Materials Procedures Committee Regular Meeting

Meeting Time/Date: June 25th, 10:00 AM

Meeting Location: MCS&T (Conference Room) - 190 Dry Branch Drive, Charleston WV, 25301

Online Meeting: Google Meet Video Conference

Online Link - (https://meet.google.com/qaq-awvh-wcv?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\2025\2025 06 25 MP Meeting

Files Available on Webpage:

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

Materials Procedures – Approved at Last Meeting

1. 106.10.50 - WVDOH Buy America Acceptance Guidelines
2. 307.00.50 - Guide for Quality Control and Acceptance Plans for Subgrade, Base Course, and Aggregate Items
3. MA-1 - Operating and Emergency Procedures for Nuclear Gauges
4. ML-25 - Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate
5. 711.03.23 - Mix Design for Portland Cement Concrete
6. 601.00.49 - Method of Test for Determining the Condition of Concrete Bridge Decks
7. 700.00.54 - Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results

Materials Procedures - Old Business

Number	Champion	Title	Description
1* - 700.04.22	Allison	Method for Approving Devices Used for Testing Density and/or Moisture Content of In-Place Material	Process for creating approved list for Density/Moisture Devices
2& - 679.02.99	Kukaua	Calibration of Concrete Continuous Mobile Mixer	This is a guideline for QC to verify the contractor's calibration of volumetric mixers.
3& 106.03.50	Harper	General Information Guide for Technician and Inspector Certification Program (TICP)	Changing 3 to 5 years for certification, adds apprentice program.
4* 700.00.50	Wagner	Method for Acceptance of Compaction Testing	New Acceptance Process through AWP.

5* 700.00.54	Brayack	Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results	Minor Updates from Previously Approved Version
6* - 601.00.49	Thaxton	Method of Test for Determining the Condition of Concrete Bridge Decks	Andrew to Discuss Changes from Previously Approved Version

Materials Procedures – Editorial Edits

1* - 700.04.22	Operating And Emergency Procedures for Nuclear Gauges	Renamed from MA-1
2* - 307.0051	Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate	Renamed from ML-25

Materials Procedures - New Business with Significant or Process Updates

1& - 601.05.50	Thaxton	Quality Assurance Procedures for Portland Cement Concrete	Changed the referenced Section in 2.4.5 to 5.2.9 from 4.2.9.
2& - 604.02.40	Thaxton	Inspection And Acceptance Procedures for Precast Concrete Products	6x12 cylinders from the Specification
3& - 711.03.23	Thaxton	Mix Design for Portland Cement Concrete	Andrew to Discuss
4& - 715.14.01	Gum	Quality Assurance of Laminated Elastomeric Bridge Bearing Pads with Internal Shims	Editorial Edits from previously approved version
5& - 109.00.23	Brayack	Auto-Authorization of Industry Sample Records	Adds a “fast pass” metric for industry sample record payment.
6& - 109.00.22	Brayack	Procedure for the Submission and Documentation of Quality Control Test Results	Adds reference to 109.00.23

Note 1: * Denotes this MP is up for Vote

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

Comments

Comments are due June 18th, 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: July 30th

Meeting Time/Date: 10:00 AM, August 20, 2025

Meeting Location: MCS&T (Tentative)

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 2025:

August 20, October 15, December 17

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

METHOD FOR APPROVING DEVICES USED FOR ~~ACCEPTANCE~~ TESTING DENSITY AND/OR MOISTURE CONTENT OF IN-PLACE MATERIAL

1. PURPOSE

1.1. The WVDOH has a long history of using nuclear moisture/density gauges and is familiar with the test procedures, reliability, maintenance, and calibration procedures of such devices. In recent years, more devices have come to the market that are low or non-nuclear. This MP is in place ~~T~~to establish procedures ~~used~~ to approve the use of any testing device~~s~~ for Density and/or Moisture ~~of~~ for in-place material on WVDOH projects.

2. SCOPE

2.1. This MP applies to moisture and density testing devices used for acceptance testing, as well as any time such devices might be used when quality control testing results are used for acceptance.~~To establish procedures used to approve the use of testing devices for Density and/or Moisture of in-place material on WVDOH projects.~~

3. REFERENCED DOCUMENTS

3.1. West Virginia Department of Transportation Specifications

~~3.1.~~3.2. AASHTO T355 - Standard Method of Test for In-Place Density of Asphalt Mixtures by Nuclear Methods

~~3.2.~~3.3. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

~~3.3.~~3.4. ASTM D4959 – Standard Test Method for Determination of Water Content of Soil by Direct Heating

3.5. ASTM D8167/D8167M – Standard Test Method for Density of Asphalt Mixtures in Place by Nuclear Methods~~Add Name~~

3.6. ASTM D7830/D7830M Standard Test Method for In-Place Density (Unit Weight) and Water Content of Soil Using an Electromagnetic Soil Density Gauge

3.7. AASHTO T 343-12 (2024) Density of In-Place Asphalt Pavement by Electronic Surface Contact Devices

Commented [1]: JC - Asphalt - PWL - Contractor can do anything they want. Contractors use it for non-nuclear for check. Will this approve list roll that out?

Commented [2]: This is only for gauges used for acceptance

Commented [3]: Do we need the 401 section here

Commented [4]: Added the specs

Commented [5]: Is this the same as T-355

~~3.4.~~3.8. ASTM D7113/D7113M Standard Test Method for Density of Asphalt Mixtures in Place by the Electromagnetic Surface Contact Methods

~~3.5.~~3.9. MP 207.07.20 – Nuclear Field Density – Moisture Test for Random Material Having less than 40% of +3/4 Inch Material

3.10. MP 700.00.24 – Nuclear Density Test by Roller Pass Methods

~~3.6.~~3.11. MP 717.04.21 – Guide for Quality Control of Compaction ~~Add MPs from BW email~~

4. APPROVAL REQUIREMENTS OF DEVICES FOR TESTING OF DENSITY AND/OR MOISTURE OF IN-PLACE MATERIAL~~TESTING PROCEDURE~~

4.1. The testing device must meet ~~WV DOH Standard~~ Specification ~~717~~716.3.2, as well as conform to the needs of the above referenced MPs and ASTM procedures as applicable.

4.2. ~~—~~The testing device must provide accurate and precise results according to the Gauge Comparison process described in section 401.6.4.1.1 of the Specifications.

4.3. The testing device must be suitable for each application. The testing device must be capable of providing wet density, dry density, and moisture of asphalt, soil, and aggregates.

4.4. ~~—~~The testing device must be entirely self-contained and must be capable of providing results for Dry Density, Wet Density and Moisture content through the operations of ~~a~~in one single test, without the need for ~~other~~supporting devices.

4.5. The testing device must be capable of completing a test and delivering ~~rapid~~ results within a ~~, suitable for the application. M~~maximum of one minute per test.

4.6. The testing device must, ~~not allow the introduction of bias into test results, i.e., the device~~under normal operations, collect a single reading and produce~~s~~ a single result~~s~~ for each operation~~s~~ of the device. This result must not be an average, minimum or maximum of values collected by the device through subsequent readings. ~~must test once and provide a reliable result, rather than test multiple times to find the best result.~~

~~The testing device must not interfere with, nor be susceptible to interference from, any other typical testing device that is expected to be on a project.~~

5. APPROVAL PROCESS

5.1. For consideration to be added to the list of approved devices, submit the ~~gauge~~device information and manufacturer's documentation to dohcompaction@wv.gov.

5.2. The WVDOH will evaluate each brand/model of moisture/density testing device as needed. Evaluations shall be based~~base~~ on ~~according to~~ the requirements listed in Section 4 and ~~compared to~~ the manufacturer's documentation. WVDOH ~~and~~ reserves th

Commented [6]: Are these MP names going to change?

Commented [7]: I would assume so based on trends, but as of now those are the current names of those MPs

Commented [8]: Doesn't exist, needs to be updated/deleted, BW to take a look at this

Commented [9]: Define Accurate, precise and comparable or reference AASHTO that does…
If you are not willing to specify hard requirements for what is allowed then just delete this whole section. This it is too vague and subjective to set a reliable and unbiased

Commented [10]: Added sentence to address this

Commented [11]: Stating precise and repeatable is redundant

Commented [12]: Combine with 4.4

Commented [13]: "The testing device must of suitable for testing the properties in 4.4 for the

Commented [14]: What would you define as another device? Even the non nukes can

Commented [15]: This is not regarding correlation. This is to address test devices

Commented [16]: I suggest writing it out, don't imply what you want.

Commented [17]: Any piece of equipment will fail this requirement… all testing has some

Commented [18]: Yes there is inherent error. That is not what this is about. Our current

Commented [19]: What device are you referring too?

Commented [20]: Nuclear gauges are susceptible to being around steel…

Commented [21]: True, and that is why we teach not to test around steel. We have

Commented [22]: specify "testing" devices.

Commented [23]: What is the Evaluation Process?

Commented [24]: added "compared to the manufacturer's documentation". Will submit to

e right to reject or remove any ~~brand or model~~device from the approval list. ~~without further explanation~~.

4.1. Devices that meet all of the requirements of this MP will be evaluated first as a QC device. Upon satisfactory field performance as a QC device, it will be listed as a QA device. The brand and model can be found on the appropriate approved list on the MCS&T website.

Commented [25]: This seems excessive… if a bunch of consultant firms buy into a piece of equipment that you have on this approval list and you abruptly remove it what are the firms supposed to do? There should be fair warning and a justification for its removal.

~~5. CURRENT APPROVED LIST OF DEVICES FOR TESTING OF DENSITY AND/OR MOISTURE OF IN-PLACE MATERIAL~~

~~Humbolt HS-5001 series~~

~~Troxler 3430/3440 series~~

~~Instrotek 3500 series~~

~~Instrotek Xplorer 2~~

~~Instrotek/CPN MC-1~~

~~5.1. Instrotek/CPN MC-3Process TBD~~

Commented [26]: These should be an online list, attachment or addendum so the entire MP doesn't have to go through committee for a change.

~~6. APPROVAL OF DEVICES FOR TESTING OF DENSITY AND/OR MOISTURE OF IN-PLACE MATERIAL~~

~~6.1.~~5.3. ~~Process TBD~~

Commented [27]: Agree. This is moving to an approved list.

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

MATERIALS PROCEDURE

QUALITY ASSURANCE PROCEDURES FOR CALIBRATION AND APPROVAL OF CONCRETE VOLUMETRIC MIXERS

1. PURPOSE

1.1. To set forth the Divisions Quality Assurance procedure which governs the calibration, and approval of concrete volumetric mixer units.

2. SCOPE

2.1. This procedure establishes guidelines for verifying the contractor's calibration of volumetric mixers; and provides an Attachment for QA documentation of the calibration.

3. CALIBRATION FREQUENCY

3.1. The Contractor shall perform the calibration of volumetric mixers prior to the start of placement in the presence of the Divisions project designated personnel.

3.2. The Division's project designated personnel shall verify the contractor has completed all mixer calibrations , per mobilization of each unit. Additional calibrations may be required at the discretion of the Divisions project designated personnel. Alterations to the approved mix design will require the unit to be recalibrated.

3.3. The Contractor shall provide documentation for any unit repair. After the unit has been repaired, it shall be recalibrated prior to use on a project.

4. PRE-CALIBRATION INSPECTION

4.1. District personnel, or the designated inspector shall verify that the contractor confirmed all components of the unit are functioning properly , and all material component bins are empty and clean, the main conveyor belt and supply systems are clean, and all vibrators are functioning properly prior to the start of the calibration.

4.2. MIX DESIGN

The Division's designated personnel shall review the approved mix design prior to the start of the calibration and record them on Attachment 1.

4.3. QUALITY CONTROL PLAN

The Division's designated personnel will review the contractor's Quality Control Plan prior to the start of calibration. Any deviations from this procedure will be documented

in the Contractors Quality Control Plan. Possible deviations include the addition of fibers, which shall be calibrated according to the manufacturer's recommendations.

5. FIELD CALIBRATION PROCEDURE

5.1. For cement, sand and stone, verify that the contractor begins each by filling the specific material bin until the augers are completely covered, set mobile mixer to run at proper operating speed, = and that the Contractor is using a clean container that can be placed under the chute of the mixer to catch all discharged material.

5.2. CEMENT CALIBRATION

The Division's designated personnel shall verify that the Contractor has checked the discharge tube at bottom of the cement bin and that it is clean and clear of residue. After reaching predetermined count, the Division's designated personnel shall record the weight of cement, the elapsed time, and the meter count provided by the Contractor on Attachment 1. The contractor shall perform a minimum of 3 trials and provide the calculations to the Division's designated personnel, who will record the data on Attachment 1.

5.3. SAND AND STONE CALIBRATION

After reaching predetermined count, the Division's designated personnel shall record the weight of aggregate, the elapsed time, and the meter count provided by the Contractor on Attachment 1. Using approximately the same number of counts. The Contractor shall perform a minimum of 3 trials at both high and low settings and record.

5.4. WATER AND LATEX CALIBRATION

Division's designated personnel will verify that the Contractor adjusts the setting to achieve the target weight of water, or latex. The Contractor shall discharge the water, or latex into a suitable container capable of catching all material. The Division's designated personnel will record the weight of material discharged provided by the Contractor on Attachment 1. The contractor shall perform a minimum of 3 trials on both the water and latex.

5.5. ADMIXTURE CALIBRATION

Division's designated personnel will verify that each admixture is calibrated and used in accordance with manufacturer's recommendations and adheres to the proportions specified in the approved mix design. The Division's designated personnel shall record the application rate provided by the Contractor on Attachment 1.

5.6. YIELD TEST

The Contractor shall perform one yield test of ¼ cubic yard for every calibration performed. . All materials and settings used during the yield test will be from those established during the calibration process.

The Division's designated personnel will record the results provided by the Contractor for the yield test in Attachment 1. The weight batched divided by the unit weight tested should be within ±2% of the theoretical quantity batched. If the unit weight is not within ±2% of the theoretical quantity batched, additional calibrations will be performed until the required yield result is achieved.

If after 3 trials a passing yield test is not achieved, at the discretion of the Engineer a unit may not be certified to perform the concrete placement until the Contractor has proven he has taken corrective action to improve the units performance

Michael A Mance, PE
Director
Materials Control, Soils, & Testing Division

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

CONCRETE VOLUMETRIC MIXER FIELD CALIBRATION SHEET

Project Number: _____ County: _____
District: _____ Contractor: _____
Truck Number: _____ Description: _____
Calibrated By: _____ Date of Calibration: _____

MIX DESIGN: Approved Mix ID: _____

Material	Cement	Sand	Stone	Water	Latex		
Amount							

Theoretical Yield: _____(cubic yard)

CEMENT:

	Weight (Lbs.)	Meter Count	Time (sec.)
1			
2			
3			
4			
5			
Totals			

$\text{Lbs./Count} = \frac{\text{Total Lbs.}}{\text{Total Counts}} = \frac{\quad}{\quad} = \_\_\_\_\_$

$\text{Lbs./Sec.} = \frac{\text{Total Lbs.}}{\text{Total Sec.}} = \frac{\quad}{\quad} = \_\_\_\_\_$

$\text{Counts for 94 Lbs.} = \frac{94}{\text{Lbs./Count}} = \frac{94}{\quad} = \_\_\_\_\_$

$\text{Sec. for 94 Lbs.} = \frac{94}{\text{Lbs./Seconds}} = \frac{94}{\quad} = \_\_\_\_\_$

SAND: Time for Calibration: _____ Moisture Content: _____

Setting					
Lbs. of Sand					

STONE: Time for Calibration: _____ Moisture Content: _____

Setting						
Lbs. of Sand						

WATER: Time for Calibration: _____

Setting					
Amount					

LATEX: Time for Calibration: _____

Setting						
Amount						

ADMIXTURE: Time for Calibration: _____

Setting					
Amount					

CALCULATED YIELD: _____(cubic yard)

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

GENERAL INFORMATION GUIDE FOR TECHNICIAN AND INSPECTOR CERTIFICATION PROGRAM (TICP)

1. PURPOSE

1.1. The purpose of the West Virginia Division of Highways (WVDOH) Technician and Inspector Certification Program is to improve the quality assurance of various materials by the certification of industry and WVDOH. This procedure is to establish guidelines for this purpose.

2. GENERAL

2.1. It is the WVDOH's intent to conduct a cooperative program of training, study, and examination so that personnel of the producer, contractor, and the WVDOH will be able to better assure, by their increased technical knowledge, the level of quality required by the governing Specifications.

3. REFERENCED DOCUMENTS

3.1. MP 720.10.01 - Guide for Using a High-Speed Inertial Profiler to Measure the Longitudinal Profile of Pavement.

~~3.1.~~3.2. MP 106.03.51 - Policy for Materials Certification Reciprocity with PCC Inspector, PCC Technician, and Aggregate Technician

4. SCOPE

4.1. This procedure is applicable to all requirements, guidelines, and other support documents of the WVDOH that reference conditions, methods, and levels of qualification specific to the WVDOH Training and Certification Program.

5. POLICIES AND ADMINISTRATION

5.1. Certification Board - The Certification Program will be carried out in accordance with general policy guidelines established or approved by the ~~Chief Engineer~~State Highway Engineer. They will be advised by a Board composed of the following members:

1. ~~Chief Engineer~~State Highway Engineer
2. Deputy General Counsel
3. Director of MCS&T - hereafter referred to as “Director”
4. Quality Assurance Training Program Administrator (QATPA)
5. Applicable MCS&T Supervisor(s)

5.1.1. The Certification Board will meet when called by the Director.

5.1.2. Administration - The program will be administered by the Director.

5.1.3. The Program Administrator shall be appointed by the Director. The Program Administrator will be assigned to assist the Director in administering the program and to handle planning, administration, and coordinating functions as may be delegated within the scope of appropriate WVDOH directives.

6. REQUIREMENTS

6.1. Where applicable, quality control representatives of the contractor and/or producer will be certified in the applicable certifications listed below, depending on the individual's duties or responsibilities. Responsibilities and qualification requirements are listed in appropriate support documents such as Specifications, Materials Procedures and/or Quality Control Plans.

6.2. For purposes of the WVDOH Quality Assurance Program, a non-WVDOH employee who is a certified Technician/Inspector represents the company of which they are a full-time employee on the project, owner, or partner (as defined by the Federal Wage and Hour Legislation). If said company has subsidiary or affiliated organizations, each organization will be required to have its own certified Technicians/Inspectors where applicable unless the ~~Chief~~ State Highway Engineer makes an exception. Exceptions will be granted only when it can be proven that the certified Technician/Inspector performs the duties of the Technician/Inspector for all the subsidiary or affiliated organizations.

7. CERTIFICATION CLASSES

7.1. The TICP offers certification classes in the following disciplines:

1. Aggregate Technician
2. Aggregate Sampling Inspector
3. Soils & Aggregate Compaction Technician
4. Asphalt Field & Compaction Technician
5. Portland Cement Concrete Technician
6. Portland Cement Concrete Inspector
7. Asphalt Plant Technician
8. Asphalt Preservation Technician
9. Radiation Safety
10. Inertial Profiler Operator

7.2. Except as noted, all certifications are valid for a ~~three~~five-year period

7.3. All certifications require written examinations. ~~—~~Some also require a practical examination after successful completion of the written examination.

7.4. It is the responsibility of the applicant to determine which certification is applicable to their assignment. Following is a description of the certifications listing relevant information about each.

8. AGGREGATE TECHNICIAN

8.1. Details of this class are available on the MCS&T Webpage[1]

8.2. The written examination for an Aggregate Inspector consists of the following areas:

1. Aggregate Specifications and Procedures
2. Aggregate Fundamentals
3. Sampling, Control, and Inspection of Aggregates
4. Aggregate Testing

8.3. After successful completion of the written examination, the applicant will be required to complete an apprentice cycle and pass ~~a~~ the practical examination. The technician must demonstrate the testing common to normal aggregate quality requirements.

Commented [DB1]: Use this same language in all sections

8.4. Certification as an Aggregate Inspector qualifies the technician to perform sampling and/or testing of aggregates for both Quality Control and Quality Assurance.

8.5. ~~APPRINTICESHIP~~APPRENTICESHIP REQUIREMENTS

8.5.1. ~~8.5.1~~ After successfully completing the written exam~~: B~~, and before scheduling ~~for~~ the Practical Exam each Pparticipant shall complete 40 hours of hands-on training under the supervision of a WV-DOH ~~e~~Certified Aggregate ~~t~~Technician in the eight different aggregate tests on which the participant will be tested~~d on~~. The tests to be trained in are:

Commented [DB2]: Be consistent with punctuation

-1) AASHTO T 11 Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing ~~AASHTO T 27 (OFFICIAL NAME)~~ ;

Commented [DB3]: Make all of these consistent, listing their official name.

2) AASHTO T 19 Bulk Density ("Unit Weight") and Voids in Aggregate

3) AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates

4) AASHTO T 84 Specific Gravity and Absorption of Fine Aggregate

5) AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate

6) AASHTO T 89 Determining the Liquid Limit of Soils

7) AASHTO T 90 Determining the Plastic Limit and Plasticity Index of Soils

8) MP 703.00.21 Standard Method of Test for Percent Crushed Particles

Once the Participant has completed the 40 hours of training, The WV-DOH ~~e~~Certified Aggregate Technician who performed the training will complete the Apprenticeship Log Sheet and include their written name, signature ~~and written name~~and certification number with the date of completion. The Log Sheet shall then be submitted to the QATPA~~QAPA~~ electronically.

8.5.2. ~~8.5.2~~ Once the Training Log has been received and verified by the ~~WV DOH MCS&T personnel~~QATPA, the participant will be contacted by the MCS&T

[1] https://transportation.wv.gov/highways/mcst/Pages/Agg-Technician.aspx

Aggregate Section ~~located at MCS&T~~ to schedule the practical exam. Each participant will be given one chance to ~~show they can proficiently run each of the eight tests in an 8-hour workday~~pass the practical. (All Practical Examinations must be completed within 90 days from the date of the original written test date.) If the participant fails, they will be denied the Certification.~~If the participant does not show proficiency during each of the eight tests the participant will be denied the Aggregate Technician Certification.~~

Commented [DB4]: Schedule?

8.5.3. ~~8.5.3 For the~~The WV~~-~~DOH Aggregate Technician who performs the training shall ensure the ~~who will be training the participant. Each~~ participant ~~should receive a copy of the AASHTO procedures and be~~is trained in each of the ~~eight~~ tests according to the AASHTO procedures.

9. AGGREGATE SAMPLING INSPECTOR

9.1. Details of this class are available on the MCS&T Webpage[2]

9.2. The web-based examination for an Aggregate Sampling Inspector consists of the following areas:

~~1.~~1) Specifications

~~2.~~2) Sampling Fundamentals

~~3.~~3) Sampling Methods and Equipment

~~4.~~4) AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates ~~Gradations~~

~~5.~~ AASHTO T 11 Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing ~~T11 Wash Test~~

~~9.3.~~5) The Aggregate Sampling Inspector requires the successful completion of an online examination.

9.3. Certification as an Aggregate Sampling Inspector qualifies the technician to perform sampling of aggregates for both Quality Control and Quality Assurance.

9.4. No practical examination nor apprenticeship is required for this certification.

Commented [DB5]: List the official AASHTO designation.

Commented [DB6]: Do this in each section that does not require a practical/apprenticeship

10. SOILS AND AGGREGATE COMPACTION TECHNICIAN

10.1. Details of this class are available on the MCS&T Webpage[3]

10.2. The written examination for this class consists of the following areas:

1. Specifications
2. Soil & Aggregate Compaction Test Procedures
3. Radiation Safety and Nuclear Gauge
4. Test Procedure Problems

10.3. After successful completion of the written examination, the applicant will be required to complete an apprentice cycle and pass the practical examination. The technician must demonstrate the testing common to the certification's requirements.

Commented [DB7]: Use this same language in all sections

~~10.3. After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating their proficiency in using the testing equipment.~~

10.4. Certification of the Soils and Aggregate Compaction Technician qualifies the technician to conduct tests on all Soil and Aggregate construction materials that require compaction testing.

10.5. ~~APPRINTICESHIP~~APPRENTICESHIP REQUIRMENTS

10.5.1. -After successfully completing the written exam~~:~~, and ~~–B~~before scheduling for the Practical Exam, each Participant shall complete 40 hours of hands-on training for the

[2] https://transportation.wv.gov/highways/mcst/Pages/aggsamplinspec.aspx

[3] https://transportation.wv.gov/highways/mcst/Pages/compactioninspector.aspx

following tests under the supervision of a WVDOH certified Soil and Aggregate Compaction technician.

1) MP 700.00.24 Nuclear Density Test by Roller Pass Method

2) MP 712.21.26 Procedure for Determining Random Location of Compaction Lots

3) MP 207.07.20 Nuclear Field Density/Moisture Test for Random Material Having Less than 40% + 3/4 inch Material

~~LIST OF TESTS~~

~~under the supervision of a WV DOH certified technician for soil and stone compaction.~~ Tests shall ~~can~~ be on any project ~~either a doh project or private work. If the testing is conducted on a private project,~~ where ~~DOT~~WVDOH ~~materials, procedures~~Materials Procedures and ~~s~~Specifications ~~amust bere followed~~required. Once the Participant has completed the 40 hours of training, ~~T~~the ~~WV DOH~~WVDOH certified Technician who performed the training will complete the Apprenticeship Log Sheet (Attachment 2) and include their written name, signature and ~~written name~~certification number with the date of completion. The Log Sheet shall then be submitted to the QATPA electronically.

10.5.2. Once the Training Log has been received and verified by the QATPA, the participant will be contacted by the MCS&T Soil and Aggregate Compaction Section to schedule the practical exam. Each participant will be given one chance to pass the practical. (All Practical Examinations must be completed within 90 days from the date of the original written test date.) If the participant fails, they will be denied the Certification.

Commented [DB8]: Schedule?

10.5.3. The WVDOH Soil and Aggregate Compaction Technician who performs the training shall ensure the participant is trained in each of the tests according to the AASHTO procedures.

~~10.5.1 ONCE THE TRAINING LOG HAS BEEN RECEIVED AND VERIFIED BY THE WV DOH MCS&T PERSONNEL THE PARTICIPANT WILL BE CONTACTED BY THE SOIL COMPACTION SECTION LOCATED AT MCS&T TO SCHEDULE THE PRACTICAL. EACH PARTICIPANT WILL BE GIVEN ONE CHANCE TO SHOW THEY CAN PROFICIENTLY RUN EACH OF TEST SPECIFIED IN THE APPRENTICESHIP CYCLE (ATTACHMENT 1). (ALL PRACTICAL EXAMINATIONS MUST BE COMPLETED WITHIN 90 DAYS FROM THE DATE OF THE ORIGINAL WRITTEN TEST DATE.) IF THE PARTICIPANT DOES NOT SHOW PROFICIENCY DURING EACH OF THE TESTS THE PARTICIPANT WILL BE DENIED THE SOIL AND AGGREGATE COMPACTION TECHNICIAN CERTIFICATION. THE DOCUMENTED EXPERIENCE HOURS SHALL BE COMPLETED BEFORE THEY CAN PROCEED WITH THEIR PRACTICAL, HOWEVER,~~

~~EXCEPTIONS ARE AT THE DISCRETION OF THE COMPACTION COORDINATOR.~~

11. ASPHALT FIELD AND COMPACTION TECHNICIAN

11.1. Details of this class are available on the MCS&T Webpage[4]

11.2. The written examination for this class consists of the following areas:

1. Specifications
2. Surface Preparation
3. Mix Delivery and Placement
4. Joint Construction
5. PWL
6. Troubleshooting
7. Compaction Test Procedures
8. Radiation Safety and Nuclear Gauge
9. Test Procedure Problems
10. Testing Forms

11.3. Successful completion of the written examination, ~~and a~~ practical examination, and apprenticeship cycle is~~test is~~ required.

11.4. Certification as an Asphalt Field and Compaction Technician qualifies the technician to oversee or inspect asphalt pavement construction. In addition, the class hand-out material is a valuable reference tool for each stage of the construction process. The required radiation safety training is included in this class and will certify attendees with a passing score to perform nuclear density testing on asphalt pavements.

11.5. APPRENTICESHIP REQUIRMENTS

11.5.1. After successfully completing the written exam, each Participant shall complete 40 hours of hands-on training for the following tests under the supervision of a WVDOH certified Asphalt Field and Compaction Technician.

1) AASHTO T 355 Standard Method of Test for In-Place Density of Asphalt Mixtures by Nuclear Methods

2) Specification 401 Gauge Comparison

~~LIST OF TESTS (Guage comparison, gauge standardizing, and gauge use)~~

~~11.5.~~11.6. ~~Asphalt Field and Compaction Technicians must also be evaluated by qualified District personnel on the first WVDOH paving project in which they perform this testing.~~

~~11.5.1.~~11.6.1. ~~The District personnel will make the decision as to whether or not the technician is correctly conducting the nuclear density tests in accordance with the Specifications.~~

[4] https://transportation.wv.gov/highways/mcst/Pages/AsphaltFieldTech.aspx

~~11.5.2.~~11.6.2. ~~The District will also complete an evaluation form and send it to the MCS&T for processing.~~

~~11.6.3.~~ ~~A technician that does not demonstrate proper nuclear density testing techniques shall not be allowed to continue testing on the WVDOH project. They must be replaced by another qualified technician. Anyone who does not meet the evaluation standards must provide proof of additional WVDOH approved radiation safety training before another evaluation will be conducted.~~

~~——~~Tests shall be on any project where WVDOH Materials Procedures and Specifications are required. Once the Participant has completed the 40 hours of training, the WVDOH certified Asphalt and Field Compaction Technician who performed the training will complete the Apprenticeship Log Sheet (Attachment 2) and include their written name, signature and certification number with the date of completion. The Log Sheet shall then be submitted to the QATPA electronically. This shall be submitted within one calendar year of passing the written exam.

11.6.4. The participant will be contacted by the MCS&T Pavement Analysis and Evaluation Section to schedule the practical exam. Each participant will be given one chance to pass the practical. (All Practical Examinations must be completed within 90 days from the date of the original written test date.) If the participant fails, they will be denied the Certification.

Commented [DB9]: Schedule?

~~11.7.~~ ~~District Verification.~~

~~11.7.1. The follow criteria is an additional requirement for the Asphalt and Field Compaction Certification.~~

~~11.7.1.1. The WVDOH Asphalt and Field Compaction Technician who performs the training shall ensure the participant is trained in each of the tests according to the AASHTO procedures.~~

~~11.1.11.7.1.2. Asphalt Field and Compaction Technicians must also be evaluated by qualified District personnel on the first WVDOH paving project in which they perform this testing.~~

~~11.1.1.11.7.1.3. The District personnel will make the decision as to whether or not the technician is correctly conducting the nuclear density tests in accordance with the Specifications.~~

~~11.1.2.11.7.1.4. The District will also complete an evaluation form and send it to the MCS&T for processing.~~

Commented [DB10]: Vince, remove this now that we're doing a apprenticeship

~~11.1.3.~~11.8. 11.6 A technician that does not demonstrate proper ~~nuclear density testing techniques~~ radiation safety training shall not be allowed to continue testing on the WVDOH ~~p~~Project. They must be replaced by another qualified technician. Anyone who does not meet the applicable ~~evaluation~~safety standards must provide proof of additional WVDOH approved radiation safety training before another evaluation will be conducted.

~~APPRENTICESHIP REQUIRMENTS~~

~~11.6.1 THE TECHNICIAN SHALL SUBMIT A APPRENTICESHIP LOG SHEET (ATTACHMENT 2) FOR 40 HOURS EXPERIENCE THAT WILL INCLUDE GUAGE COMPARISON, GAUGE STANDARDIZING, AND GAUGE USE. SEE ATTACHMENT 1 FOR REQUIRED TESTS. THIS EXPERIENCE MAY BE BEFORE OR AFTER TAKING THE PRACTICAL. THE WORKLOG MUST BE SUBMITTED ELECTRONICALLY TO THE QAPA FOR APPROVAL.~~

12. PORTLAND CEMENT CONCRETE TECHNICIAN

12.1. Details of this class are available on the MCS&T Webpage[5]

12.2. The written examination for this class consists of the following areas:

1. Specifications
2. Fundamentals
3. Sampling and Testing
4. Control and Inspection
5. Mix Proportioning and Adjustment

12.3. The Concrete Technician requires only the successful completion of the written examination; no practical examination ~~-~~test is required.

12.4. Certification of the Concrete Technician qualifies the technician to make plant and mix adjustments, proportioning, and other concrete related duties.

12.4.1. ~~—~~National Ready Mixed Concrete Association (NRMCA) Concrete Technologist Certification Course, "Short Course," will be accepted as a portion of the West Virginia PCC Technician training. However, the applicant must pass the online West Virginia PCC Technician written certification test before a certification will be issued. Refer to MP 106.03.5~~1~~1.

12.5. ~~12.5 —~~APPRENTICESHIP REQUIREMENTS

~~12.4.1.~~12.5.1. ~~12.5.1 —~~PCC Inspector certification is a required prerequisite for the PCC Technician certification.

13. PORTLAND CEMENT CONCRETE INSPECTOR

13.1. Details of this class are available on the MCS&T Webpage[6]

13.2. The written examination for this class consists of the following areas:

1. Fundamentals
2. Sampling and Testing
3. Control and Inspection

[5] https://transportation.wv.gov/highways/mcst/Pages/concretetech.aspx

[6] https://transportation.wv.gov/highways/mcst/Pages/concreteinspector.aspx

4. Specifications

13.3. After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating their proficiency in conducting tests common to concrete quality control.

13.4. Certification as a Concrete Inspector qualifies the technician to perform sampling and/or testing of concrete for Quality Control and/or Quality Acceptance.

13.4.1. American Concrete Institute (ACI) Field Testing Grade I certification will be accepted as a portion of the West Virginia PCC Inspector training. However, the applicant must pass the online West Virginia PCC Inspector written certification test before a certification ~~will be~~is issued. Refer to MP 106.03.51.

13.4.1.1. Apprenticeship requirements are waived if a certification is obtained via reciprocity.

13.5. ~~13.5~~ APPRENTICESHIP REQUIREMENTS

13.5.1. ~~13.5.1~~ After successfully completing the written exam, each participant shall complete 40 hours of hands-on training under the supervision of a WVDOH Certified PCC Inspector in the tests on which the participant will be tested. The tests to be trained in are:

1) ~~1)~~ AASHTO R60 Standard Practice for Sampling Freshly Mixed Concrete
2) ASTM C1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
3) AASHTO T119 Standard Method of Test for Slump of Hydraulic Cement Concrete
4) AASHTO T196 Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
5) AASHTO T152 Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
6) AASHTO T121 Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
7) AASHTO R100 Standard Method of Making and Curing Concrete Test Specimens in the Field
8) AASHTO T22 Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens~~TEST NAMES~~

Once the Participant has completed the 40 hours of training, the WVDOH Certified PCC Inspector who performed the training will complete the Apprenticeship Log Sheet and include their written name, signature and certification number with the date of completion. The Log Sheet shall then be submitted to the QATPA electronically.

13.5.2. ~~13.5.1~~ The participant will be contacted by the MCS&T Concrete Section to schedule the practical exam. The practical exam may be attempted prior to the completion of the apprenticeship cycle. Each participant will be given one chance to

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pass the practical exam. (All Practical Examinations must be completed within 60 days from the date of the original written test date.) If the participant fails, they will be denied the Certification.

Commented [DB12]: Schedule?

13.5.3. The WVDOH PCC Inspector who performs the training shall ensure the participant is trained in each of the tests according to the AASHTO procedures.

~~After successfully completing the written exam: Before scheduling for the Practical Exam, each Participant shall complete 40 hours of hands-on training for test outlined in the Apprenticeship Cycle (Attachment 1) under the supervision of a WV DOHWVDOH certified technician for PCC Inspector. Tests can be on either a doh project or private work. If the testing is conducted on a private project, DOT materials, procedures and specifications must be followed. Once the Participant has completed the 40 hours of training, The WV DOHWVDOH certified Technician who performed the training will complete the Apprenticeship Log Sheet (Attachment 2) and include their signature and written name with the date of completion. The Log Sheet shall then be submitted to the QAPA electronically.~~

~~13.4.1. 10.5.2 Once the Training Log has been received and verified by the WV DOHWVDOH MCS&T personnel the participant will be contacted by the Concrete Section located at MCS&T to schedule the practical. Each participant will be given one chance to show they can proficiently run each of test specified in the apprenticeship cycle (attachment 1). (All Practical Examinations must be completed within 90 days from the date of the original written test date.) If the participant does not show proficiency during each of the tests the participant will be denied the PCC Inspector Technician Certification. The documented experience hours shall be completed before they can proceed with their practical.~~

14. ASPHALT PLANT TECHNICIAN

14.1. Details of this class are available on the MCS&T Webpage[7]

14.2. The written examination for this class consists of the following areas:

1. Specifications
2. Fundamentals
3. Sampling and Testing
4. Control and Inspection
5. Mix Proportioning and Adjustment

14.2.1. After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating their proficiency in conducting tests common to Asphalt quality control.

~~14.2.2.~~ Certification of the Asphalt Technician qualifies the employee technician to take asphalt mixture samples, perform quality control or quality assurance testing on plant

[7] https://transportation.wv.gov/highways/mcst/Pages/hotmixasp.aspx

produced asphalt mixtures, make plant and mix adjustments, aggregate proportioning, and other duties.

14.3.

14.4. ~~14.3~~ APPRENTICESHIP REQUIREMENTS

14.4.1. After successfully completing the written exam, each participant shall complete 24 hours of hands-on training under the supervision of a WVDOH Certified Asphalt Plant Technician in the tests on which the participant will be tested. The tests to be trained in are:

~~1~~1) ASTM D6926 - Preparation of Asphalt Mixtures by Means of the Marshall Apparatus

2) AASHTO T 312 - Preparing and Determining the Density Of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor

3) AASHTO T 166 - Bulk Specific Gravity (GMB) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens

4) AASHTO T 331 - Bulk Specific Gravity (GMB) and Density of Compacted Hot Mix Asphalt (HMA) Using Automatic Vacuum Sealing Method

5) AASHTO T 209 – Theoretical Maximum Specific Gravity (GMM) and Density of Hot Mix Asphalt (HMA)

6) ASTM D6927 – Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus

7) AASHTO T 308 – Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) By the Ignition Method, (Method A)

8) AASHTO T 30 – Mechanical Analysis of Extracted Aggregate~~) TEST NAMES~~

9) AASHTO T 269 Standard Method of Test for Percent Air Voids in Compacted Dense and Open Asphalt Mixtures

Once the Participant has completed the 24 hours of training, the WVDOH Certified Asphalt Plant Technician who performed the training will complete the Apprenticeship Log Sheet and include their written name, signature and certification number with the

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date of completion. The Log Sheet shall then be submitted to the QATPA electronically.

14.4.2. The participant will be contacted by the MCS&T Asphalt Section to schedule the practical exam. The practical exam may be attempted prior to the completion of the apprenticeship cycle. Each participant will be given one chance to pass the practical exam. (All Practical Examinations must be completed within 90 days from the date of the original written test date.) If the participant fails, they will be denied the Certification.

14.4.3. The WVDOH Asphalt Plant Technician who performs the training shall ensure the participant is trained in each of the tests according to the AASHTO procedures.

~~APPRENTICESHIP REQUIREMENTS~~

~~14.2.3. 14.3.1 The technician shall submit an Apprenticeship Log Sheet (Attachment 2) of 24 hours of documented experience signed by QC manager/supervisor. The plant technician can run QC samples under the direct supervision of a certified tech who must sign off on testing. The technician will have one opportunity to pass the practical.~~

15. ASPHALT PRESERVATION TECHNICIAN

15.1. Details of this ~~class~~ certification are available on the MCS&T Webpage[8]

15.2. This exam is based on web-based training found in the TC3 Course "Flexible Pavement Preservation Treatment Series."

15.3. A printed copy of the Certificate of Training from this course is required to be presented for registration on the day of the exam.

15.4. The written examination for an Asphalt Preservation Technician consists of the following areas in regards to chip seals, micro surfacing, thin overlays, and crack sealing

1. Fundamentals of Preservation
2. Pavement Conditions and Treatment Selection
3. Performance Characteristics
4. Inspection and Best Practices

15.4.1. Certification of the Asphalt Preservation Technician is currently optional. This certification is for technicians who want to be more prepared for asphalt preservation style projects.

15.4.2. No practical examination nor apprenticeship is required for this certification.

Commented [DB14]: Schedule?

Commented [DH15]: Class or Certification?

Commented [DH16]: Changed from class to certification

Commented [DB17]: Do this in each section that does not require a practical/apprenticeship

[8] https://transportation.wv.gov/highways/mcst/Pages/Asphalt-Preservation-Technician.aspx

~~15.4.1.~~

16. RADIATION SAFETY

16.1. This certification is required by the Nuclear Regulatory Commission (NRC) before operating a portable nuclear gauge. The training consists of 3 - 4 hours classroom instruction and has a 25-50 question closed book exam. A minimum score of 70 percent is required for passing the course. The course and exam will cover the following areas:

~~5.~~1. Proper storage and security of portable nuclear gauges
~~6.~~2. Transportation of portable nuclear gauges
3. Personal safety while operating a portable nuclear gauge.

16.2. No practical examination nor apprenticeship is required for this certification.

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~~7.~~

17. INERTIAL PROFILER OPERATOR

Commented [DB19]: Ask Vince - separate class?

17.1. This certification does not have class, nor does the test need to be proctored by the WVDOH. The exam is provided upon request. Details of this certification are in MP 720.10.01 - Guide for Using a High-Speed Inertial Profiler to Measure the Longitudinal Profile of Pavement

17.2. The written examination for the inertial profiler operator covers of the following areas:

1. WVDOH Specifications
2. AASHTO and ASTM Specifications
3. Knowledge of operation and analysis of collected data.

17.3. This certification allows a technician to operate a lightweight/low-speed and high-speed inertial profiler.

17.4. No practical examination nor apprenticeship is required for this certification.

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~~17.3.~~

18. TESTING PROTOCOL

18.1. TESTING PROTOCOL

18.1.1. The TICP has a testing protocol that must be followed. The protocol includes testing environment, time limits, proctoring exams, etc. The entire protocol will be covered with attendees prior to testing.

18.2. CLASS SUPPLY LIST

18.2.1. We recommend that participants bring the following items with them to the certification classes:

1. Laptop Computer or Tablet (Mandatory)
2. Photo ID
3. Current WV Specification book and the latest Supplemental to the Specification book. You will need this during the test. These are also available in printable PDF format on the WVDOH Webpage.[9]
4. Hand held calculator (No electronic devices other than a Hand held calculators are allowed to be used during testing.)
5. Highlighters
6. Sticky Notes
7. Ruler / Straight edge

18.3. SPECIAL NEEDS AND REQUESTS:

18.3.1. Applicants with special needs should notify the Quality Assurance Training Program Administrator prior to the class to ensure that the training location is prepared to accommodate their needs.

Commented [DB21]: Fix header to be consistent.

19. CERTIFICATION, APPRENTICESHIP, AND RE-CERTIFICATION

19.1. Certification

19.1.1. An individual must pass the written examination in each level for which they are requesting certification. Unless otherwise noted, to pass the written examinations, the applicant must obtain a minimum score of 70 percent.

19.1.2. If an applicant fails to receive a minimum score of 70% on the first written exam, they will be given another attempt at a later date to score 70%. This second attempt shall be a subsequent, scheduled make-up written exam. Failure to attend any scheduled written examination counts as a failed exam.

19.1.2.1. If the applicant fails the second written exam, they may not attempt the written examination again until they retake the class or wait one calendar year.

~~19.1.2.~~19.1.3. If required by the certification, a practical exam must be successfully completed. Specific requirements for the practical exam are included in the respective sections. If a participant fails the practical exam, they may not retake the practical exam until they have attended the respective class and successfully passed the written examination again, or one year. An additional apprentice cycle supersedes this requirement.

Commented [DB22]: To be reviewed by section supervisors.

~~19.1.3.~~19.1.4. Upon successfully completing the requirements for certification, applicants may print their certification card from the Divisions Webpage. http://dotftp.wv.gov/materialsdir/

[9] https://transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx

19.1.5. This certification is not transferable. A certification is valid for up to ~~Three~~ five years and expires December 31, of the 5th~~3rd~~ year of certification. Radiation Safety must be renewed every 3 years from the certification date.

19.2. ~~19.2~~ APPRENTICESHIP

19.2.1. ~~19.2.1~~ For the initial certification of a technician, an apprenticeship is required which consists of three tasks; pass a written exam, hands-on experience, and pass a hands-on practical exam. Upon successful completion of the written exam, the Technician shall work as an apprentice under the supervision of a certified technician for the Apprenticeship Cycle.~~For the initial certification of a technician, a successful apprenticeship is required. the apprenticeship cycle. a period of 6 month~~This requirement shall not apply to a technician who has let their certification expire within the past 3 years or applicants who seek certification through reciprocity with documented experience.~~. before becoming a fully certified technician.~~

~~19.2.2 The apprenticeship should be completed before attempting the practical portion of the certification process.mayor after~~

19.2.2. ~~19.2.3~~ The apprentice shall keep a work log that is signed by the supervising technician. (See attachment 2). The work log shall record the number of hours doing the specified testing as outlined in the ~~Apprenticeship Cycle (Attachment 1).~~respective section. Hours shadowing or observing others does not count. ~~The work logged should be Contract or State projects.~~ The work log shall be submitted to the ~~Quality Assurance Program Administrator~~QAPTA and must be reviewed and approved by the appropriate MCS&T ~~s~~Section. ~~head and the QAPA.If the certification does not require a practical, this work log shall be submitted at the end of 6 months to obtain their certification.~~

~~19.2.4~~ ~~19.2.4~~ Apprenticeship requirements ~~may~~ vary between certifications. See the respective section for ~~each specific certification for~~ details of the apprenticeship requirements ~~for that certification~~.

19.2.3.

19.2.4. APPRENTICE CYLE

19.2.5. The Apprentice Cycle is the number of hours for specific tests which must be performed by the applicant and documented by a certified technician. For each of the certification schools, the ~~numbe~~hours~~r~~ of ~~specific~~ testings is listed in the respective section.

~~19.3.~~19.2.6. RE-CERTIFICATION

~~19.3.1.~~19.2.7. The responsibility for obtaining re-certification shall lie with the certified individual.

~~19.3.1.1.~~19.2.7.1. Certification holders are responsible ~~to ensure~~for ensuring that their certifications stay current. The ~~West Virginia Division of Highways~~WVDOH will no longer mail reminder letters to certification holders.

~~19.3.2.~~19.2.8. The renewal of all certifications shall require a written exam and a hands-on practical exam, where applicable.

~~19.3.3.~~19.2.9. Applicants will be given two scheduled attempts to pass the recertification exam and one attempt to pass the practical exam (each, respectively). Any applicant that fails to acquire a minimum score of 70% on a recertification exam or who fails the subsequent practical exam will not have their certification renewed. The applicant will be required to take the respective certification classes at the next available time given by MCS&T.

~~19.3.4.~~19.2.10. Any failed recertification examination taken prior to the expiration date of the current certification, either practical or ~~written~~written, will not result in termination of any current certification prior to the expiration date of that certification.

~~19.3.5.~~19.2.11. The certification holder is ~~responsible~~responsible for updating their personal information on the online learning website[10].

~~19.3.6.~~19.2.12. If an applicant seeking recertification disagrees with a recertification decision, they may file a written appeal with the board.

19.3. If certification is not renewed by December 31, the Technician should take the class and shall take the full exam and practical at the next available offering.

Commented [DH23]: Should be 19.3.7

19.4. ~~19.4~~ INSTRUCTOR'S EXTENDED CERTIFICATION

19.4.1. ~~19.4.1~~ Anyone who teaches during the certification classes shall have their certification extended 1 year per calendar year per certification taught.

20. RECIPROCAL CERTIFICATIONS

20.1. Acceptance of WVDOH Certifications by other state agencies is at the sole discretion of the other agency. Refer to MP 106.03.51

21. TRAINING

21.1. Training - The Division of Highways, contractors, and producers may sponsor courses of instruction consisting of schools and seminars to help prepare personnel for certification under one or more of these certification programs. To the extent possible, these courses of instruction will be joint efforts of the industry and WVDOH. Nothing in this document shall be interpreted to prohibit any party from conducting courses of instruction for their personnel to assist in preparation for these exams.

21.2. The purpose of the schools is to provide helpful information and instruction for people preparing to take the WVDOH Technician/Inspector examinations. These courses are designed to provide instruction for people with a basic foundation in the subject matter. Work experience in the subject matter is encouraged before attending classes.

[10] http://www.onlinelearning.wv.gov/student/home.html

22. EXAMINATIONS

22.1. Renewal and Certification – Certifications shall be renewed as required in this document. General guidance and information for renewal will be recommended by the Board as required by the ~~Chief~~ State Highway Engineer. All certifications, except Radiation Safety, shall terminate on December 31st of the year of expiration. There may be written, and practical examination required for recertification where applicable.

22.1.1. Upon obtaining renewal of certification, a renewal card may be printed from the MCS&T Webpage.

22.2. For further information on classes, recertification, schedules, class calendars and other helpful information please visit the MCS&T's Webpage.

23. FUNCTIONS AND RESPONSIBILITIES

23.1. Contractor or Producer - The producer and contractor will be responsible for product control of all materials during the handling, blending, and mixing operations. The contractor and producer also will be responsible for the formulation of a design mix that will be submitted to the Division for approval.

23.1.1. Technician/Inspector - A Quality Control representative of a contractor or producer should be a certified Technician/Inspector as outlined in Section 5. and whose responsibilities may include such duties as proportioning and adjusting the mix, sampling and testing the product, and preparing control charts.

23.2. ~~The WVDOH -~~ The WVDOH is responsible for all acceptance decisions.

23.2.1. District Materials Supervisor - District Materials activities are the responsibility of the District Materials Supervisor.

23.2.2. Division Technicians and Inspectors – The WVDOH Technicians and Inspectors will be assigned as necessary to carry out the required acceptance decision activities. The WVDOH representatives will not issue instructions to the contractor or producer regarding process control activities. However, the WVDOH representatives have the responsibility to question, and where necessary to reject, any operation or sequence of operations, which are not performed in accordance with the contract documents.

24. REVOCATION OF CERTIFICATION

24.1. If at any time a WVDOH, contractor's, producer's, or supplier's Technician or Inspector is found to have altered or falsified test reports or is found to have improperly performed tests or reported their results, the individual's certification may be rendered invalid by the ~~Chief~~ State Highway Engineer upon recommendation of the Board.

24.2. Generally, certifications may be revoked if in the opinion of the certifying authority, an individual has knowingly committed acts detrimental to the integrity of the

Certification Program or transportation industry. Examples of situations that warrant revocation include, but are not limited to:

1. Deliberate falsification of field or quality control test results or records.
2. Deliberate falsification of calculations, test results or materials
3. Cheating on certification/re-certification exams.
4. Submittal of false information on certification applications.
5. Submitting trial mix mixture and/or calculations completed by someone other than the signatory or knowingly supplying trial mix mixture and/or calculations for another individual's certification.

24.3. The Quality Assurance Training Program Administrator will take the lead in gathering facts and investigating any allegations which may require revocation of a certification. The review board will notify the individual in writing of intent to revoke certification(s).

25. APPEALING A DECISION

25.1. Any individual who disagrees with a decision by the Certification Board has 10 business days from the date of receipt of the notification to respond in writing to the board and present documentation to support their continued certification and/or request an opportunity for a meeting to present their case.

Appeals should be mailed to:
Certification Board
ATTN: Quality Assurance Program Administrator
West Virginia Division of Highways
190 Dry Branch Dr.
Charleston, WV 25306

25.2. If the individual fails to respond within 10 days of receipt of the original notification of revocation letter, the revocation becomes final.

25.3. Not later than 20 business days after receiving a request for a meeting from the individual, the Certification Board will schedule a meeting in which the appellant can present their case. If the Certification Board was not persuaded by the documentation provided by the appellant and believes that revocation of the certification is warranted, the appellant may file a written appeal to the ~~Chief~~ State Highway Engineer for review. All information including any letter(s) of explanation from the appellant will accompany the documents submitted to the State Highway ~~Chief~~ Engineer. The board will mail the decision of the State Highway ~~Chief~~ Engineer to the appellant. The decision by the State Highway ~~Chief~~ Engineer is final.

26. THE LENGTH OF REVOCATION:

26.1. First Offense

26.1.1. This may include revocation of all certifications for up to one year. After the revocation period the individual may obtain recertification by passing respective certification exam and a practical (if applicable). If either exam is failed, the individual will be

required to take the certification class before being permitted to test again. The individual will be required to retake and pass the written exam regardless of whether it was previously passed.

26.2. Second Offense

26.2.1. This may include revocation of all certifications for up to five years. There is also the possibility of demotion and reduced pay for WVDOH employees. After the revocation period the individual may obtain recertification by passing the respective certification exam and a practical (if applicable) at the discretion of the board. If either exam is failed, the individual will be required to take the certification class before being permitted to test again. The individual will be required to retake and pass the written exam regardless of whether it was previously passed.

26.3. Third Offense

26.3.1. This may include revocation of all certifications for life. There is also the possibility of termination, demotion and reduced pay for WVDOH employees.

27. CONTACT INFORMATION

27.1. If an applicant/technician/appellant has any questions about the DOH program or needs more information. Please contact: Qaschoolscoordinator@wv.gov

_____
Michael A Mance, PE
Director
Materials Control, Soils & Testing Division

MP 106.03.50 Steward – Personnel, Payroll Section
MM:Bh

ATTACHMENT

~~ATTACHMENT 1~~ – Apprenticeship Cycle

ATTACHMENT 2 – Apprentice Log Form

	School	Test
	PCC Inspector	R60 - Sampling
	PCC Inspector	C1064 - Temperature
	PCC Inspector	T119 - Slump
	PCC Inspector	T196 - Air by Bolume
	PCC Inspector	T152 - Air by pressure
	PCC Inspector	T121 - Unit Weight and Yield
	PCC Inspector	R100 - Casting Cylinders
	PCC Inspector	T22 - Testing Cylinders
	PCC Technician	PCC Inspector prerequesit
	Aggregate Technician	T-11 Wash test
	Aggregate Technician	T-19 Unit Weight
	Aggregate Technician	T-27 Gradation
	Aggregate Technician	T-84 Specific Graity of Fine Agg
	Aggregate Technician	T-85 Specific Gravity of Coarse Agg
	Aggregate Technician	T-89 Liquid limit of Soils
	Aggregate Technician	T-98 Plastic Limit of Soils
	Aggrete Sampling Inspector	None
	Asphalt Field Compaction Technician	T355 & 401 specifications (gauge comparison)
	Asphalt Plant Technician	ASTM D6926 - PREPARATION OF ASPHALT MIXTURES BY MEANS OF THE MARSHALL APPARATUS
	Asphalt Plant Technician	AASHTO T-312 - PREPARING AND DETERMINING THE DENSITY OF ASPHALT MIXTURE SPECIMENS BY MEANS
	Asphalt Plant Technician	AASHTO T-166 - BULK SPECIFIC GRAVITY (GMB) OF COMPACTED HOT MIX ASPHALT (HMA) USING
	Asphalt Plant Technician	AASHTO T-331 - BULK SPECIFIC GRAVITY (GMB) AND DENSITY OF COMPACTED HOT MIX ASPHALT (HMA)
	Asphalt Plant Technician	AASHTO T-209 – THEORETICAL MAXIMUM SPECIFIC GRAVITY (GMM) AND DENSITY OF HOT MIX ASPHALT
	Asphalt Plant Technician	ASTM D6927 – RESISTANCE TO PLASTIC FLOW OF ASPHALT MIXTURES USING MARSHALL APPARATUS
	Asphalt Plant Technician	AASHTO T-308 – DETERMINING THE ASPHALT BINDER CONTENT OF HOT-MIX ASPHALT (HMA) BY THE IGNITION
	Asphalt Plant Technician	AASHTO T-30 – MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE
	Asphalt Plant Technician	AASHTO T-269 Standard Method of Test for Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
	Asphalt Preserrvation Technician	None
	Soil and Aggregate Compaction	MP 700.00.24 Nuclear Density Test by Roller Pass Method
	Soil and Aggregate Compaction	MP 712.21.26 Procedure for Determining Random Location of Compaction Lots
	Soil and Aggregate Compaction	MP 207.07.20 Nuclear Field Density/Moisture Test for Random Material Having Less than 40% + 3/4 inch Material
	Radiation Safety	Does not apply (3 year renewal required by NRC)
	Interial Profile Operator	None

Apprenticship Log Form		
Technican Name:	**Certification:**	**Page of**
Test performed	**Date**	**QC Verification Signature**

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

MATERIALS PROCEDURE

METHOD FOR ACCEPTANCE OF COMPACTION TESTING

1. PURPOSE

1.1 To provide a procedure for the acceptance of compaction testing.

2. SCOPE

2.1 This procedure is applicable to all materials that require evaluation of compaction tests.

3. TESTING

3.1 The minimum frequency for acceptance testing shall be 10% of the contractor's individual tests. Five tests shall be performed in a lot for acceptance testing.

3.2 Acceptance testing shall be distributed throughout the placement of material.

3.3 The material should be categorized according to the base, subgrade, pipe backfill, embankment, etc.

4. EVALUATION

4.1 Calculations shall be rounded to the following significant digits according to ASTM Method E29.

Average (X)	0.1%
Standard Deviation	0.01
Range	1%

4.2 Determine the number of lots tested by the contractor for a particular material since the last monitoring, including the lot just tested. ~~Record the percent relative densities on the attached form.~~After completion of the QA lot, the test data shall be entered into AWP, or the current System. Enter the test data for the QC lots into AWP, or the current System. Each QC lot shall be linked to the appropriate QA lot.

~~4.3 Calculate the standard deviation (S) for the percent relative densities.~~

4.4~~4.3~~ ~~Calculate the range (R) for plus and minus 1.65 standard deviations (S) from the average (X) for the contractor's tests (R = X + 1.65 S).~~Generate the appropriate Compaction Similarity Report in AWP, or the current System.

~~4.5 Compare the acceptance tests to the calculated range.~~

~~4.5.1~~4.3.1 If all the acceptance tests in the report are within the range of plus or minus 1.65 standard deviations, the testing is similar. When the testing is similar, the degree of compaction for the lots of material represented by the acceptance evaluation may be accepted.

~~4.5.2~~4.3.2 If any of the 5 acceptance tests are outside the range, compare the acceptance tests to the range in the report calculated using 3 standard deviations.~~calculate 3 standard deviations for the contractor's tests (R = X ± 3 S).~~

~~4.5.3~~4.3.3 If all acceptance tests are within the range, the testing is considered similar, however, the quality control practices by the contractor should be reviewed for possible problems.

~~4.5.4~~4.3.4 Any test outside the 3 standard ~~3~~ deviation range indicates that there may be problems within the quality control system and no additional material shall be placed until the problem is investigated and resolved. The investigation shall~~would~~ include checking such areas as equipment, test procedures, location of tests, variability of materials, compaction techniques, etc. The results of the investigation shall be documented in the project files and a copy forwarded to Materials Control, Soils & Testing Division via email at DOHCompaction@wv.gov.

MP 700.00.50 Steward – Laboratory Support Section
MM:W
ATTACHMENT

PROJECT NUMBER: _____

ITEM NUMBER (S): _____

TYPE OF MATERIAL: _____ DATE: _____

QUALITY CONTROL
TESTS

LOT NUMBER				
	1 2 3 4 5			
	AVERAGE (X)		STANDARD DEVIATION	
ACCEPTANCE TESTS				
TEST NUMBER	1 2 3 4 5	X + 1.65 (S) = _____ X - 1.65 (S)= _____ WITHIN LIMITS	YES NO	= UPPER LIMIT = LOWER LIMIT (SIMILAR) (DISSIMILAR)
		X + 3(S) = _____ X - 3(S) = _____ WITHIN LIMITS	YES NO	= UPPER LIMIT = LOWER LIMIT (SIMILAR) (DISSIMILAR)

EVALUATED BY: _____ CHECKED BY: _____

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 to statistically compare Quality Control (QC) and Quality Assurance (QA) tests to verify the validity of the QC samples.

2. DEFINITIONS

2.1. System: The Division Approved Materials Tracking System.

2.2. Sample: The sample record test which has been documented in the System.

2.3. Quality Assurance (QA) Sample: Samples performed by the Division to evaluate for acceptance, a material on a Project.

2.4. Quality Control (QC) Sample: Samples performed by the Contractor for a material on a Project to demonstrate the material's compliance with the Specifications.

2.5. Verification: The process of statistically comparing a QA sample to a series of QC samples. This comparison serves to verify the validity of the QC testing. There are two approaches to this comparison:

2.5.1. Project Approach: A verification Data Set must contain all of the following:

1. Material Source
2. Mix Design (If Applicable)
3. Aggregate Class (If Applicable)
4. Project

2.5.2. System Approach: A verification Data Set must contain all of the following:

1. Material Source
2. Mix Design (If Applicable)

2.6. Data Set: The series QC and linked QA test result data that is statistically compared for verification. This data set includes all linked test data that follows the inclusion specified in Sections 2.5.1 and 2.5.2.

2.7. Linked Samples: This is a technical term for a process in the System which creates a data set among joined samples.

3. SCOPE

3.1. All QC samples for the following tests must be represented by a QA sample. These are to be evaluated in chronological order by a QA sample. No more than 10 QC samples shall be evaluated by a QA sample.

~~3.1.~~3.2. The following materials~~,~~ ~~tests~~ and their respective test(s) and test result(s) are evaluated by the specified approach.

~~3.1.1.~~3.2.1. Aggregate Gradations – Project Approach

1. Specification Sieves (each)
2. Pan (if applicable)

~~3.1.2.~~3.2.2. Marshall Asphalt Mixture – System Approach

1. Asphalt Content
2. Air Voids
3. VMA
4. Stability
5. Flow
6. Gradation (each Specification Sieve and Pan if applicable)

~~3.1.3.~~3.2.3. SuperPave Asphalt Mixture – System Approach

1. Asphalt Content
2. Air Voids
3. VMA
4. Gradation (each Specification Sieve and Pan if applicable)

~~3.1.4.~~3.2.4. Portland Cement Concrete – Project Approach

1. Air Content
2. Consistency
3. Strength

4. PROCEDURE

4.1. After completion of the QA sample, the test data shall be entered into the System. The QA sample shall be linked to the appropriate QC sample(s) as specified in Section 4.2. Note that all samples being linked must contain all respective test results for the material shown in Section 3 and meet the criteria stated in Sections 2.5.1 and 2.5.2.

4.1.1. ~~If tests results are missing, the District shall explain their omission.~~ If a system approach QA sample is performed and it covers multiple Districts, the QA sample shall be performed by the District in which the plant is located.

4.2. The samples shall be linked by the person creating the QA sample, based on the total number of QC samples. This will allow the System to create a data set and perform an evaluation (if applicable). For QA samples evaluating QC samples in the system approach, all QC samples taken after the last QA sample and up to the current QA sample shall be evaluated.

4.2.1. 1-4 QC Sample(s)

If there are less than five QC samples, they shall be linked, but no calculation shall be performed; The evaluation will be conducted as specified in Section 5.1

4.2.2. 5-10 QC Samples

If there are five to ten QC samples, they shall be linked; the data set shall consist of all of the available tests. The evaluation shall be conducted as specified in Section 5.2

4.2.3. 11 + Quality Control Samples

If there are eleven or more QC samples available, they shall be organized sequentially by date/time; only the first ten shall be linked. The data set shall consist of these ten samples. The evaluation shall be conducted as specified in Section 5.2.

An additional QA sample shall be completed, and the process shall be restarted independent of the prior evaluation. This extra date set shall be linked and evaluated according to the remaining QC samples.

4.2.3.1. For example, if 16 QC samples are taken, there shall be a QA sample for QC samples 1-10 and then another QA sample for ~~samples~~ QC samples11-16, which would be evaluated as "5-10" QC samples.

5. EVALUATION

5.1. If the data set contains less than 5 linked QC samples, no calculation shall be made. The test data shall be visually evaluated for significant variance~~deviance~~. If a significant ~~deviance~~variance is noted, appropriate action shall be taken by the District as specified in Section 5.3.2.1. If there is no significant ~~deviance~~variance, the report shall indicate: "This sample, <sample number recorded here> has been reviewed in accordance with MP 700.00.54~~." ~~, and judged to be similar." If it is not similar, it's handled in accordance with Section 5.3.2.1.

5.2. If the data set contains 5 or more linked QC samples, they shall be evaluated by the System. No more than 10 QC samples shall be linked; if there are more than 10 QC samples, the System shall return an error.

5.2.1. The calculation and evaluation criteria used in the System are documented in Attachment 1.

5.3. Based on the calculation and evaluation criteria, the System shall report as follows:

5.3.1. If all the test results are evaluated as "Similar", the entire data set shall be judged "Similar".

5.3.2. If any of the test results in the set are evaluated as "Non-Similar", the entire data set shall be judged as "Non-Similar".

5.3.2.1. If the data set is "Non-Similar", the District Materials Supervisor shall perform and document the following for QC:

1. Review the sampling procedure.
2. Review the testing procedures.
3. Check testing equipment.
4. Review documentation.

5. Perform any additional investigations that may clarify the discrepancy.

6. REPORTING AND SAMPLE SUBMISSION

6.1. Once the evaluation is completed, the result shall be noted by the District on the QA sample. ~~The sample shall then be submitted to the respective Materials Regional Coordinator for final evaluation and approval.~~

6.2. If applicable, the sample shall also be marked by the District as "Pass" or "Fail" along with whether the data is "Similar" or "Non-Similar" as defined in Section 6.2.1 and 6.2.2.

6.2.1. If the data set is found to be "Similar", the QA Sample shall be marked "Similar" in the System by the District.

6.2.2. If the data set is found to be "Non-Similar" the QA sample shall be marked "Non-Similar" in the System by the District.

6.2.2.1. If the Sample is marked "Non-Similar", the documentation from Section 5.3.2.1 shall be submitted with the sample by the District, including the corrective action when applicable.

6.2.2.2. In the event that other documentation is needed to resolve the material, that information shall also be provided with the sample by the District.

~~6.2.2.2.~~6.3. The sample shall then be submitted by the District to the respective MCS&T Materials Regional Coordinator for final evaluation and approval.

~~6.3.~~6.4. A sample report is shown in Attachment 2.

Michael Mance, PE
Director
Materials Control, Soils & Testing Division

MP 700.00.54 Steward – Materials Control Section
MAM:B

Attachment 1: Sample Calculations

To determine the range (R) of the QC samples, subtract the smallest test value from the largest test value.

Compute the interval (I) by substituting the values into the proper equation below.

Number of Samples Used in Calculating the Average	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	$I = \bar{X}_{5} \pm 1.61 \times R$

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. If the result obtained is greater than 100%, it will be recorded as 100%. Next, 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. If the result is less than zero, it will be recorded as zero.

For aggregate gradations, the average for each sieve must be calculated separately.

All data must fall within the range to be judged “Similar”. Otherwise, the data set is “Non-Similar”.

Attachment 2: Sample Evaluation Report

West Virginia
Department of Transportation

Marshall Verification Sample Evaluation Computation Sheet

Sample Record: TKraf20241205122921
Material Name: Base 2/Wearing 4 Asphalt Mix, Marshall
Material Code: 401.002.000.05
Facility: F-JFA4.02.704 - J.F. Allen Co. - Lorentz

Laboratory ID: D07-ASP
Sample Date: 10/17/2024
Contract ID:

Sample Record Name	% Asphalt	% Air Voids	%VMA	Stability	Flow	Lab Reference Number	Open Sample Record
TKraf20241018080012	5.0	4.5	14.1	11,648	15.0	C7B2440	Click Here
TKraf20241022120955	5.1	2.2	12.3	12,642	15.3	C7B2441	Click Here
TKraf20241022121156	4.8	3.2	12.5	11,529	14.3	C7B2442	Click Here
TKraf20241022121345	5.0	2.0	12.0	11,633	15.5	C7B2444	Click Here
TKraf20241022121524	4.9	2.9	12.5	12,417	14.8	C7B2445	Click Here
TKraf20241108123059	5.3	2.0	12.5	12,337	15.7	C7B2448	Click Here
Average:	5.02	2.8	12.65	12034.33	15.1		**Records:** 6
Range:	0.5	2.5	2.1	1113	1.4		
Upper Limit Interval:	5.69	6.13	15.44	13514.62	16.96		
Lower Limit Interval:	4.36	0	9.86	10554.04	13.24		

% Asphalt	% Air Voids	% VMA	Stability	Flow	Lab Reference Number
4.9	2.2	11.8	12,480	12.9	M7B2443
✓	✓	✓	✓	✖	

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

MATERIALS PROCEDURE

METHOD OF TEST FOR DETERMINING THE CONDITION OF CONCRETE BRIDGE DECKS

1. PURPOSE

1.1. To provide a method of testing to determine the condition of concrete bridge decks.

2. SCOPE

2.1. This procedure is applicable to concrete bridge decks.

3. REFERENCE DOCUMENTS

3.1. ASTM C39: Test Method for Compressive Strength of Cylindrical Concrete Specimens

3.2. ASTM C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

3.3. ASTM C876: Standard Test Method for Corrosion Potentials of Uncoated Reinforcing Steel in Concrete

3.4. ASTM C1152: Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete

3.5. ASTM D4580: Standard Practice for Measuring Delamination in Concrete Bridge Decks by Sounding

3.6. ASTM D6432: Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation

3.7. ASTM E11: Standard Specifications for Woven Wire Test Sieve Cloth and Test Sieves

3.8. AASHTO T-260: Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

4. EQUIPMENT

4.1. Chain Drag Test

4.1.1. Chains, steel rods, or hammers capable of producing a clear ringing sound when dragged or tapped over non-delaminated concrete and a dull or hollow sound over delaminated concrete.

4.1.2. Measuring tape capable of measuring 150 to 300 ft.

4.1.3. Measuring tape capable of measuring 12 to 25 ft.

4.1.4. Chalk for marking delaminated areas.

4.2. Potential Corrosion Test

4.2.1. Potential corrosion meter capable of generating the data required to produce the report seen in Section 11 of ASTM C876.

4.2.2. Minimum 2-gallon container of distilled water, free of contaminates.

~~4.2.2.~~4.2.3. Handheld rebar detector capable of locating rebar embedded in concrete at a minimum depth of 7 inches.

4.3. Core Sampling

4.3.1. Core drill capable of obtaining cylindrical core specimens through steel reinforced concrete.

4.3.2 4 in. diameter diamond impregnated drill bit.

4.3.3 Saw capable of trimming ends of cores and sectioning cores into 1 in. high cylindrical specimens. This saw shall be capable of cutting cores without introducing cracks or dislodging aggregate particles. Ensure cores are properly stabilized using core holders to prevent movement during sawing.

4.3.4 A grinder or pulverizer capable of grinding concrete and aggregate material fine enough to pass through an 850-µm (No. 20) sieve.

4.3.5 850-µm (No. 20) sieve complying with ASTM E11.

4.3.6 Containers capable of maintaining samples in an uncontaminated state.

4.4 Crack Mapping

4.4.1 Measuring tape capable of measuring 150 to 300 ft.

4.4.2 Measuring tape capable of measuring 12 to 25 ft.

4.4.3 Crack width gauge

4.5 Ground Penetrating Radar

4.5.1 A transmitter and receiver antenna in compliance with ASTM D6432

4.5.2 A radar control unit in compliance with ASTM D6432

4.5.3 Suitable data storage and display devices in compliance with ASTM D6432

5. PROCEDURE

5.1. The bridge deck and all lanes should be surveyed before beginning tests to create a plan of action and ensure the safest approach with traffic control.

5.2. Chain Drag Test

5.2.1. Run the 150 to 300 ft measuring tape longitudinally along bridge, repositioning if bridge length exceeds tape length

5.2.2. Drag chains over the entirety of the deck surface. Delaminated areas produce a dull or hollow sound. Any detected delaminated areas shall be outlined using chalk.

5.2.3. Using a 12 to 25 ft. measuring tape, locate the exact location and record delaminated area on grid paper seen in Attachment 3.

5.3. Potential Corrosion Test

5.3.1. Unpack and assemble the concrete corrosion potential meter.

5.3.2. Unscrew the top of the reference electrode and add sufficient copper sulphate crystals into the tube. Fill the tube with distilled water, cap and shake to mix. Ensure the mixture is in a supersaturated state by adding enough copper sulphate to have undissolved crystals after shaking.

5.3.3. Connect the electrode to the meter by pressing the adapter plate onto the bottom of the LC-4.5, securing it with Velcro pads. Screw the 15 in. intermediate electrode extension into the threaded receptacle on the adapter plate. Add more extensions until the meter is at comfortable height, reaching from the ground to the hands of the operator.

5.3.4. Plug the adaptor plate pigtail into the negative (black) terminal on the meter.

5.3.5. Place the function switch of the LC-4.5 meter to the DC position. Place the range selector switch to the 2V scale. Place the input resistance selector switch to the 200 meg-ohm position.

5.3.6. Clamp the vice-grip pliers onto ~~the~~ any exposed rebar on the bridge, or a metal expansion dam, and clip one end of the 250-foot test lead to the pliers. Plug the end of the lead into the positive (center, red) terminal on the LC-4 meter.

5.3.7. This connection must be made to ~~the rebar in the panel being tested~~either an exposed rebar or a metal expansion dam on the bridge. When an access shaft is needed to expose the embedded steel; a rebar detector shall be used to locate rebar; and a minimum 4'' core shall be drilled to the depth of the reinforcement without cutting the rebar. A minimum 1 in. area of the epoxy coating on the epoxy coated rebar will need to be removed ~~in order for~~for the entire clamp to be in contact with the rebar.

5.3.8. Place the reference electrode assembly against the prepared location on the concrete surface adjacent to the marked spot. If the electrical connection to the rebar is good, and the concrete and interface sponge are wet enough, a steady reading (measurement) between -0.010V and -0.600V should be obtained on the meter within 3-5 seconds. A slight variation in the last digit (thousandth place) can be normal. If the test setup is working satisfactorily, it should be possible to go back to a location and obtain an identical reading within ± 0.020V of the original reading.

5.3.9. Placing tape measures longitudinally and laterally, lay out a grid of the test location covering the entire area which is to be tested. (Tests do not have to be made directly over the rebars).

5.3.10. Take potential readings every 3 ft. by 3 ft. over the entire bridge deck. The sponge contacting the electrode must be kept moist during the entire test.

5.3.11. Record the results of each reading on the grid paper in Attachment 4.

5.3.12. Results generated shall be presented according to Section 9 of ASTM C876.

5.4. Core Samples

5.4.1. Compressive Strength Test

5.4.1.1. At least 1 location per lane shall be selected to obtain compressive strength cores. If the bridge deck only contains 1 lane of traffic, at least 2 locations shall be selected to obtain compressive strength cores. The chosen location should avoid the wheel path of traffic and permit the retrieval of the core underneath the bridge. The selected location will not be over the support beams of the bridge. The cores should be 4 in. diameter and the entire thickness of the bridge deck.

5.4.1.2. Each core shall be labeled with its core number, bridge name, route, lane type, and direction of traffic. Locations of cores shall be mapped per Attachment 5.

~~5.4.1.2.~~5.4.1.3. MCS&T shall coordinate with the District to have any core holes repaired.

~~5.4.1.3.~~5.4.1.4. Once the cores are obtained, using diamond impregnated bits, the compressive strength should be tested following the procedures of ASTM C42 and ASTM C39

5.4.2. Chloride ~~Potential~~Content

5.4.2.1. At least 1 location per lane shall be selected to obtain ~~chloride potential~~ cores for chloride testing. The chosen location should avoid the wheel path of traffic and permit the retrieval of the core underneath the bridge. The selected location will not be over the support beams of the bridge. The cores should be 4 in. diameter and the entire thickness of the bridge deck. Each core shall be labeled with its core number, bridge name, route, lane type, and direction of traffic. Locations of cores shall be mapped per Attachment 5.

~~5.4.2.1.~~5.4.2.2. MCS&T shall coordinate with the District to have any core holes repaired.

~~5.4.2.2.~~5.4.2.3. Cores obtained in the field in 5.4.2.1 will be cut into one (1) in. thick disc specimens maintaining their four (4) in. diameters once received in the laboratory. ~~,~~ ~~maintaining their four (4) in. diameters.~~ Successive (1) in. sections will be cut from the core starting with the section that represents the top surface of the bridge deck to the bottom approximately at a depth of 8.0 inches. Each section will be labeled with the core number and depth.

~~5.4.2.3.~~5.4.2.4. Each 1 in. cylindrical slice shall be pulverized individually into material fine enough to pass through a 850-µm (No. 20) sieve and placed into its own individual container. Do not mix or contaminate the sample with material from another sample disc. Each individual container should be labe~~l~~led with the core number and the depth it represents.

~~5.4.2.4.~~5.4.2.5. The concrete dust in the labe~~l~~led sample container will be tested for chloride content following Sections 9 and 10 of ASTM C1152.

5.4.2.5.5.4.2.6. Record the test results in the format of the table in Attachment 78.

5.5. Crack Mapping

5.5.1.1. Walk the entire area of the bridge deck looking for any cracks, longitudinally and laterally transversely.

5.5.2. Using a tape measure, record the location and length of each crack on the grid paper in Attachment 3.

5.5.3. Using a crack width gauge, record the average width of each crack on the grid paper in Attachment 3.

5.6. Ground Penetrating Radar

5.6.1. A Ground Penetrating Radar investigation may be requested on a bridge deck; it shall be run according to Refer to Section 6 in ASTM C6432. for the procedures to perform the ground penetrating radar

6. CALCULATIONS

6.1. Chain Drag Test

6.1.1. The total area of delamination, spalls, and patched shall be calculated against the total area of the bridge deck. Refer to Attachment 5 for example.

6.2. Potential Corrosion Test

6.2.1. The total area of potential readings greater than -0.20V shall be calculated against the total area of the bridge.

6.2.2. The total area of the potential readings in the range of -0.20V to -0.35V shall be calculated against the total area of the bridge.

6.2.3. The total area of potential readings less than -0.35V shall be calculated against the total area of the bridge.

6.2.4. Potentials greater than -0.20V indicate a 90% or higher probability of no corrosion taking place at the time of measurement.

6.2.5. Potentials in the range of -0.20V to -0.35V are inconclusive.

6.2.6. Potentials less than -0.35V generally indicate a 90% or higher probability of active corrosion taking place at the time of measurement. Refer to Attachment 8 for example.

6.3. Compressive Strength Cores

6.3.1. The compressive strength of the cores shall be calculated according to ASTM C39

6.4. Crack Mapping

6.4.1. The total area of cracks shall be calculated against the total area of the bridge. Refer to Attachment 6 for example.

7. REPORTING

7.1. The results will be presented through a Materials Inspection Report (MIR) by an official Memorandum.~~.~~ An example Memorandum and MIR can be found in Attachments 1 and 2. ~~include an example Memorandum and MIR.~~

7.2. The MIR shall include the following sections: Introduction, Accounting Data, Purpose of Report, Results of Bridge Deck Condition Survey, Conclusion, and Recommendations. In additions Attachments 5-9 shall be completed and provided as attachments with the MIR. ~~Attachments 1 and 2 include an example Memorandum and MIR.~~

~~7.1.~~

Michael A Mance, PE
Director
Materials Control, Soils & Testing Division

MAM:Tk
MP 601.00.49 Steward – Cement and Concrete Section
A~~TTACHMENT~~ttachment~~S~~
cc: FM (), D-#()

Example

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

Division of Highways

1900 Kanawha Boulevard East • Building Five • Room 110
Charleston, West Virginia 25305-0430 • (304) 558-3505

Deputy Secretary of Transportation
Deputy Commissioner of Highways

Secretary of Transportation
Commissioner of Highways

MONTH DAY, XX~~20~~XX

M E M O R A N D U M

TO: **NAME**
~~REGIONAL~~ DISTRICT CONSTRUCTION ENGINEER
DISTRICT NUMBER

FROM: **NAME**
DIRECTOR
MATERIALS CONTROL, SOILS AND TESTING DIVISION

THRU: **HF**

SUBJECT: **BRIDGE DECK CONDITION SURVEY**
BRIDGE NUMBERS:
BARS NUMBERS:
BRIDGE NAME, COUNTY, DISTRICT NUMBER

Attached for your review and further handling is a copy of Materials Inspection Report (MIR) Number XXXXXXX. This MIR documents our findings regarding the subject bridge and will serve as a bridge deck condition survey.

Should you have any questions, please feel free to contact NAME at XXX-XXX-XXXX.

MAM:Td

Attachment

CC: (Regional Construction Engineer)

Example

Materials Inspection Report:	XXXXXXX
Authorization Number:	XXXXXXX
Subject:	Bridge Deck Condition Survey
BARS Number:	
County:	
District:	
Date of Report:	Month Day, Year

1. **ACCOUNTING DATA**

1.1 Project Name:

State Project No.: Contract ID: XXXXXXXXXX

Federal Project No.: Authorization No.:

ORG No.:

2. **INTRODUCTION**

2.1 As requested in MONTH of YEAR by the District NUMBER Regional Construction Engineer, a bridge deck condition survey was performed beginning on MONTH DAY, YEAR, and was concluded on MONTH DAY, YEAR. The tests that were performed were as follows: chain drag test, crack mapping, compressive strength cores, chloride core content and corrosion potential.

3. **PURPOSE OF REPORT**

3.1 This report provides the data developed regarding the bridge deck condition.

4. **RESULTS OF BRIDGE DECK CONDITION SURVEY**

4.1 Surface Condition

4.1.1 The bridge deck surfaces exhibited spalling and delamination.

4.2 Subsurface Condition

4.2.1 The bridge deck subsurface condition survey was not performed because it was not requested.

4.3 Delamination Survey (ASTM D-4580)

4.3.1 The chain drag test was used to locate subsurface delamination in the bridge deck. Bridge number _____ was found to have delamination affecting ___% of the entire bridge deck. Bridge number _____was found to have delamination affecting _____% of the entire bridge deck.

4.3.2 See Attachment No. 6 for the plotted delamination of the bridge decks.

4.4 Bridge Deck Surface Cracking

4.4.1 The transverse and longitudinal cracks were measured and mapped. Bridge number _____ was found to have surface cracking on _____% of the bridge deck. Bridge number _____ was found to have surfacing cracking on ____% of the bridge deck. The transverse and longitudinal crack widths ranged from ____ to ____ throughout the top surface of the deck.

4.4.2 See Attachment No.6 for the plotted locations of the concrete cracks on the bridge deck.

4.5 Compressive Strength Cores (ASTM C39).

4.5.1 _____ compressive cores were taken in total. _____bridge cores were used to determine the compressive strength of the deck.

4.5.2 Results from northbound and southbound lanes:

Core	NB-F-2	NB-S-4	SB-SL-C1	SB-FL-C4
Length (in.)	5.428			
Diameter 1 (in.)	3.982			
Diameter 2 (in.)	3.997			
Correction Factor	0			
Load (lbs.)	95240			
Force (psi)	7579			
Break Type	D,E etc…..			

Average Force (psi)	psi

4.5.3 The depth of the overlay, from each of the ___ cores, was measured using visual indications of the different concrete layers:

NB-F-1	NB-F-2	NB-S-3	NB-S-4	SB-SL-1	SB-SL-2	SB-FL-3	SB-FL-4

2.5in.							

4.5.4 See Attachment No. 3 for the visual locations and a photograph of each core.

4.6 Chloride Content of Bridge Deck Concrete (AASHTO T-260)

4.6.1 ____, one-inch layers where cut from the cored cylinders to determine the Chloride Content of the Bridge Deck. The one-inch layers were cut from four of the ____, compressive strength cylinders. _____of the one-inch layers in the northbound cores were unable to be chloride tested because the presence of rebar compromised their ability to hold during the slicing process.

4.6.2 Results from northbound and southbound lanes:

Core Number	Location of Sample on Core	Lbs./yd^3
NB-F-1 (Lab No.)	0.5 – 1.5 inches from bottom	0.8
	1.5 – 2.5 inches from bottom	
	2.5 – 3.5 inches from bottom	
	3.5 – 4.5 inches from bottom	
	4.5 – 5.5 inches from bottom	
	5.5 – 6.5 inches from bottom	
	6.5 – 7.5 inches from bottom	
	Average for Cylinder	1.25
NB-S-3 (Lab No.)	0.5 – 1.5 inches from bottom	
	1.5 – 2.5 inches from bottom	
	2.5 – 3.5 inches from bottom	
	3.5 – 4.5 inches from bottom	
	4.5 – 5.5 inches from bottom	
	5.5 – 6.5 inches from bottom	
	6.5 – 7.5 inches from bottom	
	Average for Cylinder	

SB-Sl-C2 (Lab No.)	0.5 – 1.5 inches from bottom	
	1.5 – 2.5 inches from bottom	
	2.5 – 3.5 inches from bottom	
	3.5 – 4.5 inches from bottom	
	4.5 – 5.5 inches from bottom	
	5.5 – 6.5 inches from bottom	
	6.5 – 7.5 inches from bottom	
	Average for Cylinder	
SB-FL-C3 (Lab No.)	0.5 – 1.5 inches from bottom	
	1.5 – 2.5 inches from bottom	
	2.5 – 3.5 inches from bottom	
	3.5 – 4.5 inches from bottom	
	4.5 – 5.5 inches from bottom	
	5.5 – 6.5 inches from bottom	
	6.5 – 7.5 inches from bottom	
	Average for Cylinder	

4.6.3 The average chloride content for each layer across these four cylinders are:

Location of Sample on Core	Lbs./yd^3
6.5 – 7.5 inches from bottom	0.8
5.5 – 6.5 inches from bottom	1.2
4.5 – 5.5 inches from bottom	1.2
3.5 – 4.5 inches from bottom	1.4
2.5 – 3.5 inches from bottom	2.0
1.5 – 2.5 inches from bottom	0.8

0.5 – 1.5 inches from bottom	0.8

4.6.4 As expected, the middle layers have the highest chloride content because these layers were exposed on the surface before it was overlayed. However, the data in the overlay layers suggest a higher chloride content than when the concrete was originally placed. With data missing from the higher layers due to the rebar interference, it is predicted that the overlayed surface layer should have a more consistent chloride content with the surrounding layer

4.7 Corrosion Potential of Uncoated Reinforcing Steel in Bridge Deck (ASTM C876)

4.7.1 The corrosion potential was determined by measuring the potential difference between a reference electrode and embedded steel. In this case, the meter was connected to the steel beam beneath the concrete bridge. The corrosion potentials are documented every 3 feet longitudinally and laterally.

4.7.2 Potentials less negative than -0.20V generally indicate a 90% or higher probability of no corrosion taking place at the time of measurement. Potentials in the range of -0.20V to -0.35V are inconclusive. Potentials greater than -0.35V generally indicate a 90% or higher probability of active corrosion in the area at the time of testing.

4.7.3 Bridge number (NB) was found to have a ___% or higher probability of corrosion on ____% of the bridge deck. Bridge number _____ (SB) was found to have a ___% or higher probability of corrosion on ___% of the bridge deck.

4.7.4 See Attachment No. 9 for the plotted corrosion potentials found on the bridge decks.

5. CONCLUSION

5.1 The bridge deck condition survey revealed delamination in the bridge deck concrete to the depth of the top line of reinforcing steel in the bridge deck. The bridge deck concrete did exhibit transverse and longitudinal cracking. The bridge deck concrete did exhibit the probability of steel corrosion. The bridge deck concrete did exhibit an increase in chloride content closer to the surface.

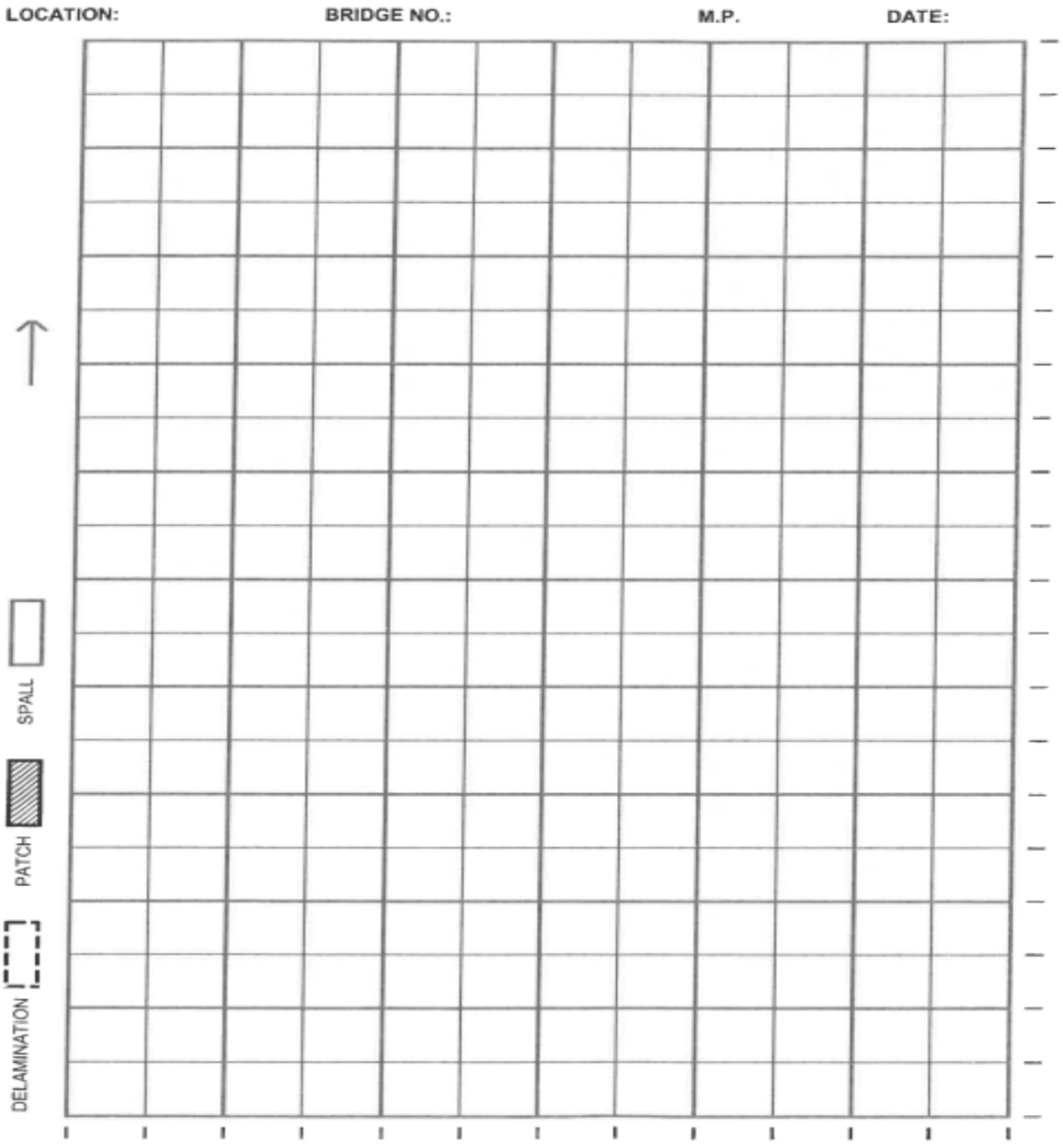
6. RECOMMENDATIONS

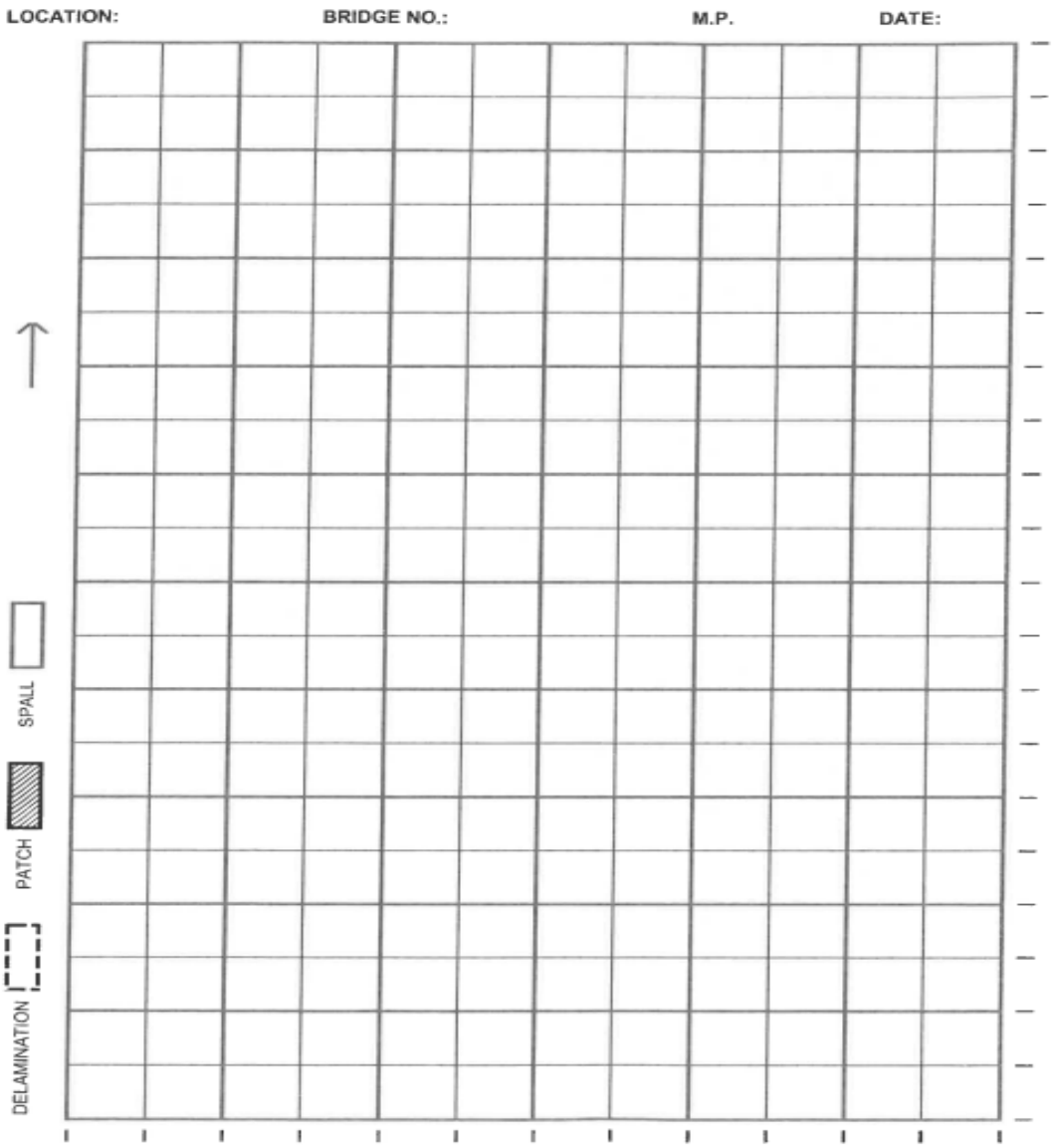
6.1 Due to the severity and extent of damage found during the bridge deck condition survey, replacement of the deck overlay is recommended.

Signature
Cement and Concrete Section

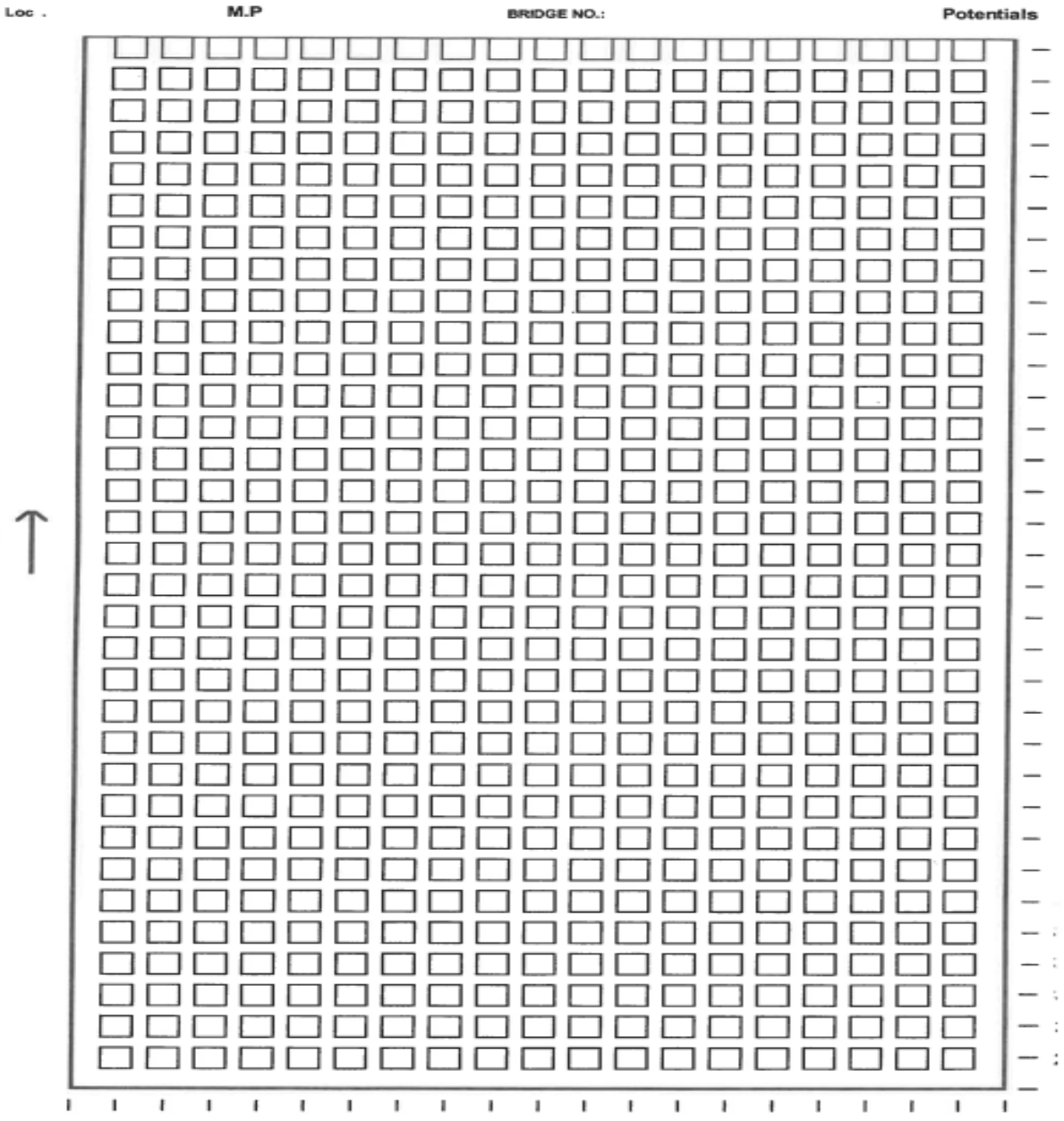
Signature
Cement and Concrete Section Supervisor

Field Defect Map



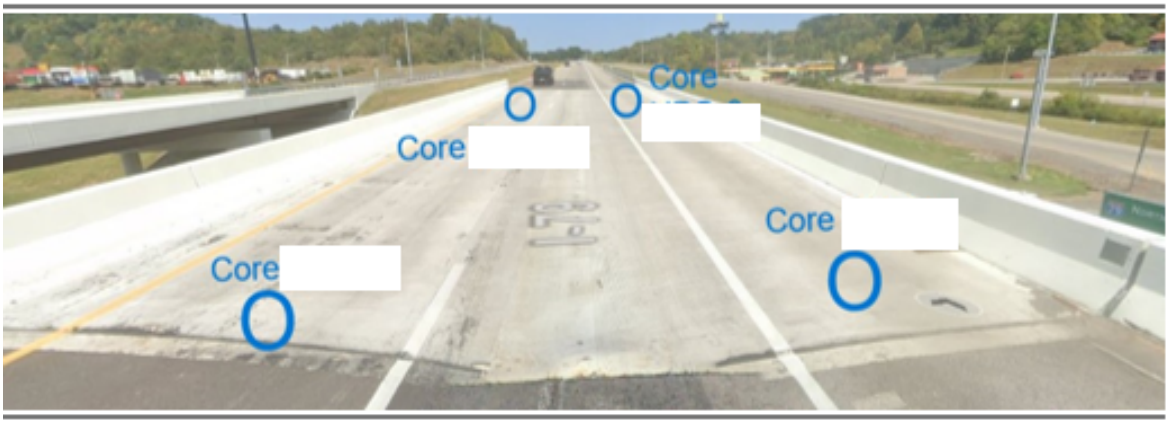

LOCATION:
BRIDGE NO.:
M.P.
DATE:
SPALL
PATCH
DELAMINATION

Field Corrosion Potential Map

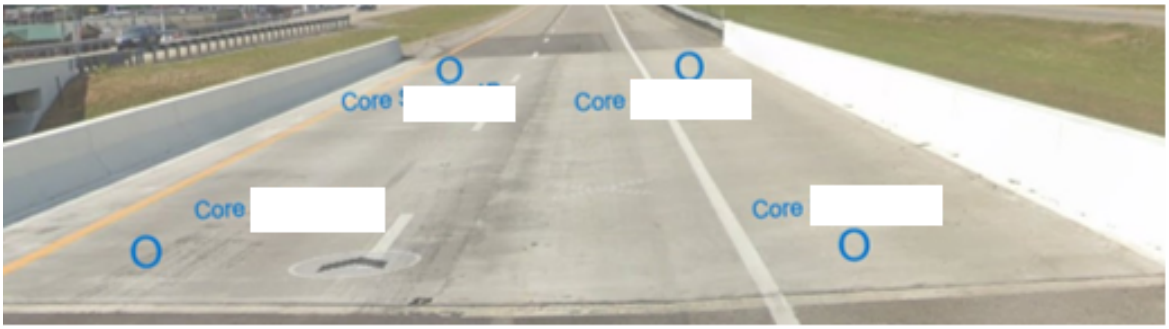


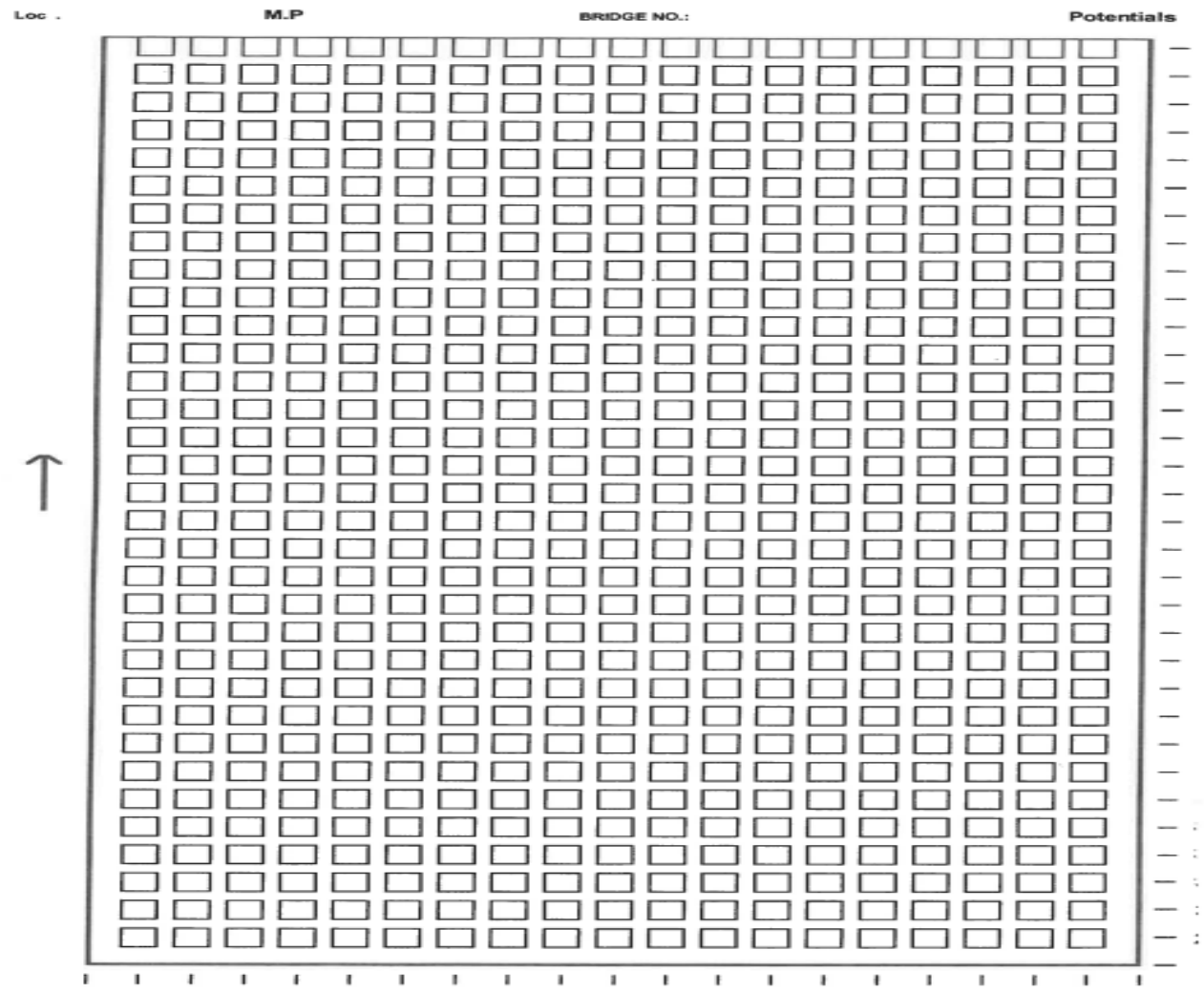
Core Loaction Maps

Northbound Core Locations



Southbound Core Locations

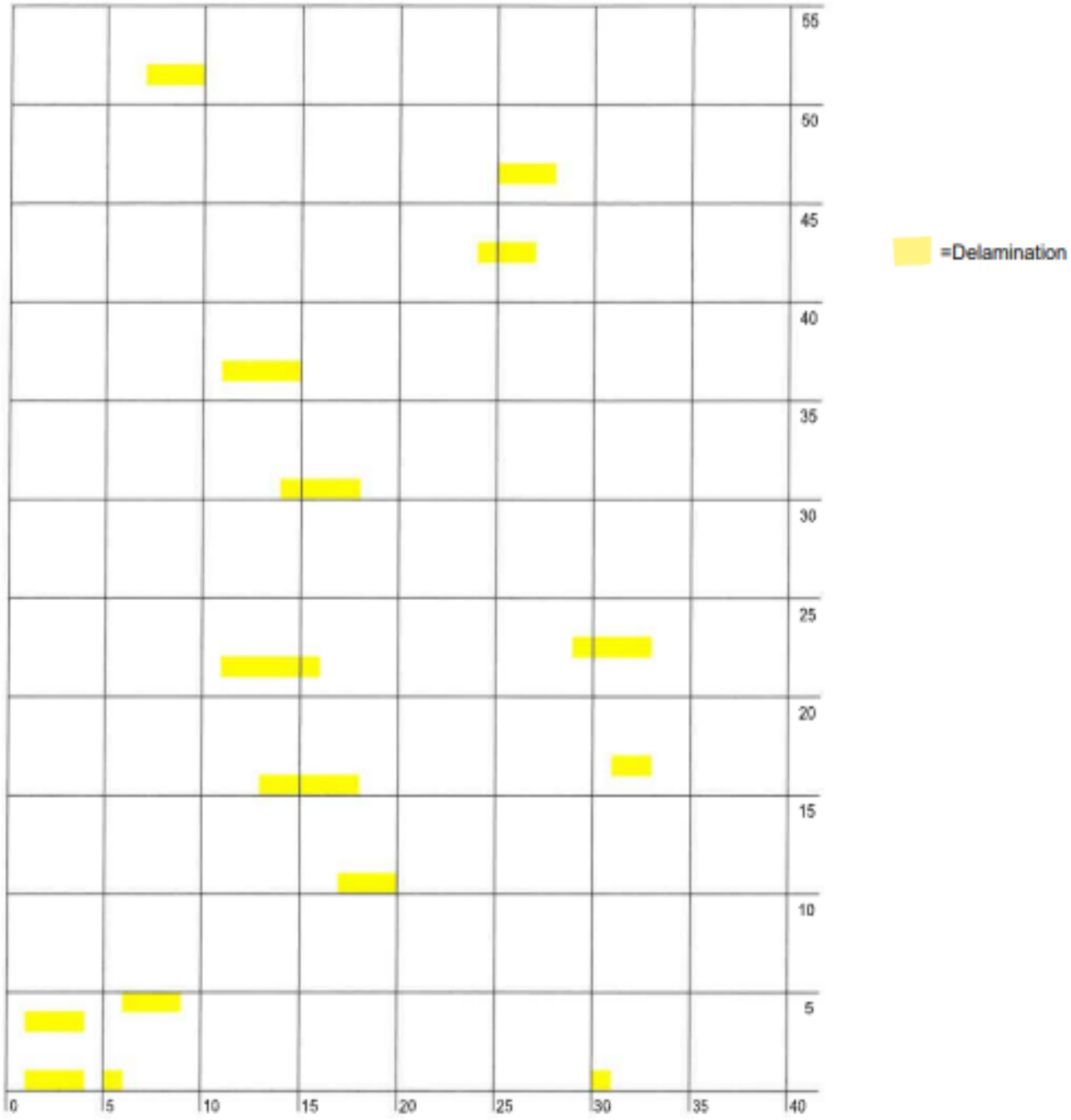



Loc .
M.P
BRIDGE NO.:
Potentials

Delamination Plotting

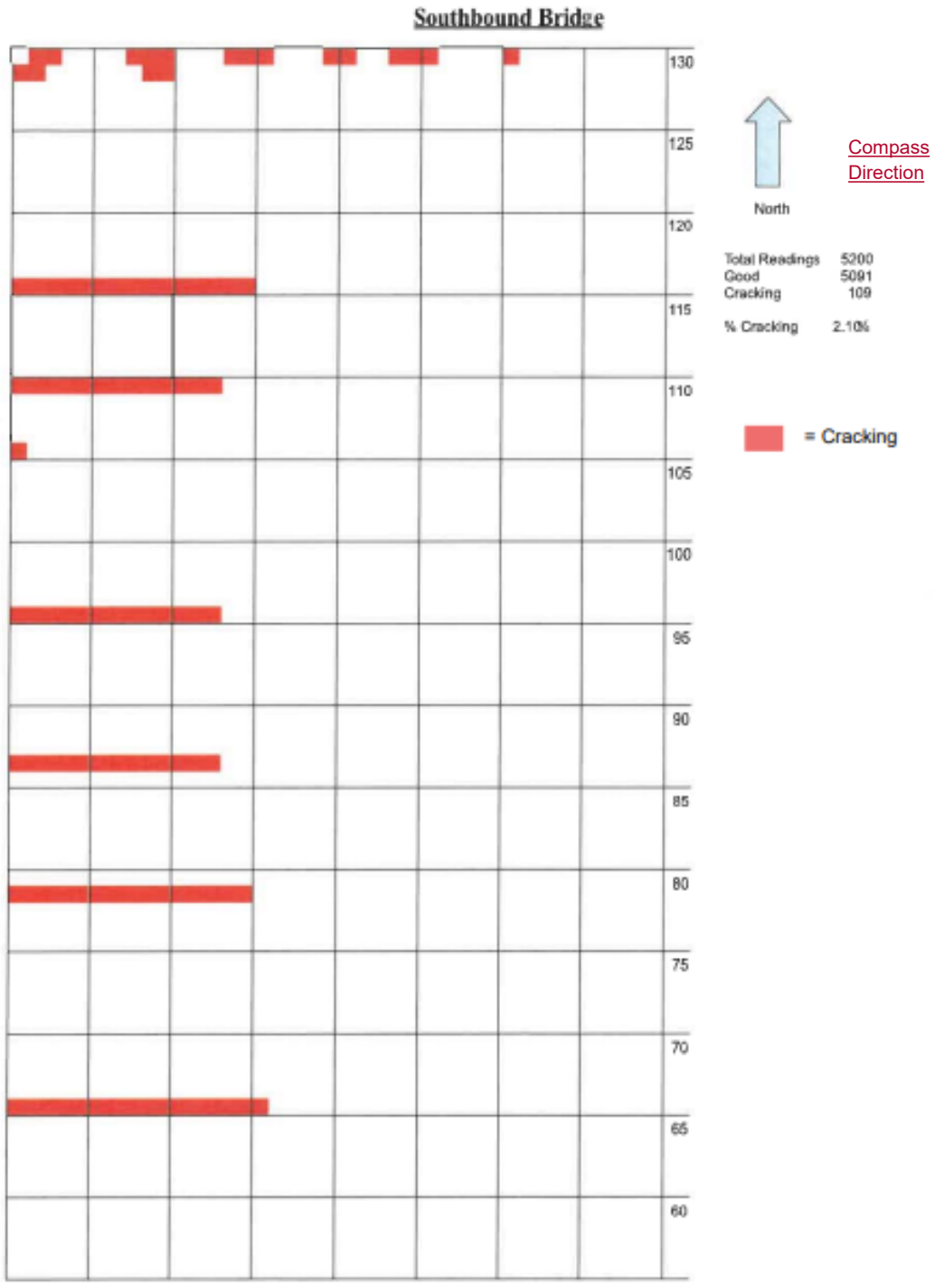
~~MP 601.00.49 ATTACHMENT 5~~
~~SIGNATURE DATE~~
~~Page 2 of 1~~

Southbound Bridge Continue



Crack Mapping

~~MP 601.00.49 ATTACHMENT 6~~
~~SIGNATURE DATE~~

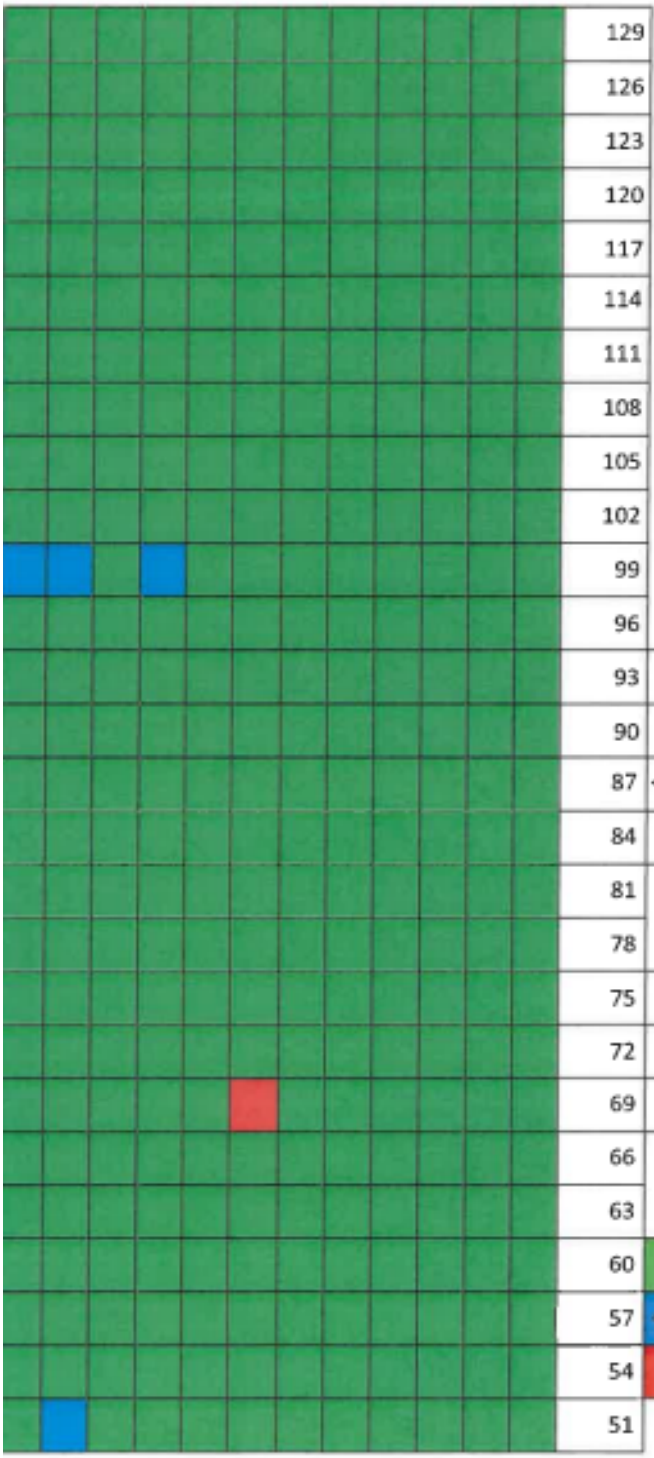


Chloride ~~Potential~~ Content Results Table

Core #	Depth in inches	lbs. of Chloride per CY of Concrete
C1	0.5 to 1.5	3
C1	1.5 to 2.5	1
C1	2.5 to 3.5	0
C1	3.5 to 4.5	0
C1	4.5 to 5.5	0
C1	5.5 to 6.5	0
C2	0.5 to 1.5	0
C2	1.5 to 2.5	0
C2	2.5 to 3.5	0
C2	3.5 to 4.5	0
C2	4.5 to 5.5	0
C2	5.5 to 6.5	0
C2	6.5 to 7.5	2
C3	0.5 to 1.5	2
C3	1.5 to 2.5	1
C3	2.5 to 3.5	1
C3	3.5 to 4.5	0
C3	4.5 to 5.5	1
C3	5.5 to 6.5	0
C4	0.5 to 1.5	2
C4	1.5 to 2.5	1
C4	2.5 to 3.5	1
C4	3.5 to 4.5	0
C4	4.5 to 5.5	0
C4	5.5 to 6.5	0
C4	6.5 to 7.5	0

Corrosion Potential Map

Northbound Bridge



North

Measured Potential	Amount
> (-0.20 V)	508
< (-0.35 V)	1
< (-0.20 V) and > (-0.35 V)	7
Total Readings	516

Probability of Steel Corrosion	Measured Potential
Less than 10%	> (-0.20 V)
Uncertain	< (-0.20 V) and > (-0.35 V)
More than 90%	< (-0.35 V)

Measured Potential	% Found in Bridge
> (-0.20 V)	**98%**
< (-0.20 V) and > (-0.35 V)	**1%**
< (-0.35 V)	**0.2%**

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

MATERIALS ADVISORY

OPERATING AND EMERGENCY PROCEDURES FOR NUCLEAR GAUGES

1. THE FOLLOWING NOTICES MUST BE POSTED:

1.1 This Notice (MA-1)

1.2 Nuclear Regulatory Commission (NRC) Form 3 (latest revision)

1.3 Regulatory Guide 8-13

1.4 NRC Regulations Part 21

1.5 NRC Appendix G Operating, Emergency, and Security Procedures

1.6 The notices must be posted in District Materials Laboratories, field offices, near storage areas, and all other areas where employees may be exposed to radiation from nuclear gauges. The notices must be located where employees can easily read them.

1.7 The NRC license, Parts 19 and 20 of the NRC regulations are available for all gauge users to read upon request. Copies are maintained at all District Materials Laboratories and Materials Control, Soils and Testing Division.

2. DOSIMETERS

2.1 All personnel who use, transport, or are near a nuclear gauge, must wear a dosimeter.

2.2 Only one employee may use a dosimeter during a three-month (quarterly) exposure period.

2.3 The dosimeter must not be stored near gauges, heat, strong light, or in a vehicle.

2.4 The dosimeters must be promptly changed when new dosimeters are received and the used dosimeters returned to Materials Control, Soils and Testing Division.

3. STORAGE OF NUCLEAR GAUGES

3.1 Nuclear gauges must not be stored in project field offices during work hours except as noted below.

3.1.1 A nuclear gauge may be placed in a field office during work hours for emergency charging. If employees are in the field office, the gauge must be at least 10 feet (3 m) from designated work areas. The field office must be locked if personnel are not present.

3.1.2 Only one gauge may be in the field office for emergency charging at one time.

3.2 If a gauge is stored in the field office during non-working hours, the source handle must be locked and the gauge locked in the shipping case. The case must be chained and locked in place or locked in a closet and the field office locked. Other storage areas on the project must meet the same requirements.

3.2.1 There may be cases when it is necessary to charge a gauge during non-work hours. In this case, the source handle must be locked and the gauge chained in place.

3.3 When a gauge is stored on a project, this is only temporary storage and extreme care must be taken to insure that employees and the public are not exposed to unnecessary radiation. The central storage area in each District and at Materials Control, Soils and Testing Division are the only permanent designated storage areas. Gauges should be stored at these facilities at all times when feasible. During periods when a gauge is not being used on a project, it must be stored in the storage building.

3.4 If it is necessary to leave a gauge in a vehicle overnight, the gauge must be locked in place, the vehicle locked, and parked in a fenced Division of Highways facility.

3.5 All storage areas, whether permanent or temporary, must be periodically checked for radiation levels. The radiation levels must be near background levels for the area.

3.6 All storage areas must be checked and evaluated on a regular basis to insure that the area is secure and all reasonable precautions have been taken to prevent a gauge from being stolen.

4. TRANSPORTATION OF NUCLEAR GAUGES

4.1 A gauge must be transported with the source handle locked and the gauged locked in the shipping case.

4.2 A gauge must be placed as far from the driver and passengers as possible. Transporting a gauge in the cab of a pickup, for example, is strictly prohibited.

4.3 The shipping case must be secured and locked to the vehicle to prevent movement and provide security measures.

4.4 The cargo area and vehicle must be locked at all times when the vehicle is not directly attended. Transporting a gauge in the back of an open pickup or a vehicle that cannot be locked is strictly prohibited.

4.5 The shipping papers for a gauge must be visible in the driver's compartment and in reach of the driver. The shipping papers must be removed from the vehicle if a gauge is not being transported.

4.6 All necessary precautions must be taken to prevent a gauge from being lost or stolen while being transported.

5. USE OF THE NUCLEAR GAUGE

5.1 When the source is extended from the shielded position, keep the gauge between the user and the exposed source. Place the source in the test hole as fast as possible keeping the gauge at arms length.

5.2 While the gauge is counting, move a few feet from the gauge.

5.3 Never touch the lower portion of the source rod.

5.4 Never remove the source rod from the gauge.

5.5 A gauge must be under the constant surveillance of the user when removed from the transport vehicle or place of storage.

5.6 Keep all unauthorized personnel away from the gauge.

5.7 Never place a gauge in an area where it can be damaged, run over, etc.

5.8 The gauge source handle must be locked when the gauge is not being used for testing.

6. CARE OF NUCLEAR GAUGES

6.1 Never allow the gauge to get wet.

6.2 Never store a gauge in a damp area.

6.3 Always keep the gauge clean. Periodically clean the shutter block and cavity in the bottom of the gauge. The source rod must be in the storage position. Always work at arms length during all cleaning operations.

6.4 It is the users responsibility to prevent a gauge from being damaged or abused.

7. TRAINING REQUIREMENTS

7.1 All gauge users must be properly trained in the use of nuclear gauges and in radiation safety before being allowed to use gauges without direct supervision.

7.2 All nuclear gauge users must have hazardous materials training at least every three years.

7.3 The training requirements and documentation necessary to verify training is specified in the NRC license. These requirements must be strictly enforced.

8. EMERGENCY PROCEDURES

8.1 In case of gauge is physically damaged, the following procedures are to be followed:

(a) Rope off the area and keep all personnel a minimum of

50 feet (15 m) from the gauge.

(b) Do not touch, move, or disturb the gauge.

(c) Make sure someone qualified remains outside the roped-off area at all times to insure that the gauge isn't touched or moved.

(d) Contact the District personnel in charge of the gauges and radiation safety.

Name: Telephone Number:

Name: Telephone Number:

(e) District personnel shall immediately contact the Radiation Safety Officer at Materials Control, Soils and Testing Division.

8.2 If a gauge is lost or stolen, immediately notify the personnel listed above.

9. CONTRACTORS' GAUGES

9.1 Division personnel shall follow the safety requirements contained herein and any other appropriate safety procedures when near a contractor's gauge.

9.2 Contractors are licensed by the NRC to possess and use their equipment. It is their responsibility to use the equipment in a safe manner.

Michael Mance, P.E.
Director
Materials Control, Soils and Testing Division

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

MATERIALS PROCEDURE

PROCEDURE FOR MONITORING THE ACTIVITIES RELATED TO SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

1. PURPOSE

1.1 To provide for management a means for checking the adequacy of equipment, procedures and testing techniques employed in the conduct of Sieve Analysis of Fine and Coarse Aggregate. For further emphasis, it is restated that this procedure is designed solely to provide a method for monitoring activities relative to sieve analysis and shall not be used in a manner that would revise or modify acceptance testing procedures for aggregate as set forth in other procedures and instructions.

2. SCOPE

2.1 This procedure shall be applied to the extent that all activities related to the sieve analysis of fine and coarse aggregate which are regularly conducted outside the District Central Laboratory shall be monitored. These activities are frequently performed at project sites, portland cement concrete batch plants and central mix plants, bituminous concrete plants and district sublabs.

3. PROCEDURE

3.1 All aggregate samples which have been tested for sieve analysis at locations other than the District Central Laboratory shall be retained until further disposition is determined by the District Materials Engineer/Supervisor. Care shall be taken to prevent loss of material when placing the weighed portions of the original sample into a clean, leak proof bag. If the original sample bag is used for this purpose, it should be leak proof and clean. Each sample shall be positively identified with a District Laboratory Number or a field sample number or both, whichever is available, and other information as necessary for complete identification. The gradation work sheet should completely identify the sample and a copy of this document placed in the sample bag would be quite adequate.

3.2 Approximately once each week, the District Materials Engineer/Supervisor or his authorized representative shall visit each location at which sieve analyses of fine and coarse aggregates have been conducted, and he shall select from the total LOT of samples which have been tested and accumulated since his last visit at least one sample to be tested in the District Central Laboratory. It is most important that the sample selection be made by the District Materials Engineer/Supervisor or his authorized representative in as random a manner as possible and without influences that would tend to give particular samples a greater chance of being selected. To aid in accomplishing the foregoing, all aggregate samples from which the selection is to be made should be prominently displayed, and a frequent check should be made to ascertain that the collection of displayed samples is complete.

3.3 Each aggregate sample shall be tested in the District Central Laboratory using the sieves and test procedures set out in the governing specification for the item represented by the sample.

The following statement shall be written on the work sheets:

"MONITOR" test made to check lab. no. where the District Laboratory Number for the original test is written in the blank space. Obtain a copy of the original gradation test report and keep it with the MONITOR test work sheets. No formal reporting of the MONITOR test worksheets. No formal reporting of the MONITOR test data need be done. Testing should be done at the earliest practical time in order to expedite the evaluation.

NOTE: If the MONITOR sample has previously been washed in conformance with the AASHTO T-11 test procedure, then this procedure need not be employed in the District Central Laboratory. Accordingly, the quantity lost in the initial application of the AASHTO T-11 shall be considered the total minus #200 sought and this quantity shall be added to the weight of the MONITOR sample prior to making test computations.

3.4 The MONITOR test data shall be compared with the original test data in the following manner:

3.4.1 Determine the differences in test values for each of the specification sieves by subtracting the smaller test value from the larger test value.

3.4.2 Obtain the sum of the differences in test values.

3.4.3 Determine the average difference in test values by dividing the sum of the differences as described in 3.4.2 above by a whole number corresponding to the number of sieves used in the gradation test. The value thus obtained will be called the AVERAGE TEST DIFFERENCE (ATD).

3.5 The following guide shall be used as an aid in evaluating the ATD and determining appropriate actions to be taken.

3.5.1 If the value of the ATD is equal to or less than 2.5

(ATD <= 2.5), the comparison would probably be considered favorable and no further investigation would be made. As a consequence, the testing technician should be instructed to discard the LOT of samples from which the MONITOR sample was selected.

3.5.2 If the value of the ATD is greater than 2.5 but equal to or less than 4 (2.5 < ATD <= 4), the comparison would probably be considered questionable and approximately one third of the remaining samples in the LOT from which the MONITOR sample was selected should be tested and they should each comply with the requirement set out in 3.5.1 above. If each of the latter tests does comply, then the action set out in 3.5.1 should be taken. If each of the latter tests does not comply, then all remaining samples should be tested and the action set out in 3.5.3 below should be taken.

3.5.3 If the value of the ATD is greater than 4 (ATD > 4), all remaining samples in the LOT from which the MONITOR sample was selected should be tested. A sufficiently thorough investigation should be made by the District Materials Engineer/Supervisor to allow him to make a judgement regarding the cause for the unfavorable test comparison. The results of this investigation and all pertinent test data will be

reported in a District Materials Inspection Report (DMIR). The investigation and reporting shall be accomplished at the earliest practicable time so that the situation may be most expeditiously resolved. The Materials Control, Soils and Testing Division should be consulted when the action set out in this article is to be taken.

3.6 At the end of each fourth evaluation period, approximately four weeks, the District Materials Engineer/Supervisor shall prepare a report entitled "Implementation of Procedures for Monitoring Activities Related to the Sieve Analysis of Fine and Coarse Aggregate". The report will generally consist of a single page on which six columns of information or data is recorded as follows:

3.6.1 Column 1 shall be headed "Test Location". Give job location, or plant or sublab location where tests were conducted.

3.6.2 Column 2 shall be headed "Date of last Monitor Sample Selection".

3.6.3 Column 3 shall be headed "Date of this Monitor Sample Selection".

3.6.4 Column 4 shall be headed "Number of Samples in LOT". Give the number of samples in LOT from which the Monitor sample was selected.

3.6.5 Column 5 shall be headed "Standard Aggregate Size". Give item number for base course materials.

3.6.6 Column 6 shall be headed "Average Test Difference". Report value of ATD to nearest 0.1. The reports shall be identified as having been issued in accordance with this memorandum, ML-25.

3.7 The reports described in article 3.5.3 and subsection 3.6 shall be distributed as follows:

3.7.1 District Materials Inspection Report:

1 copy to District Materials File
1 copy to MCS&T Division
1 copy to Contract Administrator
1 copy to District Engineer, if requested

3.7.2 Four-Week Reports:

1 copy to District Materials File
1 copy to MCS&T Division
1 copy to Contract Administration
1 copy to District Engineer

Michael Mance, P.E.
Director
Materials Control, Soils and Testing Division

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

MATERIALS PROCEDURES

QUALITY ASSURANCE PROCEDURES FOR PORTLAND CEMENT CONCRETE

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1. PLANT AND EQUIPMENT INSPECTION STICKERS

1.1 Physical plants and equipment, which prepare materials for, or deliver materials to, applicable projects shall be regularly inspected and approved by an authorized representative of the Division. The process for this inspection is shown in the Plant Inspection Flow Chart in Attachment 1.

1.2 The inspections and approval shall be documented on the MC-4 Form (sample show in Attachment 2 and live form available on the MCS&T webpage) and confirmed by an inspection sticker supplied by the Materials Control, Soils & Testing Division (MCS&T). The inspection sticker will indicate the following:

1. Name of inspector
2. Plant or portion thereof, or singular piece of equipment inspected.
3. Date of inspection
4. Date of expiration of approval
5. Lab Number

1.3 Inspections may be made at any time at the discretion of the Division, and the status of the inspected facility shall be determined by the latest inspection. The date of expiration of approval, as noted on latest inspection sticker, shall be the last day on which the facility is considered to be approved by Division, and such facility must have an approved status at time of preparing materials for or delivering materials to applicable projects.

1.4 The sole purpose of the inspection sticker is to inform all concerned that a plant, or portion thereof, or a singular piece of equipment has been inspected. The sticker indicates that it has been found to substantially meet all requirements of the specifications and is approved to supply materials to applicable projects. Said inspection sticker shall therefore be affixed to the equipment or displayed in other manners so that the purpose as above stated will be fulfilled.

1.5 The stickers shall be applied and each District shall maintain records of these inspections in ProjectWise. The records shall include all the items listed in 1.2.

1.6 A plant or portion thereof, or a singular piece of equipment, shall be approved for a period not to exceed six (6) months. The period of approval shall be determined, in general, by the age, physical condition, or durability of the plant or equipment, and the inspection interval shall be such that the Division will have reasonable assurance that the plant or equipment is maintained in an acceptable manner.

1.6.1 During the plant inspection, the plant must demonstrate their capability to produce an E-Ticket as defined in Section 109.20.1 of the Specifications. A sample ticket shall be provided to the inspector, and compliance with this requirement shall be documented on the MC-4 form.

1.6.2 After each time a plant has been inspected, the District shall notify the Director of MCS&T, or their designee. MCS&T will generate a list of approved plants and post these on the Division Webpage[1].

1.7 Additional information regarding inspections and a sample of an inspection sticker is contained in Attachment 3.

2. QUALITY ASSURANCE IN PORTLAND CEMENT CONCRETE

2.1 PURPOSE

The purpose of this procedure is to establish guidelines which will aid Division personnel in implementing in a prescribed and uniform manner the Division's Quality Assurance Program for portland cement concrete, said program being directed primarily to maintaining a predetermined and acceptable level of assurance that portland cement concretes do conform to their governing specification.

2.2 DEFINITION OF TERMS

2.2.1 QUALITY ASSURANCE

Quality Assurance is an expression of confidence which the Division has in its program of acceptance testing and inspection which determines conformance of materials and construction to governing specification. A Quality Assurance Program is a planned program of acceptance testing and inspection which is conducted by the Division for the express purpose of maintaining a predetermined and acceptable level of assurance that construction materials do conform to governing specifications. Part of any Quality Assurance Program, is an awareness and knowledge of the Producer's Quality Control Program and the level of Quality Control maintained by that Producer.

2.2.2 QUALITY CONTROL

Quality Control is a planned program of testing, inspection and related activities conducted by a concrete Producer for the purpose of measuring the various properties of concrete and its component materials which are governed by the specification and controlling these properties within the limits of the specification.

[1] https://transportation.wv.gov/highways/mcst/pages/default.aspx

2.3 GENERAL DISCUSSION

The Division and the Contractor-Supplier industry have jointly participated in a program whose primary objective is to improve the quality of concrete in highway construction. One of the outcomes of this program is that the Division will run a smaller risk of having non-conforming materials incorporated into the work, and the Contractor-Supplier industry will run a smaller risk of having suitable materials rejected.

The following major developments are outgrowths of the program just mentioned:

2.3.1 Portland cement concrete technician's certification is available in the Contractor-Supplier industry to implement a program of Quality Control.

2.3.2 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to do Quality Control of portland cement concrete and to have in his service a Certified Portland Cement Concrete Technician is specified in Sub-articles 501.4.2 and 601.4.2 of the Standard Specifications.

2.3.3 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to have a field laboratory which is equipped and maintained in specified manner so as to aid in the conduct of a Quality Control Program is specified in Sub-articles 501.5.1 and 601.5.1 of the Standard Specifications.

2.3.4 Concrete batch plants and hauling equipment are regularly inspected by the Division, and their approval as conforming to requirements of governing specification is attested to by an inspection sticker (See Section 1 of this MP for details).

2.3.5 The requirement to do concrete design, using the particular sources of materials that are to be used in the work, is specified in articles 501.3 and 601.3.1 of the Standard Specifications. This requirement allows commercial concrete suppliers to have laboratory design work done for the various classes of concrete to be supplied, and it guards against the possibility of source materials changing appreciably and affecting the quality of subsequent concrete work.

Although all producers should maintain an acceptable level of Quality Control, it is reasonable to assume that a number of producers will maintain a level of Quality Control well above the minimum accepted level.

It is generally agreed that an acceptable level of Quality Assurance may be maintained with less acceptance testing and inspection when the level of Quality Control is increased.

The capability to perform a positive and sustained level of Quality Control in practically all producer plants today is now well established. Also, the Division has the means for measuring the level of Quality Control maintained by each producing plant. Accordingly, it would be desirable to pursue a Quality Assurance Program which takes into account the level of Quality Control in a Producer's plant so that an acceptable level of Quality Assurance could be maintained with a minimum cost (man-hours and dollars) to the Department. As previously stated the purpose of this procedure is to establish guidelines

which will aid Department personnel in implementing, in a prescribed and uniform manner, such a Quality Assurance Program.

2.4 DIRECTIVE

Concrete plants will be inspected in accordance with Section 1 of this MP and the condition of conformance will be determined. Those plants which are found to conform to the specifications will be identified as Class A plants, and those which do not conform will be identified as Class B plants. The level of Quality Control at each concrete plant will also be evaluated.

Those plants which have a high level of Quality Control will be considered to have a Level 1 Quality Control, and those plants which have a lower level of Quality Control will be considered to have a Level 2. All concrete plants will then be rated with one of the following classification numbers Al, A2 or B.

2.4.1 LEVEL 1 QUALITY CONTROL

All plants producing concrete which reasonably conforms to the specification requirements, and which satisfies the following additional requirements, will be considered to have LEVEL 1 Quality Control:

2.4.1.1 The compressive strength of the concrete produced by the plant shall have a coefficient of variation of 0.15 or less and the average compressive strength shall be equal to or greater than the specified requirement plus 2 1/2 standard deviations.

2.4.1.2 The air content of the concrete produced by the plant shall have a coefficient of variation of 0.18 or less, and the average air content shall not differ from the specified optimum value by more than one standard deviation.

2.4.1.3 The consistency of the concrete produced by the plant shall have a coefficient of variation of 0.20 or less, and the average consistency shall not differ from the specified optimum value by more than two standard deviations.

2.4.1.4 The plant shall maintain an adequate Quality Control Program for aggregate gradation.

2.4.2 LEVEL 2 QUALITY CONTROL

All plants which fail to meet one or more of the requirements specified in 2.4.1 will be considered to have LEVEL 2 Quality Control.

2.4.3 PHYSICAL PLANT-EVALUATION

District personnel will inspect and evaluate concrete plants in conformance with Section 1 of this MP. A copy of the inspection data, which is specified in Subsection 1.5, will be transmitted to the Materials Division immediately after the inspection is completed.

2.4.4 LEVEL OF QUALITY CONTROL - EVALUATION

The evaluation of the level of Quality Control maintained by concrete plants will be performed and maintained current by the Materials Division. The initial evaluation of the level of Quality Control will be based on an analysis of historical data. There after, tests for strength, entrained air, and consistency will be made by certified personnel on random samples taken from plant production. This test data will be used by the Materials Division to update the statistical parameters and maintain a current and valid evaluation of each plant's Quality Control level. The Materials Division will publish a list of concrete plants with their rating numbers, said publication to be updated monthly.

2.4.5 CLASS Al PLANTS - TEST AND INSPECTION REQUIREMENTS

Concrete from Class Al concrete plant shall be sampled and tested by certified personnel on a project-by-project basis, at random, with the frequency specified in Table 1 of MP 601.03.50.

Plant inspection and monitoring of batching operations at Class Al concrete plants shall be performed by District personnel on a random basis during production for Division Projects.

A concrete batch ticket, as defined in Section ~~4.2.9~~ 5.2.9 of MP 601.03.50, shall be initiated and signed at the plant and accompany each delivery to the project.

2.4.6 CLASS A2 PLANTS - TEST AND INSPECTION REQUIREMENTS

Concrete from Class A2 concrete plants shall be sampled and tested by certified personnel on a project- by-project basis, at random, with the frequency specified in Table 1 of MP 601.03.50.

Plant inspection and monitoring of batching operations at Class A2 concrete plants shall be performed by District personnel on a continual basis during the time that concrete for items other than miscellaneous concrete are being produced for Division projects.

2.4.7 CLASS B PLANTS

Concrete purchased by a Contractor for use on Division projects shall be supplied from Class Al or A2 plants. Concrete purchased through competitive bidding with Purchase order contracts shall be supplied from Class Al or A2 plants. Class B plants are not considered to be eligible to compete with Class A plants in the furnishing of concrete to applicable projects.

In the event it is not practical to obtain small quantities of concrete for miscellaneous items (See 2.4.8) from a Class Al or A2 plant and a survey reveals that a Class B plant is conveniently situated with respect to the construction site, then a direct purchase of concrete by the Division from the Class B plant may be accomplished in conformance with the applicable Division procedures. The direct purchase of concrete from Class B plants shall also be made to conform to the requirements set out in Subsection 2.5 entitled

QUALITY ASSURANCE OF DIRECT PURCHASE CONCRETES FROM CLASS B PLANTS. Plant inspection at Class B plants and the sampling, testing and documentation of concrete from Class B plants shall also conform to the requirements set out in Subsection 2.5.

2.4.8 SMALL QUANTITIES FOR MISCELLANEOUS ITEMS

Miscellaneous concrete shall be defined as relatively small quantities incorporated into items that will not adversely affect the traffic carrying capacity of a completed facility. Such items would not include any concrete intended for major structures permanent mainline or ramp pavements, or other structurally critical items.

The following items are suggested as a guideline in establishing miscellaneous concrete:

1. Sidewalks
2. Curb and gutter
3. Slope walls for under drain outlet pipes
4. Temporary pavements and pipe crossings
5. Building floors
6. Slope paving and headers
7. Paved ditch or gutter
8. Small (less than 36” diameter) culvert headwalls
9. Catch basins, manhole bases, inlets, and junction boxes (and adjustments of such items) not located in the roadway
10. Foundations for breakaway supports
11. Utility trench fills
12. Cast-in-place survey markers

2.5 QUALITY ASSURANCE OF DIRECT PURCHASE CONCRETE FROM CLASS B PLANTS

2.5.1 PURPOSE

The purpose of this instruction is to provide guidance in specifying direct purchase of concrete and for inspection and testing of direct purchase concrete from Class B plants, so that a predetermined and acceptable level of Quality Assurance may be maintained by Division personnel. This instruction is set apart from the main directive in Subsection 2.4 because it is the intent to have concrete from Class B plants used in highway work only when it is not practical or economical to obtain concretes from Class A1 or A2 plants.

2.5.2 DEFINITION OF TERMS

2.5.2.1 Direct Purchase - Direct purchase is a formal procedure used to purchase materials for government agencies, including the Division of Highways) when it is not practical or economical to use the procedure of competitive bidding. Direct purchase requisitions will always specify the name of the proposed supplier as well as product name, quantity, specifications, etc.

2.5.3 GENERAL DISCUSSION

When highway work requiring portland cement concrete is being done by Division forces, and it is found to be impractical or uneconomical to obtain concrete from a Class Al or A2 plant but that it would be practical to obtain it from a Class B plant, then the purchase of concrete from a Class B plant shall be made to conform to the requirements of article 2.5.4.

2.5.4 INSTRUCTION

The purchase of portland cement concrete from a Class B plant will be permitted only after a field condition survey has been conducted and properly documented which indicates that it would be impractical and uneconomical to obtain concrete from a Class Al or A2 plant, and that a Class B plant does exist from which a direct purchase of concrete could practically and economically be made.

Procedures for making direct purchases of concrete shall be as prescribed by the appropriate State Agency. The method of specifying direct purchase concrete shall be as follows:

1. Specify the class of concrete.
2. Specify that the concrete mix design will be approved by the Division.
3. Specify that a Division inspector will be at the plant during the full time that concrete is being batched to direct the batching operation, and that batching shall not commence until the inspector is present.

In addition to the Quality Assurance activity performed at the plant, the Division will sample and test as deemed necessary all direct purchase order LOTS of concrete used in highway maintenance work.

3. PLANT APPROVAL STATUS

3.1 PLANT CERTIFICATION

3.1.1 When District Personnel determine that a Concrete Plant, which is not already listed as a Class A1, A2, or B plant on the Division's Approved Source Page, has met the requirements of this Materials Procedure, the Specifications, and all other applicable Materials Procedures, they shall notify MCS&T Division and provide all applicable documentation and information to MCS&T Division.

3.1.2 MCS&T Division shall then notify the subject Concrete Plant that they are approved to begin production for WVDOH projects. MCS&T Division shall also add that Concrete Plant to the Division's Approved Source Page and begin monthly evaluations of that Concrete Plant as outlined in this MP and MP 711.03.26.

3.2 PLANT DE-CERTIFICATION

3.2.1 When District Personnel determine that a Concrete Plant, which is listed as a Class A1, A2, or B plant on the Division's Approved Source Page, is not complying with the

requirements of this MP, the Specifications, or any other applicable Materials Procedure, they shall immediately notify MCS&T Division and provide all applicable documentation and information to MCS&T Division. This information shall include a summary of the reason(s) for the de-certification of the subject Concrete Plant.

3.2.2 MCS&T Division shall then immediately notify the subject Concrete Plant and all applicable WVDOH District and Divisions that the subject Concrete Plant is no longer approved to supply concrete for WVDOH projects.

3.2.3 If the subject Concrete Plant, which has been de-certified and removed from approved status, desires re-approval, they shall initiate the re-approval process by submitting a plan of corrective action, which addresses all of the reasons for which that Plant was de-certified. This plan of corrective action shall be submitted to the District in which the Concrete Plant is located and to MCS&T Division.

_____

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MP 601.05.50 Steward – Cement and Concrete Section
RLS:T
Attachments

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.

3.2.1. All fabricators must set up their invoicing as an E-Ticket that meets the requirements of Section 109.20.1 of the Standard Specification prior to approval.

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 class~~es~~ 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.

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 cubic 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 28-day compressive strength cylinders shall be fabricated from every 20 cubic yards of concrete, or fraction thereof, with a minimum of one set per day per mix design. 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. 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.

6.1.1. Shipping invoices shall document the assigned Laboratory Reference Number, type of material, number of pieces, size, and cast dates. All Division invoicing must be submitted as an E-Ticket to the project that meets the requirements of Section 109.20.1 of the Specifications.

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 as described in the following subsections.

6.2.1. Minor defects may be repaired in accordance with the pre-approved repair procedures which should be incorporated within the Fabricator QC Plan. Cracks 4 mils or less shall be sealed by silane; and cracks between 4 mils and 16 mils shall be repaired by epoxy injection in accordance with Section 603.10.2. Any crack 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 and issue a 7-digit Laboratory Reference Number for acceptance.

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

6.2.2. Major defects shall include dimensions that exceed tolerances, failure to reach required compressive strength, cracks greater than 16 mils, and any defect that could be considered structural. Lagging dimensions shall be 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. When items are load bearing, they shall be evaluated by the Designer for structural adequacy and then may be accepted by DMIR, pending concurrence by the District, and or the Engineer of Record. If a product is approved for repair, and if repairs appear satisfactory, the Inspector shall 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.

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

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)

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

Formula 2 (Constructed by Division)

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

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.

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Materials Control, Soils and Testing Division

MP 604.02.40 Steward – Cement and Concrete Section
MM:T
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 AND TESTING DIVISION

MATERIALS PROCEDURE

MIX DESIGN FOR PORTLAND CEMENT CONCRETE

1. PURPOSE

1.1 To establish a procedure for testing the physical properties of a proposed mix design.

1.2 To establish criteria for evaluating the test data to arrive at acceptable batch proportions for an approved mix design.

2. SCOPE

2.1 This procedure shall apply to the design of all portland cement concrete which is required by the specifications to be batched in accordance with an approved mix design. This procedure shall also apply to the design of self-consolidating concrete (SCC) specified in Section 603, but not to normal (non-SCC) concrete specified in Section 603.

3. REFERENCED DOCUMENTS

3.1 AASHTO Standards:

1. M 201, Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
2. R 18, Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
3. R 39, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
4. R 76, Standard Practice for Reducing Samples of Aggregate to Testing Size
5. T 11, Standard Method of Test for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
6. T 19, Standard Method of Test for Bulk Density (Unit Weight) and Voids in Aggregate
7. T 22, Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens
8. T 27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
9. T 84, Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate
10. T 85, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
11. T 119, Standard Method of Test for Slump of Hydraulic Cement Concrete
12. T 121, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

13. T 152, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
14. T 196, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
15. T 197, Standard Method of Test for Time of Setting of Concrete Mixtures by Penetration Resistance16. T 231, Standard Practice for Capping Cylindrical Concrete Specimens
16. T 358 Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration T309, Standard Method of Test for Temperature of Freshly Mixed Portland Cement Concrete
17. T395 Standard Method of Test for Characterization of the Air-Void System of Freshly Mixed Concrete by the Sequential Pressure Method

3.2 ASTM Standards:

1. C 1231, Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens
2. C 1567 Standard Test Method for Determining the Potential Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

3.3 WVDOH Materials Procedures[1]:

1. MP 700.00.06, Aggregate Sampling Procedures
2. MP 603.06.20, Test Method for the Determination of Bond Strength Between Prestressing Steel Strand and Self-Consolidating Concrete (SCC)

3.4 WVDOH Forms:

1. WVDOH Form T 301E, A-Bar Calculation Worksheet
2. Optimized Aggregate Gradation (OAG) Worksheet
3. Excel Spreadsheet for 711.03.23

4. TEST PROCEDURE

4.1 With the exception of SCC produced in accordance with Section 603, mix designs shall be performed in accordance with the applicable requirements of AASHTO R39 (ASTM C 192) by a Division Approved Laboratory. To obtain Division approval, a laboratory must be accredited by the AASHTO Accreditation Program for AASHTO R18 for the following Standards: AASHTO M201 (ASTM C511), AASHTO R39 (ASTM C192), AASHTO T22 (ASTM C39), AASHTO T119 (ASTM C143), AASHTO T121 (ASTM C138), AASHTO T152 (ASTM C231), AASHTO T196 (ASTM C173), AASHTO T197 (ASTM C403), AASHTO T231 (ASTM C617) or ASTM C1231, , AASHTO T309 (ASTM C1064), AASHTO T11 (ASTM C117), AASHTO T19 (ASTM C29), AASHTO T27 (ASTM C136), AASHTO T84 (ASTM C128), AASHTO T85 (ASTM C127), AASHTO R76 (ASTM C702), AASHTO T 358. In addition, all personal performing the SAM test must be certified by the

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

Division to run AASHTO T395. A listing of these laboratories, that are approved to develop concrete mix designs for the Division, is available on the WVDOH, MCS&T Web Page[2]. Requests to be placed on that list of Division Approved Concrete Mix Design Labs shall be sent to the following e-mail address: DOHMCSnTconcretelab@wv.gov. To be placed on that list, all Division Approved Laboratories shall agree to allow the WVDOH, CCRL, and AASHTO re:source to freely share information about assessment reports, proficiency samples, corrective actions, quality management system, and personnel competency and certification records.

4.2 The following information for each of the materials listed below that are to be used in the proposed mix design shall be listed in Attachments 1 and 6-ASR. For mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1, the following information for each of the materials listed below that are to be used in the proposed mix design shall be listed in Attachments 1 OAG and 6-ASR OAG. The Ā requirements will not apply for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. Attachments 1 S-P and 6-ASR shall be used for SCC produced in accordance with Section 603.

4.2.1 Mix Design Component Materials

Cement:	Type, Materials Code, SiteManager Materials Code, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, Alkali Content
Supplementary Cementitious Material (SCM):	Type, Materials Code, SiteManager Materials Code, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, Alkali Content
Chemical Admixtures:	Type, Materials Code, SiteManager Materials Code, Source and Location, Source Code, Producer/Supplier Code
Coarse Aggregate:	Type, Materials Code, SiteManager Materials Code, Size, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, Absorption, A-Bar, Unit Weight, ASR Aggregate Reactivity Class
Fine Aggregate:	Type, Materials Code, SiteManager Materials Code, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, Absorption, A-Bar, Fineness Modulus, ASR Aggregate Reactivity Class

The mass and volume of each material that is to be used in each batch shall be listed in Attachment 2. Attachment 2 OAG shall be used for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. Attachment 2 S-P shall be used for SCC produced in accordance with Section 603.

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

4.2.2 The aggregate correction factor, as defined in AASHTO T 152, shall be listed in Attachment 3. Attachment 3 OAG shall be used for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. Attachment 3 S-P shall be used for SCC produced in accordance with Section 603.

4.2.3 The completed WVDOH form T301E, A-Bar calculation worksheet, used to establish the target A-Bar, shall be included in the mix design submittal package. An A-Bar calculation worksheet is not required to be included with the mix design submittal package for SCC produced in accordance with Section 603 and those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. The completed optimized aggregate gradation (OAG) worksheet shall be included in the mix design submittal package.

4.2.4 Information (i.e. raw data) pertaining to the compressive strength test results of each cylinder shall be included in the mix design submittal package. This raw data shall include the specimen test age, date tested, cylinder ID, average cylinder diameter, maximum load applied to the cylinder, type of fracture, and compressive strength of the cylinder.

4.3 All classes of the concrete (except Class H, concrete for specialized overlays, and SCC produced in accordance with Section 603) for the proposed mix design shall be batched in at least five separate batches. Two of the batches shall be proportioned to produce a mix having a minimum cement factor. Two of the batches shall be proportioned to produce a mix having a minimum cement factor equal to the specified minimum cement factor plus one bag of cement [94 lb. (42.6 kg)]. These batches at the minimum cement factor plus one bag of cement shall be proportioned at a different water-cement ratio (w/c) that the batches at the minimum cement factor. A fifth batch shall also be proportioned to produce a mix at the minimum cement factor, but this batch shall be proportioned at a different water-cement ratio than the previous four batches. The slump tolerance in Section 4.4 shall not apply to this fifth batch. All batches described above shall maintain the same replacement percentage of SCMs including plus one bag.

4.3.1 The Sequential Air Meter (SAM) test shall be performed for each trial batch of any mix design used on bridge decks. The average SAM number shall be recorded on Attachment 3 and must be less than or equal to 0.20 psi for establishment of the mixture proportions in accordance with AASHTO T 395 for mix design approval.

Class H concrete, concrete for Specialized Overlays, as set forth in Section 679 of the specifications, and SCC produced in accordance with Section 603 for the proposed mix design shall be batched in at least two separate batches.

The batches for Class H concrete shall be produced at the cement factor for Class H concrete that is required in the specifications. The surface resistivity tests shall be performed accordance with AASHTO T 358, specified in Section 601.3 shall be performed, at the same test age, on each of these batches, and the same method of curing shall be used for all the test specimens.

The batches for specialized concrete overlays shall be produced at or above the minimum cement factor specified in Section 679.2.2.1 or 679.2.2.2. The surface resistivity test shall be performed, at the same test age, on each of these batches, and the same method of curing shall be used for all the test specimens.

The information (i.e. raw data), from which each surface resistivity test result was derived, shall also be included in the mix design submittal package.

The batches for SCC for prestressed concrete members shall be produced as outlined in Section 603.6.2.1 and at the cement factor required in Section 603.6.3.1.

4.4 Each batch of concrete shall be tested in the plastic state for air, consistency and yield. Each batch shall be adjusted as necessary to produce a plastic concrete having an air content, consistency, and yield equal to the specified value plus or minus a reasonable laboratory working tolerance. The following tolerances shall be used as a guide for all classes of concrete except SCC produced in accordance with Section 603: Air Content, ± ½ percent; Consistency, ± ½ in. (± 12 mm) of slump; Yield, ± 2 percent.

4.4.1 For SCC produced in accordance with Section 603, testing shall begin at the time immediately after the mixing sequence is completed. This time shall be designated as T_0. Temperature, air content, consistency, T_{50}, VSI, passing ability, rapid assessment of static segregation resistance, segregation resistance, unit weight, and yield tests shall be conducted on these batches and shall be within the tolerances set forth in Table 603.6.2.1A.

Air Content, consistency, and passing ability tests shall be conducted every thirty minutes until either the air content falls below the target value by more than 1.5%, the slump flow falls below the target spread by more than 2.0 inches (50 mm), or the J-Ring value falls below the target value by more than 1.5 inches (38 mm). For each time of testing, these values shall be plotted versus time after batching. Linear interpolation shall be used to determine the exact time when either the air content falls below the target value by more than 1.5%, the slump flow falls below the target spread by more than 2.0 inches (50 mm), or the J-Ring value falls below the target value by more than 1.5 inches (38 mm). The elapsed time, after T_0, when this occurs shall be noted as the "Workable Period" and shall be recorded in Attachment 2 S-P. This workable period shall be used as the time frame in which the entire member shall be construction, reference Section 603.6.7.

4.5 When the properties of a concrete batch have been established within acceptable limits, seven 4 by 8 in. (100 by 200 mm) cylinders shall be made from each batch produced in Section 4.3 (or 4.3.1) and tested in compression at the following ages: one cylinder at age 24 hours ± 2 hours (the exact age to the nearest hour at time of test shall be noted on the report); one cylinder at age 3 days; one cylinder at age 7 days; one cylinder at age 14 days; and three cylinders at age 28 days. The values of the physical properties of each mix produced in Section 4.3 (or 4.3.1) shall be the average of the physical properties established in the first two mixes produced at the minimum cement factor, the average of the physical properties established in the two mixes produced at the

minimum cement factor plus one bag of cement, and the physical properties of the fifth batch at the minimum cement factor and different water-cement ratio. These values shall be listed in Attachment 3. 4 by 8 in. (100 by 200 mm) cylinders shall be permitted for SCC produced in accordance with Section 603. The results of these tests shall be listed in Attachment 3 S-P.

4.5.1 The following properties of each batch of concrete produced in Sections 4.3 (or 4.3.1) shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature. The following properties of each batch of concrete produced in Sections 4.3 (or 4.3.1) shall be listed in Attachment 2 OAG, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1: optimized aggregate gradation (OAG) worksheet, consistency, air content, unit weight and yield, water-cement ratio, and temperature.

4.5.2 For SCC produced in accordance with Section 603, from one of the SCC trial batches required in 603.6.2.1, six more cylinders shall be fabricated for modulus of elasticity testing, eight more cylinders shall be fabricated for creep testing, three specimens shall be fabricated for length change testing, three specimens shall be fabricated for surface resistivity testing , and three specimens shall be fabricated for freeze-thaw resistance testing. Casting of all Class S-P specimens to be used for hardened concrete property testing shall be done in one lift without rodding or vibration. Curing and testing parameters for these specimens are noted in Section 603.6.2.1. These results of these tests shall be listed in Attachment 2 S-P.

Also, from one of the SCC trial batches required in 603.6.2.1, a prestressing strand bond strength test, in accordance with MP 603.06.20, shall be conducted, and the result shall be recorded in Attachment 3 S-P.

4.6 Mix design submittal packages including Attachments 1, 2, 3 and 6-ASR, A-bar worksheet(s), and raw data pertaining to the compressive strength and surface resistivity tests shall be submitted to the WVDOH District Materials Section in which the Source (i.e. Concrete Batch Plant) is located. Mix design submittal packages, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1 including Attachments 1 OAG, 2 OAG, 3 OAG and 6-ASR OAG, optimized aggregate gradation worksheet, and raw data pertaining to the compressive strength and surface resistivity tests shall be submitted to the WVDOH District Materials Section in which the Source (i.e. Concrete Batch Plant) is located. These submittal packages may be submitted to the District electronically, and MCS&T Division may be copied on the electronic submittal also, as this may expedite the process. All mix concrete mix designs, except SCC mix designs, that are sent to MCS&T Division shall be submitted electronically to the following e-mail address: DOHConcreteMixDesign@wv.gov.

SCC mix designs, produced in accordance with Section 603, shall be submitted directly to MCS&T Division and shall include Attachments 1 S-P, 2 S-P, 3 S-P and 6-ASR.

4.6.1 In the case of mix design submittals for a single mix design which is used at multiple concrete plants, one submittal package (for the same design) may be used for multiple

concrete plants. All the concrete plants at which the mix design is being used shall be noted on Attachment 1, and each WVDOH Materials Section in which the concrete plants are located shall be included on the submittal. Attachment 1 OAG shall be used in leu of Attachment 1, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. This submittal will be reviewed by MCS&T Division, and if the mix design is approved, a separate lab number will be assigned to the mix design for each location at which it is approved.

5. ACCEPTANCE CRITERIA

5.1 If the standard deviation of the concrete plant production has been established, the mix design must have an average laboratory compressive strength, based on the 4 by 8 in. (100 by 200 mm) cylinder results equal to or greater than the "Design 28-Day Compressive Strength" required by the specifications plus two times the standard deviation. Data used to establish the standard deviation shall be taken from the Division's data bank and shall consist of at least 30 individual test results obtained from recent plant production of concrete with proportions similar to the design mix. Information relative to the statistics for a particular plant will be furnished to the Contractor upon request.

5.2 If the standard deviation of the concrete plant production has not been established, or in the case of mobile mixer units, the mix design must have an average laboratory compressive strength equal to or greater than the "Design 28-Day Compressive Strength" plus 1,300 psi (9 MPa). The Division shall note the Plant Compressive Strength Standard Deviation, at the time of the mix design approval, in Attachment 3.

5.2.1 Note that the "Design 28-Day Compressive Strength" required by the Specifications is the minimum field strength sought in 4 by 8 in. (100 by 200 mm) cylinders representing the concrete being placed in the field and should not be confused with the laboratory compressive strengths required for design. The compressive strength, required in Section 5.1 or 5.2 for mix design approval, shall be noted as the “Mix Design Approval Strength”.

5.3 SCC mix designs, produced in accordance with Section 603, shall meet the mix design requirements as set forth in this MP and not the ACI mix requirements as specified in Section 603.6.2, except for the compressive strength “overdesign” requirements. SCC mix designs, produced in accordance with Section 603, shall meet the compressive strength “overdesign” requirements of ACI 301 Chapter 4.

6. PROPORTIONING DESIGN MIX

6.1 If the average of the batches produced in Section 4.3 (or 4.3.1), with the specified minimum cement factor, satisfies the acceptance criteria of Section 5, then it will be considered acceptable as the mix design for the class of concrete being designed.

6.2 If the average of the batches produced in Section 4.3 with the specified minimum cement factor does not satisfy the acceptance criteria of Section 5, then a linear compressive strength-cement factor relationship will be established using the average

28-day compressive strength, based on the 4 by 8 in. (100 by 200 mm) cylinder results, of the batches with the minimum cement factor and the average 28-day compressive strength of the batches with the minimum cement factor plus one bag of cement. This relationship will be interpolated to determine a cement factor [to the nearest 1 lb. (0.45 kg)] which would cause the acceptance criteria to be satisfied. This interpolated cement factor will be considered acceptable for proportioning the mix design for the class of concrete being designed.

6.2.1 If neither of the averages of the batches produced in Section 4.3 satisfies the acceptance criteria of Section 5, then that proposed mix design cannot be considered as acceptable, and a new mix design will be required.

6.2.2 Section 6.2 does not apply to Class H concrete, specialized overlay concrete, and SCC produced in accordance with Section 603. Therefore, if the average compressive strength of the Class H, specialized overlay concrete batches, or SCC produced in accordance with Section 603, in Section 4.3.1 does not satisfy the acceptance criteria of Section 4, then that proposed mix design cannot be considered as acceptable, and a new mix design will be required.

6.3 The submittal for a proposed mix design shall include completed copies of Attachments 1 and 3. It shall also include a completed copy of Attachment 2 for each of the batches at the minimum cement factor. It shall also include a completed copy of Attachment 2 for each of the batches at the minimum cement factor plus one bag of cement, and a completed copy of Attachment 2 for the batch at the minimum cement factor with a different water-cement ratio(i.e. fifth batch), when applicable. Attachments 1 OAG, 2 OAG, and 3 OAG shall be used in leu of Attachments 1, 2, and 3 respectively, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. All pertinent information supporting these attachments and pertaining to the information in them shall be submitted also. Upon approval of the subject mix design, the Division shall include a copy of Attachment 4 or 5 in ProjectWise, along with the approved mix design.

SCC mix design submittals, produced in accordance with Section 603, shall include completed copies of Attachments 1 S-P and 3 S-P. They shall also include a completed copy of Attachment 2 S-P for both batches produced in the mix design. All pertinent information supporting these attachments and pertaining to the information in them, including the test results pertaining to the workable period as outlined in Section 4.4.1, shall be submitted also.

6.4 Although the Contractor has satisfied all requirements for concrete design and a mix design has been approved by the Engineer, the Contractor may still be required to adjust the approved mix design in the field as necessary to maintain all properties within the limits of the specification. These field adjustments shall include increasing the cement factor above the value specified in the approved mix design if such an adjustment would be necessary to cause the strength of the field placed concrete to conform to the requirements of the specification. These field adjustments shall also include the addition of water in the field for slump adjustment. The procedure for determining the

maximum amount of water, which may be added to an approved concrete mix in the field, is outlined in the following sections.

6.4.1 Using the three different water-cement ratios from the batches produced in Section 4.3 and the corresponding 28-day compressive strengths from Section 4.5, the Excel file in Attachment 4 of this MP shall be used to create a best-fit line through these three points.

6.4.2 The water-cement ratio that corresponds to the Mix Design Approval Strength, as outlined in Section 5.1 or 5.2, shall be determined from the Excel file in Attachment 4 of this MP. The maximum water that is allowed to be added to an approved concrete mix in the field, shall be the amount of water, which corresponds to that water-cement ratio (i.e. the water-cement ratio that corresponds to the Mix Design Approval Strength). This maximum water amount shall be shown in Attachment 4. However, under no circumstance, shall the total amount of water in a mix, including field additions, exceed the amount of water corresponding to the maximum water content noted in Table 601.3.1A (i.e. under no circumstances shall the water-cement ratio in Table 601.3.1A be exceeded).

6.4.3 For existing approved mix designs, for which there are only two different water-cement ratios, Attachment 5 shall be used to determine the maximum water, that is allowed to be added to that approved concrete mix in the field. Attachment 4 shall be used to determine the maximum water, that can be added in the field, for all other mixes.

6.4.4 For Class H mixes and concrete mixes for specialized overlays, as set forth in Section 679 of the specifications, no additional water beyond what was used in the approved mix designs shall be added in the field.

7. MIX DESIGN RE-APPROVAL

7.1 Each mix design shall remain approved for a period of three years from the date of approval, after which the mix design may be re-approved for an additional three years based on re-qualification tests outlined in Section 7.2 and conducted at the Concrete Producer or a Division Approved Laboratory, meeting the requirements of Section 4.1. If a mix design is used often enough (at least fifteen air content, slump, and compressive strength tests for the previous three-year period), the re-qualification tests shall not be required, and the mix design may be re-approved based on the actual field tests performed during the previous three-year period.

Re-approval of SCC mix designs, produced in accordance with Section 603, shall be re-approved as outlined in Section 603.6.2.

The mix design shall meet the ASR requirements in Section 601.3.1.1 according to the most recent aggregate reactivity, alkali content of cement and SCM, and CaO content of fly ash from the Division Approved Products Lists APLs. A mix design using an SCM replacement level below that required in Table 601.3.1.1.1.4.2b of the Specifications may evaluate the effectiveness of SCM to prevent deleterious expansion as described in Section 601.3.1.1.1.6 to meet the ASR requirements.

7.1.1 When a Concrete Producer desires to have a mix design re-approved, he shall submit a written request to the WVDOH District Materials Section in which that plant is located noting such and including the current mix design lab numbers to be evaluated. The WVDOH District Materials personnel shall verify if there are a minimum of fifteen air content, slump, and compressive strength tests for that mix design in the previous three-year period.

7.1.2 If there are at least fifteen air content, slump, and compressive strength tests for that mix design in the previous three-year period, then the WVDOH District Materials personnel shall notify MCS&T Division that the subject mix design may be re-approved based on the criteria in Section 7.1. MCS&T Division shall then update the approval date of the subject mix design.

7.1.3 If there are not at least fifteen air content, slump, and compressive strength tests for that mix design in the previous three-year period, then the WVDOH District Materials personnel shall notify the Concrete Producer that the subject mix design must be re-approved as outlined in Section 7.2.

7.2 The following procedures shall be used to re-approve concrete mix designs that do not meet the criteria in Section 7.1.

7.2.1 The Concrete Producer shall provide a statement to the Engineer verifying that all sources of materials used in the approved mix designs are unchanged and the same as used in the original approved mix design. All materials shall meet the applicable sections of the specifications. The original mix design shall meet the ASR requirements in Section 601.3.1.1 according to most recent aggregate reactivity, alkali content of cement and SCM, and CaO of fly ash from the Division APLs.

7.2.2 Coarse and fine aggregate samples shall be obtained at the Concrete Producer's facility in accordance with MP 700.00.06, and the following tests shall be conducted on those aggregate samples by a WVDOH certified Aggregate Inspector: specific gravity (both coarse and fine aggregate), combined A-bar of total solids, absorption (both coarse and fine aggregate), fineness modulus (fine aggregate), and unit weight (coarse aggregate). The results of these tests shall be used by a WVDOH certified PCC Technician at the Concrete Producer or a Division Approved Laboratory, to establish a new target A-bar for the mix design and, if necessary, to adjust any batch volumes. Combined aggregate gradation shall be conducted in leu of combined A-bar of total solids for those mix designs with the optimized aggregate gradation. The working range on each sieve from cumulative combined percent retained from aggregate gradation shall be in accordance with Table 601.3.2.4.1B from Section 601.3.2.4.1.

7.2.3 The Concrete Producer shall then, at the Producer's facility and in the presence of WVDOH District Materials personnel, produce a representative batch (acceptable to both the Producer and the WVDOH personnel) in accordance with Sections 601.6 and 601.7 of no less than 6 yd^3 (4.6 m^3) of the concrete mix subject for re-approval. This batch shall be tested for air content, slump, unit weight and yield. Also, three 4 by 8 in.(100 by 200 mm) 28-day compressive strength specimens, and if applicable, ~~two~~

three surface resistivity specimens (each to be tested at an age of ~~90~~ 28 days ~~or earlier~~ and the average result used) shall be fabricated and tested from this batch.

7.2.3.1 In lieu of the batch produced at the Producer's facility, as outlined in Section 6.2.3, a batch may be produced at a Division Approved Laboratory. This batch does not need to be witnessed by WVDOH personnel. The size of this batch shall be the same as the size of the batches produced for new laboratory mix designs. If there are any changes to either the coarse or fine aggregate, certified laboratory personnel may perform the testing and mix adjustments as stated in Section 7.2.2.

7.3 The Concrete Producer or Division Approved Laboratory Personnel shall record the results of all tests required and the proportions used in the batch outlined in Section 7.2 in the applicable sections of Attachments 1, 2, and 3. Attachments 1 OAG, 2 OAG, and 3 OAG shall be used in leu of Attachments 1, 2, and 3 respectively, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. The Concrete Producer or Division Approved Laboratory Personnel shall then submit those attachments, along with the test data required in Section 7.2.2 to the WVDOH District Materials section, who will then forward them to MCS&T Division for evaluation. Based on these results, the existing mix design will either be re-approved (possibly with slight adjustments), or the current mix design will be considered to have expired, and a new mix design will be required. When a mix design is re-approved by MCS&T Division, the laboratory approval number for that mix shall not be changed, but the approval date (the "Date Sampled") shall be revised.

7.3.1 For mix design re-approval purposes, the compressive strength of the representative batch produced at the Producer, as outlined in Section 7.2.3, must meet or exceed the "Design 28-day Compressive Strength" in Section 601.3, but it does not have to meet the "overdesign" acceptance criteria outlined in Section 5.

7.3.1.1 If a laboratory batch is produced in lieu of a batch at the Producer, as outlined in Section 7.2.3.1, then the compressive strength of that batch must have a compressive strength which exceeds the "Design 28-Day Compressive Strength" required by the specifications by the value (f'_{cr}) obtained from the formula below. The criteria used to establish the standard deviation is outlined in Section 5.1.

$$f'_{cr} = f'_c + \sigma$$

Where:
f'_{cr} = Required compressive strength of the batch produced in Section 7.2.3.1 (expressed in psi)
f'_c = Design 28-Day Compressive Strength (expressed in psi)
σ = Concrete Plant Standard Deviation (outlined in Section 5.1)

7.3.2 For mix design re-approval purposes the surface resistivity test results from the representative batch produced in Section 7.2.3 or 7.2.3.1 must be ~~be~~ equal to or greater than 30 kΩ-cm in order for the mix design to be re-approved.

7.3.3 If a mix design has expired, it may still be used on projects which have started before the mix design expired. However, after its date of expiration, a mix design may not be used on any new projects; a new mix design shall be required for these projects.

8. CHANGING A COMPONENT MATERIAL USED IN A MIX DESIGN

8.1 Whenever more than one component material in an approved mix design is changed simultaneously, a new laboratory mix design, in accordance with Section 4 shall be required. This option is not permitted for SCC mix designs produced in accordance with Section 603.

8.1.1 There are circumstances when one component material in an approved mix design may be changed to another WVDOH approved component material without requiring a new laboratory mix design. Those circumstances, and the subsequent steps which must be taken for that component material change to be approved, are outlined in the following sections.

8.2 The changes, outlined below, to any of the following component materials are permitted provided the requirements in Section 8.3 are met. Only one component material may be changed at a time, otherwise a new laboratory mix design in accordance with Section 4 shall be required. When changing the type and/or source of any one component material, minor adjustments to the quantities of other component materials in the mix design are permitted, to maintain desired mix properties. When changing the type and/or source of any one component material, the mix design shall meet the ASR requirements in Section 601.3.1.1 according to the most recent aggregate reactivity, alkali content of cement and SCM, and CaO of fly ash from the APLs. ASTM C1567 testing in accordance with Section 601.3.1.1.1.6 may be used to evaluate the effectiveness of SCM to prevent deleterious expansion if the SCM minimum replacement requirements of Table 601.3.1.1.1.4.2b are not met.

8.2.1 Cement: The source of cement may be changed provided the requirements of Section 8.3 are met. A change from a Type I cement to a Type IL cement (or from a Type IL cement to a Type I cement) may also be considered a single component material change.

8.2.2 Supplementary Cementitious Material (SCM): The source and/or type of SCM may be changed provided the requirements of Section 8.3 are met.

8.2.3 Chemical Admixture: The source and/or type of any individual admixture (*i.e*., air entraining, water reducing, or water-reducing and retarding, *etc*.) may be changed provided the requirements of Section 8.3 are met. If more than one admixture is used in a mix design, a change to an individual component material means a change in only one of those admixtures. If more than one admixture is used in a mix design, and a change to one of these admixtures is desired (a change to an individual component material), then the source of the new admixture must still be the same as the source of the rest of the admixtures in the mix (*i.e*., water-reducing admixture A from Source X may be changed to water-reducing admixture B from Source X.)

8.2.4 Latex Admixture: The source of latex admixture may be changed provided the requirements of Section 8.3 are met.

8.2.5 Fine Aggregate: The source of fine aggregate may be changed provided the requirements of Section 8.3 are met. However, if the type of fine aggregate changes (*i.e.*, silica sand to limestone sand or natural sand to manufactured sand), a new laboratory mix design in accordance with Section 3 shall be required.

8.2.6 Coarse Aggregate: The source of coarse aggregate may be changed provided the requirements of Section 8.3 are met. However, if the type or size of coarse aggregate changes (*i.e.,* river gravel to limestone or #57 limestone to #67 limestone), a new laboratory mix design in accordance with Section 4 shall be required.

8.3 When a change to any individual component material in an approved mix design, as outlined in Sections 8.1.1 and 8.2, is desired, the Concrete Producer shall, at the Producer's facility and in the presence of WVDOH District Materials personnel, produce two separate representative batches (acceptable to both the Producer and the WVDOH personnel) in accordance with Sections 601.6 and 601.7. Each of these batches shall be no less than 3 yd^3 (2.3 m^3), shall be batched at the target cement factor, and shall consist of the concrete mix with the proposed material change. The proportions for these batches shall be determined by a WVDOH certified PCC Technician.

8.3.1 If there is a change to either the coarse or fine aggregate, then a sample of the new material shall be obtained at the Concrete Producer's facility in accordance with MP 700.00.06, and the following tests shall be conducted by a WVDOH certified Aggregate Inspector on that aggregate sample: specific gravity, solid A-bar of the new material and A-bar of total solids, absorption, fineness modulus (fine aggregate), and unit weight (coarse aggregate). The results of these tests shall be used by a WVDOH certified PCC Technician at the Concrete Producer to establish a new target A-bar for the mix and, if necessary, to adjust any batch volumes. Combined aggregate gradation shall be conducted in leu of solid A-bar of the new material and A-bar of total solids for those mix designs with the optimized aggregate gradation. The results of these tests shall be used by a WVDOH certified PCC Technician at the Concrete Producer to establish a new target Combined % Retained for the mix, if necessary, to adjust any batch volumes.

8.3.2 In lieu of the two batches produced at the Producer's facility, as outlined in Section 8.3, two batches may be produced at a Division Approved Laboratory, meeting the requirements of Section 4.1. These batches do not need to be witnessed by WVDOH personnel. The sizes of these batches shall be the same as the size of the batches produced for new laboratory mix designs, and their proportions shall be determined by certified laboratory personnel. If there are any changes to either the coarse or fine aggregate, certified laboratory personnel may perform the testing and mix adjustments as stated in Section 8.3.1.

8.3.3 All of the information pertaining to the materials used in these batches shall be listed in Attachments 1, 2, 3 and 6-ASR as outlined in Section 4.2. Attachments 1 OAG, 2

OAG, and 3 OAG shall be used in leu of Attachments 1, 2, and 3 respectively, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1.

8.3.4 Both batches of concrete shall be tested in the plastic state for air, consistency, and yield. Each batch shall be adjusted as necessary to produce a plastic concrete having an air content, consistency, and yield equal to the specified value plus or minus the following tolerances: Air content, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 2 percent.

8.3.4.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 8.3.2, then the batch tolerances specified in Section 4.4 shall apply.

8.3.5 When the properties of a concrete batch have been established within acceptable limits, 3 - 4 in by 8 in. (100 by 200 mm) cylinders shall be made from each batch produced in Section 8.3 and tested in compression at an age of 28 days. The values of the physical properties of this new mix design (with the component material change) shall be the average of the physical properties established in the two batches produced in Section 8.3. These values shall be listed in the column for the mix with the "Minimum Cement Factor" in Attachment 3. Attachment 3 OAG shall be used in leu of Attachment 3, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1.

The following properties of each batch of concrete produced in Section 8.3 shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature. For those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1, the following properties of each batch of concrete produced in Section 8.3 shall be listed in Attachment 2 OAG: optimized aggregate gradation (OAG) worksheet, consistency, air content, unit weight and yield, water-cement ratio, and temperature.

8.4 When it is desired to change a component material in a mix which requires the surface resistivity test (Class H, K concrete and specialized concrete overlays as outlined in Section 679), specimens shall be fabricated from each of the batches produced in Section 8.3. The average value of these surface resistivity specimens shall be no less than ten percent of the mix designs surface resistivity value, required in the applicable specification, when tested at the time frame specified in the applicable specification.

8.4.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 8.3.2, then the average value of these surface resistivity specimens shall be less than or equal to the mix design surface resistivity value required in the applicable specification, when tested at the time frame specified in the applicable specification.

8.5 The average compressive strength of the two batches produced at the Producer in Section 8.3 must have an average compressive strength which exceeds the "Design 28-Day Compressive Strength" required by the specifications by the value (f'_{cr})

obtained from the formula below. The criteria used to establish the standard deviation is outlined in Section 5.1.

$$f'_{cr} = f'_c + 2.33\sigma - 500$$

Where:
f'_{cr} = Required average compressive strength of the batches produced in Section 8.3 (expressed in psi)
f'_c = Design 28-Day Compressive Strength (expressed in psi)
σ = Concrete Plant Standard Deviation (outlined in Section 4.1)

8.5.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 8.3.2, then the average compressive strength of these batches must have an average compressive strength which exceeds the "Design 28-Day Compressive Strength" required by the specifications by the value (f'_{cr}) obtained from the formula below. The criteria used to establish the standard deviation is outlined in Section 5.1.

$$f'_{cr} = f'_c + 2\sigma$$

8.5.2 If the average compressive strength of the two batches produced in Section 8.3 (f'_{cr}) is less than the "Design 28-Day Compressive Strength" (f'_c) required by the specifications, the new mix (with the component material change) cannot be considered as acceptable, unless the requirements of Section 8.7 are met.

8.6 It is not required, but if the Concrete Producer desires, two additional separate batches may be produced, at the same time that the two batches in Section 8.3 are being produced. These two additional batches shall be acceptable to both the Producer and the WVDOH personnel and shall be produced in accordance with Sections 601.6 and 601.7. Each of these batches shall be no less than 3 yd^3 (2.3 m^3), shall be batched at the target cement factor plus one bag of cement [94 lb. (42.6 kg)], and shall consist of the concrete mix with the proposed material change.

8.6.1 In lieu of the two batches produced at the Producer's facility, as outlined in Section 8.7, two batches at the target cement factor plus one bag of cement [94 lb. (42.6 kg)] may be produced at a Division Approved Laboratory, meeting the requirements of Section 4.1. These batches, produced at a Division Approved Laboratory, do not need to be witnessed by WVDOH personnel. The sizes of these batches shall be the same as the size of the batches produced for new laboratory mix designs, and their proportions shall be determined by certified laboratory personnel.

8.6.2 Production of these two additional batches is not an option for Class H concrete or specialized overlay concrete.

8.6.3 Both batches of concrete shall be tested in the plastic state for air, consistency, and yield. Each batch shall be adjusted as necessary to produce a plastic concrete having an air content, consistency, and yield equal to the specified value plus or minus the

following tolerances: Air Content, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 2 percent.

8.6.3.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 8.7.1, then the batch tolerances specified in Section 4.4 shall apply.

8.6.4 When the properties of a concrete batch have been established within acceptable limits, three 4 by 8 in. (100 by 200 mm) cylinders shall be made from each batch produced in Section 8.7 and tested in compression at an age of 28 days. The values of the physical properties of this new mix design (with the component material change) shall be the average of the physical properties established in the two batches produced in Section 8.7. These values shall be listed in the column for the mix with the "Minimum Cement Factor + 1 Bag" in Attachment 3. Attachment 3 OAG shall be used in leu of Attachment 3, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1.

The following properties of each batch of concrete produced in Section 8.7 shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature. For those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1, the following properties of each batch of concrete produced in Section 8.7 shall be listed in Attachment 2 OAG: optimized aggregate gradation (OAG) worksheet, consistency, air content, unit weight and yield, water-cement ratio, and temperature.

8.6.5 If the average of the batches produced in Section 8.3, with the specified target cement factor, does not satisfy the acceptance criteria set forth in Section 8.6, then a linear compressive strength-cement factor relationship will be established using the average 28-day compressive strength [based on the 4 by 8 in. (100 by 200 mm) cylinder results] of the batches with the target cement factor (Section 8.3) and the average 28-day compressive strength of the batches with the target cement factor plus one bag of cement (Section 8.7). This relationship will be interpolated to determine a cement factor [to the nearest 1 lb. (0.45 kg)] which would cause the acceptance criteria to be satisfied. This interpolated cement factor will be considered acceptable for proportioning the design mix for the class of concrete being designed.

8.6.6 If neither of the averages of the batches produced in Sections 8.3 or 8.7 satisfy the acceptance criteria in Section 8.6, then that proposed component material change cannot be considered as acceptable, and a new laboratory mix design will be required to make a change in component materials.

8.7 The submittal for a proposed mix design change, as outlined in Section 8, shall include completed copies of Attachments 1 and 3. It shall also include a completed copy of Attachment 2 for each of the batches produced in Section 8. Attachments 1 OAG, 2 OAG, and 3 OAG shall be used in leu of Attachments 1, 2, and 3 respectively, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. All pertinent information supporting these attachments and pertaining to the information in them shall be submitted also. The lab numbers of the original mix design shall be included in the submittal. This new mix design shall be submitted to the

District in the same manner as a normal mix design, and it shall then be forwarded to MCS&T Division for review and approval. If approved, a new lab number will be assigned to this mix design, and it shall, from that point forward be treated as a new mix design.

8.8 No additional component material changes are permitted to this mix design (without a new laboratory mix design) until there are a minimum of 20 consecutive field test results, from this new mix design, which meet or exceed the design compressive strength requirements. Once there are 20 consecutive field test results, from this new mix design, which meet or exceed the design compressive strength requirements, this mix design is eligible for another component material change in accordance with Section 8.

9. REPLACEMENT OF FLY ASH WITH CEMENT OR ANOTHER APPROVED SOURCE OF FLY ASH IN A MIX DESIGN

9.1 When an issue arises with a fly ash source or any other circumstance arises which causes a Concrete Producer to discontinue the use of a source of fly ash in an approved mix design, an equal volume of cement, or an equal volume of fly ash from a different WVDOH approved fly ash source, may be substituted for the fly ash in that mix. This option is not permitted for SCC mix designs produced in accordance with Section 603.

9.1.1 This option of replacing fly ash with cement, or fly ash from a different approved source, does not apply to Class H concrete and concrete for specialized overlays, as set forth in Section 679 of the specifications.

9.2 The Concrete Producer shall notify the WVDOH District Materials personnel that it is desired to replace the fly ash in an approved concrete mix design with an equal volume of cement or fly ash from a different approved source. The WVDOH District Materials personnel may then approve this change on a temporary basis. Field test data, as outlined in the following sections, shall be used to approve this mix design change as a permanent new mix design. The change on a temporary basis and permanent new mix design shall meet the ASR requirements in Section 601.3.1.1 according to the most recent aggregate reactivity, alkali content of cement and SCM, CaO of fly ash from the APLs. Evaluation of the effectiveness of SCM in accordance with 601.3.1.1.1.6 may be used if SCM replacement level does not meet the minimum replacement level described in Table 601.3.1.1.1.4.2b.

9.2.1 When fly ash from a different approved source is being substituted for the existing source of fly ash in an approved mix design, tests to determine the air content of the plastic concrete shall be performed at the Concrete Producer's facility and at the job site, in the presence of WVDOH personnel, on at least the first three batches of concrete produced with this different approved source of fly ash.

9.3 Two batches of concrete, produced with this mix containing either all cement or fly ash from a different approved source shall then be tested in the presence of WVDOH District Materials personnel. Both of these batches of concrete shall be tested in the plastic state for air, consistency, and yield. Each batch shall have an air content,

consistency, and yield equal to the specified value plus or minus the following tolerances: Air content, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 2 percent.

9.3.1 Three 4 by 8 in. (100 by 200 mm) cylinders shall be made from each batch outlined in Section 9.3 and tested in compression at an age of 28 days. The values of the physical properties of this new mix design (with the fly ash replacement) shall be the average of the physical properties established in the two batches produced in Section 9.3. These values shall be listed in the column for the mix with the "Minimum Cement Factor" in Attachment 3.

The following properties of each batch of concrete produced in Section 9.3 shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and & yield, water-cement ratio, and temperature. For those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1, the following properties of each batch of concrete produced in Section 9.3 shall be listed in Attachment 2 OAG: optimized aggregate gradation (OAG) worksheet, consistency, air content, unit weight & yield, water-cement ratio, and temperature.

9.4 The average compressive strength of the two batches produced in Section 9.3 must have an average compressive strength, which exceeds the "Design 28-Day Compressive Strength" required by the specifications.

9.5 The submittal for a mix design change from a mix containing fly ash to a mix using either only cement as the cementitious material or fly ash from a different approved source, as outlined in Section 9, shall include completed copies of Attachments 1, 3 and 6-ASR. It shall also include a completed copy of Attachment 2 for each of the batches produced in Section 9.3. Attachments 1 OAG, 2 OAG, and 3 OAG shall be used in leu of Attachments 1, 2, and 3 respectively, for those mix designs which meet the requirements for optimized aggregate gradation in Section 601.3.2.4.1. All pertinent information supporting these attachments and pertaining to the information in them shall be submitted also. This mix design change submittal shall be submitted to the District in the same manner as a normal mix design, and it shall then be forwarded to MCS&T Division for review and approval. A new lab number will be assigned to this mix design, and it shall, from that point forward be treated as a new mix design, using only cement as the cementitious material, or using fly ash from a different approved source along with the original source of cement as the cementitious materials.

10. ADDITION OF HYDRATION CONTROL STABILIZING ADMIXTURES TO EXISTING MIX DESIGNS

10.1 Approved Hydration Control Stabilizing Admixtures, as specified in Section 707.15, designed to stop the hydration of cement in a concrete mix, enabling an extension to the allowable discharge time from a truck mixer as outlined in Section 601.7 of the Specifications may be added to an existing approved concrete mix design in accordance with the procedures outlined in this Section. This option is not permitted for SCC mix designs produced in accordance with Section 603.

10.2 Two separate batches of concrete shall be produced as outlined in Section 8.3. These concrete batches shall be tested as outlined in Sections 8.3 and 8.4.

10.2.1 Additional testing, as outlined in the second, third, and fourth paragraphs of Section 707.15.2.1, shall also be performed on one of the batches produced in Section 9.2 to verify that the allowable concrete discharge time may be extended.

10.3 If the requirements set forth in Section 8.6 are met, then the procedures set forth in Sections 8.8 and 8.9 shall be followed, and the existing mix shall be approved for use with the hydration control stabilizing admixture, and a new lab number will be assigned to this mix design.

10.4 No additional changes to the existing mix design are permitted at the time that these concrete batches are being produced for the acceptance of the addition of the hydration control stabilizing admixture to the existing mix design.

_____

Michael A Mance, PE
Director
Materials Control, Soils & Testing Division

MM:Td
MP 711.03.23 Steward – Cement and Concrete Section
ATTACHMENTS

MP 711.03.23

ATTACHMENT 1

Source:		Facility:	
Source Code:		Facility Code:	
Class of Concrete:		Material Code:	
Design Laboratory:		Date:	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Material (SCM) 1	Supplementary Cementitious Material (SCM) 2
Name			
Type			
Material Code			
Source			
Source Code			
Facility			
Facility Code			
Specific Gravity			

Admixture Data				
Data	Air Entrainment	Additional Admixture 1	Additional Admixture 2	Additional Admixture 3
Name				
Type				
Material Code				
Source				
Source Code				
Facility				
Facility Code				

Aggregate Data		
Data	Coarse Aggregate	Fine Aggregate
Class/Size		
Type		
Material Code		
Source		
Source Code		
Facility		
Facility Code		
Specific Gravity		
A-Bar		
Absorption		
Fineness Modulus		
Unit Weight		

MP 711.03.23

ATTACHMENT 2

Source: _____

Facility: _____

Design Laboratory: _____

Class of Concrete: _____

Date: _____

Check The Appropriate Box For Designated Batch:	Minimum Cement Factor		Mininimum Cement Factor + 1 Bag		Minimum Cement Factor with Different w/c	Additional Batch
	Batch 1	Batch 2	Batch 1	Batch 2		

Material	Mass	Units	Volume		Units
Cement		lb (kg)			ft^3 (m^3)
SCM 1		lb (kg)			ft^3 (m^3)
SCM 2		lb (kg)			ft^3 (m^3)
Latex Admixture		lb (kg)	gal (L)		ft^3 (m^3)
Water		lb (kg)	gal (L)		ft^3 (m^3)
Air Content, by volume		%			ft^3 (m^3)
Coarse Aggregate		lb (kg)			ft^3 (m^3)
Fine Aggregate		lb (kg)			ft^3 (m^3)
Total		lb (kg)			ft^3 (m^3)
Air Entrain. Admixture		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 1		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 2		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 3		oz/Cwt (mL/100kg)			fl. oz. (mL)

Mixture Test Data							
$\bar{A}$ Total Solids	W/C Ratio	Cement Factor (ft^3)	Temperature	Consistency	Air Content	Unit Weight	Yield

Compressive Stength, psi (MPa)		
Specified Test Age:	Actual Test Age (hours)	4" x 8" (100 x 200 mm) Strengths
24 ± 2 Hours		
3 Days		
7 Days		
14 Days		
28 Days		
28 Days		
28 Days		
Avg. 28 Day Strength		#DIV/0!

SAM #

Surface Resitivity Test	
Sample	Result (kΩ-cm)
A	
B	
C	
Batch Average Result (kΩ-cm)	

MP 711.03.23

ATTACHMENT 3

SUMMARY

Source: _____

Facility: _____

Design Laboratory: _____

Class of Concrete: _____

Corresponding Design 28-day Compressive Strength from Table 601.3.1A (psi): _____

Corresponding Maximum Water Content from Table 601.3.1A: _____

Date: _____

	Minimum Cement Factor		Minimum Cement Factor + 1 Bag		Minimum Cement Factor with Different w/c	
Material	Mass	Units	Mass	Units	Mass	Units
Cement		lb (kg)		lb (kg)		lb (kg)
SCM 1		lb (kg)		lb (kg)		lb (kg)
SCM 2		lb (kg)		lb (kg)		lb (kg)
Water		lb (kg)		lb (kg)		lb (kg)
Coarse Aggregate		lb (kg)		lb (kg)		lb (kg)
Fine Aggregate		lb (kg)		lb (kg)		lb (kg)
Total		lb (kg)		lb (kg)		lb (kg)
Air Entrain. Admixture		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 1		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 2		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 3		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Total A-Bar Solids						
Water Cement Ratio						
Cement Factor		ft^3 (m^3)		ft^3 (m^3)		ft^3 (m^3)
Temperature		^OF (^OC)		^OF (^OC)		^OF (^OC)
Consistency		inches (mm)		inches (mm)		inches (mm)
Air Content		%		%		%
Unit Weight		lb/ft^3 (kg/m^3)		lb/ft^3 (kg/m^3)		lb/ft^3 (kg/m^3)
Yield		ft^3 (m^3)		ft^3 (m^3)		ft^3 (m^3)
Aggregate Correction Factor per AASHTO T 152		%		%		%

Compressive Strength, psi (Mpa)	Minimum Cement Factor Batch	Minimum Cement Factor + 1 Bag Batch	Minimum Cement Factor with Different w/c
1 Day			
3 Days			
7 Days			
14 Days			
28 Days			
28 Days			
28 Days			
Avg. 28 Day Strength	#DIV/0!	#DIV/0!	#DIV/0!
Plant Standard Deviation at time of Mix Design Approval (psi):			
Average SAM Number:		Average Resistivity (kΩ-cm):	
~~Average Value of Rapid Chloride Permeability Test (Coulombs):~~			

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ATTACHMENT 4

Fields will be Automatically Filled After Attachment 3 is Completed	28-day Compressive Strength (Known Y-Value)	Water/Cementitious Material Ratio (Known X-Value)
Average Strength of Two Batches at Target (Minimum) Cement Factor (from Field D49 in Attachment 3)	#DIV/0!	0
Average Strength of Two Batches at Target (Minimum) Cement Factor + 1 Bag (from Field H49 in Attachment 3)	#DIV/0!	0
Strength of Batch at Target (Minimum) Cement Factor but with Different w/c (from Field L49 in Attachment 3)	#DIV/0!	0
	Result of Best-Fit Line (Slope) #VALUE!	Result of Best-Fit Line (Y-Intercept) #VALUE!

Class of Concrete =	0
Maximum Water Content from Table 601.3.1A =	0
Target (Minimum) Cement Factor (lbs.) = (from Fields D19, D20, and D21 of Attachment 3)	0
Design Compressive Strength (psi) from Table 601.3.1A =	0
Plant Compressive Strength Standard Deviation (psi) =	0
Mix Design Approval Strength (psi) =	0
w/c that corresponds to the Mix Design Approval Strength =	#VALUE!
Maximum w/c Allowed in the Field =	**#VALUE!**
Total Maximum Pounds of Water Allowed in the Mix (Including Field Adjustments), at the Target (Minimum) Cement Factor) =	**#VALUE!**
Total Maximum Gallons of Water Allowed in the Mix (Including Field Adjustments), at the Target (Minimum) Cement Factor) =	**#VALUE!**

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ATTACHMENT 5

Fields will be Automatically Filled After Attachment 3 is Completed	28-day Compressive Strength (Known Y-Value)	Water/Cementitious Material Ratio (Known X-Value)
Average Strength of Two Batches at Target (Minimum) Cement Factor (from Field D49 in Attachment 3)	#DIV/0!	0
Average Strength of Two Batches at Target (Minimum) Cement Factor + 1 Bag (from Field H49 in Attachment 3)	#DIV/0!	0
	Result of Best-Fit Line (Slope) #VALUE!	Result of Best-Fit Line (Y-Intercept) #VALUE!

Class of Concrete =	0
Maximum Water Content from Table 601.3.1A =	0
Target (Minimum) Cement Factor (lbs.) = (from Fields D19, D20, and D21 of Attachment 3)	0
Design Compressive Strength (psi) from Table 601.3.1A =	0
Plant Compressive Strength Standard Deviation (psi) =	0
Mix Design Approval Strength (psi) =	0
w/c that corresponds to the Mix Design Approval Strength =	#VALUE!
Maximum w/c Allowed in the Field =	**#VALUE!**
Total Maximum Pounds of Water Allowed in the Mix (Including Field Adjustments), at the Target (Minimum) Cement Factor) =	**#VALUE!**
Total Maximum Gallons of Water Allowed in the Mix (Including Field Adjustments), at the Target (Minimum) Cement Factor) =	**#VALUE!**

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ATTACHMENT 6-ASR

Class of Concrete, Precast/Prestress Member	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Materials (SCM) 1	Supplementary Cementitious Materials (SCM) 2
Mass (lb/kg)			
Alklai Content (%)			
CaO (%)(Fly Ash Only)			

Aggregate Material Data		
Data	Reactivity	Most Reactivity
Coarse Aggregate		
Fine Aggregate		

1	Level of Prevention		If Level of Prevention is "V", stop here.

For Class H Concrete, Skip 2,3,4 and 5.

For Evaluation of the Effectiveness of SCM or/and Lithium Nitrate Admixture (ASTM C1567), skip 2,3,4, and 6. If concrete mix using a 100 percent lithium nitrate admixture dosage, skip 2,3,4,5, and 6.

2	Alkali Content of Concrete (Option 1)	0.00	lb/yd³ (kg/m³)
3	Replacement Level of SCM (Option 2)		%

4	For Prevention Level "Z" Only		
	Alkali Content of Concrete		%
	Replacement Level of SCM		%

5	Evaluation of the Effectiveness of SCM or/and Lithium Nitrate Admixture (ASTM C1567)		
	Data	Evaluation with Reactive Fine Aggregate	Evaluation with Reactive Coarse Aggregate
	Expansion results (%)		
	SCM (%)		
	Replacement of SCM in Mix Design (%)		
	Lithium Nitrate Admixture Dosage Rate (%)		

6	Option chosen from Specification Table 601.3.1C for Class H Concrete	

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ATTACHMENT 1 S-P

Source:		Facility:	
Source Code:		Facility Code:	
Class of Concrete:		Material Code:	
Design Laboratory:		Date:	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Material (SCM) 1	Supplementary Cementitious Material (SCM) 2
Name			
Type			
Material Code			
Source			
Source Code			
Facility			
Facility Code			
Specific Gravity			

Admixture Data				
Data	Air Entrainment	Additional Admixture 1	Additional Admixture 2	Additional Admixture 3
Name				
Type				
Material Code				
Source				
Source Code				
Facility				
Facility Code				

Aggregate Data		
Data	Coarse Aggregate	Fine Aggregate
Class/Size		
Type		
Material Code		
Source		
Source Code		
Facility		
Facility Code		
Specific Gravity		
Absorption		
Fineness Modulus		
Unit Weight		

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ATTACHMENT 2 S-P

Source:
Facility:
Design Laboratory:
Class of Concrete:
Date:

Check the Appropriate Box for the Designated Batch:	Batch 1	Batch 2	Additional Batch

Material	Mass	Units	Volume	Units
Cement		lb (kg)		ft^3 (m^3)
SCM 1		lb (kg)		ft^3 (m^3)
SCM 2		lb (kg)		ft^3 (m^3)
Water		lb (kg)	gal (L)	ft^3 (m^3)
Air Content, by volume		%		ft^3 (m^3)
Coarse Aggregate 1		lb (kg)		ft^3 (m^3)
Coarse Aggregate 2		lb (kg)		ft^3 (m^3)
Fine Aggregate		lb (kg)		ft^3 (m^3)
Total		lb (kg)		ft^3 (m^3)
Air Entrain. Admixture		oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 1		oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 2		oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 3		oz/Cwt (mL/100kg)		fl. oz. (mL)

Mixture Test Data at T_0

W/C Ratio	Cement Factor, ft^3 (m^3)	Concrete Temperature, °F (°C)	Slump Flow, in. (mm)	Air Content, %	Unit Weight, lb/ft^3 (kg/m^3)	Yield, ft^3 (m^3)	$T_{50,\ seconds}$

VSI	J-Ring, in. (mm)	Rpd. Asmnt. of Static Seg. Resist., in. (mm)	Segregation Resistance, %	Workable Period, minutes

Compressive Strength Test, psi (Mpa)

Test Age:	24 ± 2 hours	3 days	7 days	14 days	28 days	28 days	28 days
Actual Test Age (hours)							
Compressive Strength							
Average 28-day Compressive Strength:					#DIV/0!		

Modulus of Elasticity Test, psi (Mpa)

Test Age:	3 days	7 days	14 days	28 days	28 days	28 days
Actual Test Age (hours)						
Modulus of Elasticity						
Average 28-day Modulus of Elasticity:				#DIV/0!		

Length Change (Shrinkage), % Length Change

Test Age	Initial Reading	Reading at End of 28-day Curing Period	4 days after 28-day curing period	7 days after 28-day curing period	14 days after 28-day curing period	28 days after 28-day curing period
Specimen 1						
Specimen 2						
Specimen 3						
Average Length Change (Shrinkage) after 28-days of water curing and 28-days of Air Storage:						#DIV/0!

Surface Resitivity Results	
Sample	Results (kΩ-cm)
A	
B	
C	
Average Results (kΩ-cm)	

SAM#

Freeze-Thaw Resistance		
	# of Cycles Completed	Durability Factor
Specimen 1		
Specimen 2		
Specimen 3		
Average Durability Factor:		#DIV/0!

Creep Testing

Age at Initial Loading (hours):		Comp. Str. Cylinder 1, psi (Mpa):		Comp. Str. Cylinder 2, psi (Mpa):		Initial Load, psi (Mpa):	
Initial Elastic Strain at Time of Initial Loading (Determined within 2 minutes after Initial Loading):							
	Loaded Cylinders - Total Strain	Control Cylinders - Drying Strain	Load Induced Strain	Load Induced Strain per Unit Stress	Creep Strain	Creep Strain per Unit Stress	Creep Coefficient
90 days After Initial Loading:							

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ATTACHMENT 3 S-P

SUMMARY

Source: _____

Facility: _____

Design Laboratory: _____

Class of Concrete: _____

Date: _____

	Mix Properties		
Material	Average Value from Two Trial Batches		Units
Cement			lb (kg)
SCM 1			lb (kg)
SCM 2			lb (kg)
Water	gal (L)		lb (kg)
Coarse Aggregate 1			lb (kg)
Coarse Aggregate 2			lb (kg)
Fine Aggregate			lb (kg)
Total Batch Weight			lb (kg)
Air Entrain. Admixture			oz/Cwt (mL/100kg)
Chemical Admixture 1			oz/Cwt (mL/100kg)
Chemical Admixture 2			oz/Cwt (mL/100kg)
Chemical Admixture 3			oz/Cwt (mL/100kg)
Water Cement Ratio			
Cement Factor			ft^3 (m^3)
Temperature			^OF (^OC)
Slump Flow			inches (mm)
Air Content			%
Unit Weight			lb/ft^3 (kg/m^3)
Yield			ft^3 (m^3)
T_{50}			seconds
VSI			
J-Ring			inches (mm)
Rapid Assessment of Static Segregation Resist.			inches (mm)
Segregation Resistance			%
Aggregate Correction Factor per AASHTO T 152			%

Compressive Strength, psi (Mpa)	Avg.Compressive Strength of both Trial Batches
24 ± 2 hours	
3 Days	
7 Days	
14 Days	
28 Days	
28 Days	
28 Days	
Avg. 28 Day Strength	#DIV/0!

Prestressing Strand Bond Strength Test (in accordance with MP 603.06.20) Check Applicable Box	
Pass:	
Fail:	

Average SAM Number	
Average Resistivity (kΩ-cm)	

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ATTACHMENT 1 OAG

Source:		Facility:	
Source Code:		Facility Code:	
Class of Concrete:		Material Code:	
Design Laboratory:		Date:	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Material (SCM) 1	Supplementary Cementitious Material (SCM) 2
Name			
Type			
Material Code			
Source			
Source Code			
Facility			
Facility Code			
Specific Gravity			

Admixture Data				
Data	Air Entrainment	Additional Admixture 1	Additional Admixture 2	Additional Admixture 3
Name				
Type				
Material Code				
Source				
Source Code				
Facility				
Facility Code				

Aggregate Data				
Data	Coarse Aggregate (I)	Coarse Aggregate (II)	Fine Aggregate (I)	Fine Aggregate (II)
Class/Size				
Type				
Material Code				
Source				
Source Code				
Facility				
Facility Code				
Absorption				
Fineness Modulus				
Unit Weight				

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ATTACHMENT 2 OAG

Source:
Facility:
Design Laboratory:
Class of Concrete:
Date:

Check The Appropriate Box For Designated Batch:	Minimum Cement Factor		Mininimum Cement Factor + 1 Bag		Minimum Cement Factor with Different w/c	Additional Batch
	Batch 1	Batch 2	Batch 1	Batch 2		

Material	Mass	Units	Volume		Units
Cement		lb (kg)			ft^3 (m^3)
SCM 1		lb (kg)			ft^3 (m^3)
SCM 2		lb (kg)			ft^3 (m^3)
Latex Admixture		lb (kg)	gal (L)		ft^3 (m^3)
Water		lb (kg)	gal (L)		ft^3 (m^3)
Air Content, by volume		%			ft^3 (m^3)
Coarse Aggregate (I)		lb (kg)			ft^3 (m^3)
Coarse Aggregate (II)		lb (kg)			ft^3 (m^3)
Fine Aggregate (I)		lb (kg)			ft^3 (m^3)
Fine Aggregate (II)		lb (kg)			ft^3 (m^3)
Total		lb (kg)			ft^3 (m^3)
Air Entrain. Admixture		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 1		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 2		oz/Cwt (mL/100kg)			fl. oz. (mL)
Chemical Admixture 3		oz/Cwt (mL/100kg)			fl. oz. (mL)

Mixture Test Data							
	W/C Ratio	Cement Factor (ft^3)	Temperature	Consistency	Air Content	Unit Weight	Yield

Compressive Stength, psi (MPa)		
Specified Test Age:	Actual Test Age (hours)	4" x 8" (100 x 200 mm) Strengths
24 ± 2 Hours		
3 Days		
7 Days		
14 Days		
28 Days		
28 Days		
28 Days		
Avg. 28 Day Strength		#DIV/0!

SAM #

Surface Resitivity Test	
Sample	Results (kΩ-cm)
A	
B	
C	
Results (kΩ-cm)	

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ATTACHMENT 3 OAG

SUMMARY

Source:

Facility:

Design Laboratory:

Class of Concrete:

Corresponding Design 28-day Compressive Strength from Table 601.3.1A (psi):

Corresponding Maximum Water Content from Table 601.3.1A:

Date:

	Minimum Cement Factor		Minimum Cement Factor + 1 Bag		Minimum Cement Factor with Different w/c	
Material	Mass	Units	Mass	Units	Mass	Units
Cement		lb (kg)		lb (kg)		lb (kg)
SCM 1		lb (kg)		lb (kg)		lb (kg)
SCM 2		lb (kg)		lb (kg)		lb (kg)
Water		lb (kg)		lb (kg)		lb (kg)
Coarse Aggregate (I)		lb (kg)		lb (kg)		lb (kg)
Coarse Aggregate (II)		lb (kg)		lb (kg)		lb (kg)
Fine Aggregate (I)		lb (kg)		lb (kg)		lb (kg)
Fine Aggregate (II)		lb (kg)		lb (kg)		lb (kg)
Total		lb (kg)		lb (kg)		lb (kg)
Air Entrain. Admixture		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 1		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 2		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Chemical Admixture 3		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)		oz/Cwt (mL/100kg)
Water Cement Ratio						
Cement Factor		ft^3 (m^3)		ft^3 (m^3)		ft^3 (m^3)
Temperature		^OF (^OC)		^OF (^OC)		^OF (^OC)
Consistency		inches (mm)		inches (mm)		inches (mm)
Air Content		%		%		%
Unit Weight		lb/ft^3 (kg/m^3)		lb/ft^3 (kg/m^3)		lb/ft^3 (kg/m^3)
Yield		ft^3 (m^3)		ft^3 (m^3)		ft^3 (m^3)
Aggregate Correction Factor per AASHTO T 152		%		%		%

Compressive Strength, psi (Mpa)	Minimum Cement Factor Batch	Minimum Cement Factor + 1 Bag Batch	Minimum Cement Factor with Different w/c
1 Day			
3 Days			
7 Days			
14 Days			
28 Days			
28 Days			
28 Days			
Avg. 28 Day Strength	#DIV/0!	#DIV/0!	#DIV/0!

Plant Standard Deviation at time of Mix Design Approval (psi):					
Average SAM Number:		Average Resistivity (kΩ-cm):			
~~Average Value of Rapid Chloride Permeability Test (Coulombs):~~					
Cure Method:		Standard		Accelerated		Age (Days):	

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ATTACHMENT 6-ASR OAG

Class of Concrete, Precast/Prestress Member	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Materials (SCM) 1	Supplementary Cementitious Materials (SCM) 2
Mass (lb/kg)			
Alklai Content (%)			
CaO (%)(Fly Ash Only)			

Aggregate Material Data		
Data	Reactivity	Most Reactivity
Coarse Aggregate (I)		
Coarse Aggregate (II)		
Fine Aggregate (I)		
Fine Aggregate (II)		

1	Level of Prevention		If Level of Prevention is "V", stop here.

For Class H Concrete, Skip 2,3,4 and 5.

For Evaluation of the Effectiveness of SCM or/and Lithium Nitrate Admixture (ASTM C1567), skip 2,3,4, and 6. If concrete mix using a 100 percent lithium nitrate admixture dosage, skip 2,3,4,5, and 6.

2	Alkali Content of Concrete (Option 1)	0.00	lb/yd³ (kg/m³)
3	Replacement Level of SCM (Option 2)		%

4	For Prevention Level "Z" Only		
	Alkali Content of Concrete		%
	Replacement Level of SCM		%

5	Evaluation of the Effectiveness of SCM or/and Lithium Nitrate Admixture (ASTM C1567)				
	Data	Fine Aggregate (I)	Fine Aggregate (II)	Coarse Aggregate (I)	Coarse Aggregate (II)
	Expansion results (%)				
	SCM (%)				
	Replacement of SCM in Mix Design (%)				
	Lithium Nitrate Ad. Dosage Rate (%)				

6	Option chosen from Specification Table 601.3.1C for Class H Concrete

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

QUALITY ASSURANCE OF LAMINATED ELASTOMERIC BRIDGE BEARING PADS WITH INTERNAL SHIMS

1. PURPOSE

1.1. To set forth the procedures which govern the Quality Assurance testing of laminated (with internal shims) elastomeric bridge bearing pads.

1.2. To set forth manufacturer's Quality Control requirements.

1.3. To set for acceptance procedures.

1.4. To set forth documentation and shipping procedures.

2. SCOPE

2.1. This procedure will apply to all manufacturers of laminated elastomeric bridge bearing pads.

2.2. This procedure will establish the basis for acceptance of laminated elastomeric bridge bearing pads.

2.3. This procedure will establish MCS&T Division's acceptance test procedures of laminated elastomeric bridge bearing pads.

2.4. This procedure will establish accepted dimensions of sample size submitted to MCS&T.

3. REFERENCED DOCUMENTS

3.1. All standard types of elastomeric bridge bearing pads with shims are to be manufactured and tested in accordance with Sections 715.14, of the WVDOH Specifications for Roads and Bridges.

3.2. Each production lot of laminated elastomeric bearing pads shall be tested and conform to AASHTO M251, section 4 and the Specification 106.3, and Specification sub-section 715.14.1

A production "LOT" is defined as follows:

It is a laminated bearing pad of the same size and class that is manufactured using the same process and materials during continuous days of production.

For laminated bearing pads, the sampling rate shall be one bearing pad per lot, per nominal dimensional size. (A change in nominal dimensional size is any change in the designed length, width or height of the bearing pad.)

3.2.1. The bearing pad dimension of each bearing pad LOT shall be checked in accordance with ASTM D3767, modified as follows; measure dimensions 100mm [4 in.] or less according to ASTM D3767 Procedure B; measure dimensions greater than 100 mm [4 in.] according to ASTM D3767 Procedure C. If any dimension is outside the limits in Section 6 (ASTM M251M), the bearing pad lot shall be rejected.

3.2.2. The Durometer Hardness Test (ASTM D2240 Type A) shall be used to determine material hardness in accordance with (ASTM M251M, Section 4.2, Table 1.) which shall be conducted on the individual sample selected from the LOT.

3.2.3. Oven Aging shall be conducted for samples selected as per (ASTM D573) for 70 hrs. at 212°F (100°C).

3.2.4. The minimum tensile strength and minimal ultimate elongation shall be conducted on samples selected as per (ASTM D412, Method A) for both original and oven aged samples.

3.2.5. The compression set test (ASTM D395, Method B, Type 1) shall be conducted on both original and oven aged samples selected. Tolerance shall be no greater than 35% change in compression between original and oven aged samples.

3.2.6. The low temperature test shall be performed in accordance with (ASTM D3746 Procedure B.)

3.2.7. Each sample shall be tested for adhesion to rigid substrates in accordance with (ASTM D429-14).

3.2.8. Shear Modulus shall be tested in accordance with (ASTM D4014, Annex A1).

3.2.9. Low temperature crystallization shall be tested in accordance with (ASTM D4014, Annex A1).

3.2.10. Instantaneous thermal stiffening shall be tested in accordance with (ASTM D1043).

3.2.11. Oil swell testing shall be tested in accordance with (ASTM D471).

4. QUALITY CONTROL REQUIREMENTS

4.1. Quality Control is the responsibility of the manufacturer and shall include the following:

4.1.1. Ensure all component materials used in fabrication of the bearing pads have been sampled, tested, and approved in accordance with WVDOH Standards and Specifications for Roads and Bridges (Section 715.14, and (ASTM M251).

4.2. Ensure quality workmanship as well as a quality product throughout production.

4.3. Each bearing pad shall be marked in indelible ink or flexible paint. The marking shall consist of order number, lot number, bearing identification number, up station, or face

of abutment (tapered plates only) and elastomer type and graded. Unless otherwise specified in the contract documents, the marking shall be on a face that is visible after the bridge is erected.

4.4. Notify the Division's representative upon the completion of casting of a LOT (Refer to Table 1) of bearing pads so MCS&T may select a representative sample and witness the testing.

4.5. To conduct quality control tests in accordance with (ASTM M251).

5. ACCEPTANCE CRITERIA

5.1. MCS&T will:

Sample and test the component materials to be used in the manufacturer of laminated elastomeric bearing pads in accordance with WVDOH Standards and Specification Roads and Bridges Section (715.14, and 715.15) and ASTM M251.

5.1.1. Select representative samples of the LOT to be tested and:

Representative sample shall be cut to dimensional size by the manufacturer as specified: representative sample shall be cut to dimensions of no less than 5 inch-length and 2-inch width, but no greater than 7-inch length and 2.5-inch length. A total of (6) individual representative individual samples must be taken from the selected representative sample prior to the shipping process.

a) Witness MCS&T Division test sample selection to be shipped to the Division.
b) Ensure each piece comprising of the LOT is scribed as stated in 4.3

6. SHIPPING REQUIREMENTS

6.1. The approved LOT of bearing pad sample portion can be shipped by the manufacturer providing the following provisions have been met:

6.1.1. The manufacturer will supply one copy of the shipping invoice to the MCS&T Division and one copy to the Division's representative at the project site. The invoice shall contain the following information.

a) Cast date of the approved LOT.
b) Master laboratory reference number.
c) Size, class, and type of bearing pad.
d) Project number.
e) Project authorization number.
f) Number of pieces.

7. ACCEPTANCE PRACTICE

7.1. MCS&T will Ensure the information on the shipping invoice, as required in section 6.1.2, agrees with the shipment it accompanies. (Number of pieces, size, type, etc.).

7.2. MCS&T will Check each sample of pad for the proper identification markings (Section 6.1.2) and make a visual inspection of each sample to ensure there is no evidence of damage during shipment.

8. DIVISIONAL TESTING PROCEDURE

8.1. When the bearing pad sample and T-100 Form sample identification sheet arrive in laboratory, make sure that the sample matches the T-100 form. The bearing pad should have an identifiable marking on it, such as project number, authorization number and sample number of some type.

8.1.1. Once arrived, measurement of the sample must be taken to verify that it meets the dimensions referenced on the T-100 form.

8.1.1.1. The sample measurement must be referenced on the T-100 form. The thickness has a tolerance of 1/8 inch (3.175mm) over the specified thickness. The width and length of the bearing pad sample has a tolerance of 1/4 inch (6.35mm) over the specified values, but it may not be any smaller. Sample size should be in accordance with Subsection 5.1.2 (b) of the Material Procedure.

8.1.1.2. When the paperwork and sample are shown to be in order, the bearing pad is ready to be processed for acceptance testing.

8.2. Sample Cutting- Tensile and Elongation Sets

8.2.1. Specimen must be cut to proper length as per AASHTO ASTM D412 Method A. Sample must be taken from the outside edge of the bearing bad sample on both the top and bottom. The minimum width of the sample must be 1” -inch, with a minimum of 5-inch length, and the specimen thickness after cutting must be between 0.05-inch and 0.10-inch. Several test specimen strips must be cut from the sample blocks.

8.2.2. Once the specimens have been cut, clean the specimens with water. After cleaning, the specimens must be set in the specified lab condition at least 1 hour at 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity.

8.2.3. After the proper conditioning time has been achieved, the specimens can now be cut on the arbor press with the barbell die (AASHTO ASTM D412 Method A). Do not cut more than one strip at a time. Do not pile the strips on top of each other to prevent cupping and deformation of the sample specimens.

8.2.4. A minimum of 10 total sample specimens must be cut for tensile and elongation testing. It is recommended to cut additional samples to ensure conformity of thickness of all samples selected.

8.2.5. Once cut, the specimens must be conditioned again in lab conditions for 3 hrs. at 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity.

8.3. Thickness Measurements

8.3.1. After the 3-hour conditioning in lab as specified in Subsection 9.2.4, the specimens shall be measured via thickness gauge. A total of 3 measurements shall be performed

at the narrow section of the barbell specimen. All three readings must be with 0.003 inch of each measurement, or the specimen must be discarded.

8.3.1.1. A minimum of 5 specimens closest to thickness shall be selected for original specimens (O), and a minimum of 5 specimens closest to thickness shall be selected for oven-aged testing (OA).

8.3.2. Write down the measurements and select the middle reading of the 3 measurements. Record the thickness to be assigned to the specimen. This shall be marked on each individual specimen at one end of the specimen with a silver ink pen.

8.3.3. At the opposite end of the specimen, the specimen should then be labeled O-1 through O-5, for original specimens. Additional specimens must be labeled OA-1 through OA-5 for over-aged specimens. Also label the specimen at this end with the last 2 digits of the sample lab number for identification. Record the thickness of the specimens under the original thickness, and oven aged thickness of the sample worksheet.

8.4. Oven Aging

8.4.1. Oven Aged Specimens (OA) shall be conditioned in the oven at the recommended specifications per AASHTO D412. Natural rubber specimens shall be aged at 70 ±2 °C, and Neoprene samples shall be aged at 100 ±2 °C, for 70 hrs. in accordance with AASHTO ASTM D573.

8.4.2. Oven Aged Specimens (OA) should be suspended above the oven floor from clips, also ensuring that the specimens are not in contact with each other during the oven aging process.

8.4.3. Once the 70-hour oven aging has completed, the samples must then be conditioned in the lab outside of the oven as per Subsection 9.2.5 for 3-hours.

8.5. Tensile and Elongation Test

8.5.1. Tensile and Elongation testing shall conform to AASHTO ASTM D412 Method A. All information shall be recorded on the worksheet. A minimum of three consecutive passing tests must be completed. In case of a failing sample, all 5 oven-aged samples must be tested to meet the following test acceptance criteria:

a) Tensile Strength, minimum psi (AASHTO ASTM D412): 2250 psi combined median of all samples
b) Elongation at break, minimum % (AASHTO ASTM D412) 350% combined median of all samples

8.5.1.1. Once testing has been completed. All information must be recorded.

8.6. Compression Set

8.6.1. Compression set testing must conform to (AASHTO ASTM D395, Method B-Type 1)

8.6.1.1. Specimens for compression testing must be taken from the prepared test specimen strips as laid out in Section 9.2 of this MP, with the exception that compression set thickness strip minimal thickness should be a thickness of 0.100 inches.

8.6.2. Specimens should be cut at the arbor press with the circular die (ASTM D412). A minimum of 10 samples should be cut. Do not cut more than one strip at a time. Do not pile the strips on top of each other to prevent cupping and deformation of the sample specimens.

8.6.3. Specimens should then be conditioned as-per Section 9.2.5 of this MP.

8.6.4. Once the minimum 3-hour conditioning as described in Section 9.2.5 is achieved, the samples can now be measured for thickness.

8.6.4.1. Using the thickness gauge, stack each specimen to achieve a total thickness of 0.5 ±0.02 inches. A Total of seven specimens can be used to achieve the minimum 0.5-inch requirement. You may need to rearrange different sample discs to achieve the thickness requirement.

8.6.4.2. A total of two stacks should be created and labeled as Sample A, and Sample B, along with the last 2 digits of the lab number assigned to the sample. This should be marked with a silver pen to differentiate the samples. The original thickness shall be recorded on the worksheet.

8.6.5. Continue to prepare the compression set device.

8.6.5.1. Once sample original sample thickness is recorded, the samples can then be placed in the compression device. Both spaces must be present with the hole indicator facing, and the spacer thickness (0.375) stamp facing upward. Place talc on the bottom and top stack plates. And then secure the samples between the plates. Note: make sure the spacers are properly in place before tightening the plates.

8.6.5.2. Once the samples are secured in the compression device, the sample can now be oven aged.

8.6.5.3. Place the device in the preheated oven. Natural rubber specimens shall be aged at 70 ±2 °C, and Neoprene samples shall be aged at 100 ±2 °C, for 22 hours.

8.6.6. After the 22 hours oven aging, the samples should be immediately removed from the compression device and then placed on a piece of wood for 30 minutes. The room must be within temperature and humidity tolerances 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity.

8.6.7. Once the specimens have cooled, measure the thickness of both stack A, and stack B on the thickness gauge. Record the measurements on the worksheet. Calculate the percentage of compression as follows: The compression set passes if the result is 35% or less of the original compression thickness, if the result is higher 35%, the sample fails the compression set.

(Original Thickness-Final Thickness) / (original thickness-spacer size) x 100
The spacer is 0.375 in.

Calculation for average percent of compression

((Percent of compression of A + Percent of compression of B) /2) x 100

8.7. Durometer Hardness

8.7.1. or the durometer test, unused sample blocks may be used. Measure the thickness of the rubber that is on the outside edge of the metal shim plates. If the rubber is at least 6.0mm (0.24 inches) thick, then that sample can be used. This sample will be needed for both original and oven aged durometer tests.

8.7.2. The sample must be in the specified lab condition tolerances of 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity for 3 hours before testing is performed. Durometer device must also have been in lab condition tolerance for at lease 12 hours prior to testing.

8.7.2.1. Place test sample on firm level surface with the outside layer of the pad facing up. Write the lab number on the surface with the silver pen. Place the durometer firmly on the surface and press firmly on the top of the durometer. Do not use excessive pressure as it may affect the durometer reading. Take a total of 5 readings across the surface of the sample. Make sure the readings are at least 6.0mm (0.24 inches) apart from each reading. Record each reading, and then determine the middle value of the five readings. This middle value shall then be recorded as the original durometer reading on the worksheet. The recorded durometer should be within ± 5 of the specification requirements of the material being tested. If outside the ± 5 range, then the durometer test shall be recorded as failing.

8.7.3. Prepare the oven for oven aged test

8.7.3.1. Preheat over for the following: Natural rubber specimens shall be aged at 70 ±2 °C, and Neoprene samples shall be aged at 100 ±2 °C, for 70 hours.

8.7.3.2. After the proper time has elapsed, allow specimen to cool at room temperature at the specified laboratory tolerances of 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity for 3 hours. After cooling repeat the procedure as described in Subsection 9.7.2.1

8.7.3.3. To figure the durometer change, determine the difference between the oven aged durometer value and the original durometer value. Record the change on the work sheet, recording it as a plus or minus number. Natural rubber is allowed a maximum change of ±10% (5 for 50, 6 for 60, 7 for 70 durometer material). Neoprene is allowed to change to a maximum of ±15% (7.5 for 50, 9 for 60, 10.5 for 70 durometer material). If the durometer is within the allowable limit, then the sample meets specification requirements.

9. BEARING PAD SAMPLE TEST ACCEPTED BY CERTIFICATION

9.1. On a case-by-case basis, sample test results not performed by the division as described in Section 9 of this MP may be accepted by the certifications of the manufacturer for the following:

a) Rubber Deterioration in Ozone (ASTM D1149)
b) Low Temperature Brittleness Test (ASTM C746)
c) Adhesion (ASTM D429)
d) Shear Modulus (ASTM 4014)
e) Low Temperature Crystallization (ASTM 4014)
f) Instantaneous Thermal Stiffening (ASTM 1043)
g) Oil Swell (ASTM D471)
h) Full size bearings more than 50lbs, and not exceed 8-inch width X 12-inch Length. In accordance with this MP, the manufacturer is to prepare sample sizes as described in Subsection 5.1.2 (d) of this MP prior to shipment to the division. In rare occasions, full size bearings weighing more than 50lbs may be accepted per manufacturer certification of testing.

9.2. For the manufacturer described in Section 10.1 to be accepted, a full test report must be submitted to the division. The report must be notarized and submitted to the division for review and approval. The complete test report must be submitted prior to, or with the submitted test sample to the division. The report must include the following:

a) Laboratory Test Report Material Type (i.e. Natural Rubber, Neoprene)
b) Customer (i.e. Contractor, etc.)
c) Purchase Order #
d) Certification Date
e) Test Method Required and Results
f) Project Number
g) Project Authorization
h) Quantity
i) Description of material
j) Lot number
k) Notarization
l) Signature

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

MATERIALS PROCEDURE

AUTO PAY CONDITION OF INDUSTRY SAMPLE RECORDS

1. PURPOSE

1.1. To define the AWP auto-pay condition.

1.2. To define and standardize the criteria (metric) for gaining and keeping the AWP auto-pay condition.

2. DEFINITIONS

2.1. AWP: AASHTOWare Projects, the Division's accepted materials tracking software.

2.2. Auto-Pay Condition: AWP sample record condition that allows payment. These sample records are counted, pending review. If these sample records are found to be incorrected, payment may be taken back until they are corrected.

2.3. Satisfactory Sample: A sample record shall be considered Satisfactory if it has been submitted in accordance with MPs 109.00.21 and 109.00.22 and it has been accepted by the District without a rejection. If a sample record has been rejected, corrected and then accepted, it does not count as a Satisfactory Sample.

3. GAINING THE AUTO-PAY CONDITION

3.1. In order to gain the auto-pay condition, contractors must demonstrate their ability to submit Satisfactory Samples.

3.2. Contractors are evaluated monthly for their previous two month's performance on the "Industry District Authorization Metric" report. This report is submitted to management.

3.3. A running average is also calculated on this report. This calculation evaluates the most recent 100 samples submitted by the contractor in a one-year period.

3.4. If a contractor has submitted 100 or more samples in the past year, and if 97.0% of the most recent 100 samples are satisfactory, the Contractor gains the auto-pay condition.

4. MAINTAINING THE AUTO-PAY

4.1. Once a contractor has gained the auto-pay, they must continue to demonstrate their ability to submit Satisfactory Samples.

4.2. Revocation of the auto-pay

4.2.1. If a Contractor has less than 90% Satisfactory Samples on the monthly report for the two-month reporting period, their auto-pay condition will be reviewed by the Materials Control Section at MCS&T.

4.2.2. If the review indicates a consistent lack in performance, the auto-pay condition will be revoked.

4.2.3. If a Contractor has their auto-pay condition revoked, they may re-gain the auto-pay condition in accordance with the previous Section of this document.

5. AUTO-PAY CONDITION BENEFITS

5.1. Contractors who have an active auto-pay condition will automatically have their sample records marked as "Completed, Pending District Review" if they have not been reviewed and evaluated by the District 7 calendar days after their submission date.

_____

Michael A. Mance, PE
Director
Materials Control, Soils & Testing Division

MP 109.00.23 Steward – Materials Control Section
MM:Bt

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR THE SUBMISSION AND DOCUMENTATION OF QUALITY CONTROL TEST RESULTS

1. PURPOSE

1.1 To provide guidance for the streamline submission of test results documentation from the Contractor to the District.

2. REFERENCED DOCUMENTS

2.1 MP 109.00.21 – Basis for Charges for Non-Submittal of Sampling & Testing Documentation by the Established Deadline

2.2 MP 109.00.23 - Auto Pay Condition of Industry Sample Records

3. DEFINITIONS

3.1 AWP: AASHTOWare Projects – The Division Approved Sampling and Testing Documentation Software.

3.2 Authorize: In AWP, the action in which a sample record is "completed" or "finished", regardless of the final sample status.

4. SCOPE

4.1 As required by MP 109.00.21, contractors must submit their Quality Control test results by the deadline specified in that document.

4.2 The submission of results includes the following steps: (A) generating the sample in the Division Approved Sampling and Testing software (SiteManager, AASHTOWare Projects, etc.), (B) entering all data into this system, (C) presenting the data to the District for review and (D) providing all testing documentation.

4.2.1 This procedure expands on each of these points.

5. GENERATION OF A SAMPLE RECORD IN AASHTOWARE PROJECTS

5.1 Test results shall be documented in AWP (or the current Division Approved Sampling and Testing Documentation Software) using the live version of the training guides available on the WVDOH MCS&T Webpage[1]. A sample of these guides is provided in Attachment 1.

6. ENTERING OF TEST DATA.

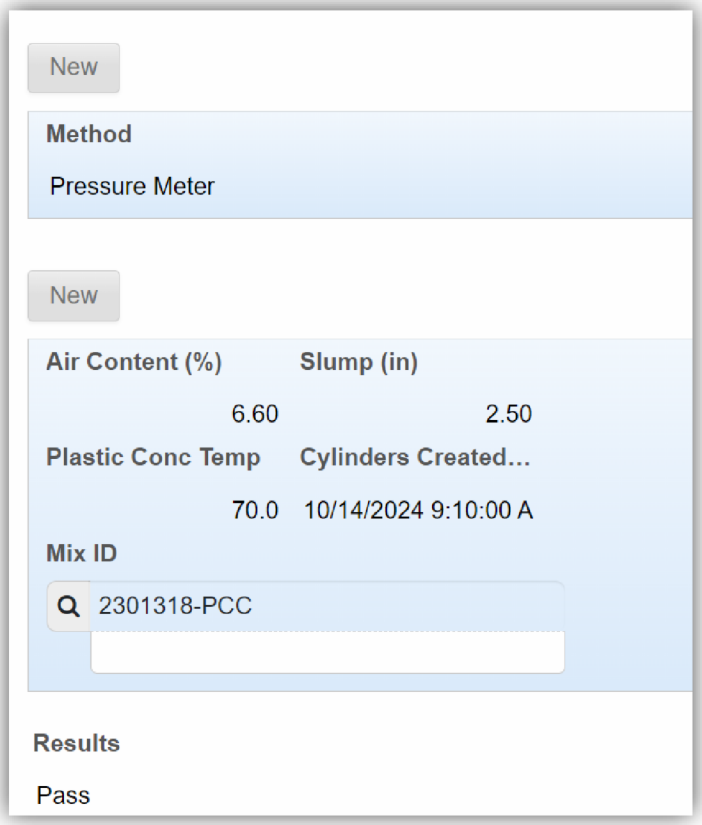
6.1 All applicable data shall be entered into AWP. This shall include all required fields as shown in the live version of the training guides available on the WVDOH MCS&T Webpage. A sample of these guides is provided in Attachment 1.

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

6.1.1 This data includes test results such as compacted density, or percentage of material passing a specific sieve.

6.1.2 Figure 1 shows an example of test data entered into AWP.

Figure 1 – An Example of Test Data Entered into AWP.



7. PRESENTING THE DATA TO THE DISTRICT FOR REVIEW AND SUBMITTING TESTING DOCUMENTATION

7.1 Once the test data has been entered, the data must be submitted to WVDOH.

7.2 An email shall be sent by the Contractor to the District Approved email submission inbox. An example of this email is shown in Attachment 2. A list of these inboxes is available on the WVDOH MCST Toolbox Webpage[2].

7.2.1 The title of the email shall contain the Contract ID and the Name of the Project, as well as "QC Test Results".

7.2.2 The email shall contain, but not be limited to the following information:

1. Contract ID
2. Name of the Project
3. Lab Reference Number
4. Sample ID
5. Material Name
6. Line Number(s)

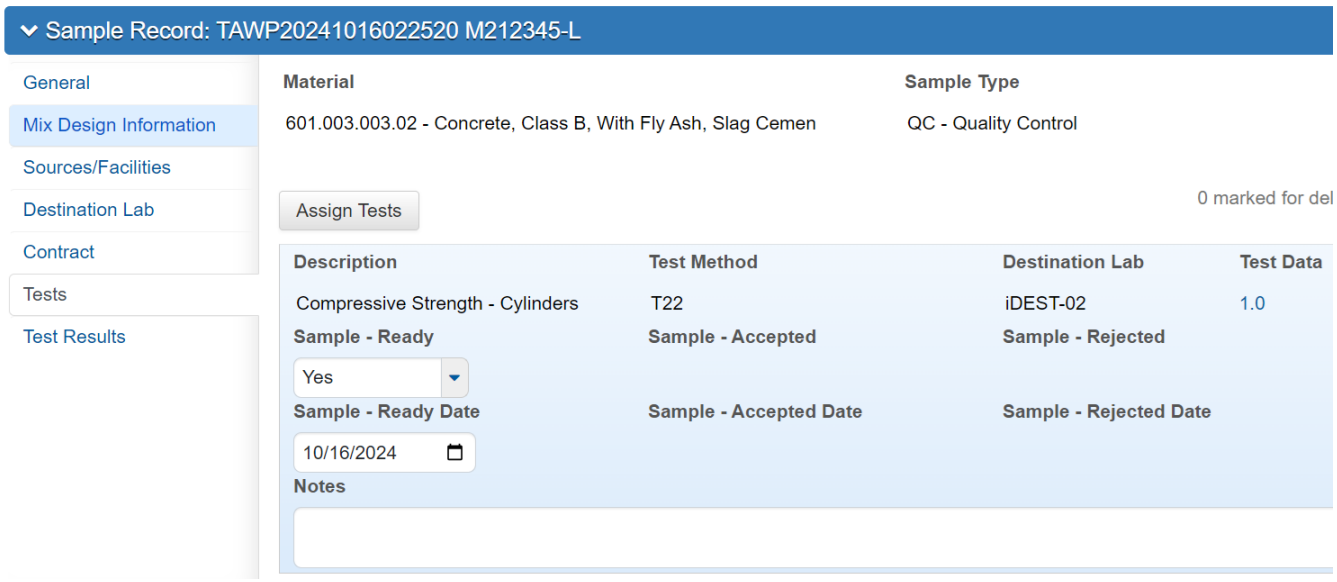
[2] https://transportation.wv.gov/highways/mcst/Pages/tbox.aspx

7. Final Status of the Material (Pass/Fail/Information Only)
8. A direct link to the AWP Sample Record
9. A PDF scan of all test data

7.3 The contractor may send multiple tests in a single email as long as each is on the same contract, for the same material and for the same testing day.

7.4 Once the sample record is ready to be submitted, the user will mark the test complete on the Sample Record. An example of this action is shown in Figure 2.

Figure 2 – An Example of a Submitted Sample Record into AWP.



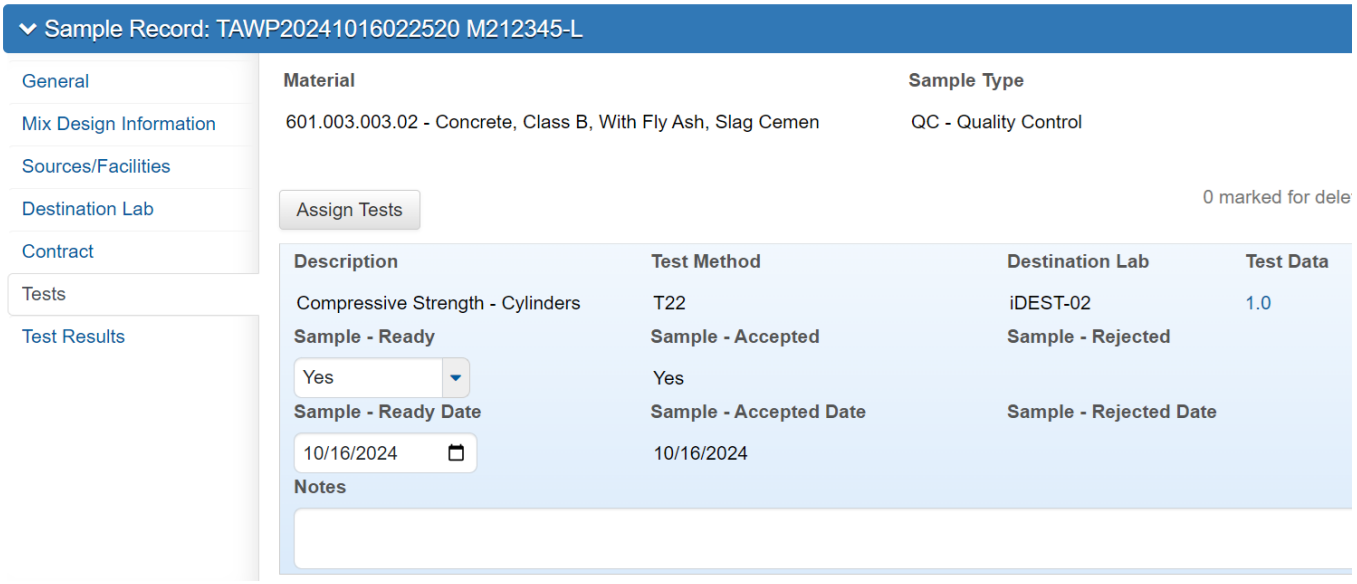
8. RECEIVING OF SAMPLES BY THE WVDOH

8.1 Once the District has received and accepted the sample record, they will "authorize" the sample. Whether the test data passes or fails, the sample record is still authorized.

8.1.1 If the sample record has been submitted to the District, and if the Contractor has an active "Auto-Pay" status as described in MP 109.00.23, the sample record will be counted toward payment if it has not been reviewed by the District after seven calendar days.

8.2 The District will also mark the sample as "Sample-Accepted" on the sample record tests tab. An example of the completed screen is shown in Figure 3.

Figure 3 – An Example of an Accepted Sample Record into AWP.



8.3 Once accepted, the District shall reply to the submission email stating that the sample record has been accepted.

8.4 If rejected, the District will mark the Sample as "rejected" with the rejection date. The District will then reply to the original email, stating the reasons for the rejection.

8.5 If a sample is rejected, the Contractor must correct the sample. Once corrected the Contractor will reply to the email stating that the sample has been corrected. The sample will then be reviewed by the District. If found acceptable, the District will process the sample.

8.6 If a sample record is once again rejected, the process shall repeat until the sample is correct.

8.6.1 In the case where a sample record has been rejected, the total number of days (timeframe) specified in MP 109.00.21 will be the sum of the days until submitted and the number of days between rejection(s) and resubmission(s).

8.6.1.1 For example, if the original submission takes 5 days and the sample is rejected, the correction(s) take an additional 5 days, the total number of days is 10. If the 10 days is greater than the allowable days in MP 109.00.21, the penalty will be applicable even if the original submission was within the allowable timeframe.

_____
Michael A. Mance, PE
Director
Materials Control, Soils & Testing Division

MP 109.00.22 Steward – Materials Control Section
MM:B
ATTACHMENT

ATTACHEMNT 1

I1-3 GENERAL TAB

Enter all the information (in Yellow) as it is Required.

NOTE: The Green Fields **MAY** be used based on the Sample Type and your District's workflow.

If you have the information, you can fill in the Green Fields.

(I1-5)

Go to the **Next Step**.

ATTACHMENT 2 – Sample Email Submission

Subject Line: 20240001243 – Contract Name – QC Test Results

Dear Scott,

I am submitting the following Sample Record(s):

20240001243
WV 19 to Allen's Run
C1N-1234
TAWP20241016022520
Class B Concrete with Fly Ash
LN 0020, LN 0030
Pass

20240001243
WV 19 to Allen's Run
C1N-1235
TAWP20241016022530
Class B Concrete with Fly Ash
LN 0020, LN 0030
Pass

https://wvXXX-pr-prod.infotechinc.com/#/SampleRecord/44209/Summary
https://wvXXX-pr-prod.infotechinc.com/#/SampleRecord/44209/Summary
(These links are examples; they are not a live.)

Attached is the Testing Documentation (PDF)

Very Truly Yours,

Jimmy John, from Tom's Construction.