>1. Brick</b>					
A. Sewer (clay) and Building	3612 to 3615	Visual Inspection		One sample per 50,000 brick or fraction thereof	6 whole bricks
B. Sewer (Concrete)*	3616	Visual Inspection		One sample per shipment.	6 whole bricks
* Air entrainment required. Obtain air content statement from supplier.					
<b>2. Concrete Masonry Units</b>					
A. For Sewer Construction	3621	Visual Inspection		One sample per shipment	6 whole units
Air entrainment required. Obtain air content statement from supplier.					
B. For Modular Block Retaining Walls	Special Provisions	Visual Inspection Check for cracks and broken corners		One sample per 10,000 units or fraction thereof, with a minimum of one sample per product (block) type per contract. *	5 whole units
All lots of block upon delivery shall have Manufacturer or Independent laboratory test results to verify passing both compression and freeze-thaw requirements. * Wall units and cap units are considered separate block types.					
<b>3. Reinforced Concrete Cribbing</b>	3661	Concrete control tests Air Tests Visual Inspection if previously tested	02415 or 2403	One cylinder per 100 units, but not less than 5 cylinders for a given contract. Other materials as required herein.	150x300mm (6 x 12 in) Cylinders
REMARKS: Will be stamped when inspected prior to shipment.					
<b>4. Stone for Masonry or Rip-Rap</b>	3601 and Special Provisions	Visual Inspection Submit Form 02415 unless special testing is specified	02415 or 2403		
REMARKS: Each source shall be approved by Project Engineer or Supervisor for quality, prior to use. For questions on quality, contact District Materials or Geology Unit.					

## SCHEDULE OF MATERIALS CONTROL

## XI. ELECTRICAL AND SIGNAL EQUIPMENT ITEMS

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
1. Lighting Standards (Aluminum or Steel)	3811	Visual Inspection			
REMARKS: The Fabricator will submit "Certificate of Compliance", on a per project basis, to the Structural Metals Engineer.					
2. Hand Holes (Precast), (PVC), and (LLDPE)	2545 2550 2565		02415 or 2403		
REMARKS: Traffic signal and street lighting projects require handholes to be listed on the Mn/DOT Signals Qualified Products List (QPL). For cast iron frame and cover: see VII.6, Drainage Castings					
3. Foundation	2545	Slump as needed		1 cylinder per 20 m <sup>3</sup> (25 Cu. yd.)	
4. Conduit and Fittings					
A. Metallic	3801 3802	Visual Inspection	02415 or 2403	None	
REMARKS: Conduit will bear UL labels. Retain Form 02415 or 2403 in Project File					
B. Non-Metallic (Rigid) and HDPE)	3803 Special Provisions	Visual Inspection	02415 or 2403		
REMARKS: Conduit will bear UL labels. Retain Form 02415 or 2403 in Project File. For traffic signal and street lighting projects, specific requirements are contained in the Special Provisions for each project.					
5a. Anchor bolts (cast in place)					
See section VII, 7.					
5b. Anchorages (Drilled In)					
See section VII, 8.					
6. Miscellaneous Hardware		Visual Inspection		Sample critical items only. One of each item per shipment. (Critical Items are load bearing, structurally necessary items.)	
REMARKS: Will carry "Inspected tag if sampled and tested prior to shipment. No sample necessary if "Inspected". <u>Do not use if not tested.</u> Field sample at sampling rate for laboratory testing. For traffic signal and street light lighting projects, various miscellaneous hardware is required to be listed on the Mn/DOT Signals and Lighting Qualified Products Lists (QPL). The Contract documents indicate, which items must be on the Signals and/or Lighting QPL.					



SCHEDULE OF MATERIALS CONTROL

XI. ELECTRICAL AND SIGNAL EQUIPMENT ITEMS (Cont'd)

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

Kind of Material	Spec. No.	Minimum Required Acceptance Testing (Field Testing Rate)	Form No.	Minimum Required Sampling Rate for Laboratory Testing	Sample Size
<b>7. Cable and Conductors</b>					
A. Power Conductors Loop Detector Conductors (No Tubing)	3815.2B1 3815.2B2(a)	Visual Inspection	02415 or 2403	None	
<b>REMARKS: Make certain the conductors are the type specified. Submit Field Inspection report showing type and quantities used. Shall bear UL label and type where applicable.</b>					
B. Electrical Cables and Single Conductors with Jacket	3815.2B2(b) 3815.2B3 3815.2B5 3815.2C1 3815.2C3 3815.2C4 3815.2C5 3815.2C6 3815.2C7 3815.2C8 3815.2C14 Special Provisions	Visual Inspection	02415 or 2403	1 sample per size per lot	1.5m (5 ft)
<b>REMARKS: Usually inspected at the distributor. Documentation showing project number, reel number(s), &amp; Mn/DOT test number(s) will be included with each project shipment. If such documentation is not received from Contractor, submit sample for testing along with material certification from manufacturer. Pre-inspected materials will <u>not</u> be tagged; an inspection report will be sent by the Mn/DOT inspector for each shipment. Project inspectors should verify that the shipping documents agree with this inspection report. Call Steve Grover at 651-366-5540 or Cindy Schellack at 651-366-5543 with questions. For traffic signal and street lighting projects, the Special Provisions for each project contain electrical cable and conductor specifications.</b>					
C. Fiber Optic Cables	3815.2C13	Visual Inspection	02415 or 2403	1 sample per size per lot	1.5m (5 ft)
<b>8. Ground Rods</b>					
	2545 2565	Visual Inspection	02415 or 2403	None.	
<b>REMARKS: Retain Form 02415 or 2403 in project file.</b>					
<b>9. Luminaires and Lamps</b>					
	2545		02415 or 2403		
<b>REMARKS: Traffic signal and street lighting projects require luminaires and lamps to be listed on the Mn/DOT Lighting Qualified Products List (QPL). The conductors shall bear UL label and type, where applicable.</b>					
<b>10. Electrical Systems</b>					
<b>Electrical Systems are to be reported as a "System" using the LIGHTING, SIGNAL AND TRAFFIC RECORDER INSPECTION REPORT. To be certified by the Project Engineer</b>					
<b>11. Traffic Signal Systems</b>					
<b>Traffic Signal Systems are to be reported as a "System" using the LIGHTING, SIGNAL AND TRAFFIC RECORDER INSPECTION REPORT. To be certified by the Project Engineer</b>					

**(2360) PLANT MIXED ASPHALT PAVEMENT**  
**Combined 2360/2350 (Gyratory/Marshall Design) Specification**  
**December 11, 2007**

This Specification requires the Contractor to provide a mix that complies with all of the design, production, and placement requirements of the specification. The Department does not make any guaranty or warranty, either express or implied, that compliance with one part of this specification guarantees that the Contractor will meet the other aspects of the specification.

All Sections titled 2360 also apply to 2350.

**2360.1 DESCRIPTION**

This work consists of the construction of one or more pavement courses of hot plant mixed asphalt-aggregate mixture on the approved prepared foundation, base course or existing surface in accordance with the specifications and in conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer. Mixture design will be either 2360 or 2350 (gyratory or Marshall) as described in the Special Provisions through the mixture designation.

**A Mixture Designations**

Mixture designations for asphalt mixtures contain the following information:

- (1) The first two letters indicate the mixture design type:  
SP = Gyratory Mixture Design  
LV = Marshall Mixture Design – Low Volume, 50 blow  
MV = Marshall Mixture Design – Medium Volume, 50 blow  
SM = Gyratory Mixture Design for Stone Matrix Asphalt (SMA)
- (2) The third and fourth letters indicate the course:  
WE = Wearing and Shoulder Wearing Course  
NW = Non-Wearing Course
- (3) The fifth letter or number indicates the maximum aggregate size\*:  
A or 4 = 12.5mm [**1/2 inch**], SP 9.5  
B or 3 = 19.0mm [**3/4 inch**], SP 12.5  
C or 2 = 25.0mm [**1 inch**], SP 19.0  
5 = 9.5mm [**3/8 inch**], (Marshall design only)  
E = See provision for SMA design  
\* Letter is used in gyratory designation; number is used in Marshall designation
- (4) **For Gyratory Design:**  
The sixth digit indicates the Traffic Level (ESAL's x 10<sup>6</sup>)  
The requirements for gyratory mixtures in this specification are based on the 20-year design traffic level of the Project expressed in Equivalent Single Axle Loads (ESAL's). The five traffic levels are shown below in Table 2360.1-A.

**Table 2360.1-A**  
Traffic Levels

Traffic Level	20 Year Design ESAL's (1 x 10 <sup>6</sup> ESAL's)
2 <sup>1</sup>	< 1
3 <sup>2</sup>	1 to < 3
4	3 to < 10
5	10 to ≤ 30
6	SMA

1 -- (AADT # 2300)

2 -- (2300 < AADT < 6000)

**For Marshall Design:**

The sixth and seventh digit indicate the Marshall design blows:

50 blow design for both LV and MV mixtures

- (5) The last two digits indicate the air void requirement:  
 40 = 4.0% for SP and SM Wear mixtures  
 35 = 3.5% for MV Wear and Non-Wear  
 30 = 3.0% for LV Wear and Non-Wear and SP Non-Wear and Shoulder
- (6) The letter at the end of the mixture designation identifies the asphalt binder grade:

Standard Grades

B = PG 58-28

C = PG 58-34

E = PG 64-28

F = PG 64-34

L = PG 64-22

Specialty Grades

A = PG 52-34

H = PG 70-28

Ex: Gyrotory Mixture Designation -- SPWEB540E (Design Type, Lift, Agg Size, Traffic Level, Voids, Binder)

Ex: Marshall Mixture Designation – LVWE35030B (Mix Type, Lift, Agg Size, Marshall blows, Voids, Binder)

Ex: SMA Mixture Designation -- SMWEE640H (Design Type, Lift, Agg Size, Traffic Level, Voids, Binder)

**B Minimum Lift thickness**

Minimum paving lift thickness will be based on maximum aggregate size:

Aggregate Size 5\*: Minimum Lift thickness = 12 mm [**1/2 inch**]

Aggregate Size A, 4\*: Minimum Lift thickness = 25 mm [**1 inch**]

Aggregate Size B, 3\*: Minimum Lift thickness = 40 mm [**1 ½ inch**]

Aggregate Size C, 2\* (for non-wear only): Minimum Lift thickness = 65 mm [**2 ½ inch**]

\* Marshall designation

**2360.2 MATERIALS**

**A Aggregate**

**A1 General**

The aggregate shall consist of sound, durable particles of gravel and sand, crushed stone and sand, or combinations thereof. It shall be free of objectionable matter such as metal, glass, wood, plastic, brick, rubber, and any other material having similar characteristics. Coarse aggregate shall be free from coatings of clay and silt to the satisfaction of the Engineer.

The Contractor shall not compensate for the lack of fines by adding soil materials such as clay, loam, or silt. Overburden shall not be blended into the asphalt aggregate.

Each different material (source, class, kind, or size) shall be fed at a uniform rate from its storage unit. An individual source, class, type, or size of material shall not be stockpile blended with another source, class, type or size of material.

**A2 Classification**

The aggregate shall conform to one of the following classifications. The class of aggregate to be used shall be the Contractor's option unless otherwise specified in the Contract.

**A2a Class A**

Class A aggregate shall consist of crushed igneous bedrock (specifically; basalt, gabbro, granite, rhyolite, diorite and andosite) and rock from the Sioux Quartzite Formation. Other igneous or metamorphic rock may be used with specific approval of the Engineer. Class A materials may contain no more than 4.0% non-Class A aggregate. This recognizes the fact that some quarries may contain small pockets of non-Class A material within that source. Intentional blending or addition of non-Class A material is strictly prohibited!

**A2b Class B**

Class B aggregate shall consist of crushed rock from all other bedrock sources such as carbonate and metamorphic rocks. (gneiss or schist)

**A2c Class C**

Class C aggregate shall consist of natural or partly crushed natural gravel obtained from a natural gravel deposit.

**A2d Class D**

Class D aggregate shall consist of 100 percent crushed natural gravel. The crushed gravel shall be produced from material retained on a square mesh sieve having an opening at least twice as large as the Specification permits for the maximum size of the aggregate in the composite asphalt mixture. The amount of carryover (material finer than) the selected screen shall not exceed ten percent.

**A2e Class E**

Class E aggregate shall consist of a mixture of any two or more of the above classes of approved aggregate (A, B, and D). The use of Class E aggregate, as well as the relative proportions of the different constituent aggregates, shall be subject to the approval of the Engineer. The relative proportions of the constituent aggregates shall be accurately controlled either by the use of a blending belt approved by the Engineer prior to production or by separately weighing each aggregate during batching operations.

**A2f Steel Slag**

Steel slag may not exceed 25 percent of the mass of the total aggregate. Steel slag shall be free of metallics and other mill waste. Stockpiles will be accepted for use if the total expansion, determined by ASTM D4792, is less than 0.50%.

**A2g Taconite Tailings (TT)**

Taconite tailings shall be obtained from ore that is mined westerly of a north-south line located east of Biwabik, Mn (R15W-R16W); except that taconite tailings from ore mined in southwestern Wisconsin will also be permitted for use.

Approved taconite tailing sources are on file with the Department Bituminous Engineer.

**A2h Scrap Asphalt Shingles**

Scrap asphalt shingles may be included in both wear and non-wear courses to a maximum of 5 percent of the total weight of mixture. Only scrap asphalt shingles from manufacturing waste are suitable. The percentage of scrap shingles used will be considered part of the maximum allowable RAP percentage (see Table 2360.3-B2a). Refer to Section 2360.2 G1 to select a virgin asphalt binder grade (use requirements for > 20% RAP, regardless of total RAP/shingle percentage). Scrap Shingle Specifications are on file in the Bituminous Office.

**A2i Crushed Concrete and Salvaged Aggregate**

Crushed concrete is allowed as an aggregate source for up to 50 percent of the aggregate in non-wear mixtures. Crushed concrete is not allowed in wearing courses.

Salvaged aggregate is allowed as an aggregate source for up to 100 percent of the aggregate in wear and non-wear mixtures. All salvaged aggregate shall be stockpiled uniformly to limit variation in mixture properties. Salvaged aggregates shall meet quality and crushing requirements as specified herein.

**A2j Sewage Sludge Ash (SSA)**

Sewage sludge ash is allowed as an aggregate source in both wear and non-wear courses to a maximum of 5 percent of the total weight of mixture. Only SSA that meets the Tier II hazard evaluation criteria as approved by Mn/DOT's Office of Environmental Services, Environmental Analysis Section, will be allowed for use in the mixture.

Approved waste incinerator ash sources are on file with the Department Bituminous Engineer.

**A3 Recycled Asphaltic Pavement Materials (RAP)**

The combined RAP and virgin aggregate shall meet the composite fine aggregate angularity or calculated crushed requirements (both coarse and fine aggregate) for the mixture being produced (calculated crushed allowed for Marshall design only). RAP containing any objectionable material, i.e., road tar, metal, glass, wood, plastic, brick, fabric, or any other objectionable material having similar characteristics will not be permitted for use in the asphalt pavement mixture.

Asphalt binder content in the RAP shall be determined according to Mn/DOT Lab Manual Method 1851 or 1852.

**B Manufactured Crushed Fines (-4 material)**

All Class A, B, D, and E material that passes the 4.75 mm [#4] screen will be considered as crushed fines.

Manufactured Crushed Fines (-4 material) from Class C Aggregate. Produce manufactured crushed fines (-4 material) from a gravel source by passing the gravel over a selected screen, 9.5 mm [3/8 inch] or larger, prior to mechanical crushing. The material which passes the 9.5 mm [3/8 inch] screen shall not be incorporated into the manufactured crushed fines but may be used as it qualifies for natural sand. The amount of carryover (material finer than) the selected screen shall not exceed ten percent.

The material retained on the 9.5 mm [3/8 inch] screen shall be crushed. The material that passes the 4.75 mm [#4] screen, after crushing, will be considered as 100% crushed fines. Material retained on the 4.75 mm [#4] screen after crushing will not be counted as +4 crushing until tested.

**C Quality Requirements**

**C1 Los Angeles Rattler Test..... AASHTO T96**

The Los Angeles Rattler loss on the coarse aggregate fraction (material retained on the 4.75 mm [#4] sieve shall not exceed 40 percent for any individual source used within the mix. An aggregate proportion which passes the 4.75 mm [#4] sieve and exceeds 40 percent LAR loss on the coarse aggregate fraction is prohibited from use in the mixture.

**C2 Soundness (Magnesium Sulfate) ..... AASHTO T104**

The magnesium sulfate soundness loss at 5 cycles on the coarse aggregate fraction (material retained on the 4.75 mm [#4]) shall not exceed the following for any individual source used within the mix: \*

- a) No more than 14 % loss on the 19 mm [3/4 inch] to 12.5 mm [1/2 inch] and larger fractions.
- b) No more than 18% loss on the 12.5 mm [1/2 inch] to 9.5 mm [3/8 inch] fraction.
- c) No more than 23% loss on the 9.5 mm [3/8 inch] to 4.75 mm [#4] fraction.
- d) No more than 18% for the composite loss. (Applies only if all three size fractions are tested).

- \* 1) If the composite requirement is met but one or more individual components do not, the source may be accepted if no individual component is more than 110% of the requirement for that component.
- 2) If each individual component requirement is met but the composite does not, the source may be accepted if the composite is no greater than 110% of the requirement.

Coarse aggregate that exceeds the requirements listed above shall not be processed for use as minus 4.75 mm [#4] material.

**C3 Spall Materials and Lumps ..... Mn/DOT Laboratory Manual**

Spall is defined as shale, iron oxide, unsound cherts, pyrite, highly weathered and/or soft phyllite and argillite (may be scratched with a brass pencil), and other materials having similar characteristics.

Lumps are defined as loosely bonded aggregations and clayey masses. If the percent of lumps measured in the stockpile or cold feed exceed the values listed below, asphalt production shall cease and compliance shall be determined by dry batching. This procedure may be repeated at any time at the discretion of the Engineer.

Maximum limits for Spall and lumps, expressed as percentages by mass, are listed in Table 2360.3-B2a.

**C4 Insoluble Residue Test ..... Mn/DOT Laboratory Manual**

If Class B carbonate material is used in the mix, the minus 0.075 mm [#200] sieve size portion of the insoluble residue shall not exceed 10 percent.

**D Aggregate Restrictions**

Class B carbonate aggregate restrictions are specified in Table 2360.3-B2a.

**E Gradation Requirement**

The coarse and fine aggregate shall be combined in such proportions to produce an asphalt mixture meeting all of the requirements defined in this specification and shall conform to the gradation as defined in Table 2360.2-E. Gradation testing shall be conducted in accordance with AASHTO T-11 (-0.075 mm [-#200] wash) and T-27.

**Table 2360.2-E**  
**Aggregate Gradation Broad Bands**  
**(% passing of total washed gradation)**

Sieve Size (mm [inch])	A or 4*	B or 3*	C or 2*	5*	E (SMA)
25.0 [1 inch]			100		See SMA Provisions
19.0 [3/4 inch]		100 <sup>(1)</sup>	85-100		
12.5 [1/2 inch]	100 <sup>(1)</sup>	85-100	45-90		
9.5 [3/8 inch]	85-100	35-90	-	100	
4.75 [#4]	25-90	30-80	30-75	65-95	
2.36 [#8]	20-70	25-65	25-60	45-80	
0.075 [#200]	2.0-7.0	2.0-7.0	2.0-7.0	2.0-7.0	

\*Marshall Designation

(1) The gradation broadband for the maximum aggregate size may be reduced to 97% passing for mixtures containing RAP, when the oversize material is suspected to come from the RAP source. The virgin material must remain 100% passing the maximum aggregate sieve size.

**F Additives**

An additive is any material added to an asphalt mixture or material, such as mineral filler, hydrated lime, asphalt additives, anti-strip, and similar products that do not have a specific pay item. When a Contract requires additives, compensation is included with the pay items for the appropriate mixture. If the Engineer directs the Contractor to incorporate additives, the compensation will be as Extra Work, at the unit price specified in the proposal. The Department will not compensate the Contractor for additives incorporated at the Contractor's option.

Additives will not be incorporated into the mixture without approval of the Department Bituminous Engineer. Anti-foaming agents shall be added to asphalt cement at the manufacturer's recommended dosage rate. Mineral filler and hydrated lime may be added in a quantity not to exceed 5 percent and 2 percent, respectively, of the total mass of the aggregate. The combination of mineral filler and hydrated lime shall not exceed 5 percent of the total mass of aggregate. The Engineer will approve or disapprove methods for addition of additives.

**F1 Mineral Filler .....3145**

**F2 Hydrated Lime .....3145**

Hydrated lime used in asphalt mixtures shall meet the requirements of ASTM C977 and have a maximum of eight percent unhydrated oxides (as received basis). The method of introducing and mixing the hydrated lime and aggregate shall be subject to approval by the Engineer prior to beginning mixture production.

**F3 Liquid Anti-Stripping Additive**

When a liquid anti-strip additive is added to the asphalt binder, blending shall be completed before the asphalt binder is mixed with the aggregate. Liquid anti-strip additives that alter the asphalt binder, such that it fails to meet the Performance Grade (PG) requirements, shall not be used. Liquid anti-strip may be added by the supplier at the refinery or by the Contractor at the plant site. The company/supplier adding the additive shall be responsible for testing the binder/additive blend to ensure compliance with the AASHTO M 320, Standard Specification for Performance Graded Asphalt Binder. No paving will be allowed until the asphalt binder/additive blend has been tested and results show that binder/additive blend properties meet the criteria in Section 2360.2G. The testing shall be done in accordance with a Mn/DOT approved Asphalt Binder QC Plan. Requirements for the Asphalt Binder QC Plan are on file in the Bituminous Office.

The following requirements for HMA mixture and asphalt binder must also be met when liquid anti-strip is added at the HMA plant site.

**Mixture Requirements at Design:**

- 1) The Contractor must design the mixture with the same asphalt binder that will be supplied to the plant site. (Both Laboratory Mixture Design (Option 1) and Modified Mixture Design (Option 2).
- 2) The Contractor must provide documentation with either design option that includes Tensile Strength Ratio results with the liquid anti-strip dosed at the optimal rate. Documentation must include verification the binder/additive blend meets AASHTO M 320 at the optimal dose rate.

**Contractor Production Testing Requirements for Asphalt Binder/Liquid Anti-Strip Blend:**

- 1) The Contractor shall, on a daily basis, sample and test the asphalt binder/anti-strip blend. Testing of the blend can be by viscosity, penetration, or dynamic shear rheometer (DSR). When a polymer modified asphalt binder is specified, the Contractor shall use the DSR as the daily QC test.
- 2) The Contractor shall, on a weekly basis, send the Engineer and Mn/DOT Chemical Laboratory Director a weekly QC report summarizing the results of the daily testing as required in number 1.
- 3) The Contractor shall, on a bi-weekly basis, test the binder/anti-strip blend to ensure compliance with the AASHTO M 320, Standard Specification for Performance Graded Asphalt Binder (minimum 1/project). Test results shall be sent to the Engineer and Mn/DOT Chemical Laboratory Director.
- 4) In addition to the sampling requirements listed above, the Contractor shall obtain asphalt binder/anti-strip blend field verification samples according to 2360.4 E12.

**Liquid Anti-Strip Additive Metering System:**

- 1) The metering system shall include a liquid anti-strip flow meter in addition to an anti-strip pump. The flow meter shall be connected to the liquid anti-strip supply to measure and display only the anti-strip being fed to the asphalt binder.
- 2) The meter readout shall be positioned for convenient observation.
- 3) There shall be a means provided for comparing the flow meter readout with the calculated output of the anti-strip pump. See number 7.
- 4) The system shall display in units of liters [**gallons**] to the nearest liter [**gallon**] or in units of metric tons [**tons**] to the nearest 0.001 metric tons [**0.001 tons**], the accumulated anti-strip quantity being delivered to the mixer unit.
- 5) The system shall be calibrated and adjusted to maintain an accuracy of  $\pm$  one percent error.
- 6) Calibration shall be required for each plant set-up prior to production of mixture.
- 7) The Engineer may require, on a daily basis, the Contractor "stick" the anti-strip tank at the end of the days production to verify anti-strip usage quantities.
- 8) The system shall provide for a convenient method for sampling the binder/anti-strip after blending has occurred.
- 9) Alternative blending and metering systems must be pre-approved by the Engineer

<b>F4</b>	<b>Coating and Anti-Stripping Additive .....</b>	<b>3161</b>
<b>G</b>	<b>Asphalt Binder Material.....</b>	<b>AASHTO M 320</b>

Asphalt binder material shall meet the requirements of PG asphalt binder testing tolerances, sampling rates, testing procedures, and acceptance criteria based on the most current Mn/DOT Technical Memorandum, titled "Inspection, Sampling, and Acceptance of Bituminous Materials." The PG asphalt binder cannot be modified with air blowing procedures unless the Department Bituminous Engineer approves it. The Contractor shall not use petroleum distillates such as fuel oil, diesel fuel or other fuels in the asphalt tanks. A statement shall be provided by the supplier for recommended laboratory mixing and compaction temperatures and field maximum mixing and compaction temperatures.



**G1 Asphalt Binder Selection Criteria for All Mixtures with RAP**

Overlay	Specified PG Asphalt Binder Grade	Virgin Asphalt Binder Grade to be used with RAP	
		≤ 20% RAP	> 20% RAP
	All PG Grades	No grade adjustment	No grade adjustment

New Construction <sup>(1)</sup>	Specified PG Asphalt Binder Grade	Virgin Asphalt Binder Grade to be used with RAP	
		≤ 20% RAP	> 20% RAP
	52-34	52-34	52-34
	58-28	58-28	58-28
	58-34	58-34	Not allowed *
	64-28	64-28	64-28
	64-34	64-34	Not allowed *
	Other PG Grades	No grade adjustment	Not allowed *

\* When approved by the Engineer, the virgin asphalt binder grade can be selected by using the blending chart procedure on file in the Bituminous Office. Mn/DOT may take production samples for information/verification of compliance with a specified asphalt binder grade.

(1) Includes cold inplace recycle, reclaiming, and reconstruction.

**2360.3 MIXTURE DESIGN**

**A Mixture Design General**

The asphalt mix may be designed using one of the following two Contractor trial mix design options as described in 2360.3B and 2360.3D. Review of mixture designs will be performed in the District Materials Laboratory where the Project is located. All mixture design test results, documentation, aggregate material samples, and mixture samples, as required by the trial mix design option, shall be submitted to the District Materials Laboratory where the Project is located (Department Bituminous Engineer in Metro area). Unless otherwise authorized by the District Materials Engineer, the addition of aggregates and materials not included in the original mixture submittal is prohibited.

It is the Contractor's responsibility to design a Marshall mixture in accordance with the most current AASHTO T-245, the Asphalt Institute's Mix Design Methods for Asphalt Concrete MS-2, and the Mn/DOT Laboratory Manual such that it meets the requirements of this specification.

For Marshall design, the design air void content of the mixture is dependent on the mixture type, regardless of the location in the pavement structure. Design air void content for LV and MV mixtures is 3.0% and 3.5%, respectively.

It is the Contractor's responsibility to design a gyratory mixture in accordance with the most current AASHTO T-312, the Asphalt Institute's Superpave Mix Design Manual SP-2 (2-hour short term aging period is used for volumetric), and the Mn/DOT Laboratory Manual such that it meets the requirements of this specification.

**B Laboratory Mixture Design (Option 1)**

To verify Laboratory Mixture Design compliance with these specifications, the Contractor shall submit mixture design test results and documentation as described in Section 2360.3C and the materials described below to the District Materials Laboratory where the Project is located (Department Bituminous Engineer in Metro area). The District Materials Engineer (Department Bituminous Engineer) will issue a Mixture Design Report when the mixture design has been successfully verified.

**B1 Aggregate sample**

At least 15 working days prior to the start of asphalt production, the Contractor shall submit aggregate samples for quality testing. A 35 kg [**80 pound**] sample of representative aggregate retained on the 4.75 mm sieve [#4] and a 15 kg [**35 pound**] sample of material passing the 4.75 mm sieve [#4] shall be submitted to the District Materials Laboratory where the Project is located (Bituminous Engineer in Metro area). The Contractor shall provide 24 hour notice of intent to sample aggregates. These samples will be tested for quality of each source, class, type, and size of virgin and non-asphaltic salvage aggregate source used in the mix design. The Contractor shall retain a companion sample of equal size until a Mixture Design Report is issued. Quality requirements are defined in Section 2360.2C.

Aggregates that require the magnesium sulfate soundness test shall be submitted to the Department Bituminous Engineer or District Materials Engineer at least 30 calendar days prior to the start of asphalt production. Dispute resolution procedures for aggregate qualities are on file in the Bituminous Office.

**B2 Mixture sample**

At least 7 working days prior to the start of asphalt production, the Contractor shall submit in writing a proposed Job Mix Formula (JMF) for each combination of aggregates to be used in the mixture. The JMF will be reviewed in the District Materials Laboratory where the Project is located (Department Bituminous Engineer in Metro area). A Level II Quality Management mix designer must sign the proposed JMF. For each JMF submitted, the Contractor shall include test data to demonstrate conformance to mixture properties as specified in Table's 2360.3-B2b and 2360.3-B2c. The proposed JMF shall be submitted on forms approved by the Department. In addition, the Contractor shall submit an uncompacted mixture sample plus briquettes compacted at the optimum asphalt content and required compactive effort conforming to the JMF for laboratory examination and evaluation. Mixture sample size and number of compacted briquettes are as follows:

**Table 2360.3-B2  
Mixture Sample Requirements**

<b>Item</b>	<b>Gyratory Design</b>	<b>Marshall Design</b>
Un-compacted Mixture Sample Size	30 Kg [ <b>75 pounds</b> ]	18 Kg [ <b>40 pounds</b> ]
Number of compacted briquettes	2	3

**B2a Mixture Aggregate Requirements**

The aggregate fractions shall be sized, graded, and combined in such proportions that the resulting mixture will meet the requirements listed in Section 2360.2-E and Table 2360.3-B2a shown below.

**Table 2360.3-B2a**  
**Mixture Aggregate Requirements**

Aggregate Blend Property	Traffic Level 2& LV	Traffic Level 3 & MV	Traffic Level 4	Traffic Level 5	SMA T. Level 6
20 year Design ESAL's	<1 million	1 - 3 million	3 - 10 million	10 – 30 million	See SMA Provisions
Coarse Aggregate Angularity (ASTM D5821) (one face / two face), %- Wear (one face / two face), %- NonWear	30/- 30/-	55 / - 55 / -	85 / 80 60/ -	95 / 90 80 / 75	-
Fine Aggregate Angularity (FAA) (AASHTO T304, Method A) %- Wear %-Non-Wear	40 <sup>(2)</sup> 40 <sup>(2)</sup>	42 <sup>(1)</sup> 40 <sup>(1)</sup>	44 40	45 40	-
Flat and Elongated Particles, max <sup>(2)</sup> % by weight, (ASTM D 4791)	-	10 (5:1 ratio)	10 (5:1 ratio)	10 (5:1 ratio)	-
Clay Content <sup>(2)</sup> (AASHTO T 176)	-	-	45	45	-
Total Spall in fraction retained on the 4.75mm [#4] sieve – Wear Non-Wear	5.0 5.0	2.5 5.0	1.0 2.5	1.0 2.5	-
Maximum Spall Content in Total Sample – Wear Non-Wear	5.0 5.0	5.0 5.0	1.0 2.5	1.0 2.5	-
Maximum Percent Lumps in fraction retained on the 4.75mm [#4] sieve	0.5	0.5	0.5	0.5	-
<b>Class B Carbonate Restrictions</b>					
Maximum% -4.75mm [-#4] Final Lift/All other Lifts	100/100	100/100	80/80	50/80	-
Maximum% +4.75mm [+ #4] Final Lift/All other Lifts	100/100	100/100	50/100	0/100	-
<b>Gyratory</b>					
Max. allowable RAP percentage <sup>(3)</sup> Wear / Non Wear	30/40	30/30	30/30	30/30	
<b>Marshall</b>					
Max. allowable RAP percentage Wear / Non Wear	30/40	30/30			

- (1) For Marshall design, the Contractor may determine –4 crushing by either FAA of uncompacted voids or calculation of crush from the composite blend. The choice must be made prior to start of production. Manufactured crushed fines requirement is 25%. RAP sand will be considered 50% crushed if the angularity index equals or exceeds 40, and 100% crushed if the angularity index equals or exceeds 45.
- (2) Not applicable under Marshall design.
- (3) When shingles are included as part of the allowable RAP percentage in Traffic Level 4 and Traffic Level 5 mixtures the ratio of added new asphalt binder to total asphalt binder shall be 70% or greater ((added binder/total binder) x 100 >= 70). A minimum of 1 spotcheck per day per mixture blend is required to determine new added binder.

**B2b Mixture Requirements**

Mixture evaluation will be based on the trial mix tests and the corresponding requirements listed in Table 2360.3-B2b and Table 2360.3-B2c.

**Table 2360.3-B2b  
Mixture Requirements**

	Traffic Level 2	Traffic Level 3	Traffic Level 4	Traffic Level 5	SMA T. Level 6
20 year Design ESAL's	< 1 million	1 - 3 million	3 - 10 million	10 – 30 million	See SMA Provisions
<b>Gyratory Mixture Requirements</b>					
Gyrations for N <sub>design</sub>	40	60	90	100	-
%Air Voids at N <sub>design</sub> , -- Wear	4.0	4.0	4.0	4.0	-
%Air Voids at N <sub>design</sub> , -- Non-Wear & All Shoulder	3.0	3.0	3.0	3.0	-
Tensile Strength Ratio <sup>(1)</sup> , min%	75 <sup>(2)</sup>	75 <sup>(2)</sup>	80 <sup>(3)</sup>	80 <sup>(3)</sup>	-
Fines/Effective Asphalt	0.6 – 1.2	0.6 – 1.2	0.6 – 1.2	0.6 – 1.2	-
VFA, % -- Wear- 4.0% Voids	65 - 78	65 - 78	65 - 76	65 - 76	
Non-Wear & All Shoulder- 3.0% Voids	70 – 83	70 - 83	70 - 82	70 - 82	
<b>Marshall Mixture Requirements</b>					
Marshall Blows	LV	MV			
Marshall Blows	50	50	-	-	-
Air Voids, %	3.0	3.5	-	-	-
Tensile Strength Ratio <sup>(1)</sup> , min%	70 <sup>(4)</sup>	70 <sup>(4)</sup>			
Stability, minimum N [lb f]	5000 [1125]	6000 [1350]			
Fines/Effective Asphalt Wear	0.6 - 1.30	0.6 - 1.30	-	-	-
Non-Wear	0.6-1.40	0.6-1.40			

- (1) See Section 2360.4 E9. Use 150mm [6 inch] specimens for gyratory and 100mm [4 inch] specimens for Marshall design.  
 (2) Mn/DOT Min = 65, <sup>(3)</sup> Mn/DOT Min = 70, <sup>(4)</sup> Mn/DOT Min = 60

**B2c VMA Criteria**

The voids in mineral aggregate (VMA) of the mixture at design and during production shall meet the minimum criteria as shown in Table 2360.3-B2c at the specified compaction level. VMA shall be calculated according to the procedures outlined in Asphalt Institutes SP-2 or MS-2 manual. VMA is a design and acceptance/process control requirement.

**Table 2360.3-B2c  
Voids in Mineral Aggregate (VMA) Mixture Requirements**

Gradation	Fine Mixture % Pass 2.36 mm [#8]	VMA Minimum	Coarse Mixture % Pass 2.36 mm [#8]	VMA Minimum
A or 4*	> 47	15.0**	≤ 47	14.5**
B or 3*	> 39	14.0	≤ 39	13.5
C or 2*	> 35	13.0	≤ 35	12.5
5*	-----	15.0**	-----	-----
E	See SMA Provisions			

\*Marshall designation.

\*\*For LV 4 and LV 5 mixes lower VMA requirements by 0.5%

**B3 Tensile Strength Ratio sample**

Mixture or briquettes that represent the mixture at optimum asphalt content, shall be submitted at least 7 days prior to actual production for verification of moisture sensitivity retained tensile strength ratio (TSR). Material submitted for TSR verification may be tested for maximum specific gravity G<sub>mm</sub> compliance in addition to TSR results. Failure to meet the G<sub>mm</sub> tolerance will result in rejection of the submitted mix design. A new mix design submittal will be required and will be subject to provisions described in Section 2360.3C. One of

the following options may be used to verify that the tensile strength ratio (TSR) meets the requirements in Table 2360.3-B2b.

Option A) The Contractor will batch material at the design proportions including optimum asphalt. Immediately (before curing) split the sample and allow samples to cool to room temperature. Submit 35 kg [77 pounds] of mixture to the District Materials Laboratory for curing and test verification. Both groups will use a two (2) hour cure time ( $\pm$  15 minutes) at 144°C [290°F] and follow procedures in ASTM D 4867-92, Mn/DOT modified as defined in the Mn/DOT Laboratory Manual.

Option B) The Contractor batches, cures (as indicated in option A), compacts, and submits briquettes and uncompacted mixture as specified below.

**Table 2360.3-B3  
Option B Mixture Requirements**

Item	Gyratory Design	Marshall Design
Un-compacted Mixture Sample Size	8,200 g	8,200 g
Number of compacted briquettes <sup>(1)</sup>	6	9
Compacted briquette air void content	6.5 – 7.5%	6.0 – 8.0%

<sup>(1)</sup> 150mm [6 inch] specimens for gyratory design  
100mm [4 inch] specimens for Marshall design

**B4 Aggregate Specific Gravity..... AASHTO T84 and T85, Mn/DOT Modified**

The Contractor shall determine the specific gravity of all aggregate used in the mixture.

**C Documentation**

Each proposed JMF submitted for review under Section 2360.3B and 2360.3D shall include the following documentation and test results.

- (1) The name(s) of the individual(s) responsible for the Quality Control of the mixture during production.
- (2) The low projects number on which the mixture will be used.
- (3) The design traffic level and the design number of gyrations.
- (4) The temperature ranges the mixture is intended to be discharged from the plant and compacted at the roadway shall be provided by the asphalt binder supplier. Temperatures to be included are, laboratory mixing and compaction temperature ranges and maximum field mixing and compaction temperatures..
- (5) The percentage in units of 1 percent (except the 0.075 mm sieve [#200] in units of 0.1 percent) of aggregate passing each of the specified sieves for each aggregate to be incorporated into the mixture. The gradation of aggregate from salvaged asphaltic material shall be derived from the material after the residual asphalt has been extracted.
- (6) The source and description of the materials to be used. The aggregate pit or quarry source number. The proportion of each material (in percent of total aggregate).
- (7) The composite gradation based on (5) and (6) above. Note: Include virgin composite gradation based on (6) and (7) above for mixtures containing RAP.
- (8) The bulk (dry) and apparent specific gravities and water absorption (by % weight of dry aggregate) of both coarse and fine aggregate, for each product used in the mixture (including RAP). Use AASHTO T-84 and T-85 Mn/DOT modified as defined in the Mn/DOT Laboratory Manual. The tolerance allowed between the Contractor’s and the Department’s specific gravities are  $G_{sb}$  (individual) = 0.040 [+4 AND -4] and  $G_{sb}$  (combined) = 0.020.
- (9) The composite gradation plotted on a FHWA 0.45 power chart. (Federal form PR-1115)
- (10) The test results from the composite aggregate blend at the proposed JMF proportions indicating compliance with Coarse Aggregate Angularity, Fine Aggregate Angularity, and Flat and Elongated as shown in Table 2360.3-B2a.

- (11) For mixtures containing RAP include extracted asphalt binder content of the RAP with no retention factor included.
- (12) The percentage (in units of 0.1 percent) and PG grade of asphalt binder material to be added, based upon the total mass of the mixture.
- (13) Each trial mixture design shall include the following:
  - (a) A minimum of three different asphalt binder contents (minimum 0.4 percent between each point), with at least one point at, one above and one below the optimum asphalt binder percentage.
  - (b) The maximum specific gravity at each asphalt binder content. The theoretical maximum specific gravity used for percent air voids determination shall be calculated based on the average of the effective specific gravities measured by a minimum of two maximum specific gravity tests at the asphalt contents above and below the expected optimum asphalt binder content.
  - (c) The test results for the individual and average bulk specific gravity, density, and heights, of at least two specimens at each asphalt binder content. For Marshall design include the test results for the individual and average bulk specific gravity, density, height, stability, and flow of at least three specimens at each asphalt binder content.
  - (d) The percent air voids in the mixture at each asphalt binder content.
  - (e) The percent Voids in Mineral Aggregate (VMA) at each asphalt binder content.
  - (f) The fines to Effective Asphalt (F/A) ratio calculated to the nearest 0.1 percent.
  - (g) TSR results at the optimum asphalt binder content.
  - (h) Graphs showing air voids, voids in the mineral aggregate, Gmb, Gmm and unit weight vs. percent asphalt binder content for each of the three asphalt binder contents submitted with trial mix.
  - (i) Evidence the completed mixture will conform to design air voids ( $V_a$ ), VMA, VFA (gyratory), TSR, F/A<sub>e</sub> (Fines to effective asphalt ratio).
  - (j) For gyratory design, the documentation shall also include labeled gyratory densification tables and curves generated from the gyratory compactor for all points used in the mixture submittal.
- (14) **Optional Add-Rock/Add-Sand Provisions**

If the Contractor chooses to use the add-material option to augment the submitted JMF, the Contractor shall provide samples of the aggregate for quality analysis in accordance with Section 2360.3B1. The Contractor shall provide mix design data for two additional design points per add-material. One point shall show a proportional adjustment to the submitted JMF that includes 5 percent, by mass, add-material at the JMF optimum asphalt percent. The second point shall show a proportional adjustment to the submitted JMF that includes 10 percent, by mass, add-material at the JMF optimum asphalt percent. The following information will be reported for each of these two points:

  - (a) The maximum specific gravity (average of two tests).
  - (b) The test results for the individual and average bulk specific gravity, density, and height of at least two specimens at the optimum asphalt binder content. For Marshall design include the test results for the individual and average bulk specific gravity, density, height, stability, and flow of at least three specimens at the optimum asphalt binder content.
  - (c) The percent air voids in the mixture for each point.
  - (d) The Fines to Effective Asphalt ratio calculated to the nearest 0.1 of a percent.
  - (e) Coarse and Fine Aggregate crushing counts

Up to two add-materials will be allowed per mix design submittal. Aggregate quality and mix characteristics are required for each proposed add-material and shall be submitted at the time of the original trial mix submittal. No mixture sample or briquettes are required for these two additional points.

**D Modified Mixture Design (Option 2)**

The Contractor shall submit mixture design test results and documentation as described in Section 2360.3C to the District Materials Laboratory where the Project is located (Department Bituminous Engineer in Metro area) to verify compliance with these specifications. The District Materials Engineer (Department Bituminous Engineer) will issue a Mixture Design Report when the mixture design has been successfully verified. Mixture submittal is not required. The Contractor may use this option if **all** of the following conditions are met:

- a) The aggregates must have been tested for and meet all applicable quality requirements in the current construction season.
- b) The Level II mix designer submitting the mixture design must have a minimum of 2 years experience in mixture design.
- c) The Contractor and his representatives cannot have violated the requirements of 1512 Unacceptable and Unauthorized Work relating to mixture design or mixture production within the last 12 month period.

**D1 JMF Submittal**

At least 2 working days prior to the start of asphalt production, the Contractor shall submit in writing a proposed Job Mix Formula (JMF) for each combination of aggregates to the Department Bituminous Engineer or District Materials Engineer for review. A Level II Quality Management mix designer must sign this proposed JMF. For each JMF submitted, the Contractor shall include documentation as outlined in Section 2360.3C to demonstrate conformance to mixture properties as specified in Table 2360.3-B2b and 2360.3-B2c. The proposed JMF shall be submitted on forms approved by the Department.

**D2 Initial Production Test Verification**

At the start of production, the testing frequency for the first 1,800 metric tons [**2,000 tons**] of each mix type shall be as specified in Table 2360.4-D.

All mixture placed on Mn/DOT projects shall meet the specified quality indicators and required field density. Failure to do so will result in reduced payment or removal and replacement with acceptable material.

The Department shall take a mix verification sample within the first four samples at the start of production of each mix type.

**D3 Tensile Strength Ratio sample**

See Section 2360.4E9

**D4 Marshall Stability (Marshall Design Only)**

On the first day of production, for each different mix design, at the same time the verification sample is obtained, an additional sample shall be obtained for Department evaluation of Marshall stability. This sample may be tested at the discretion of the District Materials Engineer. The Contractor is not required to test stability on production mixture.

If the Marshall stability fails to meet the minimum requirements as listed in Table 2360.3-B2c the Contractor shall stop production immediately. The Contractor will be required to submit a revised mix design, with bituminous mixture at optimum asphalt content, to the District Materials Laboratory. If the mixture meets the minimum stability requirement production may be resumed.

If the stability fails the second time, the Mix Design Report will be revoked. The Contractor will then be required to submit a new mix design according to Laboratory Mixture Design 2360.3B, Option 1. A new Mix Design Report will be issued upon successful verification of the new mixture design submittal.

**E Mixture Design Report**

A Mixture Design Report consists of the JMF (Job Mix Formula). The JMF includes composite gradation, aggregate component proportions, asphalt binder content of the mixture, design air voids, Voids in Mineral Aggregate, and aggregate bulk specific gravity values. JMF limits will be shown for gradation control sieves, percent asphalt binder content, air voids, and VMA. Issuance of a Mixture Design Report confirms the mixture has been reviewed for and meets volumetric properties only. No guaranty or warranty, either express or implied, is made regarding placement and compaction of the mixture

A Department reviewed Mixture Design Report is required for all paving except for small quantities of material provided under Section 2360.5H. All submitted materials must meet aggregate and mixture design requirements before a Mixture Design Report is issued. The Department will review two trial mix designs per mix type designated in the plan, per Contract at no cost to the Contractor. Additional mix designs will be verified at a cost of \$2000 per design, payable to the Commissioner of Transportation.

For city, county, and other agency projects, the Contractor shall provide to the District Materials Laboratory a complete Project proposal including addenda, supplemental agreements, change orders, and any Plan sheets (including typical sections) that affect the mix design. The Department will not start the verification process without this information.

**2360.4 MIXTURE QUALITY MANAGEMENT (Quality Control/Quality Assurance)**

**A Quality Control (QC)**

The Contractor shall provide and maintain a quality control program for HMA production. A quality control program is defined as all activities, including mix design, process control inspection, sampling and testing, and necessary adjustments in the process that are related to the production of a hot mix asphalt (HMA) pavement which meets the requirements of the specifications.

**A1 Contractor Certified Plant HMA**

**A1a Certification Procedure**

The Contractor shall:

- (1) Complete application form and request for plant inspection.
- (2) Provide a site map of stockpile locations.
- (3) Pass plant and testing facility inspection by having the Plant Inspector and Bituminous Plant Authorized Agent complete and sign the Asphalt Plant Inspection Report (TP 02142-02, TP 02143-02). By signing the Asphalt Plant Inspection Report, the HMA plant authorized agent agrees to calibrate and maintain all plant and laboratory equipment within allowable tolerances set forth in these specifications, Standard Specifications for Construction, and the Mn/DOT Bituminous Manual.
- (4) Obtain a Mixture Design Report prior to production.



**A1b Maintaining Certification**

To maintain certification, the plant must produce, test, and document all certified plant asphalt mixtures in accordance with the above requirements on a continuous basis. Continuous basis means all asphalt mixtures supplied from a certified plant to any Department project with 2360 asphalt mixtures must be sampled and tested in accordance with 2360 requirements and the Schedule of Materials Control.

The Contractor shall assure the plant certification procedure is performed annually after winter suspension and before producing material for a Project. In addition, a first-day sampling and testing frequency rate as stated in Table 2360.4-D shall be followed.

The Contractor shall recertify a plant when it is moved to a new location or a previously occupied location.

**A1c Revocation of Plant Certification**

The Department Construction Engineer may revoke certification of an asphalt plant when requirements are not being met or records are falsified. The Department may revoke the Technician Certification for the individual involved.

The Department Bituminous Engineer and Department Contract Administrator will maintain a list of companies who have had their asphalt plant certification revoked.

**B Quality Assurance (QA)**

The Department will perform QA testing as part of the acceptance process. The Engineer is responsible for QA testing, records, and acceptance. The Engineer will accomplish the QA process by:

- (1) Conducting Quality assurance and verification sampling and testing.
- (2) Observing sampling and tests performed by the QC personnel.
- (3) Taking additional samples at any time and any location during production.
- (4) Monitoring the required QC summary sheets and control charts.
- (5) Verifying calibration of laboratory testing equipment.
- (6) Communicating Mn/DOT test results to the Contractor's QC personnel in a timely manner (See 2360.4M and 2360.4N).
- (7) Ensuring Independent Assurance Sampling and testing requirements are met.

**C Contractor's Quality Control**

**C1 Personnel Requirements**

Along with the proposed mix design data, the Contractor shall submit to the Engineer an organizational chart listing the names and phone numbers of individuals and alternates responsible for mix design, process control administration, and inspection. The Contractor shall also post a current organizational chart and if required by the Engineer, post a daily roster of individuals performing QC testing in the Contractor's test facility.

The Contractor's quality control organization or private testing firm shall have Certified Technicians who have met the requirements on file with the Department's Technical Certification program. Individuals performing process control testing must be certified as a Level I Bituminous Quality Management (QM) Tester. Individuals performing mix design calculations or mix design adjustments must be certified as Level II Bituminous QM Mix Designer. The Contractor shall have a Certified Level II Bituminous QM Mix Designer available to make any necessary process adjustments. The Contractor shall have a minimum of one person per paving operation certified as a Level II Bituminous Street Inspector.

## **C2 Laboratory Requirements:**

The Contractor shall furnish and maintain a laboratory at the plant site or other site as approved by the Engineer. The laboratory shall be furnished with the necessary equipment and supplies for performing Contractor quality control testing. The laboratory equipment shall meet the requirements listed in Section 400 of the Mn/DOT Bituminous Manual, Mn/DOT Lab Manual, and these specifications, including having extraction capabilities. The laboratory shall be calibrated and operational prior to the beginning of production. In addition to the requirements listed above, the laboratory shall be equipped with a telephone for use by the Contractor or the Engineer. A fax machine and copy machine shall be available for use by the Contractor or the Engineer at the laboratory site. The Engineer may waive the requirement to have a fax machine available at the laboratory site if transfer of data and test results can be accomplished through electronic transmittal (email). The laboratory shall also include a computer and printer. The computer shall have the following minimum requirements: 1) Intel based with either Celeron or Pentium IV processor with a minimum processor speed of 1.8 MHZ. 2) CD writer with CD/RW capability and a minimum write speed of 16x. 3) Windows 2000 or Windows XP with Microsoft Excel version 97 or newer. The printer must be able to print control charts.

The Engineer shall be allowed to inspect measuring and testing devices to confirm both calibration and condition. The Contractor shall calibrate and correlate all testing equipment in accordance with the latest version of the Mn/DOT Bituminous Manual and Mn/DOT Lab Manual. Records of calibration for each piece of testing equipment shall be kept in the same facility as the equipment.

## **D Sampling and Testing**

The Contractor shall ensure that all QC samples are taken at random locations. Random number generation and determination of random sample location shall be consistent with the Mn/DOT Bituminous Manual Section 5-693.7 Table A or Section 5 of ASTM D3665. The Engineer may approve alternate methods of random number generation.

The tests for mixture properties shall be conducted on representative portions of the mix, quartered from a larger sample of mixture taken from behind the paver, or when approved by the Engineer, an alternate sampling location. The procedure for truck box sampling, an alternate sampling location, is on file in the Bituminous Office. When an alternate sampling location is approved and used by the Contractor, the daily verification sample must still be taken from behind the paver.

The Contractor shall obtain a sample of at least 25 kg [**55 pounds**]. This sample may be either split in the field or transported to the test facility by a method to retain heat to facilitate sample quartering procedures. The Contractor shall store and retain mixture bulk samples and companion samples for the Department for a period of 7 working days. The Contractor shall maintain these split samples in containers labeled with companion numbers. The Contractor shall perform QC sampling and testing according to the following schedule.

Determine the planned tonnage for each mixture to be produced during the production day. Divide the planned production by 1000. Round the number to the next higher whole number. This number will be the number of production tests required for that mixture. Required production tests are listed in Table 2360.4-E. Split the planned production into even increments and select sample locations as described above. If actual tonnage exceeds planned tonnage additional tests may be required. During production, mixture volumetric property tests will not be required when mix production is less than 270 metric tons [**300 tons**]. However, production tests will be required when the accumulative tonnage on successive days exceeds 270 metric tons [**300 tons**].

At the start of production, the testing frequency for the first 1800 metric tons [**2,000 tons**] of each mix type shall be as follows:

**Table 2360.4-D  
Production Start-Up Testing Rates**

Production Test	Testing Rates	Test Reference	Section
Bulk Specific Gravity	1 test per 450 metric tons [500 tons]	AASHTO T312, T166 Mn/DOT modified	2360.4E2
Maximum Specific Gravity	1 test per 450 metric tons [500 tons]	AASHTO T209 Mn/DOT modified	2360.4E3
Air Voids (calculated)	1 test per 450 metric tons [500 tons]	AASHTO T269, T312	2360.4E4
Asphalt Content	1 test per 450 metric tons [500 tons]	Bit & Lab Manual	2360.4E1
VMA (Calculated)	1 test per 450 metric tons [500 tons]	AI MS 2 & SP 2	2360.4E5
Gradation	1 test per 900 metric tons [1000 tons]	AASHTO T11, T27, T30Mn/DOT modified	2360.4E6
Coarse Aggregate Angularity	1 test per 900 metric tons [1000 tons]	ASTM D5821	2360.4E7
Fine Aggregate Angularity (FAA) <sup>(1)</sup>	1 test per 900 metric tons [1000 tons]	AASHTO T304, Method A	2360.4E8

(1) Marshall design allows -4.75mm [-#4] manufactured crushed fines calculation per Mn/DOT Bituminous Manual

**E Production Tests**

When more than one Mn/DOT approved test procedure is available, the Contractor shall select, with the approval of the Engineer, one method at the beginning of the Project and use that method for the entire Project. The Contractor and Engineer may agree to change test procedures during the construction of the Project.

**Table 2360.4-E  
Production Sampling and Testing Rates**

Production Test	Sampling/Testing Rates	Test Reference	Section
Bulk Specific Gravity	Divide the planned production by 1000. Round the number to the next higher whole number.	AASHTO T312, T245 T166 Mn/DOT mod	2360.4E2
Maximum Specific Gravity	"	AASHTO T209 Mn/DOT modified	2360.4E3
Air Voids (calculated)	"	AASHTO T269, T312	2360.4E4
Asphalt Content	"	Bit & Lab Manual	2360.4E1
VMA (Calculated)	"	AI MS 2 & SP 2	2360.4E5
Gradation	1 gradation per 1,800 metric tons [2,000 tons], or portion thereof (minimum of one per day)	AASHTO T11, T27, T30Mn/DOT modified	2360.4E6
Coarse Aggregate Angularity	2 tests/day for a minimum of 2 days, then 1 per day if CAA is met. If CAA >8% of requirement, 1 sample/day but test 1/week.	ASTM D5821	2360.4E7
Fine Aggregate Angularity (FAA) <sup>(1)</sup>	2 tests/day for a minimum of 2 days, then 1 per day if FAA is met. If FAA >5% of requirement, 1 sample/day but test 1/week.	AASHTO T304, Method A	2360.4E8
TSR	1 <sup>st</sup> sample at 5,000 tons or by second day of production, then sample at every 18,000 metric tons [20,000 tons]	ASTM D4867 Mn/DOT modified	2360.4E9
Aggregate Specific Gravity	1 per 9,000 metric tons [10,000 tons]	AASHTO T84 & T85, Mn/DOT modified	2360.4E10
Mixture Moisture Content	Daily unless exempted by Engineer	Mn/DOT 5-693.950	2360.4E11
Asphalt Binder	Sample 1 <sup>st</sup> load (each grade) then 1 per 1,000,000 liter [250,000 gallon-sample size 1 quart.]	Mn/DOT 5-693.920	2360.4E12

(1) Marshall design allows -4.75mm [-#4] manufactured crushed fines calculation per Mn/DOT Bituminous Manual

- E1 Asphalt Binder Content<sup>(2)</sup>**
- (a) Spot Check (Virgin only)..... Mn/DOT Bituminous Manual
  - (b) Incinerator Oven<sup>(1)</sup> ..... Mn/DOT Laboratory Manual Method 1853
  - (c) Chemical Extraction ..... Mn/DOT Laboratory Manual Method 1851 or 1852
  - (d) Meter Method (Virgin only)..... Mn/DOT Bituminous Manual

- (1) Incinerator Oven may not be used when the percentage of Class B material exceeds 50% within the composite blend, unless a correction factor is determined by the Contractor and approved by the District Materials Engineer.
- (2) For Traffic Level 4 and 5 mixtures that include shingles as part of the allowable RAP percentage a minimum of 1 spotcheck per day per mixture blend is required to determine new added asphalt binder (See footnote 3 of Table 2360.3-B2a).

**E2 Marshall Bulk Specific Gravity,  $G_{mb}$  (3 specimens).....AASHTO T166, Mn/DOT Modified, or**

**E2a Gyrotory Bulk Specific Gravity,  $G_{mb}$  (2 specimens) .....AASHTO T312, T166, Mn/DOT Modified**

**E3 Maximum Specific Gravity,  $G_{mm}$ ..... AASHTO T209, Mn/DOT Modified**

**E4 Air Voids - Individual and Isolated (calculation) .....AASHTO T269, T312**

Isolated air voids are calculated using the maximum mixture specific gravity and the corresponding bulk specific gravity from a single test. Individual air voids are calculated from the maximum specific gravity moving average and the bulk specific gravity from that single test.

For gyrotory design, compaction shall be conducted to  $N_{design}$ , as shown in Table 2360.3-B2a, for the specified Traffic Level.

**E5 Voids Mineral Aggregate (VMA) (calculation) ..... Asphalt Institute MS-2, SP-2**

**E6 Gradation - Blended Aggregate ..... AASHTO T-11, T-27, and T-30 (all Mn/DOT modified)**

Testing to determine the blended aggregate gradation shall be determined every 1800 metric tons [2,000 tons], or portion thereof (minimum of one per day), on samples taken at the same time as the required mixture sample for a given increment.

All gradations require a - 0.075 mm [-#200] wash.

- (a) Virgin Aggregate Mixtures - Drum or Screenless Plants  
Belt Samples or extracted production samples.
  - (b) All Other Mixtures:
    - 1. Hot Bins - Drybatch (Optional)
    - 2. Incinerator Oven Mn/DOT Laboratory Manual Method 1853 (Optional) except samples that contain over 50% class B. <sup>(1)</sup>
    - 3. Extraction Mn/DOT Laboratory Manual Method 1851 or 1852 (Optional)
- (1) Incinerator Oven may not be used when the percentage of Class B material exceeds 50% within the composite blend, unless a correction factor is determined by the Contractor and approved by the District Materials Engineer.

**E7 Coarse Aggregate Angularity.....ASTM D5821**

CAA test results shall meet the minimum percent fractured faces as shown in Table 2360.3-B2a. ASTM D-5821 shall be used to determine coarse aggregate angularity on the composite blend from aggregates used

in production of hot mix asphalt. Mixtures that contain virgin aggregates may be tested from composite belt samples. Mixtures that contain RAP must be tested from extracted aggregates taken from standard production samples. The percentage of fractured faces of the composite aggregate blend less than 100% shall be tested at the following rates:

- (1) Perform two tests per day for each mixture blend for a minimum of two days and then one per day if the test samples meet CAA requirements.
- (2) If CAA crushing test results exceed 8 percent of the requirement, take one sample per day and perform one test per week.

CAA results must be reported on the test summary sheet. Mixture placed and represented by results below the minimum requirement, as shown in Table 2360.3-B2a, will be subject to reduced payment as outlined in Table 2360.4-L3. Tonnage subjected to reduced payment shall be calculated as the tons placed from the sample point of the failing test until the sampling point when the test result is back within specifications.

**E8 Fine Aggregate Angularity ..... ASTM C1252 Method A**

FAA test results shall meet the minimum criteria shown in Table 2360.3-B2a. ASTM C1252 Method A shall be used to determine fine aggregate angularity on the composite blend from aggregates used in production of HMA. Mixtures that contain virgin aggregates may be tested from composite belt samples. Mixtures that contain RAP must be tested from extracted aggregates taken from standard production samples. The percentage of uncompacted voids from the composite aggregate blend shall be tested at the following rates.

- (1) Perform two tests per day for each mixture blend for a minimum of two days and then one per day if the test samples meet FAA requirements.
- (2) If FAA test results exceed 5 percent of the requirement, take one sample per day and perform one test per week.

FAA results must be reported on the test summary sheet. Mixture placed and represented by results below the minimums, as shown in Table 2360.3-B2a, will be subject to reduced payment as outlined in Table 2360.4-L3. Tonnage is subjected to reduced payment shall be calculated as the tons placed from the sample point of the failing test until the sampling point when the test result is back within specifications.

**E8a - 4.75 mm [-#4] Manufactured Crushed Fines..... (calculation) Mn/DOT Bituminous Manual**

Under Marshall design, when the -4.75 mm [-#4] crushing is calculated, adjustments in target values from the composite blend must be made at the end of each days paving. If the target quantity (percent of -4.75 mm [-#4] to be crushed) changes due to mixture proportion or composite gradation change, a new target shall be established for the next days paving.

**E9 Field Tensile Strength Ratio (TSR) ..... ASTM D4867 Mn/DOT Modified**

At the discretion of the Materials Engineer, mixture will be sampled and tested to verify tensile strength ratio (TSR)<sup>(1)</sup>. If the Materials Engineer requires sampling and testing, both the Contractor and the Department will be required to test these samples within 72 hours after it is sampled. Sample size shall be 50 kg [**110 pound**] minimum and split in half to provide a sample for the Department and the Contractor. The Department companion of this split shall be labeled with the date, time, Project number and approximate cumulative tonnage to date. The Department companion shall be given to the Department Street Inspector or Plant Monitor immediately or delivered to the District Materials Engineer within 24 hours of sampling, as specified by the Engineer. Mixture samples shall be taken from behind the paver unless the Engineer approves an alternate sampling location. Specimen size shall be 100 mm [**4 inch**] for Marshall mix design and 150 mm [**6 inch**] for gyratory design The Contractor may test the sample at a permanent lab site or a field lab site.

- (1) When utilizing Option 2 mix design, it is recommended a sample be obtained within the first 4,500 metric tons [**5,000 tons**] of HMA produced or by the second day of production, whichever comes first, to verify tensile strength ratio (TSR).

Minimum acceptable TSR values for production are shown in Table 2360.4-E9. The Contractor shall stop production immediately if minimum TSR requirements are not met. The Contractor will not be allowed to resume production until anti-strip has been added to the asphalt binder. Determination of who is responsible for the cost of the anti-strip is based on Mn/DOT and Contractor TSR values as outlined in Tables 2360.4E9A, 2360.4E9B, and 2360.4E9C. When Mn/DOT is responsible for the cost of the anti-strip, payment will be made only for the cost of the anti-strip for mixtures placed on that project. Mn/DOT will not reimburse the Contractor for any delay costs associated with making changes related to this testing.

**Table 2360.4-E9**

<b>Mixture Type- - Minimum TSR</b>					
LV and MV		Gyratory Traffic Level 2-3		Traffic Level 4-5	
Contractor	Mn/DOT	Contractor	Mn/DOT	Contractor	Mn/DOT
70%	60%	75%	65%	80%	70%

**Table 2360.4-E9A**

<b>LV and MV Mixtures</b>		<b>Contractor TSR</b>	
		$\geq 70$	$< 70$
Mn/DOT	$\geq 60$	NA	Mn/DOT
TSR	$< 60$	Contractor	Contractor

**Table 2360.4-E9B**

<b>Gyratory Level 2-3</b>		<b>Contractor TSR</b>	
		$\geq 75$	$< 75$
Mn/DOT	$\geq 65$	NA	Mn/DOT
TSR	$< 65$	Contractor	Contractor

**Table 2360.4-E9C**

<b>Gyratory Level 4-5</b>		<b>Contractor TSR</b>	
		$\geq 80$	$< 80$
Mn/DOT	$\geq 70$	NA	Mn/DOT
TSR	$< 70$	Contractor	Contractor

Another sample shall be taken and tested within the first 450 metric tons [500 tons] after production resumes. If the re-test fails to meet the minimum specified value the Contractor shall stop production immediately. Production cannot resume until the Contractor has discussed, with the Engineer, a proposal for resolving the problem. The Contractor shall not operate below the specified minimum TSR on a continuing basis. A continuing basis shall be defined as 2 or more successive tests failing the TSR requirements.

The following conditions will automatically require a sample to be taken and tested:

1. A proportion change of more than 10 percent (from the currently produced mixture) for a single stockpile aggregate.
2. The discretion of the Engineer.

Dispute resolution procedures for TSR are on file in the Bituminous Office.

**E10 Aggregate Specific Gravity (Gsb) ..... AASHTO T84 and T85, Mn/DOT modified**

At the discretion of the District Materials Engineer, aggregate stockpiles will be sampled and tested to verify aggregate specific gravity. Representative stockpile samples shall be 40 kg [90 pounds] for each aggregate component. All samples shall be split in half to provide material for both the Department and the Contractor. The Department companion of this split shall be labeled with the date, time, Project number and approximate cumulative tonnage to date.

The Department companion shall be given to the Plant Monitor immediately or delivered to the District Materials Engineer within 48 hours of sampling, as specified by the Engineer. Aggregate specific gravity results will be compared to the Contractor's values on the current Mix Design Report. If the results deviate beyond the tolerance specified in Table 2360.4-M, the District Materials Engineer will immediately contact the Contractor and issue a new Mix Design Report with the current specific gravity results. Any mixture placed following notification of new specific gravity values will be based upon Department results. The Contractor shall be notified immediately when new specific gravity values become available and what impact this will have on the calculated VMA. The dispute resolution procedure for aggregate specific gravity is on file in the Bituminous Office.

**E11            Moisture Content ..... Mn/DOT 5-693.950**

Provide a mixture with moisture content not greater than 0.3 percent. The moisture content in the mixture shall be measured behind the paver or alternate approved sampling method on file in the Bituminous Office. Sampling and testing shall be conducted by the Contractor on a daily basis unless exempted by the Engineer. Sampling and testing is suggested when rain on stockpiles exceed more than 5 mm [**0.2 inch**] in a 24 hour period. The sample shall be stored in an airtight container. Microwave testing is prohibited.

HMA that exceeds 0.3% moisture content is unacceptable. The Contractor shall take appropriate action to remove excess water from the mixture. This action may include reducing the production rate, mixing stockpile aggregates prior to placement into the feed bins, and use of covered stockpiles.

**E12            Asphalt Binder Samples**

The Contractor shall sample the first shipment of each type of asphalt binder, then sample at a rate of one per 1,000,000 liters [**250,000 gallons**]; sample size shall be 1.0L [**1 quart**]. All samples shall be taken in accordance with the Mn/DOT Bituminous Manual 5-693.920. Sampling shall be conducted by Contractor and monitored by the Inspector. The Contractor shall record sample information on Asphalt Sample Identification Card. Promptly submit the sample to the Department Materials Laboratory in Maplewood. Contact the Department Chemical Laboratory Director for disposition of failing asphalt binder samples.

**F                Documentation (Records)**

The Contractor shall maintain documentation, including test summary sheets and control charts, on an ongoing basis. The Contractor shall also maintain a file of gyratory specimen heights for all gyratory compacted samples and test worksheets. Reports, records, and diaries developed during the progress of construction activities for the Project, shall be filed as directed by the Engineer and will become the property of the Department. The Contractor shall:

- (1)        Number test results in accordance with standard Department procedures and record on forms approved/supplied by the Department.
- (2)        Facsimile or when approved by the Engineer, electronically transmit (email) all production test results on test summary sheets to the District Materials Laboratory and to other sites as requested by the Engineer, by 11 AM of the day following production.
- (2a)      Include the following production test results and mixture information on the Department approved test summary sheet.

1. Percent passing on sieves listed in Table 2360.2-E
  2. Coarse and fine aggregate crushing.
  3. Maximum specific gravity ( $G_{mm}$ ).
  4. Bulk specific gravity ( $G_{mb}$ ).
  5. Percent asphalt binder content ( $P_b$ ).
  6. Calculated production air voids ( $V_a$ ).
  7. Calculated voids in mineral aggregate (VMA).
  8. Composite aggregate specific gravity ( $G_{sb}$ ) reflecting current proportions.
  9. Aggregate proportions in use at the time of sampling.
  10. Tons where sampled.
  11. Cumulative tons.
  - 11a. Tons Represented by Test.
  12. Fines to effective asphalt ratio ( $F/A_e$ ).
  13. Signature Line for Mn/DOT and Contractor Representative.
  14. Mixture Moisture Content.
  15. Mn/DOT verification sample test result.
- (2b) Submit copies of all failing test results to the Engineer on a daily basis.
- (3) Provide the Engineer with asphalt manifests or BOL's on a daily basis.
- (4) Provide a daily plant diary to include a description of QC actions taken (adjustment of cold feed percentages, changes in JMFs, etc.) include all changes or adjustments on the test summary sheets.
- (5) Provide weekly truck scale spot checks.
- (6) Provide a Department approved accounting system for all mixes and provide a daily and final Project summary of material quantities and types.
- (6a) Provide a final hardcopy summary of all quality control test summary sheets and control charts at completion of bituminous operations on the Project to the Engineer. Because Certified Plant test data often represents test data for multiple projects, it may be necessary to make duplicate copies of the data for each project. The Contractor shall also submit a diskette of the quality control summary sheets, control charts and density worksheets to the Bituminous Engineer.
- (7) Furnish an automated weigh scale and computer generated weigh ticket. The ticket shall indicate project number, mix designation (including binder grade), Mixture Design Report#, truck identification and tare, net mass, date and time of loading. Any deviations from the minimum information to be provided on the computer generated weigh ticket must be approved by the Engineer in writing.
- (8) Test summary sheets, charts, and records for a mixture produced at one plant site shall be continued from contract to contract. The Contractor shall begin new summary sheets and charts annually for winter carry-over projects.

**G Documentation (Control Charts)**

The following data shall be recorded on the standardized control charts, all control charts and summary sheets shall be computer generated using software approved by the Engineer. Software is available from the Mn/DOT Bituminous Office at [www.mrr.dot.state.mn.us/pavement/bituminous/bituminous.asp](http://www.mrr.dot.state.mn.us/pavement/bituminous/bituminous.asp).

- (1) Blended aggregate gradation, include sieves shown in Table 2360.2-E for specified mixture.
- (2) Percent asphalt binder content ( $P_b$ )
- (3) Maximum specific gravity ( $G_{mm}$ )
- (4) Production air voids ( $V_a$ )
- (5) VMA



Individual test results shall be plotted for each test point. A solid line shall connect individual points. The moving average for each test variable shall be plotted starting with the fourth test. A dashed line shall connect the moving average points. The Department's quality assurance and verification test results shall be plotted with asterisks. Specification JMF limits shall be indicated on the control charts using a dotted line. The Engineer may waive the plotting of control charts.

**H JMF Limits**

The production air voids and VMA are based upon the minimum specified requirements as shown in Tables 2360.3-B2b and 2360.3B2c. Gradations and asphalt binder content limits are based upon the current Department reviewed Mixture Design Report. Gradation control sieves include each sieve shown in Table 2360.2-E. The mixture production targets are listed on the Mixture Design Report. JMF limits are the target plus or minus the limits shown in Table 2360.4-H. JMF limits are used as the criteria for acceptance of materials based on the moving average. A moving average is the average of the last four test results.

**Table 2360.4-H  
JMF Limits (N=4)**

<b>Item</b>	<b>JMF Limits</b>
VMA, %	- 0.3
Production Air Voids, %	± 1.0
Asphalt Binder Content, %	- 0.4
Sieve - % Passing*	
25, 19, 12.5, 9.5, 4.75 mm [ <b>1 inch, 3/4 inch, 1/2 inch, 3/8 inch, #4</b> ]	± 7
2.36 mm [ <b>#8</b> ]	± 6
0.075 mm [ <b>#200</b> ]	± 2.0

\*JMF limits are not allowed outside the broadband requirements in Table 2360.2-E.

**I JMF Bands**

JMF Bands are defined as the area between the target, as identified on the Mixture Design Report, and the JMF limits.

**J JMF Adjustment**

The Contractor shall begin mixture production with the materials (gradation, asphalt content, and aggregate proportions) closely conforming to the reviewed Mixture Design Report. Closely conforming shall be defined as aggregate proportions within 5 percent of the design proportions <sup>(1)</sup> and other mixture parameters within the JMF limits in Table 2360.4-H. This requirement may be waived if the Contractor provides the District Materials Laboratory with prior documented production data showing how production affects the mixture properties or if the Contractor provides the District Materials Laboratory with a written justification or explanation of material changes since the original mixture submittal.

<sup>(1)</sup> The Contractor shall begin mixture production using all aggregate proportions included on the Mixture Design Report unless the aggregate proportion is shown as 0 percent.

**J1 JMF Request for Adjustment**

If, during production, the Contractor determines from results of QC tests that adjustments to the mix design are necessary to achieve the specified properties, the following provisions shall apply. Unless otherwise authorized by the District Materials Engineer, no adjustments are allowed using aggregates or materials not part of the original mix design.

The Contractor shall make a request for a JMF adjustment to the Department Bituminous Engineer or District Materials Engineer. The requested change will be reviewed for the Department by a Certified Level II Bituminous QM Mix Designer. If the request meets the design requirements in Tables 2360.3-B2a and 2360.3-B2b,

a revised Mixture Design Report shall be issued. Each trial mixture design submittal as described in Section 2360.3A may have three JMF adjustments per mixture per project without charge. Additional JMF adjustments requested must be accompanied with a \$500 fee per each additional JMF adjustment, payable to the Commissioner of Transportation.

If a JMF change is requested for the 0.075 mm [#200] sieve, the Fines to Effective Asphalt Ratio shall be determined on the moving average from the previous four gradation tests conducted during actual production. The adjusted JMF shall be within the mixture specification gradation design broadbands shown in Section 2360.2E. Should a redesign of the mixture become necessary, a new JMF shall be submitted. The JMF asphalt content may only be reduced if the production VMA meets or exceeds the minimum VMA requirement for the mixture being produced.

Adjustments will be made as a result of an interactive process between the Contractor, Engineer, and District Materials Engineer. Consecutive requests for JMF adjustments, without production data, are not allowed. The calculation of the moving average shall continue after the JMF has been approved.

**J1a JMF Request for Adjustment for Proportion Change > 10%**

If a JMF adjustment is requested for a proportion change exceeding 10% (from the currently produced mixture) for a single stockpile aggregate, supporting production test data from a minimum of four tests run at an accelerated testing rate of 1 test per 450 metric tons [500 tons] must be included with the request for adjustment. In addition to the requirements listed above, acceptable verification and approval of the requested JMF will be based on individual and moving average test results. Individual test results must be within twice the requested JMF limits for percent asphalt binder, production air voids, and VMA. Individual gradation must be within twice the requested JMF bands. The moving average values must be within the control limits of Table 2360.4-H. The calculation of the moving average shall continue after the change in proportions.

If the mixture meets the specified quality indicators, the request for JMF adjustment will be signed by the District Materials Laboratory and considered effective from the point the proportion change was made. Failure to meet the quality indicators will result in reduced payment or removal and replacement with acceptable material. Consecutive requests for JMF adjustments without production data are not allowed.

**K Corrective Action -- Percent Asphalt Binder Content, VMA, and Gradation and Production Air Voids**

When the moving average values trend toward the JMF limits, the Contractor shall take corrective action. The corrective action taken shall be documented on summary sheets and, if applicable, a request for JMF adjustment shall be submitted to the District Materials Engineer for review and approval. All tests shall be part of the project files and shall be included in the moving average calculations. The Contractor shall notify the Engineer whenever the moving average values exceed the JMF limits.

**L Failing Materials**

The determination of price adjustments for failing materials will be based on the criteria outlined in this Section. Material acceptance is based on individual and moving average test results. Isolated test results are used for acceptance of air voids at the start of mixture production. Generally, individual test results which are more than twice the JMF bands are considered failing. Moving average test results are considered failing when they exceed the JMF limits. The Contractor shall begin new summary sheets annually for winter carry-over projects.

If the moving average values exceed the JMF limits, the Contractor shall stop production and make adjustments. The Contractor shall restart production only after notifying the Engineer of the adjustments that have been made. Testing shall resume at the accelerated rates and for the tests listed in Table 2360.4-D for the next 1800 metric tons [2,000 tons] of mixture produced. The calculation of the moving average shall continue after the stop in production.

Mixture produced where the moving average of four exceeds the JMF limits shall be considered unsatisfactory and subject to requirements of Section 2360.4L4, L5, L6, and L7. Individual test failures are discussed in Section 2360.4L1, L2, and L3.

When the total production of a mixture type for the entire project requires less than four tests, acceptance of material will be consistent with the criteria outlined in Section 2360.4L1, L2, and L3.

When the Contractor's testing data fails to meet specified tolerances as listed in Table 2360.4-M, quality assurance/verification data shall be used in place of the Contractor's data to determine the appropriate payment factor.

**L1 Isolated Failures at Mixture Start-Up – Production Air Voids**

At the start-up of mixture production, before a moving average of four can be established the first three (3) isolated test results for production air voids will be used for acceptance. Isolated production air voids are calculated by using the maximum mixture specific gravity and the corresponding bulk specific gravity from that single test. After four (4) samples have been tested and a moving average of four can be established, acceptance will be based on individual and moving average production air voids.

If, at the start of production, any of the first three (3) isolated test results for production air voids exceeds twice the JMF bands from the target listed on the Mixture Design Report, the material is considered unsatisfactory or unacceptable. Reduced payment as outlined in Table 2360.4-L3 shall apply to all tonnage placed from the sample point of the failing test until the sample point when the isolated test result is back within twice the JMF bands. When the failure occurs at the first test, after the start of production, the tonnage subjected to reduce payment shall be calculated as described above and shall include the tonnage from the start of production.

When isolated air voids are less than 1.0% or greater than 7.0% the Engineer will decide whether the mixture is subject to removal and replacement or reduced payment. If the mixture is to be removed and replaced, the Contractor at his expense will perform the work. To better define the area to be removed and replaced the Engineer may require the Contractor to test in place mixture. This may include testing mixture placed prior to the failing test result. Reduced payment will be 50 percent of the Contract bid price.

**L2 Individual Failure at Mixture Start-Up – VMA**

At the start-up of mixture production, before a moving average of four can be established, the first three (3) individual test results for VMA will be used for acceptance. After 4 samples have been tested and a moving average of four can be established, acceptance will be based on individual and moving average VMA.

If, at the start of production, any of the first three (3) individual VMA test results exceeds twice the JMF bands from the target listed on the Mixture Design Report, the material is considered unsatisfactory or unacceptable. Reduced payment as outlined in Table 2360.4-L3 shall apply to all tonnage placed from the sample point of the failing test until the sample point when the test results are back within twice the JMF limits. When the failure occurs at the first test, after the start of production, the tonnage subjected to reduce payment shall be calculated as described above and shall include the tonnage from the start of production.

**L3 Individual Failure - Gradation, Percent Asphalt Binder, Production Air Voids, and VMA**

**Table 2360.4-L3  
Reduced Payment Schedule for Individual Test Results**

<b>Item</b>	<b>Pay Factor <sup>(1)</sup></b>
Gradation	95 %
Coarse and Fine Aggregate Crushing	90 %
VMA	85 %
Asphalt Binder Content	85 %
Production Air Voids (individual <sup>(2)</sup> and isolated <sup>(3)</sup> )	80 %

- (1) Lowest Pay Factor applies when there are multiple reductions on a single test.
- (2) Individual air voids are calculated using the moving average maximum specific gravity and the bulk specific gravity from that single test.
- (3) Isolated air voids are calculated from the maximum specific gravity and the bulk specific gravity from that single test. Isolated void test results are used for acceptance only for the first 3 tests after mixture production start-up.

If the individual gradation test exceeds twice the JMF bands from the target listed on the Mixture Design Report the material is considered unsatisfactory or unacceptable. Reduced payment as outlined in Table 2360.4-L3 shall apply to all tonnage represented by the individual test.

If the individual tests for percent asphalt binder content, production air voids, or VMA exceeds twice the JMF bands from the target listed on the Mix Design Report the material is considered unsatisfactory or unacceptable. Reduced payment as outlined in Table 2360.4-L3 shall apply to all tonnage placed from the sample point of the failing test until the sample point when the test result is back within twice the JMF limits. When the failure occurs at the first test after the start of daily production, tonnage subjected to reduced payment shall be calculated as described above and shall include the tonnage from the start of production that day.

When individual air voids are less than 1.0% or greater than 7.0% the Engineer will decide whether the mixture is subject to removal and replacement or reduced payment. If the mixture is to be removed and replaced, the Contractor at his expense will perform the work. To better define the area to be removed and replaced the Engineer may require the Contractor to test in place mixture. This may include testing mixture placed prior to the failing test result. Reduced payment will be 50 percent of the Contract bid price.

#### **L4 Moving Average Failure at Mixture Start-Up - Production Air Voids**

When a moving average failure occurs within any of the first 3 moving average results after mixture start-up (tests 4, 5, 6), the mixture will be considered acceptable if the individual air void, corresponding to the moving average failure is within the JMF limits. If the individual air void is not within the JMF limit, the mixture will be considered unacceptable and the Engineer will decide whether the mixture is subject to removal and replacement or reduced payment. The Engineer may waive the penalty if the isolated air void corresponding to the individual air void is within the JMF limit. If the mixture is to be removed and replaced, the Contractor at his expense will perform the work. Reduced payment will be 50 percent of the Contract bid price. Tonnage subjected to replacement or reduced payment shall be calculated as the tons placed from the sample point of the failing moving average result and corresponding individual air void beyond the JMF limit to the sampling point when the individual test result is back within the JMF limit.

#### **L5 Moving Average Failure at Mixture Start-Up - VMA**

When a moving average failure occurs within any of the first 3 moving average results after mixture start-up (tests 4, 5, 6), the mixture will be considered acceptable if the individual VMA, corresponding to the moving average failure is within the JMF limits. If the individual VMA is not within the JMF limit, the mixture will be considered unacceptable and the Engineer will decide whether the mixture is subject to removal and replacement or reduced payment. If the mixture is to be removed and replaced, the Contractor at his expense will perform the work. Reduced payment will be 75 percent of the Contract bid price. Tonnage subjected to replacement or reduced payment shall be calculated as the tons placed from the sample point of the failing moving average result and corresponding individual VMA beyond the JMF limit to the sampling point when the individual test result is back within the JMF limit.

#### **L6 Moving Average Failure - Production Air Voids**

A moving average production air void failure occurs when the individual production air void moving average of four exceeds the JMF limit. This mixture is considered unacceptable and the Engineer will decide whether the mixture is subject to removal and replacement or reduced payment. If the mixture is to be removed and replaced, the Contractor at his expense will perform the work. Reduced payment will be 70 percent of the Contract bid price. Tonnage subjected to replacement or reduced payment shall be calculated as the tons placed