Materials Procedures Committee Regular Meeting

Meeting Time/Date: 10:00am, April 19, 2023

Meeting Location: MCS&T (Conference Rm.) - 190 Dry Branch Drive, Charleston, WV 25306

Online Meeting: Google Meet Video Conference

Online Link - (https://meet.google.com/apa-rvti-ndx?authuser=0)

Files Available on ProjectWise for DOT users – See Invite or Follow P/W path:

WVDOH ORGS\MCS&T (0077) - FM\Materials Procedure Committee\MP Committee Meeting Files\2023\2023 04 19 Meeting

Files Available on Webpage:

https://transportation.wv.gov/highways/mcst/Pages/MP-Committee-Page.aspx

Materials Procedures approved at the last meeting (3/22/23)

1. 615.20.01 - Preparing, Recording and Transmitting Information on Approved List of Welded Stud Shear Connectors
2. 715.07.20 - Standard Method of Test for Determining the Quality of Water Used with Hydraulic Cement
3. 712.05.57 - Criteria to Approve Fence Producer/Suppliers and Their Materials
4. 100.00.03 - Method of Evaluation of Non-Standard Or Non-Conforming Materials In Construction Via DMIR

Materials Procedures - Old Business

Number	Champion	Title	Description
1 - 106.00.21*	Mullins	Acceptance Procedure for Mash Compliant Roadside Safety Hardware	Creates acceptance guidelines for MASH Safety Hardware. Updates from last meeting including voting members and APL procedure
2 - 700.00.53*	Brayack/Mullins	Acceptance Procedure for Evaluating Independent Assurance Samples with Samples Used for Acceptance	Major update to the IA process.
3 - 604.02.40*	Thaxton	Inspection And Acceptance Procedures for Precast Concrete Products	Updates to the handling of material that does not meet strength, or has other defects
4 - 658.05.06&	Whitmore	Ancillary Structure Anchor Bolt Tightening	Ted making significant changes to update bolt tightening.

Materials Procedures - New Business

1-106.00.20&	Brayack	West Virginia Acceptance Plan "a" Method of Estimating Percentage of Material of Construction That Will Fall Within Specification Limits	Minor formatting edits, no content change.
2-402.02.30&	Jobes	Rapid determination of the polish Susceptible Carbonate Particle Content in Aggregates	Formatting Updates
3-661.20.00&	Hanna	Procedure for Determining the Torque on Tamper Resistant Hardware	Minor edits, mostly units
4-700.00.01&	Brayack	Sampling and Testing of Materials at the Source (Coverage)	Minor edits, updating to common lingo.
5-710.01.40*	Simmons	Acceptance Criteria to Designate a Wood Treatment Plant as an Approved Source of Wood Products	Minor edits for reconfirmation.
6-700.00.54&	Farley	Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results	Significant updates to match current computer system and practices
7-711.00.22&	Preston	Quality Assurance Testing of Coating Products Listed on WVDOH Approved Product Lists (Apls)	New MP, Adds yearly testing for paint on the approved list.
8-212.02.20&	Ross	Procedure For Determining a Reduced Unit Price to Be Paid for Select Material for Backfilling Which Does Not Conform to Grading Requirements of Governing Specifications	Section 6.1, discussion of DMIR for non-conforming material.
9-107.00.40*	Preston	Determination Criteria for Monitoring Ground Vibrations in Residential Areas	Reconfirmation with no content edits

10-701.01.11*	Preston	Determination of Chemical Constituents in Hydraulic Cements	Reconfirmation with no content edits
11-711.00.20*	Preston	Paint Testing Methods	Reconfirmation with no content edits

Note 1: * Denotes this MP is up for Vote

Note 2: & Denotes this MP is not up for Vote

Comments

Comments due April 12th, so the Champion may review and address them. Submit comments to Adam Nester (Adam.W.Nester@wv.gov)

Next Meeting

New or Updated MPs due to the MP Chair 3-weeks before the next meeting: April 26th

Meeting Time/Date: 10:00 am, May 17, 2023

Meeting Location: MCST

Online Meeting: Google Meet Video Conference (Link TBD)

Additional MP Committee Meeting Information

For details of previous meetings, please visit the MCST MP Committee Webpage

https://transportation.wv.gov/highways/mcst/Pages/MP-Committee-Page.aspx

Tentative MP Committee Dates for 2023:

June 21, July 19, August 16

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

ACCEPTANCE PROCEDURE FOR MASH COMPLIANT ROADSIDE DEPARTURE~~SAFETY~~ HARDWARE

1. PURPOSE

1.1 To set forth a procedure for acceptance of Roadside Safety Hardware to ensure compliance with Joint Implementation Agreement for the Manual for Assessing safety hardware (MASH) between FHWA and AASHTO by memorandum, dated January 7, 2016.

2. REFERENCED DOCUMENTS

~~2.1~~ Manual for Assessing safety hardware (MASH) ~~between FHWA and AASHTO by memorandum, dated January 7~~That MASH Document

2.1

2.2 ~~Our MASH Specification~~WVDOH DOH Specifications Roads and Bridges

2.3 MP 106.00.02 – "Procedure for Evaluation of New Products for Use in Highway Construction"

2.4 MP 106.00.03 – "Guidelines for Establishing and Maintaining Approved Product Lists of Materials, Systems and Sources."

~~2.2~~

3. SCOPE

3.1 This procedure is applicable to any roadside highway safety hardware that is to be reviewed by the Roadway Departure Task Force that will be placed on the Division's Approved Product List (APL).[1]

4. ~~PROCEDURE~~EVALUATION OF SUBMITTED PRODUCTS

4.1 P~~The p~~roduct shall be submitted to MCS&T in accordance with MP 106.00.02. ~~to the Director of Materials Control, Soils & Testing and will be assigned to the Roadway Departure Task Force for evaluation.~~

4.2 The product will then be reviewed via the ~~Traffic Certification Supervisor will distribute the product information to the~~ Roadway Departure Task Force representatives. Those representatives shall consist of voting and non-voting members who provide expertise to review and recommend action on highway safety hardware~~be be~~~~from the following Division:~~. The voting members are:

a. Director of ~~Director of~~ Traffic Engineering Division
b. Director of Director of Technical Support~~Director of Contract Administration~~ Division
c. Director of ~~Director of~~ Materials Control, Soils & Testing Division
d. Director of Operations Division

[1] https://transportation.wv.gov/highways/mcst/Pages/APL_By_Number.aspx

Commented [BDA1]: Ted and Donna will certainly have some input into this as well.

Commented [BDA2]: Same with RJ

Commented [SRL3]: Should MP 106.00.03 also not be listed here?

Commented [MGW4]: done

Commented [SRL5]: These members are they assigned by this MP or are they assigned by others? If by others should we not then revise this?

Commented [MGW6]: Assigned by MP

e. Director of Engineering Division
f. Traffic Mobility and Safety Engineer

The nonvoting members are: ~~Traffic Mobility and Safety Engineer~~~~Maintenance~~~~Operations Engineering Division~~
~~d.~~ Director of Contract Administration~~Technical Support~~ Division

4.3 A ~~Meeting~~ meeting to discuss the submission shall be scheduled~~.~~ within 304~~60~~ calendar days of the receipt of the submission.

4.4 The submission shall be evaluated ~~and accepted~~ based on ~~one of~~ the following criteria, in descending order of preference:

4.4.1 Letter of Eligibility (LOE) from FHWA

4.4.2 Full suite of passing MASH testing at an accredited facility, but no LOE

4.4.3 Previous issue of NCHRP 350 Letter of Eligibility and an acceptable In-Service Performance Evaluation. If suitable MASH compliant devices are available, NCHRP-350 devices will not be considered.

4.4.4 A ~~profession~~professional opinion letter of due diligence has been issued by an accredited testing facility determination of the hardware being MASH eligible.

4.4.5 Minor modifications of hardware previously determined to be eligible by the DOH process that in the opinion of the Roadway departure Group determine are not significant modification to performance.

4.5 Products used by other DOT's will be considered after reviewing the data from the state standards coordinator as to the state's reasoning for usage after implementation dates.

Commented [SRL7]: If the WVDOH requires NTPEP audit for a product being evaluated should we also not mention that?

IE Guardrail suppliers will now be required to participate in the NTPEP audit program.

Commented [MGW8]: I believe this is addressed in section 5.2. It has to meet specs.

5. ACCEPTANCE OF MASH MATERIAL

5.1 The voting members will determine if the product meets MASH criteria.

5.2 The voting members shall also evaluate the product to ensure that it meets other agency requirements and considerations such as maintenance requirements, other DOH Specifications and MUTCD requirements.

5.2.1 If applicable the product shall meet NTPEP requirements.

5.3 If approved, the submitted material will be added to the APL as per MP 106.00.02.

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils & Testing Division

MP 106.00.21 ~~XXX.XX.XX~~ Steward – Traffic Certification Section
RLS:M

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

ACCEPTANCE PROCEDURE FOR EVALUATING INDEPENDENT ASSURANCE SAMPLES WITH SAMPLES USED FOR ACCEPTANCE

1. PURPOSE

1.1 To provide a procedure for the immediate evaluation of Independent Assurance (IA) Samples with samples used for acceptance.

2. SCOPE

2.1 This procedure is intended to apply to the following materials:

2.1.1 Aggregate

2.1.2 Hot Mix Asphalt

2.1.3 Portland Cement Concrete

3. REFERENCED DOCUMENTS

3.1 Office of Pavement Technology Publication No. FHWA-HIF-12-001[1], October 2011. Included as Attachment 4.

4. DEFINITIONS

4.1 Quality Assurance ~~Verification~~ Samples and Tests - All of the samples and tests performed by the Division of Highways (DOH) or its designated agent used to validate the quality and acceptability of the materials and workmanship which have been used or are being incorporated in the project.

4.2 Quality Control Samples and Tests - All the samples and tests performed by the contractor that are performed or conducted to fulfill the contract requirements.

4.3 Independent Assurance Samples and Tests - Independent and unbiased samples or other activities performed by the DOH or its designated agent who do not normally have direct responsibility for quality control or ~~verification~~ quality assurance sampling and testing. IA samples and tests are taken to evaluate the sampling and testing procedures used in the acceptance program.

4.4 Split Sample - One of two selected samples that have been halved, quartered, etc. from a single sample taken in the field. The field sample must be of adequate size to render each "split sample" sufficient material for test.

[1] https://www.fhwa.dot.gov/pavement/materials/hif12001.pdf

4.5 Adjacent Sample - One of two field samples taken in close proximity to each other in both time and space. Adjacent samples must represent the same material, production process, and other activity through the point ofsampling.

4.6 Proficiency Sample - A single (homogeneous) sample that ~~has~~ is distributed by an agency and then ~~been~~ tested by ~~two or more~~multiple laboratories. These distributing agency will provides a "score" statistically comparing results amongst the laboratories. ~~and used to assure that the quality control testing is performed correctly, and that the equipment is in calibration.~~

Commented [BDA1]: Update from Janie's Email

4.7 Active Tester – A person who has performed a material test for acceptance in a calendar year.

4.8 Active Test Equipment – A piece of equipment which has been used to perform acceptance testing in a calendar year.

4.9 Satisfactory Evaluation – If the results of a test fall within the guidelines established in this document, the test will be considered satisfactory.

~~4.7~~4.10 Non-Satisfactory Evaluation – If the results of a test do not fall within the guidelines established in this document, the test will be considered non-satisfactory.

5. SYSTEM APPROACH ~~TO~~ FOR IA SAMPLING AND TESTING

5.1 ~~The p~~Personnel and equipment will be verified on a ~~"~~system~~"~~ basis as ~~recommended by the FHWA tech briefing~~per FHWA-HIF-12-001. The system approach evaluates each Active Tester and each Active Testing Equipment once per calendar year.

5.2 If possible, all IA samples shall be the result of a split/adjacent sample. If this is not achieved, a proficiency sample may be used to satisfy the yearly IA requirement.

~~5.1 The purpose is to cover all testers and equipment over a period of a year. This approach is a more effective means of performing IA since it ensures that the WVDOH is evaluating a larger portion of testers instead of redundant testing of the same testers.~~

6. POPULATION OF ~~VERIFICATION~~ QUALITY ASSURANCE TESTERS

6.1 Once per year, before any work is performed by District Technicians, a signed letter stating the names of each of their quality assurance testers shall be submitted by the District Construction Engineer to the Director of MCS&T. In-lieu of this letter, Districts may utilize a MCS&T provided online form.

6.2 If, during the calendar year, additional testers are added to the District's roster, the Construction Engineer shall submit an amended list to the Direct of MCS&T. This shall be done before any quality assurance work if performed by the technician.

6.16.3 In the event where a project incorporates non-DOH acceptance tester, the District Construction Engineer shall submit to the Director of MCS&T a signed letter stating the names of each of the quality assurance testers.

Commented [BDA2]: Once again, QAM. Do we need to state this?

7. PORTLAND CEMENT CONCRETE

7.1 The means and methods of meeting the yearly IA requirement for PCC is outline in Attachment 1: IA Work Plan.

7.2 The IA frequency goal for each tester and each piece of testing equipment is as follows:

Commented [BDA3]: List ASTM/AASHTO T22 etc

PCC IA Samples Frequency	
Slump	1/Year
Air	1/Year
Compressive Strength Testing	1 Set/Year

7.3 The evaluation of these tests shall be described in Section ~~10~~ 11 of this document.

8. SUPERPAVE HOT MIX ASPHALT

8.1 The means and methods of meeting the yearly IA requirement for Superpave HMA is outline in Attachment 1: IA Work Plan.

8.2 The IA frequency goal for each tester and each piece of testing equipment is as follows:

SuperPave IA Samples	
Asphalt Content by Ignition - AASHTO T308~~% Asphalt~~	1/year
Bulk Specific Gravity, Vacuum - AASHTO T331~~Bulk Specific Gravity - Vacuum Seal~~	1/year
Bulk Specific Gravity, SSD - AASHTO T166~~Bulk Specific Gravity - Gyratory~~	1/year
Maximum Specific Gravity - AASHTO T209~~Max Specific Gravity~~	1/year
Percent Passing the #200 Sieve - AASHTO T30~~Gradation on the #200 Sieve~~	1/year

8.3 The evaluation of these tests shall be described in Section ~~10~~ 11 of this document.

9. MARSHALL HOT MIX ASPHALT

9.1 The means and methods of meeting the yearly IA requirement for Marshall HMA is outline in Attachment 1: IA Work Plan.

9.2 The IA frequency goal for each tester and each piece of testing equipment is as follows:

Marshall IA Samples	
Asphalt Content by Ignition - AASHTO T308~~% Asphalt~~	1/year
Bulk Specific Gravity, SSD - AASHTO T166~~Max Specific Gravity~~	1/year
Maximum Specific Gravity - AASHTO T209~~Bulk Specific Gravity~~	1/year
Air Voids - AASHTO T269~~Air Voids~~	1/year
Marshall Stability/Flow - AASHTO T245~~Stability/Flow~~	1/year

9.3 The evaluation of these tests shall be described in Section ~~10~~ 11 of this document.

10. MARSHALL HOT MIX ASPHALT

10.1 The means and methods of meeting the yearly IA requirement for Marshall HMA is outline in Attachment 1: IA Work Plan.

10.2 The IA frequency goal for each tester and each piece of testing equipment is as follows:

Aggregate Gradation Samples	
Class 1,3, or 10	1/year

10.3 The following sieves will be evaluated:

10.3.1 3/8" sieve

10.3.2 #30 sieve

10.3.3 #200 sieve.

10.4 The evaluation of these tests shall be described in Section ~~10~~ 11 of this document.

11. EVALUATION PROCEDURE

11.1 ~~In the case of less than 5 split samples,~~When evaluating split/adjacent samples, ~~The~~ the criteria for evaluation shall be as denoted in Attachment 2: Evaluation of IA results.

11.2 Evaluation of the active tester's proficiency sample shall be based on their rating assigned by AASTO:resource. A rating of 3, 4, 5 shall be considered satisfactory. Any score of 0, 1 or 2 shall be considered "non-satisfactory."

11.3 If the results of an evaluation are deemed satisfactory, the evaluation will be considered successful. A successful evaluation will verify both the Active Tester and the Active Testing Equipment used during the material test.

11.4 If the results of an evaluation are deemed non-satisfactory, the material test will be reviewed by the respective District or Managing Office Representative. Within 30 days of notification, the District Construction Engineer or Managing Office Representative shall submit a corrective action report to the Director of Materials Control Soils and Testing Division. This Corrective Action Report will be including in the yearly IA report. A sample of this Corrective Action Report is provided in Attachment 3. The live version of the file will be provided to the District in the event of a non-satisfactory result.

Commented [BDA4]: This is for a QAM. Should is just be the CE? As they'd be managing the QAM too?

11.4.1 If a Concrete Slump and Air IA test is determined to be un-satisfactory, the IA sampler shall perform another 1-1 test with the testing technician to determine the root cause. The IA sampler may have the technician use either the IA testing equipment or another previously satisfactory test equipment to isolate the issue.

11.4.2 If the Technician is determined to be satisfactory using another piece of equipment, the IA sampler shall perform additional testing with both devices to determine if the testing equipment is the root cause.

11.4.3 In the above-described instance, all pertinent information shall be provided in a corrective action report.

_____
Ronald L. Stanevich, PE
Director
Materials Control, Soils & Testing Division

MP 700.00.53 Steward – Materials Control Section
RLS:BMc
ATTACHMENTS

Attachment 1: Independent Assurance Work Plan for Processing IA Sample Testing

1. INTRODUCTION:

1.1 The following materials are to be sampled by the District and tested by both the District and MCS&T for IA sampling compliancy requirements.

a) Asphalt – Superpave and Marshall

b) Aggregate – Class Material

c) Concrete – Cylinders, Slump and Air.

2. TESTERS

2.1 The District is required to identify testing quality assurance testing technicians who perform the tests and provide this information to MCS&T at the start of the season. This needs to be updated on a regular basis, specifically when testing technicians are added. This includes the following personnel:

a) QAM / Consultant Testing Technicians

b) District Testing Technicians

3. TESTS:

3.1 The following tests will be evaluated for the IA Program:

a) Superpave Mixture Testing

b) Marshall Mixture Testing

c) Class Aggregate Gradation

i) Only Class 1,3,10

d) PCC Cylinder Testing

i) Only 4x8 cylinders

ii) Only 28-day breaks

e) PCC Field Testing (Slump and Air)

4. SAMPLING:

4.1 The samples are to be prepared by the District as a split sample from project acceptance testing.

4.1.1 The District will collect one IA sample per test, per testing technician, per year. Example: In the occurrences where a District has two Aggregate Testers, they will need two Class samples per year.

4.1.2 The samples will be labeled, and all documentation shall be provided with the sample, including the District Lab Number, Project Information, etc.

4.1.3 The District will test the sample as per normal guidelines and provide the IA sampler with the Sample ID for the test results.

4.1.4 The District will enter a note on the sample record in AWP that an IA sample was taken with this sample.

5. PLASTIC CONCRETE TESTING:

5.1 In the occurrences of tests done on plastic concrete, there will be no change in the current procedure. IA sampler will visit each District and perform 1/1 testing with each. Each testing technician shall bring their testing equipment for this evaluation.

6. SAMPLE PICKUP:

6.1 The District will notify the IA sampler that a sample has been created and is available for pickup. The IA sampler will be responsible for the transportation of the sample to MCS&T.

6.2 No sample will be dropped off at MCS&T unless specifically instructed by the IA sampler.

6.3 In the occurrences of a PCC cylinder, the District will notify the IA sampler of the creation date of the sample within 3 days of the sample creation. The District will also notify the IA sampler of the intended break date.

7. TESTING AT MCS&T:

7.1 The IA sampler will be responsible for coordinating testing of the IA sample with the respective MCS&T Section Supervisor.

7.2 The IA sampler will be responsible for entering the test results into AWP.

8. PROFICIENCY SAMPLES

8.1 Proficiency samples shall be considered a second layer of assurance for the WVDOH IA program. Though these are still required, the results of these should only be used in extenuating circumstances where a split/adjacent sample could not be obtained.

Attachment 2: Evaluation of Split or Adjacent Samples

INDEPENDENT ASSURANCE SAMPLE
MAXIMUM DIFFERENCE VALUES
GRADATION ANALYSIS COMPARISON PER SIEVE

TABLE 1

Split Samples		Adjacent Samples	
Average % Passing Column 1	(md) Max. Difference From Average Column 2	Average % Passing Column 3	(md) Max. Difference From Average Column 4
0 ---> 7.0	2.0	0 ---> 4.5	2.5
7.5 ---> 11.5	2.5	5.0 ---> 7.5	3.0
12.0 ---> 16.0	3.0	8.0 ---> 10.5	3.5
16.5 ---> 19.5	3.5	11.0 ---> 13.5	4.0
20.0 ---> 23.5	4.0	14.0 ---> 16.0	4.5
24.0 ---> 27.0	4.5	16.5 ---> 18.5	5.0
27.5 ---> 31.5	5.0	19.0 ---> 21.0	5.5
32.0 ---> 36.0	5.5	21.5 ---> 23.5	6.0
36.5 ---> 42.5	6.0	24.0 ---> 26.0	6.5
43.0 ---> 65.0	6.5	26.5 ---> 28.5	7.0
65.5 ---> 71.5	6.0	29.0 ---> 31.0	7.5
72.0 ---> 76.0	5.5	31.5 ---> 34.0	8.0
76.5 ---> 80.0	5.0	34.5 ---> 37.0	8.5
80.5 ---> 83.5	4.5	37.5 ---> 40.5	9.0
84.0 ---> 87.0	4.0	41.0 ---> 44.5	9.5
87.5 ---> 90.0	3.5	45.0 ---> 50.0	10.0
90.5 ---> 93.5	3.0	50.5 ---> 66.5	10.5
94.0 ---> 97.0	2.5	67.0 ---> 71.5	10.0
97.5 ---> 100	2.0	72.0 ---> 79.5	9.5
		80.0 ---> 81.5	8.0
		82.0 ---> 83.5	7.5
		84.0 ---> 85.5	7.0
		86.0 ---> 87.0	6.5
		87.5 ---> 88.5	6.0
		89.0 ---> 90.0	5.5
		90.5 ---> 91.5	5.0
		92.0 ---> 93.0	4.5
		93.5 ---> 94.0	4.0
		94.5 ---> 95.5	3.5
		96.0 ---> 96.5	3.0
		97.0 ---> 97.5	2.5
		98.0 ---> 99.0	2.0
		99.5 ---> 100	1.5

To Use Table

1) Calculate the average percent passing for each sieve size for the IA and Verification sample.

2) Individually locate each average to the appropriate interval in the Table in Column 1 or 3 depending on sample selection (split or adjacent).

3) For the maximum difference (md) between the sample result(s) and the average, read the values listed in column 2 or 4 depending upon the sample selection.

4) If the difference between the result(s) and the average is equal to or less than the listed value, the individual sieve size will be considered similar. If the difference is greater than the listed value, the individual sieve size will be considered dissimilar.

SAMPLE GRADATION COMPUTATION SHEET

PROFICIENCY SAMPLE

A	B	C	D
Sieve Size	IA Sample Gradtaion	QC Sample Gradation	Difference B-C
1.5"	100	100	0
¾"	86	84	2
#4	26	23	3
#40	1	2	1
#200	0.1	0.4	0.3

Sum of the differences = 6.3

$$\frac{\text{Sum of the differences}}{\text{No. of Sieves}} = \frac{6.3}{5} = 1.26 \text{ (ATD)}$$

ATD	Difference Allowed	Similar	Dissimilar
1.26	1.8	YES	

SAMPLE GRADATION COMPUTATION SHEET
SPLIT OR ADJACENT SAMPLE

A	B	C	D	E	F	G	H
Sieve Size	IA Sample Gradation	Verification Sample Gradation	X(bar) $\frac{B + C}{2}$	"md" MAXIMUM Diff.	"ad" ACTUAL Diff.	Similar ad ≤ md	Dissimilar ad > md
1.5"	100	100	100	2.0	0	YES	
¾"	86	73	79.5	5.0	6.5		YES
#4	26	25	25.5	4.5	0.5	YES	
#40	1	1	1	2.0	0	YES	
#200	0.1	0.1	0.1	2.0	0	YES	

Sample Represents a split __X__ adjacent _____
Samples similar _____ Dissimilar __X__

ASPHALT CONTENT

IA Result	Verification or Quality Control Result	Difference Allowed	Actual Difference	Similar	Dissimilar
6.3	6.5	0.8	0.2	YES	

Sample Represents a split __X__ adjacent _____

AIR VOIDS

IA Result	Verification or Quality Control Result	Difference Allowed	Actual Difference	Similar	Dissimilar
3.6	4.1	3.0	0.5	YES	

Sample Represents a split __X__ adjacent _____

IA FIELD TEST
DOCUMENTATION
FOR AIR AND SLUMP COMPARISONS

IA Sampler: _____

Project: _____

Date of Test: _____

Type of Test: _____

Batch ID: _____

IA Sample ID: _____

Verification sample ID: _____

Quality Control Sample ID: _____

IA Test Result: _____

Comparison Test Result: _____

Check Spaces - Use Only if Check Comparisons are Made

[Check _____]

[Check _____]

[Check _____]

[Check _____]

[Check _____]

[Check _____]

Calculations:

Largest: _____ - Smallest _____ = _____ Difference

Check: Largest: _____ - Smallest _____ = _____ Difference

Similar? For Slump The Difference Must Be 1.5 inches or Less

Yes _____ No _____ [Check: Yes _____ No _____]

For Air Content The Difference Must Be 1.5 % or Less

Yes _____ No _____ [Check: Yes _____ No _____]

If Dissimilar, Use This Space for IA Samplers Comments:

Attachment 3: Sample Corrective Action Report

WVDOH Independent Assurance Corrective Action Report		
Form 2023-IA-CAR		
Date of Occurrence:		
Date Submitted:		
Name of Tester:		
Testing Equipment:		
Material Tested:		
Describe the issue reported:		
What was the root cause of the issue?		
What actions have been done to correct this issue?		
Signature of Testing Technician	Date	
Signature of District Materials Supervisor	Date	
Signature of District Construction Engineer	Date	Review: MCST

Attachment 4: Office of Pavement Technology Publication No. FHWA-HIF-12-001[2], October 2011

[2] https://www.fhwa.dot.gov/pavement/materials/hif12001.pdf

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

INSPECTION AND ACCEPTANCE PROCEDURES FOR PRECAST CONCRETE PRODUCTS

1. PURPOSE

1.1 To set forth procedures for the inspection and acceptance of precast concrete products, including inlets, manholes, box culverts, 3-sided bridge units, retaining wall panels, headwalls, wingwalls, lagging, junction boxes, and any other precast products, and the approval of the plants at which they are fabricated.

2. SCOPE

2.1 This procedure will apply to all precast concrete products supplied for use on West Virginia Division of Highways projects and to all precast concrete product fabricators that supply material for use on West Virginia Division of Highways projects.

2.2 For prestressed concrete members refer to MP 603.10.40 “Inspection and Acceptance Procedure for Prestressed Concrete Bridge Beams.”

3. FABRICATOR APPROVAL

3.1 All precast concrete product fabricators (hereafter referred to as the Fabricator) shall be approved by Materials Control Soils and Testing MCS&T Division prior to the start of any work for the WVDOH. If not listed on the WVDOH Approved List of Precast Concrete Fabricators, a Fabricator shall contact MCS&T Division a minimum of six weeks prior to the planned date on which fabrication is to begin to initiate the approval process.

3.2 In order for a Fabricator to be approved and listed on the WVDOH Approved List of Precast Concrete Fabricators, they must be NPCA (National Precast Concrete Association) certified, QCAST (American Concrete Pipe Association) Certified, or have an equivalent type of certification.

3.3 The process for approving a Fabricator shall include, but not be limited to, an on-site visit to the fabrication plant by a WVDOH representative from MCS&T Division. During this visit, the WVDOH Quality Assurance (QA) personnel shall inspect the fabrication facility, the Quality Control (QC) lab, and meet with QC and other key personnel from the Fabricator. Component materials which will be used in the fabrication of precast items shall be sampled for testing. Batch scales shall be calibrated in accordance with MP 700.00.03 at a minimum once per year..

3.3.1 Sampling and testing of component materials shall be done in accordance with MP 603.02.10. Copies of recent component delivery tickets should be presented on the day of sampling. All component materials must be approved prior to the start of fabrication.

3.3.1.1 Any Fabricator which does not produce for the WVDOH for a period of 2 years shall be removed from the Approved Fabricator list. After removal from the approved list, before a Fabricator can again produce for the WVDOH, they must repeat the approval process. Sampling of component materials will not continue when the plant is not listed on the Approved Fabricator list.

3.3.2 Personnel from the Fabricator required to be present during the initial on-site visit and meeting between WVDOH and Fabricator shall include representatives from Production and Quality Control. Any questions and concerns regarding WVDOH requirements, including applicable Specifications, Materials Procedure (MP's), Standard Details, and QC/QA Inspections shall be addressed at this meeting.

3.3.3 The Fabricator must submit the Quality Control Manual/Plan for review at this meeting.

3.4 All Concrete Mix Designs which will be used on products fabricated for the WVDOH must be submitted for review & approval, prior to the start of fabrication. Any design mix with an aggregate(s) that has a reactivity ~~classes~~ R1, R2, or R3, as shown as in Approved Aggregates Source List, shall be developed in accordance with WVDOH specifications, subsection 601.3.1.1. If an aggregate Source is not listed on the Approved Aggregates Source List, the Division will test the fine and coarse aggregate from the Source, in accordance with AASHTO T 303, to determine the reactivity class of the aggregate prior to its use on any WVDOH project. The Division will inform the Fabricator of the reactivity class of aggregates that they are proposing to use. If a cement Source and/or a SCM Source are not listed on the Approved Source List, the Division will test cement and/or SCM from that Source prior to its use on any WVDOH project.

3.5 The Fabrication Plant QC Personnel, as a minimum, shall be a certified ACI Grade I Concrete Field Testing Technician and/or a WVDOH PCC Inspector. In addition, if Self-Consolidating Concrete (SCC) is used, Fabrication Plant QC Personnel shall be a certified ACI SCC Testing Technician.

3.6 All Precast Concrete items shall be accepted by Direct or Master Coverage except when a Fabricator is certified as an Approved Source of concrete lagging as defined in Section 7.0.

4. FABRICATION & INSPECTION OF PRODUCTS FOR DIRECT & MASTER COVERAGE

4.1 Prior to beginning fabrication of any precast concrete products, the Fabricator shall provide written or email notification to MCS&T Division at least one calendar week in advance of the date on which fabrication is to begin.

4.1.1 Depending upon the precast items being fabricated, MCS&T Division may choose to monitor fabrication. Fabrication of structurally significant products such as box

culverts and 3-sided bridge units shall be monitored. Other items may be monitored at the discretion of MCS&T.

4.1.2 After fabrication has begun, the Fabricator shall keep MCS&T Division and the Inspector (whether a WVDOH employee or a contract employee representing the WVDOH) informed in advance of the days on which fabrication will take place.

4.2 Shop Drawings must be approved by the West Virginia Division of Highways prior to the start of any work by the Fabricator. The Inspector must have a copy of these approved shop drawings prior to start of any work by the Fabricator.

4.3 Concrete cylinders shall be made for compressive strength testing with 6-inch by 12-inch or 4-inch by 8-inch molds. The cylinders are to be cured in the same area as the products for which they represent (Field Cured as outlined in AASHTO R100) until tested to create a curing environment similar to the product that they represent. A compressive strength test shall consist of the average result of a set of cylinders, which is at least two cylinders. Form removal for wet cast concrete is not permitted until concrete has reached 50% of the design strength, unless otherwise specified. If forms are stripped from box culverts at 50% of the design strength, another curing method from section 601.12, or ASTM C1577 must be used until 70% of the design strength is obtained. Form removal limitations do not apply to elements fabricated with dry cast concrete. Dry cast concrete is defined as concrete with a slump less than 1-inch.

4.3.1 For both conventional wet cast concrete and SCC mixes, a minimum of one set of compressive strength cylinders shall be fabricated from every 7 yards of concrete, or fraction thereof, with a minimum of one set per day per mix design. Both the form removal strength and the 28-day strength must be confirmed by a set of cylinders. Cylinders shall be the same size as those used in the initial approved mix design. For conventional concrete, slump, temperature, and air content tests shall be conducted on the first batch of concrete each day and every time that cylinders are fabricated. For SCC mixes, spread, temperature, and air content tests shall be conducted on every batch. For all types of concrete, unit weight and yield tests shall be conducted on the first batch of concrete each day and thereafter as deemed necessary by Quality Control and Quality Assurance Personnel.

4.3.2 For dry cast mixes, the 28-day strength shall be confirmed by a set of compressive strength cylinders. Compressive strength testing for form removal is not required for dry cast mixes. A minimum of one set of compressive strength cylinders shall be fabricated for each item fabricated. The cylinders are to be fabricated in the molds on the vibration table in accordance with ASTM C497. For dry cast mixes, slump testing

is not required, and concrete temperature testing shall be performed on the first batch of concrete each day and every time that cylinders are fabricated.

4.4 For precast manholes fabricated with wet cast and SCC mixes, absorption tests are to be conducted in accordance with ASTM C642. Tests should be conducted on a weekly basis for each mix design used, at a minimum; unless otherwise specified.

4.5 For precast products fabricated with dry cast mixes, absorption tests are to be conducted in accordance with ASTM C642, and tests should be conducted on a weekly basis for each mix design used. The maximum allowable absorption shall be 9%.

4.6 Unless otherwise specified, for conventional wet cast and SCC mixes, plastic concrete shall have an air content measured at 7.0 ± 2.0%. For dry cast concrete, the air content test requirement is waived.

4.6.1 Prior to the use of Self-Consolidating Concrete in precast items all mix designs must be submitted to MCS&T for approval and meet the requirements of the following table. Test results from trial batches produced by the laboratory which designed it shall be included in the submittal. The compressive strength of the design mix shall be at least 15% above the specified design strength.

Table 4.6.1 - SCC Mix Design Acceptance

Fresh Property	**Mix Design Batch Acceptance Criteria**
Air Content	7.0± 1.5%
Spread (ASTM C1611)	Target ± 1.5 inches 2 seconds $\leq T_{50} \leq$ 7 seconds Visual Stability Index ≤1.0
Passing Ability (ASTM C1621)	J-Ring Value $\leq$ 1 inch
Segregation Resistance (ASTM C1610)	Segregation ≤ 12%
Unit Weight and Yield	±2% of Theoretical

4.6.2 The following table lists the criteria for SCC production.

Table 4.6.2 - SCC Production Acceptance

Fresh Property	**Production Acceptance Criteria**
Air Content	7.0± 2.0%
Spread (ASTM C1611)	Target ± 2 inches 2 seconds $\leq T \leq$ 7 seconds Visual Stability Index ≤1.0
Concrete Temperature	<90°F
Unit Weight and Yield	±2% of Theoretical

4.6.3 SCC should only be given minimal vibration; and shall not be dropped from a distance greater than 4 feet relative to the top of the form.

4.6.4 Precast products fabricated with dry cast concrete shall be limited to a maximum wall thickness of 12 inches when single sided vibration is used and 18 inches when double sided vibration is used.

5. FINAL INSPECTION

5.1 After fabrication is completed and prior to shipment, the precast items will be stored on dunnage. The Fabricator shall provide MCS&T Division with a written or email request for final inspection a minimum of one calendar week prior to the desired date of inspection. Effective communication from the Fabricator to MCS&T Division and Consultant Inspection Agency is the key to avoiding any scheduling conflicts regarding final inspection.

5.2 At the final inspection, the fabricator shall provide the inspector with documentation of required data pertinent to the product(s) being produced. Attached to this document is a sample inspection sheet to be used as a guide for presenting this information. This documentation is also available on the MCS&T Division Website[1].

5.2.1 For the final inspection, the Inspector may witness compressive strength tests if required, inspect repairs as needed, and conduct a thorough visual examination of each member. A copy of the Inspector's daily reports, a copy of the final inspection report, and all other pertinent information provided to the Inspector by the Fabricator shall be kept on file by MCS&T Division.

5.2.2 For box culverts, trial fitting of adjacent pieces, prior to shipping, will be required as part of the final inspection process. Each adjacent box culvert will be trial fitted in pairs horizontally or vertically; the gaps between each pair will be measured. Dunnage will be placed on a smooth level surface below the bottom of the culvert to prevent damage.

[1] https://transportation.wv.gov/highways/mcst/Pages/WVDOH-Materials-Procedures.aspx

The maximum gap between the adjacent pieces shall not exceed ½ inch (13 mm), unless otherwise stated in the construction plans.

6. ACCEPTANCE & REJECTION

6.1 Upon completion of final inspection, if a precast product meets all specification requirements and does not contain any defects, the Inspector will stamp the precast product as accepted by MCS&T Division and provide a 7-digit Laboratory Reference Number for shipment.

6.2 If, however, the precast product does not meet all specification requirements due to damage, defect, or dimensional tolerance, the product must be further evaluated before potential acceptance by the MCS&T Division ~~or the District for which the product was produced, as discussed further in the next sections.~~ as described in the following subsections.

6.2.1 Minor ~~damage and/or~~ defects may be repaired in accordance with the pre-approved repair procedures which should be incorporated within the Fabricator QC Plan. ~~For~~ Cracks 4 mils or less ~~a~~ shall be sealed by silane; ~~treatment may be used.~~ and ~~c~~Cracks between 4 mils and 16 mils shall be repaired by epoxy injection in accordance with Section 603.10.2. Any ~~Products item with~~ crack~~s~~ exceeding 16 mils shall be considered a major defect and the item shall be rejected by MCS&T. If repairs have been approved, and appear satisfactory and all other specifications are met, the Inspector shall stamp the product as approved for shipment~~. MCS&T Division will then issue~~ , and issue a 7-digit Laboratory Reference Number for acceptance.

6.2.2 Major ~~damage and/or~~ defects shall ~~be~~ include: dimensions that exceed tolerances, failure to reach required compressive~~shipping~~ strength, cracks greater than 16 mils, and any defect that could be considered structural. Lagging dimensions shall be ~~measured~~ within ~~a~~± ¼'' from the specified dimension, and all other items must meet relevant tolerances in AASHTO~~,~~ and ASTM Standards. Items with major defects shall be rejected by MCS&T Division, and a 7-digit Laboratory Reference Number will be assigned documenting MCS&T Division's rejection. ~~Major defects shall be~~ When items are load bearing they shall be ~~,but~~ evaluated ~~on a case-by-case basis~~ by the Designer for structural adequacy and then may be accepted by DMIR, pending concurrence by the ~~Engineer of Record~~District, and or the Engineer of Record~~District~~. If a product is approved for repair, and if repairs appear satisfactory, the Inspector shall ~~stamp the product as approved for shipment.~~ proceed with a final shipping inspection of the piece. Any items found to be not acceptable by the Engineer of Record, Designer, or the District/Division; shall be rejected by the Division.

~~If a product does not meet specification requirements due to dimensional measurements not within tolerance, the product must be evaluated by the contractor and or District as to its potential acceptance. If the decision is made to accept the product, acceptance shall be provided by the District through a DMIR. If, however, the product will not be~~

~~accepted, the Inspector will reject the product, and MSC&T Division will apply a Laboratory Reference Number documenting the rejected product.~~

6.2.3 When an item does not achieve the specified 28-day compressive strength ~~it's compressive strength required for shipping~~ prior to shipment, and if it is accepted by a DMIR, the following formula for the price ~~cost~~ adjustment shall be used in ~~apply for~~ the DMIR ~~if accepted~~, plus ~~not including~~ any administrative fee.

Commented [MMA1]: Should we say "specified 28-day compressive strength" instead of "compressive strength required for shipping"? There usually isn't a shipping strength specified anywhere for precast items, and usually just the 28-day strength is specified. Also, the formula below is based on 28-day strength.

f'_c – 28 *Day Compressive Strength* (psi)
$\overline{X}$ – *Average* 28 – *day Compressive Strength* (psi)
IC - The invoiced cost of the precast item only.

Formula 1 (Constructed by Contractor)

$$\text{Price Reduction} = \left[\frac{f'_c - \overline{X}}{.5\,f'_c}\right] x\ 40\%\ \textit{Unit Bid Price}$$

Formula 2 (Constructed by Division)

$$\text{Price Reduction} = \left[\frac{f'_c - \overline{X}}{.5\,f'_c}\right] x\ IC$$

7. PROCEDURE FOR APPROVED SOURCE OF PRECAST CONCRETE LAGGING

7.1 Precast concrete Fabricators may be classified as an Approved Source of precast concrete lagging if they have met the requirements of Section 3 and are producing lagging which is made in accordance with the relevant WVDOH Standard Details. Once classified as an Approved Source of precast concrete lagging, an Approved Source Lab Number will be assigned to the Fabricator for material tracking.

7.2 MCS&T Division may perform regular quality assurance inspections prior to shipment and/or, monitor fabrication of lagging from a Fabricator that is an Approved Source. The Approved Source Lab Number shall be noted on all shipping documents from the fabricator, and material coverage will be requested under the assigned Approved Source Lab Number. All relevant concrete test data, component material information, QC inspection data, and shipping information shall be kept on file at the Fabricator for the last three years of fabrication and shall be available upon request by the Division. Failure to produce requested documentation may result in revocation of the Fabricator's Approved Source certification status.

7.3 Approved Sources will be evaluated by the Division by random audits. Audits will be conducted on the material that is available to the Inspector at the time of the audit. All

documentation and records for the pieces must be made available to the Inspector on the day of the audit and must be complete, current, and accurate. Failure to produce records shall be a cause for decertification.

7.3.1 All shipping documentation, concrete test data, and component material certifications shall be made available to the Inspector for review. These documents shall include all documents from material that has been shipped to state projects since the last audit. If data indicates that any material did not conform to this MP, the applicable Specifications, or Standard Detail; and was used in a state project, then the Fabricator will be de-certified as an Approved Source of precast concrete lagging.

7.3.2 In addition to documentation, the audit will consist of fabrication monitoring, test observance, and a visual inspection of material that is stocked for shipping on the day of the audit.

7.3.2.1 Each material test monitored during the audit must be performed in accordance with the applicable Standards, and Specifications. Visual inspection of stocked material will include quality checks of surface finish for cracks, spalls, and other surface blemishes after all repairs have been performed and dimensional checks. The material shall be properly stored to avoid handling damage and be accessible to the Inspector. Audits shall be graded on a point system deducted from 100 and weighted based on the Non- Conformance Points found per Table 7.3. A minimum score of 75 shall be considered passing.

TABLE 7.3

Audit Category	**Non-Conformance Points**
Material Test Data Review	10 (per error)
Component Material Certification Review	10 (per error)
Shipping Documentation	10 (per error)
Stocked Material Visual Inspection	15 (per defect)
Dimension Check	20 (per error)
Test Performance Check	15 (per Test)

7.4 When a Fabricator, which is an Approved Source, fails an audit, the Fabricator must submit a written corrective action plan to bring their QC program back into compliance with this MP and corresponding Specifications during a probationary period of one month during which time the fabricator must prove they have fulfilled the corrective actions they submitted before supplying the material again. If the Fabricator fails to bring their material back into compliance within the probationary period, the Approved Source status will be revoked for a minimum of one year from the date of the end of the probationary period, or until the Fabricator has corrected the nonconformances listed during the failed audit. Two failing audits in a year shall result in revocation of the Fabricator's Approved Source status for one year from the date of the last failed audit. Any evidence of document falsification shall result in immediate loss of Approved Source status, and removal from the Approved List of Concrete Fabricators

for a minimum 2 years. Depending on the severity and the legality of the falsified documents the removal may be permanent.

7.5 Non-Conforming material received by WVDOH projects and reported to MCS&T shall result in an immediate failing audit and will require the Fabricator to submit corrective actions. If the Fabricator fails the subsequent audit, it will result in the loss of their Approved Source status.

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils and Testing Division

MP 604.02.40 Steward – Cement and Concrete Section
RLS:Mt
ATTACHMENT

PRECAST CONCRETE PRODUCTS
WVDOT DIVISION OF HIGHWAYS MCS&T DIVISION

SAMPLE FABRICATION CHECKLIST

Preliminary Verifications

NPCA (National Precast Concrete Association) Certification _____

CONCRETE COMPONENTS

Mix Design Lab # (if applicable): _____

Cement Source: _____ **Fly Ash Source: _____**

Coarse Aggregate Source 1: _____ **Coarse Aggregate Source 2: _____**

Cement Type: _____ **Approved/Tested: _____**

Fly Ash Type: _____ **Approved/Tested: _____**

Coarse Aggregate 1: _____ **Approved/Tested: _____**

Coarse Aggregate 2: _____ **Approved/Tested: _____**

Fine Aggregate 1: _____ **Approved/Tested: _____**

Fine Aggregate 2: _____ **Approved/Tested: _____**

Batch Water Source: _____ **Approved/Tested: _____**

Admixtures: _____

STEEL COMPONENTS

Reinforcement: Supplier(s): _____

Description: _____ **Lab Number: _____**

Description: _____ **Lab Number: _____**

Description: _____ **Lab Number: _____**

Inserts: **Supplier(s): _____**

Description: _____ **Lab Number: _____**

_____

_____

SHIPLOOSE MATERIAL

Grates: **Fabricator: _____**

Mill Certs.: _____ Galvanize Cert.: _____ Lab Number: _____

Mastic: **Fabricator: _____**

Inspected at: _____ **Lab Number: _____**

SHOP DRAWING REVIEW

Approval Date: _____ **Approved By: _____**

PRECAST CONCRETE PRODUCTS
WVDOT DIVISION OF HIGHWAYS MCS&T DIVISION
SAMPLE FABRICATION CHECKLIST

Preliminary Verifications

POST POUR WORK

Repairs: **Approved Repair Procedures: _____**

Approved by: _____ **Approval Date: _____**

Repair Witnessed: _____

Comments: _____

Sample Form Inspection (Pre-Placement of Concrete)

Product Type (s)				
Criteria	**Design Dimension**	**Tolerance (±)**	**Actual Measurement**	**Within Tolerance**
Fill in Form Information (if applicable)				
Height of Product (ft-inch)				
Depth of form (ft-inch)				
Inside Width of form (inch)				
Outside Width of form (inch)				
Inside Length of form (inch)				
Outside Length of form (inch)				
Wall Thickness (inch)				
Forms Square and Level (√)				
Skew dimensions [if applicable (ft-inch)]				
Locations of inserts, sleeves, block outs, etc. (√)				

Product Type(s)		**Form Properly sealed at joints & edges (√)**	
Framework Constructed of metal on concrete foundation (√)		**Form Clean & Free of debris (√)**	
Form dimensionally correct (√)		**Release Agent applied (√)**	
Other Information:			

Reinforcing Steel	
Reinforcing Steel (Condition)	
Fill in steel information (if applicable)	
Size & Grade	
Location & Lapping Length (√)	
Spacing and Clearances (√)	
Chairs, Spacers properly used	

Sample Concrete Placement & Curing

Quality Control Concrete Testing			
Concrete Truck Arrival Time		**Concrete Truck Departure Time**	
Concrete Temp		**Ambient Temp, Weather Conditions**	
Slump/Spread (inch)		**Air Content (%)**	
QC Tests performed per Specifications & Passing		**Number & diameter (inch) of Cylinders**	
Comments:			

Placement of Concrete			
Lift	**Start Time**	**Completion Time**	**Vibrated (External/Internal/Both)**
1st			
2nd			
3rd			
4th			
Placement of Concrete Completion Time			
Comments:			

Curing/Finishing of Concrete	
Top Surface Finished Per Specification	
Lifting loops/inserts accessible	
Product Curing Location (Inside/Outside)	
Product Covered & Heat Applied (Time Start & Time Finished)	
Heat Sensors Installed (√)	
Compressive Strength Cylinders Stored with Product under Curing/Normal Environment (√)	
Compressive Strength Test Conducted when curing was discontinued (√)	
Comments:	

Sample Concrete Post Pour Product Inspection

Product	
Visual Inspection for Damage (√)	
Notes (Size & Location of cracks, spalls, honeycomb, etc.)	
Products in Need of Repair (√)	
Repair Method Approved (√)	
Comments:	

Product Type (s)				
Criteria	**Design Dimension**	**Tolerance (±)**	**Actual Measurement**	**Within Tolerance**
Fill in Form Information (if applicable)				
Height of Product (ft-inch)				
Inside Width of product (inch)				
Outside Width of product (inch)				
Inside Length of product (inch)				
Outside Length of product (inch)				
Wall Thickness (inch)				
Product Square and Level (√)				
Skew dimensions [if applicable (ft-inch)]				
Locations of inserts, sleeves, block outs, etc. (√)				

Product	
Dimensional Tolerances Met? (yes or no)	
Heights (yes or no)	
Widths (yes or no)	
Depths (yes or no)	
Wall Thickness(es) (yes or no)	
Inserts, sleeves, lifting points, etc. (yes or no)	
All Concrete Finishes per specification (yes or no)	
Product properly transported (yes or no)	

Product stored on proper dunnage (yes or no)	
Design Shipping Strength met (yes or no)	
Repairs Satisfactory (yes or no)	
Product Stamped for Final Inspection (yes or no)	
Comments:	

Sample Inspection Sheet

Inspection Date_____ QC Personnel_____ QC Signature_____

Fabricator_____ Location_____

Project Name_____ WV State Project #_____ Federal Project #_____

Authorization # _____ Inspection done by_____

Steel Reinforcement

Reinforcement Supplier _____

Description_____ Approved Lab #_____

Description_____ Approved Lab #_____

Description_____ Approved Lab #_____

Product Description	Quantity	Date Cast	Slump/ Spread (inch)	Air Content (%)	Design Strength (psi)	Cylinder Breaks (psi)	Date Of Break	Absorption (%)
Type "D" inlet								
Type "G" inlet								
36-inch Manhole (base, riser, top)								
48-inch Manhole (base, riser, top)								
10'0"x 12'0" Box Culvert								NA
Lagging 8"x24"x54"								NA
Type A Reinforced Panel								NA
6'0" Coping								NA
24-inch Wing wall								

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

MATERIALS CONTROL, SOILS & TESTING DIVISION

MATERIALS PROCEDURE

ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING

1. PURPOSE

1.1 To establish equipment, procedure, documentation, and documentation transmittal requirements for the tightening of anchor bolt nuts associated with signing, signal, lighting, and intelligent transportation systems (ITS) related roadway ancillary structures.

1.1.1 This Materials Procedure is specifically focused on the procedure to be followed when tightening anchor bolt nuts and does not address all requirements and procedures pertaining to the installation of ancillary structures. Individual component pre-inspection and repair, structure pre-assembly, structure installation preparation, pre-application of protective coatings, overall installation procedure, and proper tightening of structural connection bolts are included as part of the Standard Specifications.

2. MATERIALS AND EQUIPMENT

2.1 The mandatory materials and equipment required to properly tighten the anchor bolts include lubricant, snug tightening wrenches, and a hydraulic fastener tightening wrench.

2.1.1 Wrenches used for a snug tightening are to have an appropriate handle length in order to achieve a level of initial snug tightening as predictable and uniform as possible. The handle length used for fasteners 3/4-inch to 1-1/4-inches in diameter is to be 23-inches. The handle length used for fasteners 1-1/2-inches to 2-1/4-inches in diameter is to be 36-inches.

2.1.2 Beeswax or toilet ring wax may be used as lubricant.

2.1.3 Hydraulic wrenches and accompanying documentation are to meet the requirements herein.

2.1.3.1 The wrenches are to be capable of generating the necessary torque in order to tighten the anchor bolt nuts as described herein.

2.1.3.2 The hydraulic wrench consists of a wrench and a hydraulic power pack to power and operate the wrench.

2.1.3.3 Hydraulic wrenches are to have the wrench and the pressure or torque readout gauge associated with the power pack calibrated regularly. Prior to the tightening of any

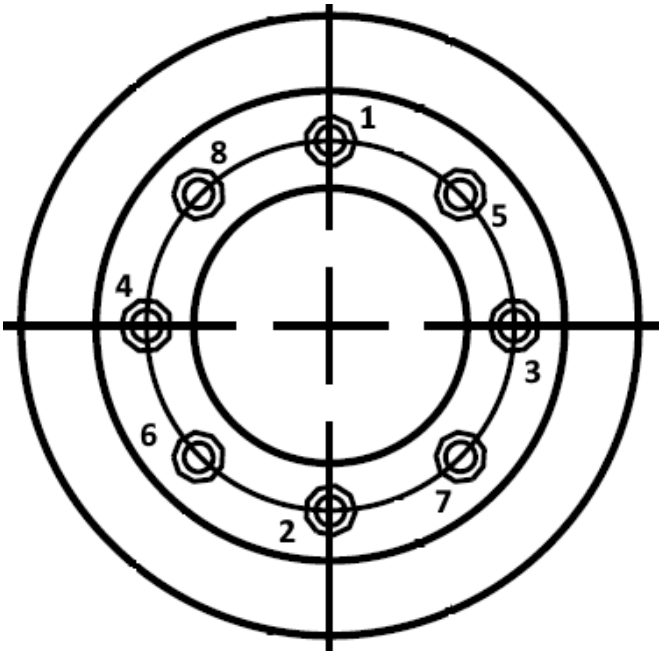
anchor bolt nuts, the project Engineer is to be provided with separate calibration certificates for the wrench and the gauge. The dates of the calibrations are to be one year or less prior to the date that the bolt tightening is performed. The certificates are to be from a calibration lab that is International Organization for Standardization (ISO) 17025 accredited, with the certificate indicating as such. The certificate for each is to display a serial number matching that shown on the wrench or gauge. If the gauge does not provide readings directly in torque values, the calibration certificate is to be accompanied by calibration charts which equate gauge pressure readings to torque values. Example calibration certificates and charts are included as part of attached ATTACHMENT 2.

3. DOCUMENTATION

3.1 The tightening of all anchor bolt nuts is to be documented using the form "WVDOH ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING RECORD" (documentation form) attached as ATTACHMENT 1, and available at the MCS&T DOH Webpage.[1]

4. PROCEDURES

4.1 Install the top nuts and washers and snug tighten the top nuts using the appropriate handle length wrench. Snug tightening is to proceed from nut to nut in a star pattern and the specific sequence chosen is to be indicated on the base plate by numbering the sequence using a permanent marker (see Figures 1 and 2 below). Snug tightness is considered to be the tightness which exists due to the full effort of a person using a spud wrench with the appropriate length handle for the bolt being tightened.



[1] https://transportation.wv.gov/highways/mcst/Pages/tbox.aspx

FIGURE 1 - EXAMPLE NUT TIGHTENING SEQUENCE FOR 8 BOLT BASE PLATE

FIGURE 2 -SNUG TIGHTENING SEQUENCE NUMBERING ON BASE PLATE

4.1.1 Snug tighten the leveling nuts following a star pattern.

4.2 After verifying that all nuts and washers have been brought into firm contact and the necessity or unnecessity for repeating the snug tightening procedure with beveled washers has been determined and performed if required, snug tight condition reference marks are to be placed on the nut and base plate using a permanent marker to prepare for the full tightening procedure(see Figure 3 below). One reference mark is to be placed on the top of the nut at one of the corners. One reference mark is to be placed on the base plate such that this reference mark and the reference mark on top of the nut will be aligned when the nut is rotated one half of the amount specified in Section 4.3.1. An additional reference mark is to be placed on the base plate such that this reference mark and the reference mark on top of the nut will be aligned when the nut is rotated the complete amount specified in Section 4.3.1. All reference marks are to be placed such that they will remain visible when the tightening wrench is placed on the nut.

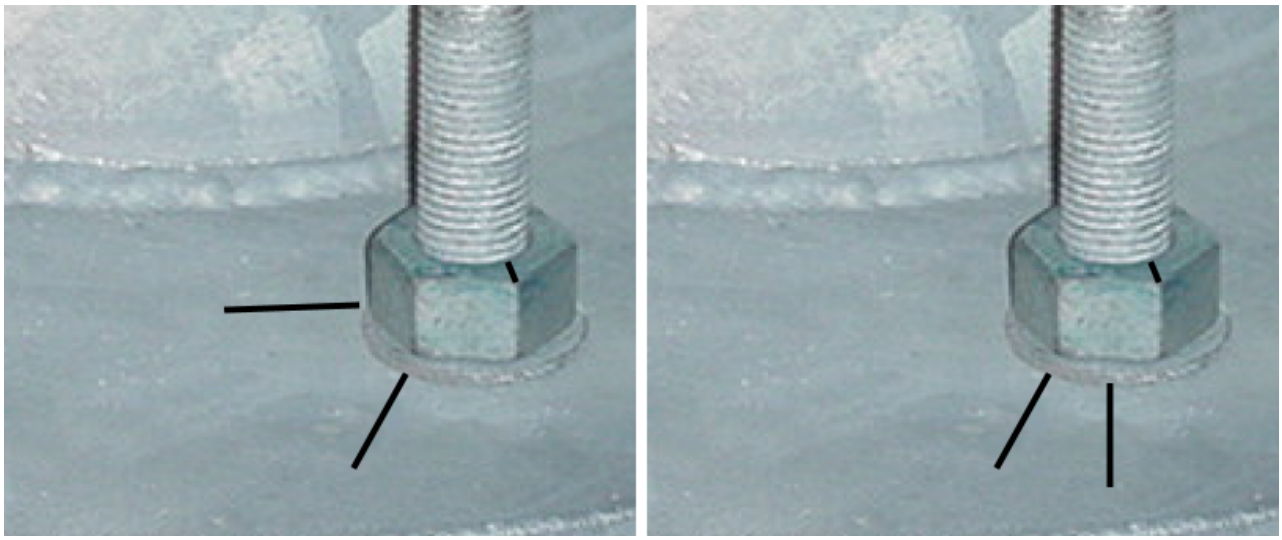


FIGURE 3 - SNUG TIGHT CONDITION REFERENCE MARKS FOR BOLTS 1-1/2" DIAMETER OR LESS (LEFT) AND BOLTS GREATER THAN 1-1/2" DIAMETER (RIGHT)

4.3 Fully tighten the top nuts using the hydraulic wrench.

4.3.1 Full tightness of each nut is achieved by rotating the nut a prescribed number of flats beyond the reference position. Rotation is to be 1/3 (2 flats) beyond the reference position for bolts 1-1/2-inches in diameter or less. Rotation is to be 1/6 (1 flat) beyond the reference position for bolts greater than-1-1/2 inches in diameter.

4.3.2 Tightening is to proceed from nut to nut in the same star pattern that was used for the snug tightening procedure and is to be achieved over two cycles. Using a structure with 2-inch anchor bolts as an example, each nut is to be tightened ½ flat. Each nut is to then be tightened an additional ½ flat. The amount of torque, as indicated on the power pack gauge, at the point when the full rotation of each nut is achieved is to be recorded on the documentation form. If the gauge associated with the power pack does not provide a torque readout, the pressure readout is to be recorded and the associated torque is to be determined from the power pack calibration charts and recorded on the documentation form.

4.4 Upon completion of the tightening of all nuts, a verification torque (Tv) is to be applied to each nut using the same hydraulic wrench and power pack that was used to tighten the nuts. This step is necessary to verify threads have not been stripped and is not intended to tighten the nuts further. The verification torque should be insufficient to

further turn and tighten the nuts. The required verification torque is to be calculated using the following formula and documented on the documentation form:

$$Tv = 0.12\ (Db)\ Fi$$

Where:

Tv = verification torque (inch-kips)
Db = nominal body diameter of the anchor bolt (inches)
Fi = 60% of the anchor bolt minimum tensile strength (kips.) For the commonly specified ASTM F1554 Grade 55 bolts, this calculated value is equal to 45
Multiply Tv by 83.3 to calculate Tv in ft-lbs

If the gauge associated with the power pack does not provide a torque readout, the pressure readout required to achieve the verification torque is to be determined from the power pack calibration charts.

4.4.1 The documentation form is to be marked where indicated to indicate that application of the verification torque did not result in further turning of each nut. If the application of the verification torque results in further turning of any nuts, the Traffic Engineering Division should be notified of this issue.

4.5 At least 48-hours after the tightening and verification torque procedures are completed, a torque equal to 110% of the Tv torque (1.10Tv) is to be applied to each nut using the same hydraulic wrench and power pack that was used to tighten the nuts. This step is necessary to verify threads have not been stripped and is not intended to tighten the nuts further. The 1.10Tv torque should be insufficient to further turn and tighten the nuts. If the gauge associated with the power pack does not provide a torque readout, the pressure readout required to achieve a torque of 1.10Tv is to be determined from the power pack calibration charts.

4.5.1 The documentation form is to be marked where indicated to indicate that application of the 1.10Tv torque did not result in further turning of each nut. If the application of the 1.10Tv torque results in further turning of any nuts, the Traffic Engineering Division should be notified of this issue.

5. DOCUMENTATION TRANSMITTAL

5.1 Upon completion of all procedures described herein and the documentation form being completed in its entirety, the Engineer is to transmit an electronic copy of the documentation form to the email address DOH.OS.AnchorNutTightening@wv.gov, which is established by the Traffic Engineering Division for this purpose. Prior to transmittal, the calibration certificates for the wrench and power pack pressure or torque readout gauge, as well as the calibration charts for the gauge, should be attached to the documentation form and included with the submittal. The subject line of the email should be named using the following format: D(*District Number*)-(*Contract ID Number*)-(*Sign, Signal, Lighting, or ITS*) Structure (*Structure Number as indicated on the project Plans*). Examples of this would be D4-2016000994-Sign Structure 6 and D7

-2006001093-Lighting Structure HML1. An example of all documents that should be included as part of a complete transmittal is attached as ATTACHMENT 2.

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils and Testing Division

MP 658.05.06 Steward – Traffic Certification Section
RLS:W
ATTACHMENTS

Will add header after signatured (includes signature date)

WVDOH ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING RECORD

District: _____ State Project Number:_____

Contract ID number: _____ Federal Project Number:_____

Plan Assembly Number:_____

Structure Utility: __ Signing __Signal __Lighting __ITS

Structure Type: __ Cantilever __(Sign) Butterfly __(ITS) Butterfly __Span __Strain Pole
__Mast Arm __High Mast Tower __Conventional Light Pole

Anchor Diameter:_____inches Tv: _____foot-lbs = _____ PSI

1.10Tv:_____foot-lbs = _____ PSI

Wrench Serial Number: _____ Gauge Serial Number:_____

Diagram of Structure (Plan view of structure showing all base plates. Show and label diagram with base plate numbers and location/position of structure in relation to a reference feature)

Base Plate 1 Diagram (Plan view of base plate with anchor bolt locations. Number anchor bolts the same as the anchors are numbered and tightened. Label diagram to indicate orientation of base plate in relation to a reference feature)

Full Tightness Gauge Pressure and Torque Values (Pressure recording not necessary if readout of gauge is in torque)

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

	1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

	1	2	3	4	5	6	7	8

Will add header after signatured (includes signature date)

Base Plate 2 Diagram

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Base Plate 3 Diagram

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Will add header after signatured (includes signature date)

Base Plate 4 Diagram

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

_____ Date of Tightening

_____ Date of Application of 1.10Tv

_____ Installation Contractor

_____ Bolt Tightening WVDOH Rep. (Print)

_____ Contractor Rep. (Print)

_____ Application of 1.10Tv WVDOH Rep. (Print)

_____ Contractor Rep. (Signature)

_____ WVDOH Project Engineer (Print)

Will add header after signatured (includes signature date)

WVDOH ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING RECORD

District: _____ State Project Number:_____

Contract ID number: _____ Federal Project Number:_____

Plan Assembly Number:_____

Structure Utility: _X Signing __Signal __Lighting __ITS

Structure Type: __ Cantilever __(Sign) Butterfly __(ITS) Butterfly _XSpan __Strain Pole

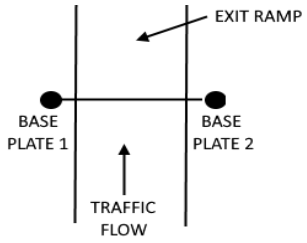
__Mast Arm __High Mast Tower __Conventional Light Pole

Anchor Diameter:_____2_____inches Tv: ____900___foot-lbs = ___2,787__ PSI

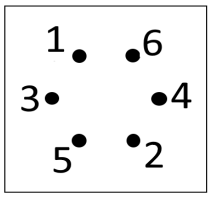
1.10Tv:____990____foot-lbs = ___3,110__ PSI

Wrench Serial Number: ___0916506063__ Gauge Serial Number:_____353228_____

Diagram of Structure (Plan view of structure showing all base plates. Show and label diagram with base plate numbers and location/position of structure in relation to a reference feature)



Base Plate 1 Diagram (Plan view of base plate with anchor bolt locations. Number anchor bolts the same as the anchors are numbered and tightened. Label diagram to indicate orientation of base plate in relation to a reference feature)



RAMP TRAFFIC →

Full Tightness Gauge Pressure and Torque Values (Pressure recording not necessary if readout of gauge is in torque)

	1	2	3	4	5	6	7	8
PSI	3350	3347	3354	3362	3343	3351		
foot-lbs	1064	1064	1066	1068	1062	1065		

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

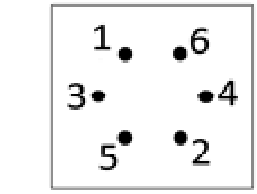
1	2	3	4	5	6	7	8
x	x	x	x	x	x		

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8
x	x	x	x	x	x		

Will add header after signatured (includes signature date)

Base Plate 2 Diagram



←RAMP TRAFFIC

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI	3370	3338	3360	3372	3325	3341		
foot-lbs	1071	1061	1068	1072	1056	1062		

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8
x	x	x	x	x	x		

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8
x	x	x	x	x	x		

Base Plate 3 Diagram

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Will add header after signatured (includes signature date)

Base Plate 4 Diagram

Full Tightness Gauge Pressure and Torque Values

	1	2	3	4	5	6	7	8
PSI								
foot-lbs								

Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

Mark Each Box to Indicate Application of 1.10Tv did not Result in Further Turning of Nut

1	2	3	4	5	6	7	8

_____ Date of Tightening

_____ Date of Application of 1.10Tv

_____ Installation Contractor

_____ Bolt Tightening WVDOH Rep. (Print)

_____ Contractor Rep. (Print)

_____ Application of 1.10Tv WVDOH Rep. (Print)

_____ Contractor Rep. (Signature)

_____ WVDOH Project Engineer (Print)

EXAMPLE WRENCH CALIBRATION CERTIFICATE

CERTIFICATE INDICATES LAB IS ISO 17025 ACCREDITED

CERTIFICATE OF CALIBRATION

CERTIFICATE # TW-01193

[redacted] certifies that the instrument below has been calibrated in accordance with [redacted] calibration procedures under the conditions noted below using laboratory standards which are traceable to SI units.

The uncertainty represents an expanded uncertainty at approximately the 95% confidence level using a coverage factor of k=2.

The information on this certificate applies only to the identified instrument and may not be reproduced, except in full, without the written consent of [redacted]

WRENCH MODEL AND SERIAL NUMBER

MODEL	2503MFRMH
SERIAL #	0916506063
TYPE	Click
CAL DATE	9/2/2021
CAL DUE	9/2/2022
ACCURACY	(+/-) 4%
RANGE MAX	260
RANGE MIN	48

Customer	[redacted]
Address	[redacted]

Tech:	Temp (°F)	RH %
[redacted]	75.2	52
Test Method:	TI-CAL-1	

CALIBRATION DATE

AS FOUND			
PERCENT OF RANGE	WRENCH SETTING	AS FOUND	TOLERANCE
100%	250 FTLB	251.56 FTLB	(+/-) 4%
60%	150 FTLB	147.14 FTLB	(+/-) 4%
20%	50 FTLB	47.596 FTLB	(+/-) 4%

AS LEFT			
PERCENT OF RANGE	WRENCH SETTING	AS LEFT	TOLERANCE
100%	250 FTLB	248.38 FTLB	(+/-) 4%
60%	150 FTLB	147.98 FTLB	(+/-) 4%
20%	50 FTLB	48.286 FTLB	(+/-) 4%

STANDARDS USED FOR CALIBRATION

MODEL USED	MFGR	SERIAL #	CERT #	EXPIRES	RANGE
MTMDP-4L-100	AWS	10963-1	25500-1	7/23/2022	10-100 IN-LBS
MTMDP-4L-500	AWS	10963-2	25501-1	7/23/2022	50-500 IN-LBS
MTMDP-4L-250	AWS	10963-3	25502-1	7/23/2022	25-250 FT-LBS
MTMDP-4L-750	AWS	10963-4	25503-1	7/23/2022	75-750 FT-LBS

Expanded Uncertainty	
Range	k=2
10-100 inlb	1.08 inlb
50-500 inlb	4.98 inlb
25-250 ftlb	7.44 ftlb
75-750 ftlb	8.86 ftlb

9/2/2021

SIGNATURE DATE

EXAMPLE GAUGE CALIBRATION CERTIFICATE AND CHARTS

CERTIFICATE INDICATES LAB IS ISO 17025 ACCREDITED

Certificate of Calibration

CERTIFICATE # 14-03066

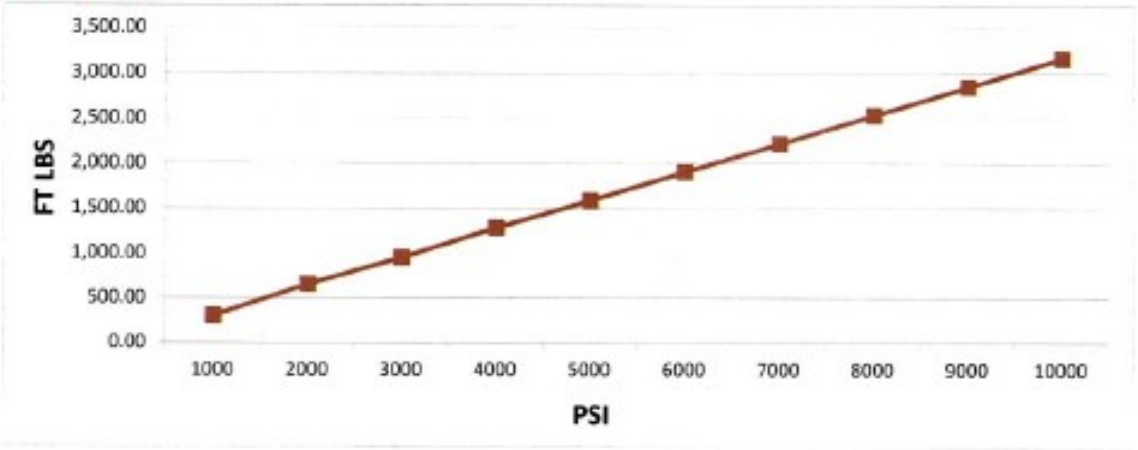
Calibration Date:	August 18, 2021
Calibration Due:	February 18, 2022
Temperature (F):	74.3
Relative Humidity(%):	57
Test Method:	TI-CAL-7, TI-CAL-8

Model Number:	3MD
Serial Number:	353228
Type:	Hydraulic
Technician:	[redacted]
Signature:	

Customer:	[redacted]
Address:	[redacted]

CALIBRATION DATE

GAUGE MODEL AND SERIAL NUMBER



TEST EQUIPMENT

Manufacturer	AKO	AKO
Model Number	TSD20011	TSD10KPT
Serial Number	6240	127064
Accuracy (+/-)	0.5%	0.1%
Calibration Certificate #	21238-1	21239-1
Calibration Due Date	10/15/2021	10/15/2021

CALIBRATION CHART

ANAB ACCREDITED CALIBRATION LABORATORY

Calibration Date:	8/18/2021	Model Number:	3MD
Calibration Due:	2/18/2022	Serial Number:	353228

PSI	FT/LBS	PSI	FT/LBS	PSI	FT/LBS	PSI	FT/LBS	PSI	FT/LBS
100	2	2100	692	4100	1307	6100	1940	8100	2573
200	52	2200	721	4200	1337	6200	1971	8200	2605
300	93	2300	752	4300	1368	6300	2003	8300	2637
400	125	2400	776	4400	1401	6400	2035	8400	2669
500	163	2500	797	4500	1434	6500	2067	8500	2702
600	195	2600	836	4600	1465	6600	2098	8600	2732
700	228	2700	880	4700	1496	6700	2131	8700	2764
800	259	2800	903	4800	1527	6800	2163	8800	2797
900	287	2900	924	4900	1560	6900	2194	8900	2828
1000	306	3000	956	5000	1591	7000	2225	9000	2860
1100	351	3100	987	5100	1622	7100	2257	9100	2891
1200	397	3200	1017	5200	1654	7200	2289	9200	2923
1300	426	3300	1048	5300	1685	7300	2321	9300	2954
1400	458	3400	1081	5400	1717	7400	2353	9400	2986
1500	491	3500	1113	5500	1749	7500	2384	9500	3018
1600	524	3600	1145	5600	1780	7600	2416	9600	3049
1700	556	3700	1177	5700	1812	7700	2447	9700	3081
1800	589	3800	1222	5800	1844	7800	2479	9800	3112
1900	623	3900	1267	5900	1876	7900	2511	9900	3143
2000	659	4000	1288	6000	1908	8000	2542	10000	3177

Tv = 900 ft-lbs = 2,787 psi*

1.10Tv = 990 ft-lbs = 3,110 psi*

[redacted] certifies that the above instrument has been calibrated in accordance with [redacted] calibration procedures under the conditions noted above using laboratory standards which are traceable to SI units. The uncertainty represents an expanded uncertainty at approximately the 95% confidence level using a coverage factor of k=2.

*DETERMINED USING LINEAR INTERPOLATION BETWEEN ADJACENT DATA POINTS

Expanded Uncertainty

Range	k = 2	Units
0-20,000	78.52	FT/LBS

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

WEST VIRGINIA ACCEPTANCE PLAN "A" METHOD OF ESTIMATING PERCENTAGE OF MATERIAL OF CONSTRUCTION THAT WILL FALL WITHIN SPECIFICATION LIMITS

1. SCOPE

1.1 This procedure provides a method of estimating the percentage of each lot or sublot of material, product, item of construction, or completed construction which may be expected to be within specified tolerances.

2. REFERCED DOCUMENTS

2.1 West Virginia Department of Transportation, Division of Highways, Standard Specifications, Current Addition. Section 106.3.1.1.

3. DEFINITIONS

3.1 Xi = the individual values under consideration.

3.2 n = the number of individual values under consideration.

3.3 X = the arithmetic mean, or average of values under consideration. X may be expressed as Xi/n, or the sum of the individual values divided by the number of individual values.

3.4 R = the range, or the difference between the largest and smallest values under consideration.

3.5 Q = Quality Index, found by subtracting the average, X, from the upper or lower tolerance limit and dividing by the range, R.

3.6 P = Percent within tolerance.

4. PROCEDURE

4.1 Locate n sampling positions on the lot, or sublot, in a random manner.

4.2 Make a measurement at each position or take a test portion and make the measurement on the test portion.

4.3 Average all measurements to find X.

4.4 In cases where n is less than 10, find R by subtracting the smallest value from the largest value in the group of measurements.

4.5 In cases where n is equal to or greater than 10, arrange the measurements in the order in which they were taken and divide into subgroups of 5 each. Find R for each subgroup, add these values, and divide by the number of subgroups to find R.

4.6 Find the Upper Quality Index, QUX by subtracting the average, X, of the measurements from the upper tolerance limit, U, and dividing the result by R or R.

Qu = v (Equation 1)

4.7 Find the Lower Quality Index, QL, by subtracting the lower tolerance limit, L, from the average, X, and dividing by R or R.

QL = R or -R (Equation 2)

4.8 Estimate the percentage, Pus that will fall within the upper tolerance limit by entering the-tables of Attachment l, with Qu, using the column appropriate to the total number, n, of measurements.

4.9 Estimate the percentage, PL, that will fall within the lower tolerance limit by entering the tables of Attachment 1, with QLS using the column appropriate to the total number, n, of measurements.

4.10 In cases where both Upper, U, and Lower, L, tolerance limits are concerned, the total percentage, P, of the lot or sublot estimated to fall within tolerances is the sum of the percentage, Pu, within the upper limit, U, and the percentage, PL, within the lower limit, L, subtracted from 100.

P (Pu + PL) - 100 (Equation 3)

Ronald L. Stanevich, PE
Director
Materials Control, Soils & Testing Division

MP 106.00.20 Steward – Materials Control Section
RLS:B
Attachment

Tables 106-1-5

Table for Estimating Percent of Lot Within Tolerance (Range Method)

Percent Within Tolerance	Negative Values of Qu and Ql												
	n=3	n=4	n=5	n=6	n=7	n=10	n=15	n=25	n=30	n=35	n=40	n=50	n=60
20	0.49	0.40	0.36	0.33	0.31	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
19	0.50	0.42	0.37	0.34	0.32	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38
18	0.51	0.43	0.38	0.35	0.33	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
17	0.52	0.44	0.40	0.36	0.34	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41
16	0.53	0.46	0.41	0.38	0.36	0.42	0.42	0.42	0.43	0.43	0.43	0.42	0.42
15	0.54	0.47	0.42	0.39	0.37	0.43	0.44	0.44	0.44	0.44	0.44	0.44	0.44
14	0.54	0.48	0.44	0.40	0.38	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.46
13	0.55	0.50	0.45	0.42	0.40	0.47	0.47	0.47	0.48	0.40	0.40	0.40	0.40
12	0.56	0.51	0.46	0.43	0.41	0.48	0.49	0.50	0.50	0.50	0.50	0.50	0.50
11	0.57	0.52	0.48	0.45	0.43	0.50	0.51	0.52	0.52	0.52	0.52	0.52	0.52
10	0.58	0.54	0.50	0.46	0.44	0.52	0.53	0.54	0.54	0.54	0.54	0.55	0.55
9	0.58	0.55	0.51	0.48	0.46	0.54	0.55	0.56	0.57	0.57	0.57	0.57	0.57
8	0.59	0.56	0.53	0.49	0.47	0.57	0.58	0.59	0.59	0.59	0.59	0.60	0.60
7	0.59	0.58	0.55	0.51	0.49	0.59	0.61	0.61	0.62	0.62	0.62	0.62	0.62
6	0.59	0.59	0.57	0.53	0.51	0.62	0.63	0.64	0.65	0.62	0.66	0.66	0.66
5	0.60	0.60	0.58	0.55	0.53	0.64	0.66	0.68	0.68	0.69	0.69	0.70	0.70
4	0.60	0.62	0.60	0.57	0.55	0.68	0.68	0.72	0.73	0.73	0.73	0.74	0.74
3	0.60	0.63	0.62	0.59	0.58	0.71	0.74	0.77	0.78	0.78	0.78	0.79	0.79
2	0.60	0.64	0.65	0.62	0.61	0.76	0.80	0.83	0.84	0.85	0.85	0.86	0.86
1	0.60	0.66	0.66	0.65	0.65	0.82	0.88	0.93	0.94	0.95	0.95	0.97	0.97

When N >= 10, the samples are arranged consecutively in subgroups of five, the range R of each subgroup determined, and then the average range R of all subgroups computed for use in finding Qu or Ql

Tables 106-1-5

Table for Estimating Percent of Lot Within Tolerance (Range Method)

Percent Within Tolerance	Negative Values of Qu and Ql												
	n=3	n=4	n=5	n=6	n=7	n=10	n=15	n=25	n=30	n=35	n=40	n=50	n=60
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	0.09	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
40	0.19	0.13	0.11	0.10	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
39	0.20	0.15	0.13	0.11	0.10	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
38	0.22	0.16	0.14	0.12	0.11	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
37	0.24	0.17	0.15	0.13	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
36	0.26	0.19	0.16	0.15	0.13	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15
35	0.27	0.20	0.17	0.16	0.14	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
34	0.29	0.21	0.18	0.17	0.15	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
33	0.31	0.23	0.19	0.18	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
32	0.32	0.24	0.21	0.19	0.17	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
31	0.34	0.26	0.22	0.20	0.18	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
30	0.36	0.27	0.23	0.21	0.19	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23
29	0.37	0.28	0.24	0.22	0.20	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
28	0.39	0.30	0.25	0.23	0.22	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
27	0.40	0.31	0.27	0.24	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27
26	0.41	0.32	0.28	0.25	0.24	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
25	0.43	0.34	0.29	0.27	0.25	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
24	0.44	0.35	0.30	0.28	0.26	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
23	0.46	0.36	0.32	0.29	0.27	0.32	0.32	0.31	0.31	0.32	0.32	0.32	0.32
22	0.47	0.38	0.33	0.30	0.28	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
21	0.48	0.39	0.34	0.31	0.29	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35

When N >= 10, the samples are arranged consecutively in subgroups of five, the range R of each subgroup determined, and then the average range R of all subgroups computed for use in finding Qu or Ql

Tables 106-1-5

Table for Estimating Percent of Lot Within Tolerance (Range Method)

Percent Within Tolerance	Negative Values of Qu and Ql												
	n=3	n=4	n=5	n=6	n=7	n=10	n=15	n=25	n=30	n=35	n=40	n=50	n=60
79	0.48	0.39	0.34	0.31	0.29	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35
78	0.47	0.38	0.33	0.30	0.28	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.30
77	0.46	0.36	0.32	0.29	0.27	0.32	0.32	0.31	0.31	0.32	0.32	0.32	0.32
76	0.44	0.35	0.30	0.28	0.26	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
75	0.43	0.34	0.29	0.27	0.25	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
74	0.41	0.32	0.28	0.25	0.24	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
73	0.40	0.31	0.27	0.24	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27
72	0.39	0.30	0.25	0.23	0.22	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
71	0.37	0.28	0.24	0.22	0.20	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
70	0.36	0.27	0.23	0.21	0.19	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23
69	0.34	0.26	0.22	0.20	0.18	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
68	0.32	0.24	0.21	0.19	0.17	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
67	0.31	0.23	0.19	0.18	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
66	0.29	0.21	0.18	0.17	0.15	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
65	0.27	0.20	0.17	0.16	0.14	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
64	0.26	0.19	0.16	0.15	0.13	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15
63	0.24	0.17	0.15	0.13	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
62	0.22	0.16	0.14	0.12	0.11	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
61	0.20	0.15	0.13	0.11	0.10	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
60	0.19	0.13	0.11	0.10	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
55	0.09	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

When N >= 10, the samples are arranged consecutively in subgroups of five, the range R of each subgroup determined, and then the average range R of all subgroups computed for use in finding Qu or Ql

Tables 106-1-5

Table for Estimating Percent of Lot Within Tolerance (Range Method)

Percent Within Tolerance	Negative Values of Qu and Ql												
	n=3	n=4	n=5	n=6	n=7	n=10	n=15	n=25	n=30	n=35	n=40	n=50	n=60
99	0.60	0.66	0.66	0.65	0.65	0.82	0.88	0.93	0.94	0.95	0.95	0.97	0.97
98	0.60	0.64	0.65	0.62	0.61	0.76	0.80	0.83	0.84	0.85	0.85	0.86	0.86
97	0.60	0.63	0.62	0.59	0.58	0.71	0.74	0.77	0.78	0.78	0.78	0.79	0.79
96	0.60	0.62	0.60	0.57	0.55	0.68	0.68	0.72	0.73	0.73	0.73	0.74	0.74
95	0.60	0.60	0.58	0.55	0.53	0.64	0.66	0.68	0.68	0.69	0.69	0.70	0.70
94	0.59	0.59	0.57	0.53	0.51	0.62	0.63	0.64	0.65	0.65	0.65	0.66	0.66
93	0.59	0.58	0.55	0.51	0.49	0.59	0.61	0.61	0.62	0.62	0.62	0.62	0.62
92	0.59	0.56	0.53	0.49	0.47	0.57	0.58	0.59	0.59	0.59	0.59	0.60	0.60
91	0.58	0.55	0.51	0.48	0.46	0.54	0.55	0.56	0.57	0.57	0.57	0.57	0.57
90	0.58	0.54	0.50	0.46	0.44	0.52	0.53	0.54	0.54	0.54	0.54	0.55	0.55
89	0.57	0.52	0.48	0.45	0.43	0.50	0.51	0.52	0.52	0.52	0.52	0.52	0.52
88	0.56	0.51	0.46	0.43	0.41	0.48	0.49	0.50	0.50	0.50	0.50	0.50	0.50
87	0.55	0.50	0.45	0.42	0.40	0.47	0.47	0.47	0.48	0.48	0.48	0.48	0.48
86	0.54	0.48	0.44	0.40	0.38	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.46
85	0.54	0.47	0.42	0.39	0.37	0.43	0.44	0.44	0.44	0.44	0.44	0.44	0.44
84	0.53	0.46	0.41	0.38	0.36	0.42	0.42	0.42	0.43	0.43	0.43	0.42	0.42
83	0.52	0.44	0.40	0.36	0.34	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41
82	0.51	0.43	0.38	0.35	0.33	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
81	0.50	0.42	0.37	0.34	0.32	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38
80	0.49	0.40	0.36	0.33	0.31	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36

When N >= 10, the samples are arranged consecutively in subgroups of five, the range R of each subgroup determined, and then the average range R of all subgroups computed for use in finding Qu or Ql

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

RAPID DETERMINATION OF THE POLISH SUSCEPTIBLE CARBONATE PARTICLE CONTENT IN AGGREGATES

1. PURPOSE

1.1 To establish a rapid testing procedure for determining the approximate percentage, by weight, of polish susceptible carbonate particles in aggregate.

2. SCOPE

2.1 This procedure is designed to be used in conjunction with the testing of heterogeneous aggregate such as river gravel.

3. APPLICABLE DOCUMENTS ASTM E-11

3.1 ASTM C-702 or AASHTO T-248

3.2 MP 700.00.06

4. APPARATUS

4.1 A- 4.75 mm (No. 4) #4 U. S. Standard 203 mm diameter sieve, conforming to ASTM E-11 Specifications.

4.2 Balance or scale, having a capacity of at least 300 grams and a sensitivity of at least 0.1 grams.

4.3 Oven capable of being maintained at 110 ± 5ºC (230 ± 9ºF).

4.4 Containers: an acid resistant 225 ×~~X~~ 175 ×~~X~~ 51 mm ~~pyrex~~Pyrex dish.

4.5 Receiving beaker: 400 or 600 ml ~~pyrex~~Pyrex beaker.

4.6 Tongs: ~~acid~~Acid resistant

4.7 Hydrochloric Acid: 6N solution

4.8 Safety Apparatus (rubber gloves, apron~~s~~, respirator~~s~~, ventilation hood, ~~etc~~ eye protection.)

4.9 A source of magnification, ~~preferable~~ preferably a microscope of sufficient power, to discern grain sizes as small as 2 mm.

5. SAMPLE PREPARATION

5.1 Samples shall be representative of the sources from which they are obtained and shall be reduced to an appropriate size by use of a sample splitter or by quartering in accordance with ASTM C-702 or AASHTO T-248.

5.2 Samples shall be sieved and thoroughly washed over a 4.75 mm (No. 4) sieve and dried in an oven to constant weight at 110± 5°C (230 ± 9ºF).

5.3 An oven dry sample, weighing a minimum of 350 grams, shall be used for the test and shall be weighed to the nearest 0.1 gram.

5.3.1 The selection of samples of an exact predetermined weight shall not be attempted.

6. PROCEDURE

6.1 Under a ventilation hood, pour a quantity of 6N hydrochloric acid into the Pyrex dish to cover the largest piece of aggregate in the sample.

6.2 Place a small number of aggregate particles from the sample into the acid and observe signs of effervescence.

6.3 Immediately remove all pieces of aggregate exhibiting strong signs of effervescence and place in the receivinga beaker containing water to stop the acid--carbonate reaction.

6.4 Repeat this process until all particles exhibiting effervescence have been removed from the sample.

6.5 Thoroughly wash and oven dry all pieces which exhibited effervescence and discard the remainder of the sample.

6.6 Each individual piece of aggregate should be carefully examined under a microscope by a person qualified by education and experience to employ petrographic techniques for the recognition of characteristic properties of rocks and minerals.

6.6.1 It is the intent of this test to determine those carbonate particles which would be considered to be polish susceptible and detract from the overall anti-skid properties of the aggregate. Those carbonate particles which exhibit frictional properties by virtue of a coarse grained texture (> 2 mm) should not be counted as polish susceptible. Calcareous sandstone, for example. would not be considered as a carbonate particle because only the matrix would be made up of carbonate material.

6.7 After this final separation has been made, weigh the carbonate particles to the nearest 0.1 gram.

7. CALCULATIONS

7.1 Calculate the percentage of carbonate particles as follows:

~~C = W1 x 100 W2~~

$$C = \frac{W_1}{W_2} \times 100$$

Where:

~~C = Percentage of carbonate particles~~ C = Percentage of carbonate particles

~~W1 = Total weight of carbonate particles~~ W_1 = Total weight of carbonate particles

W_2 = Total weight of test sample coarser than 4.75mm

~~W2 = Total weight of test sample coarser than a 4.75 mm.~~

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils and Testing Division

MP 402.02.20 Steward – Aggregate & Soils Section
RLS:M

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR DETERMINING THE TORQUE ON TAMPER RESISTANT HARDWARE

1. PURPOSE

1.1 To set forth a procedure for determining the torque on tamper resistant hardware.

2. SCOPE

2.1 The procedure is applicable for tamper resistant hardware furnished under Section 661.2.2 of the West Virginia Division of Highways Standard Specifications for Roads and Bridges.

3. EQUIPMENT

3.1 Calibrated torque wrench which will read in inch-pounds or foot pounds.

3.2 12 inch section of 1 lb/ft u-channel post.

3.3 6 inch x 9 inch plate manufactured of 0.080 inch aluminum meeting the requirements of ASTM B-209, alloy 5052-H38. The plate shall contain two 3/8 inch holes drilled 1.5 inch from either end and be centered from both ends.

3.4 4 inch x 4 inch shim manufactured of 0.080 inch aluminum meeting the requirements of ASTM B-209, alloy 5052-H38. The shim shall contain one 3/8 inch hole drilled offset 1.5 inch on the center of the shim.

3.5 Screwdriver

4. SAMPLE REQUIREMENTS

4.1 Samples are to be selected in accordance with Section 4.6 of MP 661.02.40.

5. PROCEDURE

5.1 Place the shim on the flange side of the u-channel post.

5.2 Place the plate on top of the shim and line up the holes.

5.3 Place the steel washer, then the nylon on the bolt and push through the plate, shim and back of the u-channel.

5.4 Hand tighten the nut on to the bolt until it touches the back of the u-channel.

5.5 Set the reading on the torque wrench to zero.

5.6 Using the torque wrench, slowly turn the nut until the hex shaped drive head separates from it. Hold the bolt head with the screwdriver to prevent any movement during the torquing operation.

5.7 Read the torque wrench to determine the breaking point. Results are to be reported in foot-pounds.

_____

Ronald L. Stanevich, PE, Director
Materials Control, Soils & Testing Division

MP 661.20.00 Steward – Metals Section
RLS:H

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

SAMPLING AND TESTING OF MATERIALS AT THE SOURCE (COVERAGE)

1. PURPOSE

1.1 To provide definitions and general guidelines of source sampling and testing to minimize non specification material arriving at the project site.

2. SCOPE

2.1 This procedure applies to materials sampled at the source (or some intermediate storage area) on a lot-by-lot basis.

3. DEFINITIONS

3.1 Pre-~~sampling~~ sampling - The sampling operation that is completed while the material is at the source, or other intermediate storage area, prior to shipment to the project site. ~~Pre~~ Pre-sampled material cannot be used until authorization of approval is received from Materials Control, Soil and Testing Division.

3.2 Pretesting - The testing of ~~pre~~ pre-sampled material. A pretested material is that which has been sampled, tested, and evaluated prior to shipment to the project site. Such material may be used upon arrival at the project site.

~~3.2~~3.3 Directive: Applicable Materials Procedures and/or Specifications.

4. PROCEDURE

4.1 Sampling Frequency

4.1.1 Frequency of sampling shall be in accordance with applicable directives for specific items.

4.2 Sampling

4.2.1 All material will be sampled by an authorized representative of the Division. Sampling will be conducted in accordance with the applicable directives.

4.3 Identifying Pre-~~sampled~~ sampled Material

4.3.1 When a specific quantity (lot) of material has been sampled, the material shall be set aside (isolated) and marked, sealed, tagged, or otherwise identified during storage as being ~~pre~~ pre-sampled. The material shall be stored with reasonable

assurance that it will not be contaminated, included, or mixed with other materials that have not been represented in the sampling plan.

4.3.2 Identifying records shall include the following ~~(where applicable)~~, and must accompany the sample to the laboratory:

a) Name of ~~Manufacturer~~Producer/Supplier
b) Date of ~~Manufactur~~Fabrication~~er~~
c) Batch or Lot Identification (Coverage Number)
d) Quantity of Material Represented by Inspection
e) Date Sampled
f) Test(s) Required
g) Sampler/Inspector
h) Project Number (If known at the time of testing)
i) Any other information necessary to identify the material.

4.4 Identifying Pre-tested Material

4.4.1 Packaged Material - When tests indicate packaged material has met the specification requirements they may be tagged, sealed, stamped, or otherwise identified by the state representative as having been pretested and approved.

4.4.2 Bulk or Miscellaneous Materials - When tests indicate bulk or miscellaneous materials have met specification requirements they may be stored in suitable enclosures until shipped. These enclosures may be tagged, sealed, stamped, or otherwise identified by the state's representative as having been pretested and approved. If appropriate, miscellaneous materials may be individually identified by tag, seal, or stamp as being pretested and approved. When closed conveyances are used to ship pretested materials, these conveyances may be tagged, sealed, stamped, or similarly treated to identify the contents as being pretested and approved for shipment to the project site.

5. DOCUMENTATION

5.1 Documentation of Samples - Samples must be documented setting forth all information necessary for proper identification of the materials in accordance with section 4.3.2.

5.2 Sample Document Distribution - Original documentation shall be transmitted with the sample to the testing laboratory. The sampler will retain a copy of this documentation.

5.3 Documentation of Test Results - The testing laboratory will perform all required tests and document the results on the appropriate form. A concluding statement on the form shall indicate that the material does or does not meet the requirements of the controlling specifications. This form shall also contain all applicable identifying information described in Section 4.3.2.

5.4 Testing Document Distribution

5.4.1 When testing is done by a Division approved laboratory, a copy of the test report will be furnished to Materials Control, Soil and Testing Division.

5.4.2 Test reports will be reviewed, assigned a laboratory number, and distributed by Materials Control, Soil and Testing Division as required.

5.5 Shipping Documentation - When test results indicate the material has met the specification requirements, authorization is given for shipment to the project site. The supplier shall prepare a shipping document and shall include as a minimum the following:

1. All information applicable in Section 4.3.2
   a) Information applicable for the shipment of aggregate, asphalt, and concrete include all items except c, e, f, and g of the above referenced section.
   b) Information applicable to shipment of paint include all items except e, g, and h of the above referenced section.
2. Date of shipment
3. The laboratory number assigned to the approval document.

When the material is from stock identified by a ~~Master Laboratory~~Coverage Number, a copy of the shipping document will be transmitted to the ~~Finalization~~ Materials Control Section of ~~the Division~~MCS&T. A copy of the shipping document will always accompany the shipment and be included in the project file.

5.6 Final Acceptance of Pre-tested Material - Tests completed on materials at the source may be used by the Division for acceptance. However, the Division reserves the right to inspect, resample and/or retest the materials at the source or after the materials have arrived at the project.

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils and Testing Division

MP 700.00.01 Steward – Materials Control Section
RLS:B

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

ACCEPTANCE CRITERIA TO DESIGNATE A WOOD TREATMENT PLANT AS AN APPROVED SOURCE OF WOOD PRODUCTS

1. PURPOSE

1.1 To provide the procedures for the quality assurance of wood products and for the certification of wood treatment plants.

2. SCOPE

2.1 This procedure shall apply to all treated and untreated wood products purchased by the West Virginia Division of Highways (WVDOH).

3. REFFERENCED DOCUMENTS

3.1 AASHTO Standards

3.1.1 AASHTO M 168

3.1.2 ASHTO M 133

3.2 ASTM Standards

3.2.1 ASTM D 25

3.3 Other Standards

3.3.1 American Wood Protection Association (AWPA) Book of Standards

3.3.2 Southern Pine Inspection Bureau Grading Rules

3.3.3 U.S. Department of Commerce Standard PS-1

3.3.4 U.S. Department of Commerce Standard PS-20

4. TREATED WOOD PRODUCTS

4.1 Wood treaters will be identified as either certified or noncertified.

4.2 Certified Wood Treatment Plants

4.2.1 Certified wood treaters will provide the following information about their plant and agree to the following conditions:

4.2.1.1 Grading rules,

4.2.1.2 Drying process,

4.2.1.3 Treatment process,

4.2.1.4 Method of sampling,

4.2.1.5 Method of testing preservative and retention,

4.2.1.6 Name of the person responsible for each above item,

4.2.1.7 Method of documentation, and

4.2.1.8 Provide documents that indicate the plant complies with the requirements of the AWPA Book of Standards, and AASHTO M 133 when producing wood products for Division purchase.

4.2.2 Upon successful completion of the above. the Division will assign the wood treater a laboratory number. This number will be used as identification on all documents provided the Division.

4.3 Noncertified Wood Treatment Plants

4.3.1 Treatment plants who do not meet the requirements of Section 4.2 or who do not want to become certified may provide material to the Division under the following conditions

4.3.1.1 Material will be graded, sampled, and tested on a lot to lot basis by an inspection agency acceptable to the Division. Applicable test results must be submitted to Materials Control. Soils and Testing Division.

4.3.2 The Division will review the data provided in Section 4.3.1.1. If the material meets specification requirements, a laboratory number will be assigned to the lot of material.

5. ACCEPTANCE PROCEDURE FOR CERTIFIED TREATERS

5.1 At least once a year, the Division or its representative will perform an inspection of the wood treatment's plant. The inspection may consist of the following:

5.1.1 An in depth review of the wood treater's quality control procedures to assure compliance with the approved quality control plan.

5.1.2 Random samples will be selected of materials supplied by the wood treater. These samples need not to be taken from materials being supplied to the Division, but must be of similar specification requirement. These samples will be tested by the Division.

5.2 If the quality control documentation, or random sampling, and testing reveal noncompliance with the specification, the wood treater may be removed from the approved list.

5.3 Approval may be reinstated at the discretion of the Division, after the corrections of all deficiencies can be documented and the wood treater has reestablished their quality control to the satisfaction of the Division.

6. SHIPPING DOCUMENTATION (CERTIFIED OR NONCERTIFIED)

6.1 The wood treater shall furnish to the project or the Division (when Purchase Order material is shipped) a shipping document. This document must include the following information:

1. Date of shipment,
2. Project or purchase order number,
3. Description and quantity of material shipped, and
4. Wood treater's approval laboratory number or laboratory number assigned to the lot of material by the Division.

7. PROCEDURE AT DELIVERY SITE

7.1 Division personnel will visually inspect each shipment and review information on the shipping document in accordance with Section 6.1.

7.2 All shipments that are damaged, incomplete, or otherwise considered to be in noncompliance with the specifications shall be rejected.

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Materials Control, Soils & Testing Division

MP 710.01.40 Steward – Metals Section
RLS:H

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR EVALUATING QUALITY CONTROL SAMPLE TEST RESULTS WITH VERIFICATION SAMPLE TEST RESULTS

1. PURPOSE

1.1 To provide a procedure for the comparison of quality control sample test results with verification sample test results (similarity).

2. SCOPE

2.1 This procedure is ~~primarily applicable to the contractor's test results when used in the acceptance process~~used to review and evaluate contract quality control samples.~~. Other tests, not necessarily applicable to the acceptance process but used for control of materials, may also apply.~~

2.2 Materials and Tests

2.2.1 Aggregate Gradations

2.2.2 Hot Mix Asphalt (Marshall)

1. Asphalt Content
2. Air Voids
3. Stability
4. Flow
5. Gradation

2.2.3 Hot Mix Asphalt (SuperPave)

1. Asphalt Content
2. Air Voids
3. Gradation

~~2.2.3~~2.2.4 Portland Cement Concrete

1. Air Content
2. Consistency

3. PROCEDURE

3.1 The following procedure will be implemented by the District Materials ~~Engineer/~~Supervisor.

3.2 ~~Immediately after~~After completion of the ~~verification~~ similarity sample test, the data will be entered into the Division approved materials tracking program. ~~it~~ This data will be compared by the software to the applicable quality control sample test results for the same item. Note that all samples being compared must be taken from the same sampling location, e.g., stockpile, roadway, etc., and sampled and tested in the same manner. ~~The comparison will be made in the following manner (also see example sample computation sheets in the attachments).~~

3.2.1 If there are more than ten quality control samples ~~available~~, a verification sample shall be done for first ten samples. Additional similarity samples shall be done at the frequency of one in ten. For example, if 16 QC samples are taken, there shall be a similarity for samples 1-10 and then another for 11-16.

~~3.2.1~~3.2.1.1 If~~determine the average of the ten consecutive quality control samples $\bar{X}_{10}$ whose midpoint is nearest chronologically to the verification sample. Should there only be~~ there are only five to ~~ten~~ nine quality control samples available, determine the average of all the available consecutive quality control test results. When comparing the grading characteristics of an aggregate, the average ($\bar{X}$) for each sieve will be determined.

3.2.2 In the event there are less than five quality control samples available when the ~~verification~~ similarity sample is complete, the District Materials ~~Engineer/~~Supervisor will make an informal review of the data. If the data is such that a dissimilarity appears obvious (even without a formal comparison) then Section 4.1 of this procedure would apply. If, however, the verification sample results appear to be similar to the quality control sample results then the verification sample would be judged at this point by the District Materials ~~Engineer/~~Supervisor to be similar, and the applicable portions of Section 5.1 of this procedure would apply with the following statement: "This verification sample (verification sample number recorded here) has been judged to be similar in accordance with Section 3.2.2 of MP 700.00.54." This statement shall be on the sample record for the similarity.

3.2.3 Determine the range (R) of the quality control samples used in Section 3.2.1 by subtracting the smallest test value from the largest test value. When comparing the grading characteristics of aggregate, the range (R) for each sieve will be determined.

3.2.4 Compute the interval (I) by substituting the values calculated in Sections 3.2.1 and Section 3.2.3 into the proper equation below. When comparing the grading characteristics of aggregate, the interval(I) for each sieve will be determined.

No. of Samples Used in Calculating the Average in Section 3.2.1	Equation for Computing the Interval (I)
10	$I = \bar{X}_{10} \pm 0.91 \times R$
9	$I = \bar{X}_{9} \pm 0.97 \times R$
8	$I = \bar{X}_{8} \pm 1.05 \times R$
7	$I = \bar{X}_{7} \pm 1.17 \times R$

6	$I = \bar{X}_6 \pm 1.33 \times R$
5	$I = \bar{X}_5 \pm 1.61 \times R$

3.2.5 The interval (I) is determined by first adding the average ($\bar{X}_n$) to the product of the range (R) times the given constant. This determines the upper limit of the interval. Note that for gradings, if the result obtained is greater than 100, it will be recorded as 100. And second, subtract the product of the range (R) times the given constant from the average ($\bar{X}_n$). This determines the lower limit of the interval. Note here that if the result is less than zero, it will be recorded as zero.

3.2.6 Compare the verification sample test result with the calculated interval. When comparing the grading characteristics of aggregates, a comparison for each sieve will be determined.

3.3 If the verification sample is an aggregate and all sieve results coincide with or lie between the upper and lower limits of the interval, the quality control sample test results will be considered similar to the ~~verification~~ verification sample test results.

3.4 If the ~~verification~~ similarity sample is an aggregate and any one of the compared values (on any sieve) does not coincide with or lie between the upper and lower limits of the interval, the quality control samples test results will be considered dissimilar to the verification sample.

3.5 If the ~~verification~~ similarity sample is an asphalt mix, and the asphalt content and air voids coincide with or lie between the upper and lower limits of their interval, the quality control samples will be considered to be similar to the verification sample.

3.6 If the ~~verification~~ similarity sample is an asphalt mix, and any one of the compared values is not similar to the quality control data, the quality control samples will be considered to be dissimilar ~~to the verification sample~~.

3.7 If the ~~verification~~ similarity sample ~~(test)~~ is Portland Cement concrete, and both the air content and consistency coincide with or lie between the upper and lower limits of their interval, the quality control samples (tests) will be considered to be similar ~~to the verification sample~~.

4. EVALUATION

4.1 If the quality control sample data is dissimilar to the verification sample the following action will be taken where appropriate.

4.1.1 Review the quality control sampling procedure.

4.1.2 Review the quality control testing procedures.

4.1.3 Check testing equipment

4.1.4 Review computations.

4.1.5 Review documentation.

4.1.6 Perform any additional investigations that may clarify the dissimilarity.

5. REPORTING AND SAMPLE SUBMISSION

5.1 If the quality control samples are found to be similar to the verification sample, ~~proof of the similarity will be shown on the back of, or attached to, the original verification sample test report. The proof will include all of the calculations specified in Section 3.2.1 through 3.2.6 using the format similar to that shown on the appropriate sample computation sheet (attached). The report should be signed by the District Materials Engineer/Supervisor and distributed as specified in Sections 5.5 and 5.6~~the sample shall be marked as "Similar Passed" and submitted to the respective Materials Regional Coodinator for final evaluation using the currently materials tracking software.

5.2 If the quality control samples are dissimilar to the verification sample,~~ the sample shall be marked as "Non-Similar or Similar Passed" and submitted to the respective

Materials Regional Coodinator for final evaluation using the currently materials tracking software ~~the investigation described in Section 4.0 will be documented on the reverse side, or attached to, the original verification sample test report as described below, omitting the words in parenthesis which do not apply. A copy of all calculations specified in Section 3.2.1 to using the format similar to that shown on the appropriate sample computation sheet will also accompany the test report~~.

~~1. Quality control sampling procedures (are, are not) in accordance with applicable directives.~~

~~2. Quality control testing procedures (are, are not) in accordance with applicable directives.~~

~~3. Testing equipment (is, is not) in proper working order.~~

~~4. Computations (are, are not) correctly performed.~~

~~5. Documentation (is, is not) properly performed.~~

~~6. Report any other information that may have been determined in accordance with Section 4.1.6.~~

5.3 ~~All negative replies noted above will be explained.~~ If the Sample is not similar, a note will be made on the sample record including ~~This will include~~ a brief statement of the action taken to correct the deficiency. In the event other documentation is needed, such as a District Materials Inspection Report, to explain and/or support the final resolution of the dissimilarity, the dissimilar verification sample number should be referenced therein.

5.4 Results of the investigation as reported will ~~be signed~~noted by the District Materials ~~Engineer/Supervisor~~in their email submission.

5.5 ~~On the~~ The test ~~report~~ agency view ~~at the bottom will be typed the following~~shall contain the information: "Issued by District (Number) per MP 700.00.54, (Date)."

5.6 ~~The signed, issued report should be prepared in duplicate and distributed as follows~~When the sample is completed, it shall be authorized by the respective Materials Regional Coodinator.~~:~~

~~5.6~~5.7 The testing technician shall be listed on each verification sample.

~~5.6.1 The original copy will be submitted to the Division.~~

~~5.6.2 One copy should be maintained in the District Materials file.~~

Ronald L. Stanevich, PE

Director
Materials Control, Soils & Testing Division

MP 700.00.54 Steward – Materials Control Section
RLS:Bf

COMPUTATION SAMPLE SHEET ASPHALT

Quality Control Lab Number	Date	Asphalt Content (%)	Air Voids (%)	Stability (Newton)	Flow (0.25 mm)
C7-68439	9-15-98	3.8	2.5	9586	11.3
C7-68676	9-16-98	4.3	3.2	9512	9.8
C7-68922	9-16-98	3.5	4.1	9688	10.6
C7-69314	9-17-98	4.0	4.4	9450	11.5
C7-69658	9-17-98	4.2	3.8	9498	10.2
C7-69770	9-18-98	4.0	5.0	9725	9.1
C7-69879	9-22-98	4.0	4.6	9531	10.3
C7-69891	9-22-98	4.0	3.7	9706	11.1
C7-70126	9-23-98	4.5	3.0	9825	11.6
C7-70245	9-24-98	4.3	4.6	9412	10.8
$\bar{X}$		4.06	4.01	9593.3	10.63

Property	Average $\bar{X}_{10}$	Constant (C)	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
Asphalt Content	4.06	0.91	1.0	5.0/3.2[2]	4.5	Yes
Air Voids	4.01	0.91	3.0	6.7/1.3[2]	3.9	Yes
Flow	10.63	0.91	2.5	12.9/8.4[2]	10.3	Yes
Stability	9593	0.91	413	9969/9217[3]	9650	Yes

Note: All four of these tests may not apply to any one sample. For those tests that do apply and all replies in the "Similar column are Yes", take action specified in Section 5.1. If one or more of the applicable test replies in the "Similar column are No", take action specified in Section 5.2.

1 - Verification Sample.

2 - $I=\bar{X}_n \pm C \times R$, round calculated intervals to nearest 0.1 percent.

3 - Round calculated interval to nearest whole Newton.

COMPUTATION SAMPLE SHEET PORTLAND CEMENT CONCRETE

Quality Control ID or Lab Number	Date	Air Content(%)	Consistency Slump (inch)
01	9-15-98	6.2	2.50
02	9-16-98	7.0	2.75
03	9-16-98	5.2	2.50
04	9-17-98	6.4	3.00
05	9-17-98	5.0	2.75
06	9-18-98	5.8	2.25
07	9-22-98	5.4	2.50
08	9-22-98	5.0	2.75
09	9-23-98	6.0	3.00
10	9-24-98	6.0	2.50
$\bar{X}$		5.8	2.65

Property	Average $\bar{X}_{10}$	Constant (C)	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
Air Content	5.8	0.91	2.0	7.6/4.0[2]	7.6	Yes
Consistency	2.65	0.91	0.75	3.25/2.00[3]	3.00	Yes

Note: All four of these tests may not apply to any one sample. For those tests that do apply and all replies in the "Similar column are Yes", take action specified in Section 5.1. If one or more of the applicable test replies in the "Similar column are No", take action specified in Section 5.2.

1 - - Verification Sample.

2 - - $I=\bar{X}_n \pm C \times R$, round calculated intervals to nearest 0.1 percent.

3 - - Round calculated interval to nearest 0.25 inches.

COMPUTATION SAMPLE SHEET AGGREGATE GRADATION

Quality Cont Lab Number	Date	1½″	1″	½″	#4	#8	#200
C7-68439	9-15-98	100	100	25	4	2	0.6
C7-68676	9-16-98	100	100	30	2	2	0.6
C7-68922	9-16-98	100	99	28	2	1	0.4
C7-69314	9-17-98	100	99	49	8	2	1.0
C7-69658	9-17-98	100	100	32	2	1	0.5
C7-69770	9-18-98	100	100	36	1	1	0.6
C7-69879	9-22-98	100	100	42	2	2	0.7
C7-69891	9-22-98	100	100	19	1	1	0.5
C7-70126	9-23-98	100	100	36	2	2	0.3
C7-70245	9-24-98	100	100	43	1	1	0.3
$\bar{X}$		100	99.8	34	2.5	1.5	0.57

Sieve Size	Average $\bar{X}_{10}$	Constant (C)	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
1	100	0.91	0	100/100[2]	100[2]	Yes
1½	99.8	0.91	1	100/99	100[2]	Yes
½	34.0	0.91	30	61/7	24[2]	Yes
#4	2.5	0.91	7	9/0	2[2]	Yes
#8	1.5	0.91	1	2/0	1[2]	Yes
#200	0.57	0.91	0.7	1.2/0	0.4[3]	Yes

Note: All four of these tests may not apply to any one sample. For those tests that do apply and all replies in the "Similar column are "Yes", take action specified in Section 5.1. If one or more of the applicable test replies in the "Similar column are No", take action specified in Section 5.2.

1 – Verification Sample.

2 – $I=\bar{X}_n \pm C \times R$, round calculated intervals to nearest whole number.

3 – Round calculated interval to nearest tenth.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS & TESTING DIVISION

MATERIALS PROCEDURE

QUALITY ASSURANCE TESTING OF COATING PRODUCTS LISTED ON WVDOH APPROVED PRODUCT LISTS (APLs)

1. PURPOSE

1.1 To establish a procedure to perform quality assurance (QA) testing on coatings products listed on MCS&T's approved product lists (APLs).

1.2 To establish a procedure for maintaining a record of such information.

2. REFERENCED DOCUMENTS

a. *WVDOH Specifications for Roads and Bridges, Section 711 Protective Coatings, Stains, and Traffic Paints.*

b. *WVDOH Specifications for Roads and Bridges, Section 601.13.3 Concrete Protective Coating.*

c. *WVDOH Specifications for Roads and Bridges, Section 707.16 Concrete Protective Coating Materials.*

d. *MP 711.00.20 Paint Testing Methods, most recent edition.*

e. *MCS&T Division Approved Product Lists (APLs) for coating products.*

f. *National Transportation Product Evaluation Program (NTPEP).*

g. *North East Protective Coating Committee (NEPCOAT).*

3. QUALITY ASSURANCE TESTING PROCEDURE

3.1 The quality assurance (QA) testing shall be performed on each approved coating listed on any of MCS&T's APLs.

3.2 The QA testing shall be performed in MCS&T's Paint Laboratory and by MCS&T personnel.

Commented [1]: The purpose of this MP is to test, once a year, all the coating products and coating related products that are listed on our APLs in our paint lab at MCS&T. Our test data will be used to reassure the products listed on the APLs are still meeting our established criteria. This will also include testing any products that were placed on an APL using NTPEP or NEPCOAT test data.

Commented [2]: This section is so we can do QA testing on all the coating products currently listed on our APLs each year and the coatings group at MCS&T does the testing in their paint lab.

3.3 The QA testing shall be performed every calendar year.

3.4 MCS&T shall obtain a sample of each approved product from the coating manufacturer.

3.5 The coating manufacturer shall supply a sufficient quantity of the product to perform all the required testing.

3.6 Each coating product shall be tested in accordance with the appropriate WVDOH Specification.

3.7 Each product shall be tested based on the testing requirements in the WVDOH Specifications.

3.8 The coating manufacturers will submit Safety Data Sheets (SDS) and Product Data Sheets (PDS) directly to MCS&T.

3.9 The coating manufacturers shall submit clearly marked samples, as well as, all required documentation for mixing and application directly to MCS&T.

4. QUALITY ASSURANCE HISTORICAL DATA

4.1 MCS&T shall maintain a spreadsheet for the purpose of collecting historical data for each coating product tested.

4.2 The historical data for each coating product will be analyzed yearly to determine if each product continues to meet the specification requirements necessary to remain on our APLs.

4.3 MCS&T will store the spreadsheet in a ProjectWise folder located under the Environmental & Coatings Group's folder.

5. NTPEP TEST DATA

5.1 MCS&T shall obtain NTPEP's test data for each product by using the DataMine function located on the NTPEP website. www.data.ntpep.org.

5.2 NEPCOAT uses test data from NTPEP to generate their Qualified Product List. The NEPCOAT Website

5.3 Any product that uses NTPEP's test data to obtain APL approval shall be compared to MCS&T's test data each year.

Commented [3]: This section is to setup our spreadsheet that we will use to keep historical test data on each product. The data will be analyzed each year and kept in our groups PW folders.

Commented [4]: The purpose of this section is to show where we obtained NTPEP's test data and to mention we will also be using NTPEP test data to compare to our test data.

We will also be testing products that were added to an APL based on NTPEPs test data.

NEPCOAT uses test data from NTPEP to make their QPLs.

6. MCS&T'S QUALITY ASSURANCE TESTING

6.1 MCS&T will use the spreadsheet data, as described in Section 4, to perform QA testing analysis.

6.2 The purpose of the QA testing is to determine if each of the coating products listed on our APLs are still satisfying our specification requirements.

6.3 Products that meet the specification requirements, based on MCS&T's test data, will remain on the APL.

6.4 Products that do not meet the specification requirements, based on MCS&T's test data, shall go through an internal investigation.

7. MCS&T INTERNAL INVESTIGATION

7.1 MCS&T shall perform an internal investigation on any coating product that does not meet the specification requirements necessary to remain listed on our APLs.

7.2 MCS&T shall run a second test on any sample that fails. If MCS&T's test data from the second test passes, then the product will remain listed on our APLs.

7.3 However, if MCS&T's test data from the second test does not pass, then NTPEP shall run a second test on the sample. If NTPEP's test data from the second test passes, then the product will remain on our APLs.

7.4 If the second test data from both MCS&T and NTPEP fails, then the product will be removed from our APLs.

7.5 The findings from the internal investigation shall be kept with the historical data spreadsheet, described in Section 4.

7.6 MCS&T shall notify the company about the removal of their product from our APLs. The company must wait one-year from the date of the removal before they will be allowed to resubmit their product to MCS&T.

7.7 The company must resubmit their product through MP 106.00.02 *Procedure for Evaluating Products for use in Highway Construction*. MP 106.00.02 requires HL-468 Form to be submitted to MCS&T. MP-100s (wv.gov).

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Materials Control, Soils and Testing Division

RLS:Mp

Commented [5]: This section is our internal investigation for what we will do if a product fails. The product will be retested a second time by MCS&T and if it passes then ok. If fails, then ask NTPEP to do a second test.

Products can be removed from our APL for failing test data.

Commented [6]: Not sure if we can require NTPEP to do a second test for us or do we have to pay them to do a second test.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR DETERMINING A REDUCED UNIT PRICE TO BE PAID FOR SELECT MATERIAL FOR BACKFILLING WHICH DOES NOT CONFORM TO GRADING REQUIREMENTS OF GOVERNING SPECIFICATIONS

1. PURPOSE

1.1 To define a range of nonconformance in the grading of aggregates used for Select Material for backfilling which would necessitate its removal from the project, and provide a procedure for reducing the price to be paid for said aggregate. When more than one sample is taken in succession, this procedure is applicable to MP 300.00.51: "Procedural Guidelines for Maintaining Control Charts". In some cases, however, because of the nature of the item, only one sample is taken. In this regard a control chart may not be ~~necessary~~necessary, and conformance will be based on the results of the single sample.

2. SCOPE

2.1 This procedure shall apply only to those aggregates specified for use as Select Material for Backfilling.

3. DEFINITION OF TERMS

3.1 Sublot - The quantity of material represented by a single test value.

3.2 LOT - The quantity of material represented by an average test value.

3.3 In those cases where only one sample is taken to represent the total quantity the sublot and LOT will be considered the same.

4. DESIGNATION OF QUANTITIES FOR EQUITABLE PRICE ADJUSTMENT

4.1 When an average gradation test value, or three individual test values, fall outside the limits of the Specifications, the LOT of material represented thereby is considered to be nonconforming to the extent that the last of its sublots is nonconforming. When a lot of material is nonconforming, then the last sublot contained therein shall have its price adjusted in accordance with Table 1. In no event, however, shall a sublot of material have its price adjusted more than once, and the first adjustment which is determined shall apply.

4.2 When only one sample is taken to represent the total quantity of material used, and any sieve value falls outside the limits of the specification, the material represented thereby is considered to be nonconforming. This material shall have its price adjusted in accordance with Table 1.

5. DEGREE OF NONCONFORMANCE

5.1 When a sublot of material is to have its price adjusted, the percentage point difference between the nonconforming test value and the specification limit shall be determined for each sieve determined to be nonconforming (nonconforming as described in 4.1 above), and this value shall be compared to Table 1. The total measure of the degree of nonconformance is, therefore, the sum of nonconformance on the two sieve sizes of the sublot.

Table 1

Degree of Nonconformance	Designated Action
1.0 to 3.0	Reduced Price 2%
3.1 to 5.0	" " 4%
5.1 to 8.0	" " 7%
8.1 to 12.0	" " 11%

6. DETERMINATION OF EQUITABLE ADJUSTMENT

6.1 When the total degree of nonconformance has been established and it is 12.0 or less, the designated action shall be initiated from Table 1. When the degree of nonconformance for a sublot is greater than 12.0, ~~said sublot will not be incorporated into the project, and in fact, removed from the project as soon as possible.~~ the nonconforming sublot shall be resolved on an individual basis, requiring a special investigation by the Engineer to determine the appropriate course of action to be followed. (DMIR)

7. METHOD OF ACCOUNTING AND CHANGE ORDER PREPARATION

7.1 Equitable reductions for nonconformance will be determined, for each lot or sublot. These adjustments may be processed with a single change order when the item is complete by tabulating the data for all nonconforming sublots, and preparing the change order for the total dollar adjustment shown on the tabulation. A copy of the tabulation should accompany and be made a part of the change order.

7.2 Dollar reduction shall be calculated by (A) quantity ×~~x~~ (B) % reduction from Table 1 ×~~x~~ (C) unit contract price. (A sample tabulation sheet is attached).

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Director
Materials Control, Soils and Testing Division

MP 212.02.20 Steward – Aggregate & Soils Section
RLS:M
ATTACHMENT

Equitable Reduction Procedure

TABULATION OF EQUITABLE REDUCTIONS (partial)

Sublot Identity (Note 1)	Quantity	Degree of Nonconformance	% Price Reduction	Unit Contract Price	Dollar Reduction From Contract (A)×(B)×(C)
	800 FT^3	7.5	7	3.50	196.00
	200 FT^3	2.6	2	3.50	14.00
	500 FT^3	5.0	4	3.50	70.00

Subtotal (1) (Note 2) $280.00

	1000 FT^3	1.2	2	3.50	70.00
	1000 FT^3	11.7	11	3.50	385.00

Subtotal (2) (Note 2) $455.00

Total Reduction (Note 3) $735.00

Note 1: Station numbers may also be used to identify sublots.

Note 2: These subtotals should be made at the end of contract pay periods, and the subtotal amounts deducted from contract payments on a current basis.

Note 3: This total reduction should be processed in one change order when the construction of the item is complete.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

DETERMINATION CRITERIA FOR MONITORING GROUND VIBRATIONS IN RESIDENTIAL AREAS

1. PURPOSE

1.1 To establish a procedure for event inspection, recording, and determination of possible damaging vibrations in structures caused by highway traffic.

1.2 This procedure shall apply to property or areas that have been requested to be instrumented to assist in the determination of possible vibration damage. The Division may elect to use other control procedures if special conditions dictate.

2. REFERENCED DOCUMENTS

2.1 *Other Standards:*

a. *Bureau of Mines Report of Investigations #8507 Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting* by D.E. Siskind, M.S. Stagg, J.W. Kopp, and C.H. Dowding.

b. Federal Highway Administration Report, Vibrations Induced by Construction Traffic, a historic case study by Henwood and Khamis Y. Haramy.

c. *1996 Report on Estimated Airblast and Blast-Related Vibration at the Lincoln Project*, Placer County, California. Green Valley, Arizona by W. L. Bender.

3. APPARATUS AND EQUIPMENT

3.1 One electronic recording seismograph capable of operation for at least three days of continuous monitoring. This device may be all self contained or have separate transducer sensors.

3.2 A power source such as a battery, or AC power outlet suitable to operate seismograph for approximately one week of continuous monitoring, if required.

3.3 A water resistant, vented protective covering to prevent moisture build-up if seismograph is used in an outside environment.

3.4 Two small sandbags weighing approximately 15 lbs each, to maintain stability in mounting seismographs when monitoring inside a structure.

3.5 A power transfer cable capable of transferring power from auxiliary battery to seismograph device.

3.6 A leveling plate to attach to the seismograph when used indoors to provide better coupling and leveling to structure.

3.7 If recording seismographs are used outside for monitoring, ground spikes may be used as per manufactures recommendations.

4. MONITORING PROCEDURES

4.1 Adjust seismograph to manufacturer's recommendations for monitoring ground vibrations, with emphasis on setting Geo trigger minimum level at 0.5 inches per second, and Geo trigger maximum range at 10.00 inches per second. Additionally, when monitoring device is active it must be placed as level as possible.

4.2 When locating seismographic device inside or outside a structure, the most preferable method for measuring vibration is to direct couple the geophone transducer device to a structure. This may not be possible due to physical or property owner considerations.

4.3 For monitoring inside a structure or residence, place seismograph recording sensors in a non-obtrusive location away from pets or other possible interference. Place preferably on a hard surface such as a hardwood floor, using small sandbags to stabilize the device if a direct coupling with structure is not possible.

4.4 If device is used for outside monitoring, use ground spikes attached to geophone sensors and firmly place in level soil, making a tight firm fit between the sensor and ground then place a 30lb sand bag on sensor to secure it, or bury geophone sensor completely, taking notice to place seismograph in area not to be disturbed by interference such as lawn mowing or children's play areas. Additionally, locate in a manner not to attract attention and to discourage theft.

4.5 Once a location has been chosen to place geophone transducer sensors, make sure the sensor transducer is oriented as per manufacturer's specifications to possible source of vibrations.

4.6 Once geophone transducers are properly seated and power supply is sufficient, activate recording device as per manufactures specifications and begin recording data for a minimum of 24 hours, unless otherwise directed.

5. REPORT

5.1 Vibration strength determination shall be defined by the maximum rate of velocity of particle movement, and referred to as Peak Particle Velocity (PPV) measured in inches per second (in/sec).

5.2 After all data is collected and evaluated, determination of the severity of vibration will be documented as listed in the table below:

Response	**Ground Vibration, PPV (in/sec)**
Barely to distinctly perceptible	0.02 - 0.10
Distinctly perceptible to strongly perceptible	0.10 - 0.50
Strongly perceptible to mildly unpleasant	0.50 - 1.00
Mildly unpleasant to distinctly unpleasant	1.00 - 2.00
Distinctly unpleasant to intolerable	2.00 - 10.00

_____
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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS & TESTING DIVISION

MATERIALS PROCEDURE

DETERMINATION OF CHEMICAL CONSTITUENTS IN HYDRAULIC CEMENTS

1. PURPOSE

1.1 To set forth procedures for determining the chemical constituents of hydraulic cement by wet chemical and instrumental methods.

1.2 To establish a procedure for maintaining a record of such information.

2. REFERENCED DOCUMENTS

2.1 a. *ASTM C114 - Standards Test Methods for Chemical Analysis of Hydraulic*

b. *ASTM C150 - Standard Specification for Portland Cement*

3. PROCEDURE FOR CONSTITUENTS

3.1 Procedure set forth for the following constituents:

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1. Silicone Dioxide (SiO_2)
2. Ammonium Hydroxide Group ($A1_2O_3$, Fe_2O_3, TiO_2, and P_2O_3)
3. Ferric Oxide (Fe_2O_3)
4. Calcium Oxide (CaO)
5. Magnesium Oxide (MgO)
6. Insoluble Residue (IR)
7. Sulfur Trioxide (SO_3)
8. Loss on Ignition
9. Alkali Oxides
10. Sodium Oxide (Na_2O)
11. Potassium Oxide (K_2O)

4. TEST PROCEDURES

4.1 The test procedures to be used are given in Table 1

TABLE 1

TEST	TEST PROCEDURES
Silicone Dioxide	ASTM C 114 Reference Method/XRF
Ammonium Hydroxide Group	ASTM C 114 Reference Method/XRF
Calcium Oxide	ASTM C 114 Reference Method/XRF
Insoluble Residue	ASTM C 114 Reference Method
Sulfur Trioxide	ASTM C 114 Reference Method/XRF
Loss on Ignition	ASTM C 114 Reference Method/TGA(Note 1)
Magnesium Oxide	Atomic Absorption/ICAP/XRF
Ferric Oxide	Atomic Absorption/ICAP/XRF
Sodium Oxide	Atomic Absorption/ICAP/XRF
Potassium Oxide	Atomic Absorption/ICAP/XRF
Aluminum Oxide	Atomic Absorption/ICAP/XRF
Tricalcium Aluminate	Calculated as per Note C of ASTM C 150, Table 1

Note 1 Porcelain crucibles may be used in place of platinum crucibles.

Note 2 Qualification data for atomic absorption methods available Cement and Concrete Reference Laboratory round-robin testing program historical data.

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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS & TESTING DIVISION

MATERIALS PROCEDURE

PAINT TESTING METHODS

1. PURPOSE

1.1 To set forth the standard test methods to be used in analyzing paint.

2. REFERENCED DOCUMENTS

a. American Society for Testing and Materials (ASMT) Section 6, *Paints, Related Coatings, and Aromatics.*

b. Federal Test Methods Standard Number 141D, *Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing.*

3. TESTING METHODS

3.1 Table I contains the following information:

3.1.1 Test, Reference and Test Method Number

4. GENERAL INFORMATION

4.1	Adhesion (Film thickness greater than 5 mils (125 µm)) (METHOD A)	3.1	D3359
	Adhesion (Film thickness 5 mils (125 µm) or less) (METHOD B)	3.2	D3359

4.2 Test Panel Preparation

4.2.1 Panels for testing shall meet the requirements of Federal Test Method 2011.

4.2.2 Panels that receive hot-dip galvanizing should be blast clean to near white finish (SSPC-SP10) and galvanized in accordance with the AASHTO M111. Average galvanized coating thickness should be 1.8 Mils.

4.2.3 Coating applied over galvanizing will be done in accordance with the manufacturer's product data sheets. If the dat sheet does not show how to apply the coating over galvanizing, then the manufacturer shall furnish this information in writing. Failure to provide this information could result in incorrect preparation of the galvanized surface, thus resulting in failure of the paint system.

4.2.4 All coatings shall be applied at the normal field application thickness. Primers will be applied over panels that have been cleaned to a near white (SSPC-SP10) condition. All coatings, which are part of a coating system, shall be applied over the previous coating in the system.

4.3 Curing Conditions

4.3.1 All coatings except zinc primers shall be cured seven days prior to testing. The curing will be done in the laboratory under normal laboratory conditions of temperature and humidity.

4.3.2 Zinc primers shall be cured, as in 4.3.1, except the cure period will be 10 days.

4.3.3 All coatings which require chemical resistance testings, will be cured an extra 24 hours at 221□F - 230□F (105□C - 110□C).

4.4 Chemical analyses of pigments shall be conducted by ASTM test methods. In cases where no ASTM test method is available, Federal test methods or a mutually agreed procedure shall be used.

4.5 Any test method not included in Table I shall be conducted according to ASTM, Federal Testor mutually agreed to procedures.

4.6 Initial approval of a paint requires that all specified tests be conducted. Subsequent batches, at the Division's option, may have randomly selected tests conducted.

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Attachment

TABLE I

	Test	Reference	Test Methods
1.	Density (Weight/Gallon)	3.1	D1475
2.	Consistency (Viscosity)	3.1	D562
3.	Drying Time	3.1	D1640
4.	Drying (Traffic Paint - No Pick Up)	3.1	D711
5.	Pigment - Vehicle	3.2	4021
6.	Total Solids	3.1	D2369
7.	Nonvolatile Vehicle	3.2	4051
8.	Coarse Particles	3.1	D185
9.	Fineness of Grind	3.1	D1210
10.	Flexibility	3.2	6221
11.	Condition of Container	3.2	3011
12.	Water	3.2	4081
13.	Color	3.1	D2244
14.	Working Properties	3.2	4541, 4321, 4331
15.	Compatibility	3.2	4203
16.	Storage Stability	3.1	D1849
17.	Specular Gloss (60□)	3.1	D523
18.	Skinning	3.2	3021
19.	Chemical Resistant (Spot Test)	3.1	D1308
20.	Infrared Scan	3.1	D2621
21.	Salt Spray	3.1	B117
22.	Accelerated Weathering	3.1	G53
23.	Leafing	3.1	D480
24.	Adhesion Section	5.1	MP 711.00.20
25.	Chemical Analysis of Pigments	3.1	MP 711.00.20
26.	Sampling	3.1	D3925