

Materials Procedures Committee Regular Meeting

Meeting Time/Date: 10:00am, March 22, 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 03 22](#)

Files Available on Webpage:

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

Materials Procedures approved at the last meeting (2/15/23)

1. 401.03.50 - Guide for Quality Control Plans for Asphalt

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.
2 - 700.00.53	Brayack/Mullins	Acceptance Procedure for Evaluating Independent Assurance Samples with Samples Used for Acceptance	Major update to the IA process. Hope to vote at the April meeting.
3 - 615.20.01*	Hanna/Mance	Preparing, Recording and Transmitting Information on Approved List of Welded Stud Shear Connectors	Change from an IM to an MP, removal of language about removal of a material from the APL, discuss from George Hanna/Mike Mance
4 - 715.07.20*	Perrow	Standard Method of Test for Determining the Quality of Water Used with Hydraulic Cement	Revised MP 715.07.20 incorporating the test methods that were supposed to be referenced in MP 642.40.20.

Materials Procedures - New Business

1 - 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
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2 - 658.05.06*	Brayack	Ancillary Structure Anchor Bolt Tightening	Editorial change, ready to vote.
3 - 712.05.57*	Brayack	Criteria To Approve Fence Producer/Suppliers and Their Materials	Editorial edits from previous version.

Note 1: * Denotes this MP is up for Vote

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

Comments

Comments due March 15th, 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: March 29th

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

Meeting Location: MCST/TBD

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:

May 17, June 21, July 19

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

MATERIALS PROCEDURE

ACCEPTANCE PROCEDURE FOR MASH COMPLIANT
ROADSIDE ~~DEPARTURES~~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

- 2.2.3 MP 106.00.02 – “Procedure for Evaluation of New Products for Use in Highway Construction”

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 The product shall be submitted to the Director of Materials Control, Soils & Testing and will be assigned to the Roadway Departure Task Force for evaluation.

- 4.2 The Traffic Certification Supervisor will distribute the product information [to](#) the Task Force representatives. Those representatives shall ~~be~~ [from the following Division](#):

- a. ~~Director of~~ Traffic Engineering Division
- b. ~~Director of~~ Contract Administration Division
- c. ~~Director of~~ Materials Control, Soils & Testing Division
- d. Traffic Mobility and Safety Engineer
- e. ~~Maintenance~~ Operations Division
- f. Engineering Division
- d-g. Technical Support Division

Commented [BDA1]: Should we include operations or maintenance?

Commented [MGW2]: Done.

Commented [BDA3]: Send this list up the chain of command

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

- 4.3 A ~~Meeting-meeting~~ to discuss the submission shall be scheduled, within ~~4560~~ 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 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.

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

Commented [BDA4]: Crane - wants some sort of deadline in here.

Commented [BDA5]: David Price also feels that way.

Commented [BDA6]: DB to look into deadline on RL 468.

Commented [BDA7]: I believe these are sorted in order of preference, for example, if they have that LOE, they're pretty good to go. Maybe say something like "in descending order of preference"? Etc?

Commented [MGW8]: done

Commented [BDA9]: Maybe flesh this out? Or maybe not, since we already explain the process in the MP.

Ronald L. Stanevich, P.E.

Director

Materials Control, Soils & Testing Division

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 of sampling.
- 4.6 Proficiency Sample - A single (homogeneous) sample that has distributed by an agency and then been tested by two or more multiple laboratories. These distributing agency then 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.
- 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.
- 4.74.10 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 WVDOT 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 [BDA1]: 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:

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

Commented [BDA2]: List ASTM/AASHTO T22 etc

- 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	1/year
Bulk Specific Gravity - Vacuum Seal	1/year
Bulk Specific Gravity - Gyratory	1/year
Max Specific Gravity	1/year
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	1/year
Max Specific Gravity	1/year
Bulk Specific Gravity	1/year

Air Voids	1/year
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 [BDA3]: 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 Gradation	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

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

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: _____ [Check _____]

IA Sample ID: _____ [Check _____]

Verification sample ID: _____ [Check _____]

Quality Control Sample ID: _____ [Check _____]

IA Test Result: _____ [Check _____]

Comparison Test Result: _____ [Check _____]

Check Spaces - Use Only if
Check Comparisons are Made

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	

MP 700.00.53 – ATTACHMENT 4
SIGNATURE DATE
PAGE 1 OF 1

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

PREPARING, RECORDING AND TRANSMITTING INFORMATION ON APPROVED
LIST OF WELDED STUD SHEAR CONNECTORS

1. PURPOSE

- 1.1 To establish a system whereby manufacturers may prequalify their welded stud shear connectors for use on Division of Highways projects.
- 1.2 To establish a procedure for maintaining a record of such information.
- 1.3 To establish a procedure for transmitting such information to the Districts and to the Contractor on Division of Highways projects.

2. SCOPE

- 2.1 Certified test reports.
- 2.2 Valid age of tests.
- 2.3 Record keeping.
- 2.4 Transmittal of information.

3. PROCEDURE

- 3.1 Certified test reports.
 - 3.1.1 The manufacturer shall furnish to the Central Laboratory in Charleston, certified copies of test reports of all pertinent required tests of the Division of Highways of West Virginia, Standard Specifications for Roads and Bridges, section 615.3.3, Welded Stud Shear Connection
- 3.2 Valid Age of Tests
 - 3.2.1 The tests submitted shall be valid until such time as the manufacturer makes any change in the base stud, the flux, or the arc shield, which may effect the welding characteristics.
 - 3.2.2 The manufacturer may submit certified reports of tests at any time.
 - 3.2.3 The manufacturer may request removal of his name from the approved list at any time.

Commented [1]: original said 615.33. change to 615.3.3

3.3 Record Keeping

3.3.1 As certified reports of tests are received, they shall be ~~reviewed~~reviewed, and the approved manufacturer's name listed and filed together with the test data. A separate file shall be kept of those failing to qualify for the approved list, together with the reason for failure.

3.3.2 ~~Should any manufacturer request the removal of his name from the approved list, it shall immediately be deleted acknowledgement to the manufacturer. Such information shall be promptly transmitted to each Department of Highways District Materials Engineer and/or Supervisor, who in turn shall notify any contractor using welded stud shear connectors from that manufacturer.~~

Commented [2]: We can remove this section

3.4 Transmittal of Information

3.4.1 As soon as a manufacturer has been placed on the approved list this information shall be promptly sent to all District Materials Engineers and/or Supervisors.

3.4.2 Additional copies of the approved list shall be sent to all District Materials Engineers and/or Supervisors on request.

3.4.3 Additions to or deletions from the list shall immediately be sent to all District Materials Engineers and/or Supervisors who turn shall notify any Contractors using such ~~materials~~materials.

3.4.4 This approved list of manufacturers of welded stud shear connectors shall be available to all Contractors on Department of Highways projects by navigating to: <https://transportation.wv.gov/highways/mcst/Pages/default.aspx> ~~application to the District Materials Engineer and/or Supervisor.~~

3.5

Signature Block

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

MATERIALS PROCEDURE

STANDARD METHOD OF TEST FOR DETERMINING THE QUALITY
OF WATER USED WITH HYDRAULIC CEMENT

1. PURPOSE

- 1.1 To establish a standard method of test and acceptance criteria to be used in determining the quality of water used with hydraulic cement.
-

2. PURPOSE

- 2.1 This procedure is applicable to untreated water sources used in combination with mixtures containing hydraulic cement. An untreated water source may be defined as a source other than a treated public water system.
- 2.2 Treated water systems may be used without testing.
-

3. APPLICABLE DOCUMENTS

- 3.1 ~~MP 642.40.20~~ [ASTM C1602](#)
- 3.2 AASHTO T 106
- 3.3 AASHTO T 162
- 3.4 ASTM C191
-

4. PROCEDURE

- 4.1 Untreated water shall be tested at the source for pH. When the pH of the water is between 4.5 and 8.5 no further testing is necessary.
- 4.2 If the pH is less than 4.5 or more than 8.5, all tests listed in this procedure will be conducted. A water source whose pH is determined to be within the limits defined in section 4.1 but appears to be contaminated with foreign material which could have an adverse effect on the Portland cement concrete shall have a sample forwarded to the Materials Division and all tests listed in this procedure will be conducted. The sample shall be accompanied with the required documentation indicating the sampler's reasons for requesting testing. These tests shall be conducted before first use and thereafter once every 6 months, or more often when there is reason to believe that a change has occurred in the characteristics of the water source.
-

5. TEST METHODS

- 5.1 Total Solids ~~Content~~ [by Mass](#), Chloride as Cl^- , Sulfate as SO_4 , and Alkalies as $(\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O})$.
- 5.1.1.1 Tests shall be conducted in accordance with ~~MP 642.40.20~~ [ASTM C1602](#).

5.2 Compressive Strength

5.2.1 The water under test shall be compared, in mortar, with distilled water. The proportions of dry materials in the mortar shall be 500 grams of Type III Cement, 1500 grams of graded OTTAWA sand and the amount of water sufficient to produce a flow of 110 ± 5 in 25 drops in accordance with AASHTO T 106 using the sample under test and compared to three specimens made using distilled water.

5.3 Time of Setting by Vicat Needle

5.3.1 Time of set will be prepared with the test sample and Type III Cement in accordance with ASTM C191. A control specimen will be made with distilled water for basis comparison.

6. ACCEPTANCE CRITERIA FOR UNTREATED WATER SOURCES

Performance Requirements for Untreated Water Source	Limit
Requirements for Mixing Water	Limit
Compressive Strength (Min% Control at 1 day)	90
Time of Set, (deviation from control)	-60 to +90 minutes

Chemical and Physical Limits for Untreated Water Source	
Maximum Concentration in Combined Mixing Water, ppm	Limit
A Chloride as Cl^- , ppm	
In prestressed concrete or bridge decks	500
Other reinforced concrete in moist environments or containing aluminum embedments or dissimilar metals or with stay-in-place galvanized metal forms	1,000
B Sulfate as SO_4 , ppm	3,000
C Alkalies as $(\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O})$, ppm	600
D Total solids by mass, ppm	50,000

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Director
Materials Control, Soils and Testing Division

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 $7.0 \pm 2.0\%$. 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	$7.0 \pm 1.5\%$
Spread (ASTM C1611)	Target ± 1.5 inches $2 \text{ seconds} \leq T_{50} \leq 7 \text{ seconds}$ Visual Stability Index ≤ 1.0
Passing Ability (ASTM C1621)	J-Ring Value ≤ 1 inch
Segregation Resistance (ASTM C1610)	Segregation $\leq 12\%$
Unit Weight and Yield	$\pm 2\%$ 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 ≤ T ≤ 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 cracks 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 ± 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~~

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~~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 adjustment shall be used in apply for the DMIR if accepted, plus not including any administrative fee.~~

~~f_c - 28 Day Compressive Strength (psi)~~

~~$\bar{X}$ - Average 28 - day Compressive Strength (psi)~~

~~IC - The invoiced cost of the precast item only.~~

Formula 1 (Constructed by Contractor)

$$\text{Price Reduction} = \left[\frac{f_c - \bar{X}}{.5 f_c} \right] \times 40\% \text{ Unit Bid Price}$$

Formula 2 (Constructed by Division)

$$\text{Price Reduction} = \left[\frac{f_c - \bar{X}}{.5 f_c} \right] \times IC$$

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.

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

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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: _____

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)
1 st			
2 nd			
3 rd			
4 th			
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

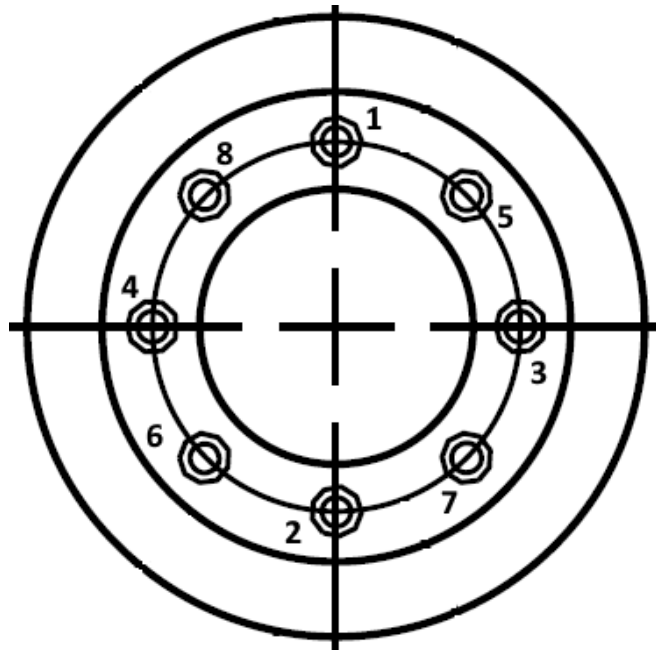
anchor bolt nuts, the project Engineer is to be provided with separate calibration certificates for the wrench and the gauge. The dates of the calibrations are to be one year or less prior to the date that the bolt tightening is performed. The certificates are to be from a calibration lab that is International 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 unnecessary 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.

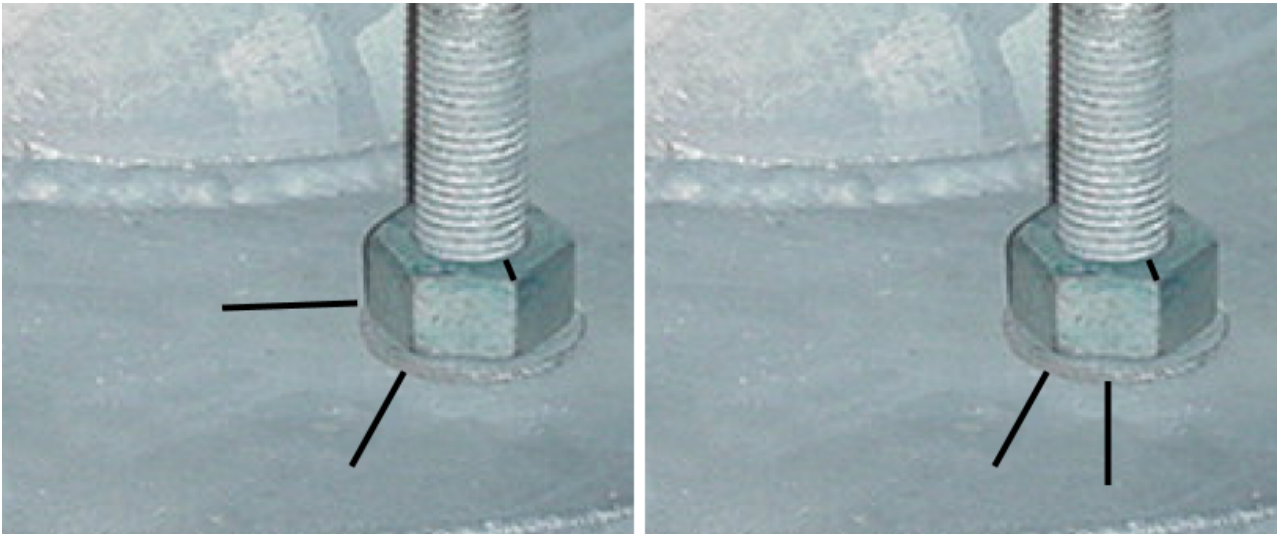


FIGURE 3 - SNUG TIGHT CONDITION REFERENCE MARKS FOR BOLTS 1-1/2" DIAMETER OR LESS (LEFT) AND BOLTS GREATER THAN 1-1/2" DIAMETER (RIGHT)

- 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 $\frac{1}{3}$ (2 flats) beyond the reference position for bolts 1-1/2-inches in diameter or less. Rotation is to be $\frac{1}{6}$ (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 $\frac{1}{2}$ flat. Each nut is to then be tightened an additional $\frac{1}{2}$ 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 (T_v) 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:

$$T_v = 0.12 (D_b) F_i$$

Where:

T_v = verification torque (inch-kips)

D_b = nominal body diameter of the anchor bolt (inches)

F_i = 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 T_v by 83.3 to calculate T_v 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 T_v torque ($1.10T_v$) 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 $1.10T_v$ 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 $1.10T_v$ 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 $1.10T_v$ torque did not result in further turning of each nut. If the application of the $1.10T_v$ 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

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
☐ 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

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 signed (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)

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

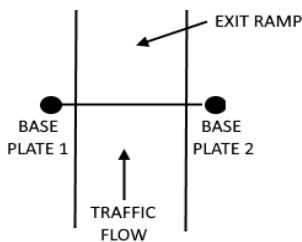
Structure Type: ☐ Cantilever ☐ (Sign) Butterfly ☐ (ITS) Butterfly ☒ Span ☐ Strain Pole
☐ Mast Arm ☐ High Mast Tower ☐ Conventional Light Pole

Anchor Diameter: 2 inches Tv: 900 foot-lbs = 2,787 PSI

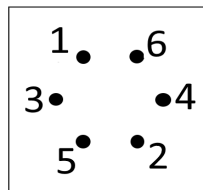
1.10Tv: 990 foot-lbs = 3,110 PSI

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		

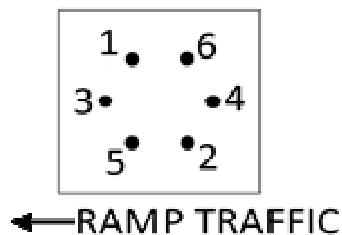
Mark Each Box to Indicate Application of Tv did not Result in Further Turning of Nut

	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		

Base Plate 2 Diagram



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 signed (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

certifies that the instrument below has been calibrated in accordance with 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

WRENCH MODEL AND SERIAL NUMBER

MODEL	2503MFRMH
SERIAL #	0916506063
TYPE	CRK
CAL DATE	9/2/2021
CAL DUE	5/2/2022
ACCURACY	(+/-) 4%
RANGE MAX	260
RANGE MIN	48

Customer

Address

Tech:	Temp (°F)	RH %
	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

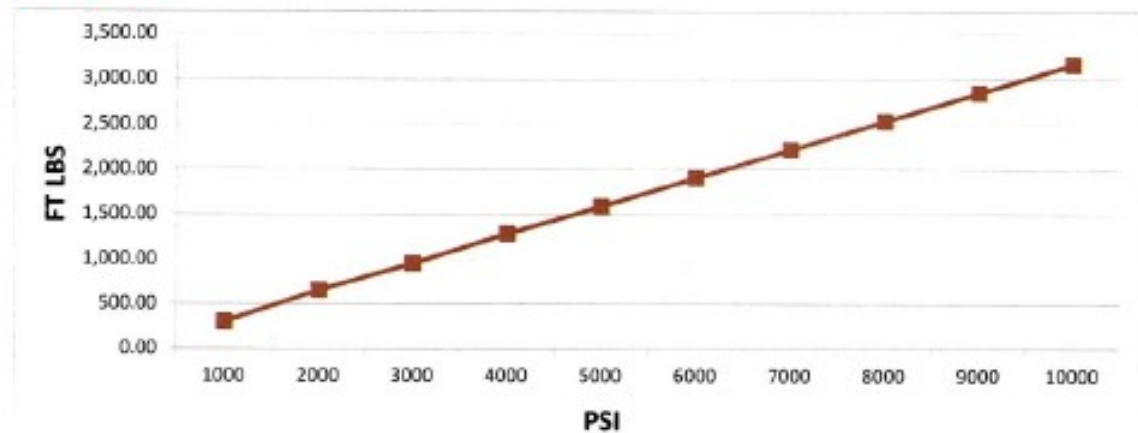
Calibration Date:	August 18, 2021
Calibration Due:	February 18, 2022
Temperature (F):	74.3
Relative Humidity(%):	57
Test Method:	TI-CAL-7, TI-CAL-8

Model Number:	3MD
Serial Number:	353228
Type:	hydraulic
Technician:	[REDACTED]
Signature:	[REDACTED]

Customer:	[REDACTED]
Address:	[REDACTED]

GAUGE MODEL AND SERIAL NUMBER

CALIBRATION DATE



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

Page 1 of 2

CALIBRATION CHART



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"

certifies that the above instrument has been calibrated in accordance with 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

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

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

MATERIALS PROCEDURE

CRITERIA TO APPROVE FENCE ~~PRODUCER~~/SUPPLIERS AND THEIR MATERIALS.

1. PURPOSE

- 1.1 To establish procedures for qualifying ~~Producer/suppliers~~ Suppliers of fence materials acceptable for use on West Virginia Division of Highways (WVDOH) projects.
- 1.2 To establish a procedure for maintaining a record of such information.
- 1.3 To establish a procedure for transmitting such information to the WVDOH Districts and contractors on WVDOH projects.

2. SCOPE

- 2.1 This procedure shall apply to all suppliers who supply fence materials such as chain link fence, farm field fence, fence posts, tie wire, bolts, nuts, gate latches, barb wire, and other related fence materials.
- 2.2 This procedure shall apply to all fence products used by WVDOH projects unless project plans state otherwise.

3. APPLICABLE DOCUMENTS

- 3.1 *WVDOH Specifications for ~~roads~~ Roads and ~~bridges~~ Bridges.*
- 3.2 *UL Underwriters laboratories specifications*

4. ACCEPTANCE PROCEDURE

- 4.1 With each shipment, of fence material to a WVDOH project, the fence Supplier shall provide shipping documents which contain an APL source number reflecting materials meeting quality specified by the WVDOH.

5. ACCEPTANCE PROCEDURE (APPROVED SOURCE)

- 5.1 For a ~~Producer~~/Supplier to be considered an approved source of fence items as stated in Section 2.1 the supplier must comply with the following requirements where applicable.
- 5.2 The ~~Producer~~/Supplier is to complete and submit form HL-468 attainable from the website:
https://transportation.wv.gov/highways/mcst/Pages/newproduct_evaluationprocedure.aspx and be submitted to the WVDOH Materials Control, Soils and Testing Division.

- 5.3 Once form HL-468 form is correctly submitted, an on-site investigation evaluation will be conducted by an Evaluator from the WVD OH at the supply distribution location, to determine if the proposed location should be listed as an approved source for fence items.
- 5.4 The initial evaluation and yearly renewal of the Producer/Supplier shall be conducted using guidelines set forth in Attachment 1 where applicable.
- 5.5 At the initial and subsequent annual investigation evaluations, all appropriate management, sales, and warehousing personnel will be made aware of specifications, shipping policies and requirements to sell and ship fence materials to WVD OH projects.
- 5.6 After the initial investigation evaluation has been completed, the Evaluator-WVD OH evaluator shall document the findings in an inspection report, indicate that the location was evaluated and whether it met the criteria to be included on an APL for fence items. If the report notes that the Supplier-Producer/Supplier didn't meet the required criteria, then the reasons why will be stated in the inspection report.
- 5.7 Providing the evaluation was found to meet specifications, the inspection report shall be signed by the Evaluator and shall be given a laboratory approval number. This laboratory approval number will be the APL number used by the WVD OH. An example of the inspection report can be seen in Attachment 2.
- 5.8 The signed inspection report is a certification from the Evaluator that the Producer/Supplier has met the criteria to be included on the APL for Fence Producer/Suppliers. This report will be filed under the Producer/Supplier's name in the WVD OH electronic filing system.
- 5.9 Once the above requirements are met, Producer/Supplier approval status can be verified by accessing the WVD OH online APL for fence items.
- 5.10 If a Producer/Supplier is removed from approved source status for not meeting specification requirements, then the Producer/Supplier will be removed from the APL listing for one year. After a year, the Producer/Supplier may be reevaluated to ensure corrective measures have been met.

6. ACCEPTANCE PROCEDURES (NON-APPROVED SOURCE)

- 6.1 Any fence materials not supplied by an approved source are to be accepted or rejected by the direct coverage process.
- 6.2 If direct coverage inspection is required, the inspection or evaluation will conclude with a 7-digit Laboratory reference number indicating approval or rejection.

Commented [BDA1]: who is the "evaluator" doing an "inspection report" ??

7. DOCUMENTATION REPORT

- 7.1 The approved source list for ~~Producer/suppliers~~ Suppliers of fence items used on WVDOH projects may be updated at any time with the addition of a new facility, or with the removal of a facility.

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

MP 712.05.57 Steward – Metals Section
RLS:H
ATTACHMENTS

Attachment 1

Below is a summary of topics that the prospective ~~Producer/supplier~~ Supplier of fence materials will be evaluated in accordance with.

- 1 To ascertain if the supply location is a business or a storage lot, meaning is the location a bare storage lot with material or a location with an office building with salespeople.
- 2 To determine if the location is an industrial ~~Producer/supplier~~ Supplier or a homeowner quality ~~Producer/supplier~~ Supplier. Meaning does the location supply for industrial applications or residential applications.
- 3 To determine if the location is a wholesaler/retailer or just a retailer, meaning does the location provide material to business or to retail customers.
- 4 To inform sales personnel that materials supplied such as barbed wire, chain link fence, farm field fence, steel posts, post braces, gate frames come from established APL lists, and where to find them online if necessary. All gates must have padlock hardware equipped prior to shipment.
- 5 To inform sales personnel of shipping procedures, meaning documents must have lab numbers, CID numbers, if direct coverage. If shipped from an approved source, then sales tracking numbers and APL numbers must be listed for WVDOT District personnel.
- 6 Informing sales personnel of what materials are covered under buy American requirements and what materials are not subject to buy American. This is done mostly during the outdoor evaluation at inventory during the initial evaluation.
- 7 An outside and inside inventory evaluation of materials describing what materials have their own APL and what do not. Informing what materials are not covered by locations with an APL number.
- 8 Discuss with sales personnel how to ship backorder material and partial material, also drop shipped materials, or how materials may be obtained by other sources, such as other approved sources or other non-approved sources.
- 9 Discuss with sales personnel about grounding kits, and that they are to be approved by location APL and not by other means.
- 10 Discuss with sales personnel that all items shall be coated by hot dip galvanizing or may be aluminumized by deposit coatings, all requiring 20 yr. minimum guarantee unless project plans indicate otherwise
- 11 All right of way fence shall meet requirements of WVDOT Specification Section 608.
- 12 Discuss with sales personnel that silt fence is not covered by location APL but is covered by other means.

- 13 Discuss with sales personnel that all right of way fence posts, braces and grate frames shall meet AASHTO M181 requirements and be on their own APL number covered by other means.
- 14 Discuss with sales personnel that all studded tee posts shall meet AASHTO M281/ASTM A702 requirements and be approved on their own APL number
- 15 Discuss with sales personnel that bolts and hardware must be hot dipped galvanized or be cadmium coated to ASTM B766 specifications. And be of industrial quality.
- 16 Discuss with sales personnel that chain link fence shall be approved only if material meets AASHTO M181
- 17 Discuss with sales personnel that all barbed wire shall meet AASHTO M280 for the correct classification of barbed wire, class 1 unless otherwise specified by contractor.

Attachment 2

Below is an example of the report from the evaluator to certify that the location is suitable to be included on an APL for fence materials.

REPORT NUMBER 1112458

LOCATION EVALUATION REPORT

SUBJECT: Location evaluation of:

Wombat Fence Products,
Producer/Suppliers of fence items,
located in Metropolis, Illinois

DATE OF REPORT: October 27, 2021

1. INTRODUCTION

- 1.1 The purpose of this evaluation is to affirm confidence in the ability of Wombat Fence Products, of Metropolis, Illinois to supply industrial fence materials in accordance with WVDOH and ASTM international standards used in West Virginia Department of Transportation, Division of Highways (WVDOT/DOH) construction projects.

2. INVESTIGATION

- 2.1 In January 2022, Mr. Brice Banner of the WVDOH Materials Control, Soils and Testing Division traveled to Wombat Fence Products, in Metropolis, Illinois, to meet with Mr. Cecil Kent, General Manager, and Billy Wayne industrial sales coordinator, to discuss specifications and supply demands required by the WVDOH. Additionally, an extensive evaluation tour of the entire manufacturing facility was conducted.

3. CONCLUSION

- 3.1 After the meeting and the supply location evaluation were completed, it was determined that fence materials provided by Wombat Fence Products, of Metropolis Illinois, did meet the requirements for fence materials used in highway construction on WVDOT projects where specified and the criteria noted in Attachment 1 of MP 712.05.57. It is recommended that Wombat Fence Products be added to the approved source list (APL) for fence materials.

Nicholas Fury
Evaluator