Materials Procedures Committee Regular Meeting

Meeting Time/Date: February 19th, 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 02 19 MP Meeting

Files Available on Webpage:

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

Materials Procedures – Approved at Last Meeting

1. 106.10.51 - WVDOH Buy America Waiver and Exception Guidelines
2. 106.03.51 - Policy for Materials Certification Reciprocity
3. 109.00.21 - Basis For Charges for Nonsubmittal of Sampling & Testing Documentation by The Established Deadline
4. 109.00.22 - Procedure for the Submission and Documentation of Quality Control Test Results
5. 604.02.40 - Inspection and Acceptance Procedures for Precast Concrete Products
6. 712.21.26 - Procedure For Determining the Random Location of Compaction Tests
7. 106.00.03 - Guidelines For Establishing and Maintaining Approved Product Lists of Materials, Systems and Sources
8. 603.10.40 - Inspection and Acceptance Procedures for Prestressed Concrete Bridge Members

Materials Procedures - Old Business

Number	Champion	Title	Description
1* -106.10.50	Brayack	WVDOH Buy America Acceptance Guidelines	Removes waiver for Manufactured Materials in anticipation of FHWA Update.
2* - 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
3* - 212.02.20	Brayack	Procedure For Determining a Reduced Unit Price to Be Paid For Select Material For Backfilling Which Does Not	Removal of Table 1

		Conform To Grading Requirements Of Governing Specifications	
4* - 718.00.00	Titus	Sewer and Waterline Materials Procedure	Define the specifications, standards, and requirements for materials used in sewer and waterline construction projects
5* - 715.14.01	Gum	Quality Assurance of Laminated Elastomeric Bridge Bearing Pads with Internal Shims	To set forth the procedures which govern the Quality Assurance testing of laminated (with internal shims) elastomeric bridge bearing pads.
6* - 401.02.29	Jack	Guide For Quality Control and Acceptance Requirements for Superpave Asphalt Mixtures	Removal of VFA Calculation
7* - 100.00.00	Boothroyd	Preparing Materials Procedures	Addition of Definition
8* - 109.00.22	Brayack	Procedure for the Submission and Documentation of Quality Control Test Results	Update to add process for when a sample record is rejected.

Materials Procedures – Editorial Edits

None on this agenda

Materials Procedures - New Business with Significant or Process Updates

1& - 307.00.50	Ross	Guide for Quality Control and Acceptance Plans for Subgrade, Base Course, and Aggregate Items	Addition of Trail Surface Aggregate
2& - 679.02.99	Kukaua	Calibration of Concrete Continuous Mobile Mixer	New Document. Kiana to discuss.
3& - MA-1	Whelan	Operating and Emergency Procedures for Nuclear Gauges	Reconfirmation/update of practices
4& - ML-25	Ross	Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate	Reconfirmation/update of practices
5& - 711.03.23	Thaxton	Mix Design for Portland Cement Concrete	Replacing the Rapid Chloride Permeability test with the Surface Resistivity Test, and the SAM testing requirements for Mix Design approval.
6& - 601.00.49	Kukaua	Method of Test for Determining the Condition of Concrete Bridge Decks	New Document. Kiana to discuss.

7& 700.00.54	Brayack	Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results	Significant Updates, Dan to discuss.
8& 106.03.50	Harper	General Information Guide for Technician and Inspector Certification Program (TICP)	Changing 3 to 5 years for certification, adds apprentice program.

Note 1: * Denotes this MP is up for Vote

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

Comments

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

Next Meeting

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

Meeting Time/Date: 10:00 AM, April 16, 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:

February 19, April 16, June 18, August 20, October 15, December 17

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

MATERIALS PROCEDURE

WVDOH BUY AMERICA ACCEPTANCE GUIDELINES

1. PURPOSE

1.1 To set forth instructions for compliance with both State and Federal Buy America Requirements (henceforth referred to as "Buy America Requirements"), as listed in this document.

2. REFERENCED DOCUMENTS

2.1 PUBLIC LAW 117–58—NOV. 15, 2021, Infrastructure Investment and Jobs Act.

2.2 Build America, Buy America Act (BABA).

2.3 23 U.S.C. 313 and 23 CFR 635.410 "Buy America Requirements".

2.4 2 CFR part 184 Buy America Preferences for Infrastructure Projects.

2.5 M-22-11 Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure.

2.6 M-24-02 Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure.

2.7 Chapter 5, Article 19 and Chapter 5A, Article 3, Section 56 of the West Virginia Code, entitled "West Virginia American Steel Act of 2001."

2.8 West Virginia Notary Handbook, Current Edition.

2.9 MP 106.10.51 – WVDOH Buy America Waiver Guidelines.

3. ACCEPTANCE OF MATERIALS

3.1 This procedure applies to the following:

1. Steel and Iron
2. Manufactured Products
3. Construction Materials
4. Section 70917(c) Materials

3.2 An article, material, or supply shall only be classified into a single category listed in Section 3.1. In some cases, an article, material, or supply may not fall under any of these categories. Classification of the category must be made based on the status of article, materials, or supply at the time it is brought to the work site for incorporation into the project. The work site is generally the location of the project at which the materials will be incorporated. An article, material, or supply permanently incorporated into a project must meet the Buy America Preference for only the single category in which it is classified.

3.3 A Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to a project. As such, it does not apply to

tools, equipment, and supplies, such as temporary scaffolding brought to the construction site and removed at or before the completion of the project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished project but are not an integral part of the structure or permanently affixed to the project.[1]

3.3.1 Buy America preference does not apply to materials such as temporary paint or temporary traffic control devices.

3.3.2 Glass added to a permanent paint product requires a Certificate of Compliance.

4. STEEL AND IRON

4.1 Pursuant to Buy America Requirements, all manufacturing processes for steel and iron ~~materials~~ products must take place in the United States.

4.2 Definition

4.2.1 "Iron or steel products" means articles, materials, or supplies that consist wholly or predominantly of iron or steel or a combination of both.

4.2.1.1 "Predominantly of iron or steel or a combination of both" means that the cost of the iron and steel content exceeds 50 percent of the total cost of all its components. The cost of iron and steel is the cost of the iron or steel mill products (such as bar, billet, slab, wire, plate, or sheet), castings, or forgings utilized in the manufacture of the product and a good faith estimate of the cost of iron or steel components.

4.3 Standard

4.3.1 This includes all processes from the initial melting stage through application of coatings occurs in the United States.

5. MANUFACTURED PRODUCTS

Commented [DB1]: Work with Janie to create PSP for Projects that this is applicable (Obligation date is known to WVDOH not the Contractor)

5.1 Pursuant to Buy America Requirements, all Manufactured Materials are required to be produced in the United States. All manufacturing processes shall occur in the United States.

~~5.1 The Federal Highway Administration (FHWA) has a longstanding waiver in effect exempting Manufactured Products from Buy America Requirements.~~

5.2 Definition

~~5.1.1~~5.2.1 Manufactured products means articles, materials, or supplies that have been processed into a specific form and shape, or combined with other articles, materials, or supplies to create a product with different properties than the individual articles, materials, or supplies. If an item is classified as an iron or steel product, an excluded material, or other product category as specified by law or in 2 CFR part 184, then it is not a manufactured product. However, an article, material, or supply classified as a manufactured product may include components that are iron or steel products, excluded materials, or other product categories as specified by law or in 2 CFR part 184. Mi

[1] M-24-02: Memorandum for the Heads of Executive Departments and Agencies, Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure, Page 4

xtures of excluded materials delivered to a work site without final form for incorporation into a project are not a manufactured product.

~~5.1.2 Manufactured products means:~~

~~1. Articles, materials, or supplies that have been:~~
~~A. Processed into a specific form and shape;~~
~~B. or Combined with other articles, materials,~~
~~C. or supplies to create a product with different properties than the individual articles, materials, or supplies.~~

~~2. If an item is classified as an iron or steel product, or a construction material, then it is not a manufactured product. However, an article, material, or supply classified as a manufactured product under 2 CFR 184.4(e) and paragraph (1) of this definition may include components that are construction materials, iron or steel products, or Section 70917(c) materials.~~

5.3 Standard for Projects Obligated on or after October 1st, 2025 (Final Assembly Standard)

5.3.1 Pursuant to Buy America Requirements, all manufactured products used in the project are produced in the United States; this means the final assembly of the manufactured product was manufactured in the United States.

5.4 Standard for Projects Obligated on or after October 1st, 2026 (55 Percent Standard)~~Standard~~

~~5.1.3~~5.4.1 Pursuant to Buy America Requirements, all manufactured products used in the project are produced in the United States; this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard that meets or exceeds this standard has been established under applicable law or regulation for determining the minimum amount of domestic content of the manufactured product.[2]

~~5.1.3.1~~5.4.1.1 In determining whether the cost of components for manufactured products is greater than 55 percent of the total cost of all components, use the following instructions:

1. For components purchased by the manufacturer, the acquisition cost, including transportation costs to the place of incorporation into the manufactured product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued).
2. For components manufactured by the manufacturer, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1), plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the manufactured product.

[2] M-24-02: Memorandum for the Heads of Executive Departments and Agencies, Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure, Page 15-16.

6. CONSTRUCTION MATERIALS.

6.1 Pursuant to Buy America Requirements, all Construction Materials are required to be produced in the United States. All manufacturing processes for the Construction Materials shall occur in the United States.

6.2 Definition

6.2.1 Construction materials means articles, materials, or supplies that consist of only one of the items listed in Section 6.2.1.1, except as provided in Section 6.2.1.2. To the extent one of the items listed in Section 6.2.1.1 contains as inputs other items listed in this section, it is nonetheless a construction material.

6.2.1.1 The listed items are:

1. Non-ferrous metals;
2. Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
3. Glass (including optic glass);
4. Fiber optic cable (including drop cable);
5. Optical fiber;
6. Lumber;
7. Engineered wood; and
8. Drywall.

6.2.1.2 Minor additions of articles, materials, supplies, or binding agents to a construction material do not change the categorization of the construction material.

6.3 Standard

6.3.1 The Buy America Preference applies to the following construction materials incorporated into projects. Each construction material is followed by a standard for the material to be considered "produced in the United States."

1. Non-ferrous metals. All manufacturing processes, from initial smelting or melting through final shaping, coating, and assembly, occurred in the United States.
2. Plastic and polymer-based products. All manufacturing processes, from initial combination of constituent plastic or polymer-based inputs, or, where applicable, constituent composite materials, until the item is in its final form, occurred in the United States.
3. Glass. All manufacturing processes, from initial batching and melting of raw materials through annealing, cooling, and cutting, occurred in the United States.
4. Fiber optic cable (including drop cable). All manufacturing processes, from the initial ribboning (if applicable), through buffering, fiber stranding and jacketing, occurred in the United States. All manufacturing processes also include the standards for glass and optical fiber, but not for non-ferrous metals, plastic and polymer-based products, or any others.
5. Optical fiber. All manufacturing processes, from the initial preform fabrication stage through the completion of the draw, occurred in the United States.

6. Lumber. All manufacturing processes, from initial debarking through treatment and planing, occurred in the United States.
7. Drywall. All manufacturing processes, from initial blending of mined or synthetic gypsum plaster and additives through cutting and drying of sandwiched panels, occurred in the United States.
8. Engineered wood. All manufacturing processes from the initial combination of constituent materials until the wood product is in its final form, occurred in the United States.

6.3.2 Except as specifically provided, only a single standard under this section should be applied to a single construction material.

7. SECTION 70917(C) MATERIALS

7.1 The standards developed under BABA 70915(b) (1) shall not include cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives as inputs of the construction material. These are referred to as 70917(C) materials.

7.2 Definition

7.2.1 Section 70917(c) materials means cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives. See section 70917(c) of the Build America, Buy America Act.

7.3 These materials are exempt from Buy American Requirements.

8. BUY AMERICA COMPLIANCE.

8.1 On a given project, the Division shall not accept, approve, authorize, or make any payments to any Contractor not fully compliant with Buy America.

8.1.1 When Buy America Requirements apply, the Contractor shall furnish a notarized Certificate of Compliance signed by their official with knowledge and authority to certify that all applicable materials and products to be incorporated into the project, including those of any subcontractors and suppliers, are compliant with Buy America Requirements. This shall be done prior to the permanent incorporation of the materials into the project.

8.1.2 The notarized Certificate of Compliance shall contain the following information:

8.1.2.1 Title: Buy America Certification of Compliance.

8.1.2.2 The Name, Address and Contact Information for the Contractor.

8.1.2.3 A contractor statement that demonstrates compliance with Buy America Requirements.

8.1.2.4 The Contract ID for the Material (if applicable).

8.1.2.5 Both the Federal and State Project Number for the Material (if applicable).

8.1.2.6 The name of the material referenced in the Certificate of Compliance. This material name shall be a clear, common name for the material as stated in the proposal. Part Numbers, etc., may also be on the document if the contractor wishes.

8.1.2.7 The Line Item for the Material (if applicable).

8.1.2.8 The Bid and/or Placed Quantity of the Material.

8.1.2.9 Signature of the Contractor and date.

8.1.2.10 A list of materials on the project that "Buy America" applies but are not Buy America compliant.

8.1.2.11 The document must be notarized as per the "West Virginia Notary Handbook."

8.2 Attachment 1 shows a sample Certificate of Compliance.

8.2.1 Multiple items may be listed on the Certificate of Compliance, though all the information for each line must be on the document.

8.2.2 A list of these materials may be referenced on an attached page as long as that page is also signed and notarized.

9. BUY AMERICA WAIVERS

9.1 Buy America Waivers are outlined in MP 106.10.51 as per "§ 184.7 Federal awarding agency's issuance of a Buy America Preference waiver" and "23 CFR 635.410(c)".

10. BUY AMERICA MATERIALS

10.1 Attachment 2 includes a list of materials and products used in WVDOH construction projects and the applicability of Buy America Requirements. This attachment also shows each category of each based on Section 3.1 of this document. Finally, if the material is not applicable to Buy America Requirements, justification is given. Example exemptions are as follows:

1. Historic Waiver: Manufactured Product is waived by FHWA as per Section 5 of this Document.
2. Temporary Material: Material is not permanently incorporated into the project.

10.1.1 This materials and products list may be updated by the Director of MCS&T as needed to ensure compliance with Buy America Requirements. Any update to this form will be in accordance with guidance from and through an affirmation process with FHWA.

10.1.2 Attachment 3 includes OMB Memorandum M-24-02[3], dated October 25, 2023, for additional guidance and as the source material for WVDOH's compliance.

[3] https://www.whitehouse.gov/wp-content/uploads/2023/10/M-24-02-Buy-America-Implementation-Guidance-Update.pdf

11. DOCUMENTATION OF BUY AMERICA CERTIFICATION OF COMPLIANCE

11.1 The Certificate of Compliance shall be placed in the QC Plan Folder in ProjectWise (or the current WVDOH approved document retention software) under the contract.

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

MP 106.10.50 Steward – Materials Control Section
ATTACHMENTS

Buy America Certification of Compliance

Acme Construction Company
123 Main Street
Charleston, WV 25302

Ship Date: 10/31/2023

The below listed materials and products meets all the requirements of all Federal and State Laws for Buy America, including but not limited to: Chapter 5, Article 19 and Chapter 5A, Article 3 Section 56 of the West Virginia Code; 23 U.S.C. 313 Buy America, 23 CFR 635.410 Buy America Requirements, and Build America, Buy America Act, Section 70914.

This Certification of Compliance is for the material and project listed below:

CID: 22000005R1
Federal Number: B-0010(000)X
State Number: U002-00-1.00

Line: 0020	Widget, Part Q^{i}	500 Cubits
Line: 0025	Widget, Part H^{r}	300 Cubits

Non-Compliant Buy America Materials

Line: 0055	Widget, Part I^{z}	300 Cubits

Janie Doe, Contractor President

Attachment 2: Full document is available at the WVDOH MCST Toolbox[4].

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

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 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

~~1.1~~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.~~

4.7. 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

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

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

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

~~4.1.~~5.3. 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~~

~~5.1.6. Instrotek/CPN MC-3P~~~~rocess 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.

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

~~**6.7. APPROVAL OF DEVICES FOR TESTING OF DENSITY AND/OR MOISTURE OF IN-PLACE MATERIAL**~~

~~6.1.~~7.1. ~~Process TBD~~

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

MATERIALS PROCEDURE

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

1. PURPOSE

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

2. SCOPE

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

3. REFERENCED DOCUMENTS

3.1 MP: 300.00.51 – Procedural Guidelines for Maintaining Control Charts

3.2 Section 212 of the Specifications

4. DEFINITION OF TERMS

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

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

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

5. DESIGNATION OF QUANTITIES FOR EQUITABLE PRICE ADJUSTMENT

5.1 When an average gradation test value, or three individual test values, fall outside the limits of the Specifications, the LOT of material represented thereby is considered to be nonconforming to the extent that the last of its sublots is nonconforming. When a lot of material is nonconforming, then the last sublot contained therein shall have its price adjusted in accordance with Table 212.12.1 of the Specifications.

In no event, however, shall a sublot of material have its price adjusted more than once, and the first adjustment which is determined shall apply.

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

6. DEGREE OF NONCONFORMANCE

6.1 When a sublot of material is to have its price adjusted, the percentage point difference between the nonconforming test value and the specification limit shall be determined for each sieve determined to be nonconforming (nonconforming as described in 4.1 above), and this value shall be compared to Table 212.2.5.3. The total measure of the degree of nonconformance is, therefore, the sum of nonconformance on the two sieve sizes of the sublot.

~~Table 1~~

~~Degree of Nonconformance~~	~~Percent of Contract Price to be Reduced~~
~~to 3.0~~	~~2~~
~~3.1 to 5.0~~	~~4~~
~~5.1 to 8.0~~	~~7~~
~~8.1 to 12.0~~	~~11~~
~~Greater than 12.0~~	~~*~~

7. DETERMINATION OF EQUITABLE ADJUSTMENT

7.1 ~~When the total degree of nonconformance has been established and it is 12.0 or less, the designated action shall be initiated from Table 212.12.1 of the Specifications.~~ When the degree of nonconformance requires a DMIR as specified in Table 212.2.5.3~~for a sublot is greater than 12.0~~, ~~a special investigation (DMIR~~it ~~)~~ shall be performed within 14 calendar days. ~~of determining the degree of nonconformance~~. ~~If the special investigation~~DMIR ~~is not performed with~~in ~~14 calendar days, said the sublot will not be incorporated into the project, and in fact, removed from the project as soon as possible.~~

8. METHOD OF ACCOUNTING AND CHANGE ORDER PREPARATION

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

8.2 Dollar reduction shall be calculated by (A) quantity × (B) % reduction from Table 212.~~2~~12.~~5~~1.~~3~~ × (C) unit contract price. (A sample tabulation sheet is attached).

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

MP 212.01.21 Steward – Aggregate Section
MM:R
ATTACHMENT

Equitable Reduction Procedure

TABULATION OF EQUITABLE REDUCTIONS (partial, Imperial Units)

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

Subtotal (1) (Note 2) $280.00

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

Subtotal (2) (Note 2) $455.00

Total Reduction (Note 3) $735.00

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

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

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

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

SEWER AND WATERLINE MATERIALS PROCEDURE

Commented [DB1]: Review spec to make sure these are applicable.

1. PURPOSE

1.1. Define the specifications, standards, and requirements for materials used in sewer and waterline construction projects managed by the West Virginia Division of Highways (WVDOH).

1.2. Establish procedures for reviewing and approving Producer/Suppliers of sewer and waterline materials acceptable for use on WVDOH projects.

1.3. Ensure materials meet industry standards to guarantee durability, performance, and safety in the construction and operation of sewer and waterline systems.

1.4. Maintain a record of approved suppliers and their compliance with established standards.

2. SCOPE

2.1. This procedure applies to the acceptance, approval, and use of materials for sewer and waterline construction, including, but not limited to, pipe materials, valves, hydrants, service lines, meters, and other related materials.

2.2. This procedure applies to all sewer and waterline products used on WVDOH projects unless otherwise specified in the project plans.

2.3. It applies to all producers/suppliers who provide sewer and waterline materials for use on WVDOH projects, ensuring compliance with specifications outlined in referenced standards.

3. REFERENCED DOCUMENTS

The following documents provide standards and specifications for materials covered by this procedure:

3.1. MP on APLs and HL-468

3.2. AWWA C151 - Ductile Iron Pipe

3.3. AWWA C104 - Cement Lining for Ductile Iron Pipe

3.4. AWWA C110 - Ductile Iron and Gray Iron Fittings

3.5. AWWA C153 - Ductile Iron Compact Fittings

3.6. AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

3.7. AWWA C115 - Flanged Ductile Iron Pipe with Rubber Gasket Joints

3.8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe

3.9. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe for Water Distribution

3.10. ASTM D2241 - Polyvinyl Chloride (PVC) Pipe for Pressure Systems

3.11. ASTM D3034 - Polyvinyl Chloride (PVC) Sewer Pipe

3.12. ASTM D2239 - Polyethylene (PE) Pipe

3.13. AWWA C800 - Copper Service Line Fittings

3.14. AWWA C502 - Fire Hydrants

3.15. ASTM A53 - Steel Pipe

3.16. ASTM A139 - Electric-Fusion (Arc) Welded Steel Pipe

3.17. ASTM A252 - Steel Pipe Piles

3.18. ASTM B88 - Seamless Copper Water Tubing

3.19. AWWA C700 - Water Meters

4. MATERIAL REQUIREMENTS

The following are the material specifications for sewer and waterline construction:

4.1. 718.1 - DUCTILE IRON PIPE

4.1.1. 718.1.1: Ductile iron pipe used for waterline applications shall conform to AWWA C151.

4.1.2. 718.1.2: Cement lining for ductile iron pipe shall conform to AWWA C104.

4.1.3. 718.1.3: Fittings for ductile iron pipe shall conform to AWWA C110 or AWWA C153.

4.1.4. 718.1.4: Joints for ductile iron pipe shall conform to AWWA C111; flanged joints shall conform to AWWA C115.

4.2. 718.5 - PVC PIPE

4.2.1. PVC pipe used in water and sewer applications must meet the following requirements unless specified otherwise by the utility:

4.2.2. Pipe Size:

- Less than 4 inches (100 mm):
  - Pressure applications: ASTM D2241, SDR 21
  - Non-pressure applications: ASTM D3034
- 4 inches (100 mm) to 12 inches (300 mm):
  - Pressure applications: AWWA C900, DR 14

        - Non-pressure applications: ASTM D3034
    - 14 inches (350 mm) to 16 inches (400 mm):
        - Pressure applications: AWWA C905, DR 14
        - Non-pressure applications: ASTM D3034

4.2.3. Joint Requirements:

- Pressure Applications: ASTM D3139
- Non-Pressure Applications: ASTM D3212

4.3. 718.7 - POLYETHYLENE PIPE

4.3.1. Polyethylene pipe shall conform to ASTM D2239 “PE3408.”

4.3.2. For potable water use, polyethylene pipe must be approved by the National Sanitation Foundation (NSF) for transmitting liquids intended for human consumption.

4.4. 718.9 - COPPER SERVICE LINE

4.4.1. Copper service lines shall conform to ASTM B88.

4.4.2. Fittings used in copper service lines shall conform to AWWA C800.

4.5. 718.10 - GATE VALVES

4.5.1. Gate valves shall conform to AWWA C500 or AWWA C509.

4.6. 718.11 - VALVE BOXES

4.6.1. Valve boxes shall be specified on the construction plans.

4.7. 718.12 - STEEL CASING PIPE

4.7.1. Steel casing pipe shall conform to one of the following:

- ASTM A53, Grade B
- ASTM A139, Grade B
- ASTM A252, Grade 2
- Hydrostatic test requirements for waterline and sewer line applications are waived for these steel casing pipes.

4.8. 718.13 - FIRE HYDRANTS

4.8.1. Fire hydrants shall conform to AWWA C502. Specific details for fire hydrants should be referenced in the construction plans.

4.9. 718.14 - WATER METERS

4.9.1. Meters shall conform to AWWA C700, with the type specified in the construction plans.

5. ACCEPTANCE PROCEDURE

5.1. With each shipment of sewer and waterline materials to a WVDOH project, the producer/supplier shall provide shipping documents that include an APL approval number confirming that the materials meet WVDOH quality specifications.

6. ACCEPTANCE PROCEDURE (APPROVED SOURCE)

6.1. To become an approved source, producers/suppliers must comply with the following requirements

6.2. Submit completed Form HL-4681, as outlined in MP 106.00.02, indicating intent to be listed on the WVDOH APL.

6.3. Undergo an on-site evaluation conducted by MCS&T or Approved consultants to verify compliance with material standards and storage practices.

6.4. Initial and annual evaluations are guided by criteria in Section 9 where applicable, including compliance with shipping policies and technical specifications.

6.5. MCS&T personnel will document evaluation findings in an inspection report. Approved suppliers will be assigned a laboratory approval number, which becomes the APL number.

6.6. Suppliers removed from the approved source list for non-compliance may reapply after one year, provided corrective measures are implemented.

7. ACCEPTANCE PROCEDURES (NON-APPROVED SOURCE)

7.1. Any Sewer or Waterline materials not supplied by an approved source are to be accepted or rejected by the direct coverage process.

7.2. If direct coverage inspection is required, the inspection or evaluation will conclude with a 7-digit Laboratory reference number indicating approval or rejection.

8. DOCUMENTATION

8.1. The approved source list for sewer and waterline materials will be updated as new producers/suppliers are added or removed.

9. EVALUATION CRITERIA FOR SEWER AND WATERLINE MATERIAL SUPPLIERS

9.1. Establish if the supply location is a business or a storage facility. Is the location primarily a storage yard, or does it include an office building with personnel capable of sales inquiries?

9.2. Determine if the location supplies industrial-quality sewer and waterline materials or residential-grade products. Does the supplier primarily cater to industrial and municipal applications?

9.3. Determine whether the supplier operates as a wholesaler, retailer, or both. Assess whether the location primarily provides materials for business-to-business transactions or serves retail customers.

9.4. Inform sales personnel that materials supplied, such as ductile iron pipe, valve boxes, and plastic pipe (poly),ect. must come from established APL (Approved Products List) sources and where to find these lists online.

9.5. Inform sales personnel of shipping procedures. Documents must include laboratory approval numbers, CID numbers for direct coverage, and tracking numbers. For approved sources, APL numbers must be included for WVDOH District personnel.

9.6. Inform sales personnel on materials subject to "Buy American" requirements.

9.7. An outside and inside inventory evaluation of materials to identify those covered by their own APL versus those not covered. Ensure that sales personnel are aware of which materials require additional certifications or approvals.

9.8. Inform sales personnel how to manage backordered, partial, or drop-shipped materials and the proper procedures for sourcing from other approved producers/suppliers.

9.9. Ensure that all sewer and waterline systems meet the requirements of applicable WVDOH specifications, such as those outlined in Section 718.

9.10. To ensure that all valves, hydrants, and related hardware comply with AWWA standards (e.g., C500, C502)

9.11. Confirm that polyethylene pipes, copper service lines, and other specialty items meet ASTM and AWWA standards

9.12. To confirm that all steel casing pipes, valves, and water meters comply with applicable AWWA and ASTM standards (e.g., ASTM A53, AWWA C700), ensuring suitability for the project’s specifications.

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 WVDOT Roads and Bridges 2024, 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.

Commented [MM1]: Need to come up with an MP number for this MP.

Commented [JG2]: 715.014.01 was selected. Added proper page number, and date as per MP platform

Commented [MM3]: Is this for Plain and Elastomeric Pads or Pads with and without shims?

Commented [JG4]: This is for Elastomeric with internal shims only. Plain pads are accepted via certification documentation as per specification 715.14.2

Commented [MM5]: What about Plain bearing pads? Need to include that if it's going to be referenced in the title. Also, need to explain the difference between Plain and Elastomeric bearing pads. I don't see Plain Bearing Pads outlined in the Specs, just Elastomeric Bearing Pads.

Commented [JG6]: Reference title changed to Elsatomeric Bearing Pads with Shims (Laminated).

Commented [JG8]: Changed format to Referenced Documents

Commented [MM7]: I think the format that Dan is currently using for all of the MPs has this section titled as "Referenced Documents".

Commented [MM9]: A spec change will also need to be written that references this MP in Sections 715.14 & 715.15. Also, 715.14 needs to include which AASHTO standard the pads need to meet. Also, by referencing 715.5, we are including bearing pads for bridge railing posts. Is that the intent?

Commented [JG10]: This MP was intended for Laminated Bearing Pads with internal shims only. 715.15 reference has been removed.

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.)

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. SAMPLING AND TESTING FREQUENCY FOR LAMINATED ELASTOMERIC BEARING PADS

5. QUALITY CONTROL REQUIREMENTS

5.1. Quality Control is the responsibility of the manufacturer and shall include the following:

Commented [MM11]: Need to define LOT. How many pieces, batch, days of production, etc.

Commented [JG12]: Included LOT definition as per WVDOT specification 106.3 and AASHTO M251, section 4

Commented [MM13]: Reject the pad or the entire LOT?

Commented [JG14]: Bearing sample only, changed to reflect

Commented [GH15]: Should we not reject the entire lot?

Commented [JG16]: Yes sir, changed to lot

Commented [MM17]: How many samples per LOT?

Commented [JG18]: Added quantity description, based on 106.3 and 715.14.1 specifications

Commented [MM19]: Original or Oven Aged?

Commented [JG20]: Added both original and oven aged to define

Commented [MM21]: This method isn't referenced in AASHTO M251. Is this a WVDOH specific requirement? If so, it's not currently required in our specs.

Commented [JG22]: Redacted. Cut and paste error.

Commented [MM23]: Looks like a letter is missing in front of this number.

Commented [JG24]: Appropriate letter designation added

Commented [JG26]: Typo was removed. Lot description was moved to 3.2 No table intended (typo)

Commented [MM25]: I don't see a table. Shouldn't this be in Section 3.2? What about Plain Bearing Pads?

5.1.1. 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).

5.2. Ensure quality workmanship as well as a quality product throughout production.

5.3. 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.

5.4. 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.

5.5. To conduct quality control tests in accordance with (ASTM M251).

6. ACCEPTANCE CRITERIA

MCS&T will:

6.1. 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.

6.1.1. 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 dimension 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

7. SHIPPING REQUIREMENTS

7.1. The approved LOT of bearing pad sample portion can be shipped by the manufacturer providing the following provisions have been met:

Commented [GH27]: Do we test these? These are for railing posts.

Commented [JG28]: Must have been cut and paste from a referenced document, it has been removed

7.1.1. 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.

8. ACCEPTANCE PRACTICE

8.1. 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.).

8.2. 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.

9. DIVISIONAL TESTING PROCEDURE

9.1. 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 a sample number of some type.

9.1.1. Once arrived, measurement of the sample must be taken to verify that it meets the dimensions referenced on the T-100 form.

9.1.1.1. 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 (d) of the Material Procedure.

9.1.1.2. When the paperwork and sample are shown to be in order, the bearing pad is ready to be processed for acceptance testing.

9.2. Sample Cutting- Tensile and Elongation Sets

9.2.1. 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.

9.2.2. 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.

9.2.3. 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.

9.2.4. 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.

9.2.5. 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.

9.3. Thickness Measurements

9.3.1. 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.

9.3.1.1. 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 over aged testing (OA).

9.3.2. 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.

9.3.3. On 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.

9.4. Oven Aging

9.4.1. 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.

9.4.2. 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.

9.4.3. 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.

9.5. Tensile and Elongation Test

9.5.1. 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

9.5.1.1. Once testing has been completed. All information must be recorded ~~on the worksheet~~.

9.6. Compression Set

9.6.1. Compression set testing must conform to (AASHTO ASTM D395, Method B-Type 1)

9.6.1.1. 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.

9.6.2. 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.

9.6.3. Specimens should then be conditioned as per Section 9.2.5 of this MP.

9.6.4. Once the minimum 3-hour conditioning as described in Section 9.2.5 is achieved, the samples can now be measured for thickness.

9.6.4.1. 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.

9.6.4.2. 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.

9.6.5. Continue to prepare the compression set device.

9.6.5.1. 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 in between the plates. Note: make sure the spacers are properly in place before tightening the plates.

9.6.5.2. Once the samples are secured in the compression device, the sample can now be oven aged.

9.6.5.3. 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.

9.6.6. 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. Room must be within temperature and humidity tolerances 23 ± 2° C (73.4 ± 3.6° F) and at 50 ± 5% humidity.

9.6.6.1. 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 precent of compression as follows:

(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

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.

9.7. Durometer Hardness

9.7.1. 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.

9.7.2. 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.

9.7.2.1. 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.

9.7.3. Prepare the oven for oven aged test

9.7.3.1. 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.

9.7.3.2. 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

9.7.3.3. 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.

10. BEARING PAD SAMPLE TEST ACCEPTED BY CERTIFICATION

10.1. 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.

10.2. 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) Company Letterhead
b) Laboratory Test Report Material Type (i.e. Natural Rubber, Neoprene)
c) Customer (i.e. Contractor, etc.)
d) Purchase Order #
e) Certification Date
f) Test Method Required and Results
g) Project Number
h) Project Authorization

i) Quantity
j) Description of material
k) Lot number
l) notarization

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

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL AND ACCEPTANCE REQUIREMENTS FOR SUPERPAVE ASPHALT MIXTURES

1. PURPOSE

1.1 To provide a method for daily monitoring and quality assurance of Superpave asphalt mixtures.

1.2 To provide guidelines for adequate acceptance plans.

1.3 To provide plant personnel with criteria upon which to base decisions of continuing or ceasing plant production.

1.4 To provide field personnel with criteria upon which to base decisions of accepting or rejecting material.

1.5 To provide an equitable and uniform method for determining price adjustments in those instances where adequate production control has not been maintained and non-specification material has found its way into the completed work.

2. SCOPE

2.1 This acceptance procedure shall be applicable to all Superpave asphalt mixture types relative to compliance with job mix formula (JMF) acceptance limits as specified in the governing specifications.

3. DEFINITIONS

3.1 Job Mix Formula – The specification for a single mix produced at a single plant. This mix may be used on a single project or on multiple projects if the basic design criteria (design compaction level and PG Binder grade) are the same.

3.2 Lot - The quantity of material represented by the average of four (4) consecutive test values.

3.3 Sublot – The quantity of material represented by an individual test value within the Lot.

3.4 Field Design Verification Samples and Tests - Those samples taken, and tests conducted by the contractor to verify that a mix design can be produced within the limits of the criteria set forth by this Materials Procedure. These samples are taken during the initial use of each mix design or whenever circumstances described in this MP require a new field design verification. These samples should not be confused

with the Division verification samples that are used to determine specification compliance.

3.5 Quality Control Samples and Tests - Those samples taken and tests conducted by the Producer/Contractor to monitor and control the production of this product.

3.6 Verification Samples and Tests - Those samples taken and tests conducted by the Division to determine specification compliance.

4. DOCUMENTATION

4.1 The Contractor shall maintain adequate records of all testing and records of any production changes required to control their product. The records shall indicate the nature and number of observations made, the number and types of deficiencies found, and the nature of corrective actions taken. The Contractor's documentation procedures will be subject to the review and approval of the Division and shall be available to the Division at any time during the progress of the work being performed.

4.2 Forms and Distribution: All test data shall be documented on forms provided by the Division. The original copy of the form shall be delivered to the District Materials Supervisor. One copy of each completed form is to be retained by the contractor until the project is completed. Testing shall be conducted using only the approved test methods listed in Section 401.5.1 of the Specifications unless specified otherwise in contract documents. Asphalt content and gradation test results shall be recorded on form T417. Mix design property test results shall be recorded on form T419. To maintain an effective quality control program, tests shall be completed in a regular and timely manner. If QC test results are not completed and submitted within 2 working days, the Division will reserve the right to stop further production until tests are completed, submitted, and reviewed by District Materials staff. Field design verification test results must be performed and submitted daily during production.

4.3 The Contractor shall take prompt action to correct conditions that have resulted, or could result, in the submission to the Division of materials and products that do not conform to the requirements of the applicable Specifications, Materials Procedures, or Contract documents. The Contractor shall establish a detailed plan of action regarding the disposition of non-specification material. In the event that non-specification material is incorporated into the project, the Division shall be notified immediately.

4.4 All asphalt mixture component materials shipped to the plant must have proper documentation which identifies the type and source of each material. This information shall be made accessible to the Division for review at any time.

5. JOB MIX FORMULA FIELD DESIGN VERIFICATION

5.1 For each JMF, a field design verification shall be conducted during the first days of plant production for the purpose of demonstrating that the mix can be produced within the specified tolerances set forth in this MP.

5.2 This field design verification shall consist of a randomly selected HMA sample taken in accordance with AASHTO T 168 for each three hours of production, with

no more than three samples in one day. A minimum of three samples are required for verification, however, three additional samples are required if none of the first three samples are completely within the specification limits. Samples used for gradation analysis during the verification process shall be obtained from the asphalt ignition oven samples (AASHTO T 308). If there is a problem with major aggregate breakdown affecting the gradation test results when using the ignition oven, gradation samples may be obtained from hot bins, cold feeds, or extracted HMA samples.

5.3 Field design verification testing shall not be conducted if less than 200 tons of material is to be produced in a single day. In such cases daily quality control testing shall be conducted in accordance with Section 6.0 and the sample shall meet the gradation requirements set forth in Table 401.02.29B. The sample shall also meet the design asphalt content within ± 0.4%, and a minimum VMA of 0.5% below the design criteria., ~~and the VFA design criteria specified in MP 401.02.28.~~

5.4 The percent air voids shall be within the range of 2.8 – 5.2 percent.

5.5 The field design verification mix property requirements are listed in Table 401.02.29A. Field design verification test results shall be documented on Form T 419.

TABLE 401.02.29A: Mix Property Field Design Verification Requirements

Property	Field Verification Tolerances
Asphalt Content (%)	JMF ± 0.4 %
Air Voids (%)	3.0 – 5.0 %
Voids in Mineral Aggregate (VMA) %	Min. of 0.5% Below Design Criteria

5.6 Gradation requirements for the field design verification samples shall be as indicated in Table 401.02.29B. The gradation results shall fall within the limits of each listed control point with the exceptions as noted on the 2.36 mm (No. 8) sieve. ~~The gradation must also pass beneath the restricted zone as described in Table 401.02.29B.~~ Gradation results for all sieves listed in this table for each mix type shall be documented on Form T 421.

5.7 After each of the field design verification samples are tested, the results shall be evaluated to determine conformance to the requirements of Tables 401.02.29A and 401.02.29B. If any test results fall outside the allowable tolerance limits, then steps must be taken to make any necessary production adjustments to bring the mix back to within specification limits. If, after three samples the design criteria and gradation requirements of at least one of the samples is within all of the allowable tolerance limits then verification of the design is complete. If the criteria are not met, then three additional samples shall be tested. If, after six samples, the Division determines that

the mix cannot be produced within specification limits, the mix design shall be rejected, and a new mix design will be required. If the mix design is rejected the average percent asphalt and the average percent air voids of the six verification samples shall be determined. If either or both average values are

outside the allowable tolerance limits of Table 401.02.29C then the material represented by these samples shall have its price reduced in accordance with the schedule set forth in Section 7.0. District Materials shall notify MCS&T immediately upon the rejection of any mix design.

TABLE 401.02.29B: Design Aggregate Gradation Requirements (Note 1)

Nominal Max. Size	**37.5 mm (1 ½ inch)**	**25 mm (1 inch)**	**19 mm (3/4 inch)**	**12.5 mm (1/2 inch)**	**9.5 mm (3/8 inch)**	**Gradation Tolerances Shall Be The Design Control Points With Exception As Noted Below**
Standard Sieve Size	**Base-I**		**Base-II (P&L) Wearing-IV**		**Wearing-I (Scratch)**	
50 mm (2")	100.0					-
37.5 mm (1½")	90.0 – 100.0	100				-
25 mm (1")	90.0 max	90.0 – 100.0	100.0			-
19 mm (3/4")		90.0 max	90.0 – 100.0	100.0		-
12.5 mm (1/2")			90.0 max	90.0 – 100.0	100.0	-
9.5 mm (3/8")				90.0 max	90.0 – 100.0	-
4.75 mm (No.4)					90.0 max	-
2.36 mm (No.8)	15.0 – 41.0	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0	JMF ± 6
1.18 mm (No.16)						-
600 µm (No.30)						-
300 µm (No. 50)						-
75 µm (No.200)	0.0 - 6.0	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	-

~~Sieve Size~~	~~Restricted Zone~~					
	~~37.5 mm (1 ½ inch)~~	~~25 mm (1 inch)~~	~~19 mm (3/4 inch)~~	~~12.5 mm (1/2 inch)~~	~~9.5 mm (3/8 inch)~~	
~~4.75 mm (No.4)~~	~~34.7~~	~~39.5~~				~~Mix gradation 45 power plot must fall below the restricted zone~~
~~2.36 mm (No.8)~~	~~23.3 - 27.3~~	~~26.8 – 30.8~~	~~34.6~~	~~39.1~~	~~47.2~~	
~~1.18 mm (No.16)~~	~~15.5 - 21.5~~	~~18.1 – 24.1~~	~~22.3 - 28.3~~	~~25.6 – 31.6~~	~~31.6 - 37.6~~	
~~600 µm (No.30)~~	~~11.7 - 15.7~~	~~13.6 - 17.6~~	~~16.7 - 20.7~~	~~19.1 – 23.1~~	~~23.5 - 27.5~~	
~~300 µm (No. 50)~~	~~10.0~~	~~11.4~~	~~13.7~~	~~15.5~~	~~18.7~~	

Note 1: Allowable tolerances for each JMF shall be the specified design control points shown in Table 401.02.29A with the exception as indicated on the 2.36 mm (No.8) sieve. These tolerances shall be applied to both the field verification testing of the JMF and the daily contractor quality control testing. ~~The gradation of the mix shall also continue to pass beneath the restricted zone~~.

5.8 Volumetric production targets shall be established at the end of the field design verification process. The production target asphalt content shall be selected at a value within ± 0.2 % of the approved design asphalt content using the results of the field verification testing to determine the appropriate value. The VMA production target shall be determined from the field verification test data at a value which also provided an air void content that was at or near the JMF target air void content. This VMA value may be adjusted to optimize the ± 1.0 % tolerance of Table 401.02.29C if the result is near the minimum allowable requirement. ~~The production target for~~ VFA shall be reported for informational purposes only~~the limits of the design criteria~~. The production target for air voids shall remain at 4.0 %.

5.9 When new plant production targets are established from the field verification process, a new target maximum density shall also be determined for compaction control by averaging the maximum density results of all the samples used for verification of the mix. The District shall forward the verification test data to MCS&T Division.

5.10 An approved mix design (JMF) may be used on other projects during the year without reverification if all the mix design criteria are the same.

5.11 The maximum allowable blend change for a mix design shall be ten percent on any single aggregate component. If an aggregate blend change of more than five percent on any single aggregate component is required, the Contractor shall evaluate the mix to determine whether the volumetric properties, FA ratio, and aggregate properties (coarse and fine aggregate angularity, clay content, and flat and elongated particles) are adversely affected by the change in blended aggregates. The Contractor shall also determine whether the aggregate gradation still passes between the control points and beneath the restricted zone. The calculations used in this evaluation shall be provided to the District. The District shall review and verify the results of this evaluation. If

the District determines any of the abovementioned properties are adversely affected by the blend adjustment, they may revoke the change in the JMF. If the JMF volumetric properties cannot be

maintained without these changes, then the contractor will be required to provide a new mix design.

5.12 After the field design verification has been successfully completed and quality control testing (as described in Section 6.0) has begun, the Contractor shall monitor the maximum specific gravity of the mix for any consistent change. If, over a five-sample period, there is an average change in the maximum specific gravity of ± 0.02 or greater from the verified value of the mix then a field design reverification may be required. A reverification shall not be conducted if the averages of the percent~~%~~ asphalt, percent~~%~~ air voids, and percent~~%~~ VMA~~, and % VFA~~ of the five quality control samples do not meet the requirements of Table 401.02.27C. The District will review the Contractor's test data, compare it to their verification sample test data, and determine if a reverification is necessary. If the District determines that a reverification of the mix is needed, a new blended aggregate bulk specific gravity shall also be determined for the mix before the field reverification begins. The District will forward the reverification and bulk aggregate specific gravity test results to MCS&T Division.

5.13 All approved mix designs shall be reverified on the first project on which they are used in any subsequent years as long as there are no changes to the design specifications that would require a new mix design. In addition, the blended aggregate bulk specific gravity shall be determined before reverification begins.

6. QUALITY CONTROL REQUIREMENTS

6.1 After the field design verification has been successfully completed, quality control sampling and testing shall begin. If production is to continue for four hours or more after the last field design verification sample was taken, then the first randomly selected quality control sample shall be taken within that remaining time. If production continues for less than four hours after the last field design verification sample was taken, then the first randomly selected quality control sample will not be required until the next production day.

6.2 The material produced shall conform to the verified plant production target values established and controlled within the tolerances of Table 401.02.29C. The aggregate gradation shall conform to the requirements of Table 401.02.29B.

6.3 Adjustments to the accepted JMF aggregate proportions shall be made only for the purpose of maintaining the gradation requirements of Table 401.02.29B and/or the design properties of Table 401.02.29C. The maximum allowable adjustment shall be as indicated in Section 5.10. The minimum sample requirements of the approved quality control plan will be sufficient when the allowable adjustments are made as a result of deficient or borderline test properties of the previous test sample.

TABLE 401.02.29C: Quality Control Mix Property Tolerances

Property	Production Tolerances
Asphalt Content (%)	Verified JMF ± 0.4 %
Air Voids (%)	4.0 ± 1.2 %
Voids in Mineral Aggregate (VMA) %	Verified JMF ± 1.0 % with a minimum of 0.5% below the minimum design criteria

6.4 If the previous test sample meets all specification requirements, but the Contractor later determines that the gradation of the material entering the plant has changed, then an aggregate proportion adjustment up to two percent will be allowed without requiring an additional test sample. However, if more than one such change is made during the production day, then an additional test sample beyond that specified in the approved quality control plan will be required for each adjustment.

6.5 Minimum Sampling and Testing Frequency: During each day of plant production a minimum of one sample shall be taken for production periods of six hours or less. When the production period exceeds six hours, a minimum of one sample for each half of the production period shall be taken. If the production period exceeds twelve hours, a third sample shall be taken. The Contractor's sampling frequency shall be in accordance with their approved Quality Control Plan.

6.6 For the purpose of administration, the quantity of material represented by an individual test shall be determined as follows: the first sample taken after the field design verification has been approved shall represent the quantity produced from the beginning of production after field design verification until the time the sample was taken. The second sample shall represent the material produced between the time that the first and second samples were taken and so on. The last sample taken prior to a halt in production under a given JMF shall represent that quantity of material produced from the time that the next to last sample was taken until production was stopped. Sampling and testing for evaluation of compliance with the verified JMF shall be as follows: Obtain a sample large enough for determining the percent asphalt, percent air voids, percent VMA, and gradation of the mix in accordance with the specified test methods listed in Section 401.5.1 of the Specifications. If excessive aggregate breakdown in the ignition oven prevents proper gradation analysis, aggregate samples may be obtained from hot bins, cold feeds, or extracted HMA samples. The VFA calculation shall be conducted for informational purposes only.

6.7 A four-sample average shall be used for the purpose of determining whether the material meets specification requirements. The test results of the first four samples shall be averaged. After the fifth sample is taken a four-sample moving average shall begin. This first moving average shall consist of the average of the second through fifth test samples. Each time a new sample is taken a new moving average shall be

calculated by averaging the new sample with the previous three samples. The moving average shall continue through a single paving season (one calendar year).

6.8 In cases where production is limited and less than four samples of the specified mix design are taken, then the average shall consist of the total number of samples taken during the paving season in accordance with the Quality Control Plan. A new four sample average shall be established at the first startup of a new paving season after the field design verification has been completed.

6.9 The Contractor shall maintain control charts for percent asphalt, percent air voids, and percent VMA~~, and percent VFA~~. These control charts shall be prepared in accordance with the guidelines of MP 300.00.51. As an alternative method, the control charts may be prepared with a personal computer using software that can generate such charts and provide a distinct graphic representation of all data points. Data points required on the control charts are the daily individual Contractor quality control tests, district verification sample tests, and the moving average of every four Contractor quality control tests. A~~VFA data points shall be calculated to the nearest one percent and a~~ll ~~other~~ data points shall be calculated to the nearest 0.1 percent.

6.10 For hand drawn charts, the quality control test data points shall be represented by a small blue circle symbol "O" and connected by a dashed line. The four-sample moving average data points shall be represented by a small red square symbol "■" and connected by a solid line. District verification sample test data points shall be represented by a small red circle symbol "O" but shall not be connected. The upper and lower tolerance limits of the test properties which were established through the field design verification described in Section 6.0 shall be represented by solid horizontal lines.

6.11 If the computer-generated control chart cannot be produced using the symbols and lines described above, then a graph legend shall be included which shall indicate the graphic symbols used to represent the required data points and lines.

6.12 The quality control charts shall be updated daily and placed in a location that is easily accessible to the Division for review at any time.

7. DEGREE OF NONCONFORMANCE

7.1 Should the four-sample average of test values for percent asphalt, percent air voids, or percent VMA~~, or percent VFA~~ fall outside the verified JMF tolerances by more than the allowable deviation of Table 401.02.29C then production shall be halted until the Contractor takes necessary steps to bring production under control. Production shall also be halted if three consecutive aggregate gradation tests fall outside the tolerance limits of Table 401.02.29B. Actions taken by the Contractor to bring production back in control shall be documented in the plant diary.

7.2 When the four-sample average of the Contractor's quality control tests for percent asphalt and/or percent air voids falls outside the JMF tolerances of Table 401.02.29C, the Sublot of material represented by the last individual test value in the moving average shall have its price reduced in accordance with the schedule set forth in Section 7.3. In the case where the average is nonconforming and the last tested Sublot is conforming, then there would be no price adjustment.

7.3 The degree of nonconformance shall be determined using the following relationship:

When the moving average is greater than the upper control limit

$Q_U = X_n - UL$

When the moving average is less than the lower control limit

$Q_L = LL - X_n$

Where Q_U = Percent of non-conformance at Upper Limit
Q_L = Percent of non-conformance at Lower Limit
UL = Upper Limit LL
LL= Lower Limit
X_n = Average of four consecutive test values (less than four when production is limited)

If it is decided by the Division that the material is allowed to remain in place, then the Sublot shall have its price reduced in accordance with Tables 401.02.29D and/or 401.02.29E, as applicable.

TABLE 401.02.29D: ADJUSTMENT OF CONTRACT PRICE FOR MIX NOT WITHIN TOLERANCE LIMITS OF PERCENT ASPHALT

QU or QL	Percent of Contract Price to be Paid
0.0	100
0.1	98
0.2	96
0.3	92
Greater Than 0.3	*

* The Division will make a special evaluation of the material and determine the appropriate action.

TABLE 401.02.29E: ADJUSTMENT OF CONTRACT PRICE FOR MIX NOT WITHIN TOLERANCE LIMITS OF PERCENT AIR VOIDS

QU or QL	Percent of Contract Price to be Paid
0.0	100
0.1	98
0.2	96
0.3	92
Greater Than 0.3	*

* The Division will make a special evaluation of the material and determine appropriate action.

7.4 Should the moving average of both the test properties for the same Sublot fall outside of the JMF tolerance, thus resulting in a reduced price for each, then the following procedure shall be used. The quantity of material represented by the last Sublot in the moving average will have an adjusted unit price which is the product of the original price times the percent as a result of non-conformance of the first test property times the percentage unit price as a result of non-conformance of the second test expressed in the following formula.

AUP = OUP x PUPAC x PUPAV *

Where:

AUP = Adjusted Unit Price

OUP = Original Unit Price

PUPAC = Percent Unit Price as a result of Asphalt Content Analysis expressed as a decimal

PUPAV = Percent Unit Price as a result of Air Void Analysis expressed as a decimal

* PUPAC and PUPAV are used in the formula as needed as a single non-conforming item or together for both non-conforming items as shown.

7.5 A new moving average shall start with the fourth sample that is taken after production is resumed (less than four when production is limited). If, at any time, the Division determines that a mix cannot be consistently produced within the tolerance limits of the verified design properties, approval of the mix may be revoked, and the contractor will be required to provide a new mix design.

8. SMALL QUANTITY TESTING

8.1 If project activities are such that not more than 75 tons of a specific mix design are being produced per day during the period of an entire calendar week, then the following small quantity testing requirements shall apply.

8.2 If the plant has a current inspection and approval by District Materials and has successfully verified the mix design being produced, then the minimum quality-control sample requirements shall be one sample per week. The sample shall be taken on the first day of use during the week. If the plant has not verified the mix design being produced and quantities do not meet the minimum threshold for verification sampling, then the normal testing requirements of this MP shall apply.

9. DIVISION VERIFICATION SAMPLING AND TESTING

9.1 Verification testing of asphalt mixtures is the responsibility of the Division. Quality control tests conducted by the Contractor may be used as a part of the verification process. The Division shall sample and test for applicable items completely independent of the contractor at a frequency equal to approximately ten (10) percent of the frequency for testing given in the approved QC Plan. Witnessing the contractor's sampling and testing activities may also be a part of the acceptance procedure, but only to the extent that such tests are considered "in addition to" the ten (10) percent independent tests.

9.2 The verification samples taken by the Division will be statistically evaluated for similarity to the Contractors' quality control tests in accordance with the guidelines of MP 700.00.54. If the evaluation indicates that the Division's test results are similar to the Contractor's test results, then the material represented by this evaluation will be considered acceptable. Those properties to be evaluated, as referenced in MP 700.00.54, will consist of percent asphalt, percent air voids, and gradation. In addition, the VMA ~~and VFA~~ test results will be evaluated using the guidelines of MP 700.00.54.

9.3 If a dissimilarity is detected, an immediate investigation will be conducted to determine the cause. The intent of the investigation is to define and correct any testing deficiencies that may cause a misrepresentation of the tested material.

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

MP 401.02.29 Steward – Asphalt Section
RLS:J

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

MATERIALS PROCEDURE

PREPARING MATERIALS PROCEDURES

1. PURPOSE

1.1 To set forth instructions for drafting Materials Procedures (MP) concerning sampling, testing, reporting, and inspection.

1.1.1 To establish a numbering system for MPs.

1.1.2 To establish a styles guideline for MPs.

1.2 To establish a workflow for the creation, acceptance, and approval for MPs.

1.2.1 To set up a reconfirmation schedule for existing MPs.

1.3 To provide further guidance and clarification from that set forth in DD-105.

2. REFERENCED DOCUMENTS

2.1 AASHTO Publications Style Manual and Process Guide[1], current edition.

2.2 Using SI Units in ASTM Standards: A Guide to Form and Style for ASTM Standards, Part H[2]

2.3 WVDOH Design Directives DD-105[3]

2.4 ASTM E29 - Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3. NUMBERING GUIDELINES

3.1 A MP consists of a sequence of numbers such as 120.20.01.

3.1.1 The first set (three digits) of an MP are taken from the WVDOH Specifications Roads and Bridges to denote the general area to which the procedure applies.

3.1.2 The second set (two digits) of an MP are taken from the WVDOH Specifications Roads and Bridges denotes the particular area to which the procedure applies.

3.1.3 The third set (two digits) is defined by this Division thus:

1. .00 - .09 Field Sampling
2. .10 - .19 Pre-sampling (Source or Intermediate Points)
3. .20 - .29 Testing
4. .30 - .39 (For future designation)
5. .40 - .49 Inspection
6. .50 - .59 Quality Assurance System

[1] https://materials.transportation.org/

[2] https://sn.astm.org/rules-and-regs/using-si-units-astm-standards-nd12.html

[3] https://transportation.wv.gov/highways/engineering/Pages/Design-Directives.aspx

7. .60 - .69 Reporting (laboratory)
8. .70 - .79 Reporting (issuance under master control)
9. .80 - .89 (For future designation)
10. .90 - .99 Miscellaneous

4. COMMON DEFINITIONS

4.1 To stay consistent, this section will define some commonly used terms and specify the term that is to be used in Materials Procedures.

4.2 Authors may choose to spell out these terms in titles, sections, or headers.

4.3 Specific Terms:

4.3.1 DWR: When referring to a Daily Work Report that is performed on a WVDOH project, the term to be used is "DWR".

4.3.2 Coverage: When referring to coverage for a material, traditionally referred to as "Direct Coverage" or "Master Coverage", the term to be used is "coverage".

4.3.3 Specifications: When referring to the WVDOH Standard Specifications, Roads and Bridges, current edition including Supplementals and Special Provisions, the term to be used is "Specification(s)" with a capital "S". There is no need to list the Specifications in the referenced document, this link is assumed. Specific references to aid in navigation are encouraged.

4.3.4 Should: When referring to a rule or provision, indicates that said rule or provision is not mandatory, but is recommended as part of good practice.

4.3.5 Shall: When referring to a rule or provision, indicates that said rule or provision is mandatory.

4.3.6 WVDOH project: When referring to any construction project in the state that is governed by the Specifications, the term to be used is "WVDOH project(s)."

4.3.7 MS&P: When referring to Manufacture and/or a Supplier and/or a Producer, the term to be used is: "MS&P". This author may choose to define this in the first instance of use in the document as this is not a common, industry wide term.

4.3.8 Chief Engineer: When referring to the final approving entity, the term "Chief Engineer" shall be used based on the WVDOH org chart.

4.3.9 Division: When referring to the Department of Transportation, Division of Highways as an entire entity, the term: "Division" shall be used with a capital "D". There is no need to spell out the name in any materials procedure.

4.3.10 MCS&T Division: When referring to the Materials Control, Soils and Testing Division, the term: "MCS&T Division" shall be used. There is no need to spell out the name in any materials procedure, though the author may choose to do so.

4.3.11 TED Division: When referring to the Traffic Engineering Division, the term: "TED Division" shall be used. There is no need to spell out the name in any materials procedure.

4.3.12 All other Divisions shall be spelled out once and then given an appropriate abbreviation. For example, Engineering Division "Engr Division"

4.3.13 APL: When referring to MCS&T Approved Product List, the term to be used is "APL", with all letters capitalized.

4.3.13.1 When referring to an APL submission, the following text shall be used: "Prospective Producers/Suppliers shall complete form HL-468, as per MP 106.00.02 indicating their intention to be included on the WVDOH APL".

5. UNITS

5.1 For units each champion has the option of using solely SI, or both SI and Imperial (combined units) as the standard.

5.2 When writing a procedure, the following two statements govern:

5.2.1 For solely SI, the values stated in SI are to be regarded as standard. No other units of measurement are included.

5.2.2 For combined units, the values stated in either SI or Imperial are to be regarded separately. The value stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance.

5.2.3 When providing a sample calculation or an example of a filled form, the champion may choose to use any single unit system.

5.2.4 When converting units, rounding shall be performed as specified in ASTM E29-Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

5.2.4.1 In the instance of length measurement, inches and feet shall be rounded to the nearest 5 mm. For example, 1 foot or 12 inches is 305 mm.

5.3 An example of the unit syntax is as follows:

5.3.1 The distance between the earth and moon is 238,900 mi (384,400 km).

5.3.2 The cylinder shall be 6 in (150 mm) x 12 in (305 mm).

6. FORMAT GUIDELINES

6.1 The style guides for MPs shall follow the general guidelines established in "Section 6.4.3" of AASHTO Publications Style Manual and Process Guide Typography in Design[4]. These guidelines are further refined in this document.

6.1.1 The font shall be Times New Roman, size 12, fully justified for all text except for the section title. The section title shall be all capital letters, fully justified, Times New Roman, size 12 and bold. There shall also be a horizontal line above this text.

6.1.2 The line numbering shall be as follows: "x." For a section title and "x.x" for a section paragraph. From here, follow the format of "x.x.x…" for additional layers of sub paragraphs. This document provides an example of the formatting.

6.1.3 Links shall be blue and clickable[5]. The link path shall also be included as a footnote. An example of this is demonstrated by the "blue and clickable" text and link above and the footer at the bottom of this page.

[4] https://downloads.transportation.org/Publications/aashto_style_manual.pdf

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

6.1.3.1 Any instances of an email address shall also be clickable and adhere the guidelines for a link.

6.1.4 Figure labels shall follow the guidelines of "Section 2.1.4" of AASHTO Publications Style Manual and Process Guide Typography in Design. This section states: "The title should be succinct noun or noun phrase that describes the figure, but does not provide unnecessary background information, nor repeat information found in the text." Do not abbreviate "Figure" and capitalize key words such; an example of this is as follows: "Conditions Determined to Be Pre-Existing."

6.1.4.1 Formatting for labels shall be the same as normal body text, except that "Figure X." shall be bold. All figure text shall be centered and located below the figure.

7. HEADER GUIDELINES

7.1 A standard numbering and indexing system shall appear in the upper right-hand corner shall of pages of all MPs. All header text shall be in "All Caps" format.

7.1.1 The letters MP shall appear first, denoting Materials Procedure. The number of the MP shall follow that text and be in the header of every page. The numbering of the MP shall follow the format as described in this document.

7.1.2 All MPs shall contain headers in the manner described in this section. There are two instances of a header. If an MP has been reconfirmed, the header will follow the example in Figure 1. This includes the date the latest date the MP was approved, and the date of confirmation.

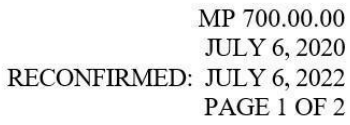


Figure 1 – MP Header with Approval Date and Reconfirmation Date

7.1.3 In the instance of either a new MP or an approved update to a MP, only the Director signature date (located at the end of the body section of the document) is in the header. A sample is provided in Figure 2.

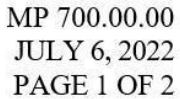


Figure 2 – MP Header With Approval Date

7.1.4 In the instance of an attachment, the first line of the MP header shall be in the format: MP XXX.XX.XX – ATTACHMENT. All other lines shall follow the guidelines previously described. This is demonstrated in Figure 3.

MP 100.00.00 - ATTACHMENT
JULY 6, 2020
PAGE 4 OF 5

Figure 3 – MP Attachment Header

7.1.4.1 In all instances, on all pages (do not use different first page), the text "PAGE X1 to X2" shall be last, with X1 being the current page and X2 being the total pages in the section. The main body and each attachment shall be considered a separate section; numbering shall be restarted on any new attachment instance.

8. MP APPROVAL PROCESS

8.1 In the instance of any MP Committee work, the champion is a person defined as the person who is the primary author, editor and/or liaison for the document. The champion is responsible for introducing and presenting the document. The champion is also responsible for addressing comments on the document.

8.2 Attachment 1 provides an overview of the approval process of an MP. First the document is brought to the MP committee chair (chair) by the champion. The document is distributed by the chair and discussed at the next MP committee meeting. After the document has been at a minimum of two consecutive MP meetings, the committee may vote to recommend or reject the proposed document. The document is then reviewed, and if approved, signed by the Director of Materials Control, Soils and Testing Division (Director, MCS&T). The signed document is sent through DOH management for review and approval. Once the review is complete, the document is reviewed and affirmed by Federal Highways Administration (FHWA). Once the document is affirmed by FHWA, the document is posted and distributed. If any comment is received during the approval process, the document is cycled back to the MP Committee meeting for review and another approval vote.

8.2.1 In the instance where a document has no content changes (editorial changes only), the MP committee may choose to vote to approve the document after one meeting. In this case, any voting member of the MP committee or the FHWA representative may veto this decision.

8.2.2 The details of the MP committee, including the submission process, distribution practices, and current voting members is available for review in Design Directive 105 and available at the WVDOH Technical Support Webpage[6]

9. RECONFIRMATION PROCESS

9.1 Each MP shall be periodically reviewed for both relevancy and accuracy. At a minimum frequency, each MP shall be reviewed every 4 years by the applicable MCS&T Section Supervisor (Reconfirmation Champion). In the instances where

[6] https://transportation.wv.gov/highways/TechnicalSupport/Pages/Design-Directives.aspx

there is no obvious Section Supervisor, the delegation of the review shall be the responsibility of the chair in liaison with the Director of MCS&T.

9.2 After reviewing the document, if the Reconfirmation Champion determines that no changes are required, they will submit the document to chair for reconfirmation. The reconfirmation shall be done by the voting members.

9.3 If approved by the Committee, the MCS&T Director shall review the document and if accepted, sign the document. Because no changes were made to this document, once the document is signed, it shall be posted and distributed.

10. POSTING AND DISTRIBUTION OF MPS

10.1 Active MPs are available on the WVDOH MCST MP Webpage[7]. The webpage shows the MP number, the title of the MP and the latest approval or reconfirmation date.

10.1.1 For each document (if appliable), an archived link is available to provide a documented history of updates. Figure 4 provides an example.

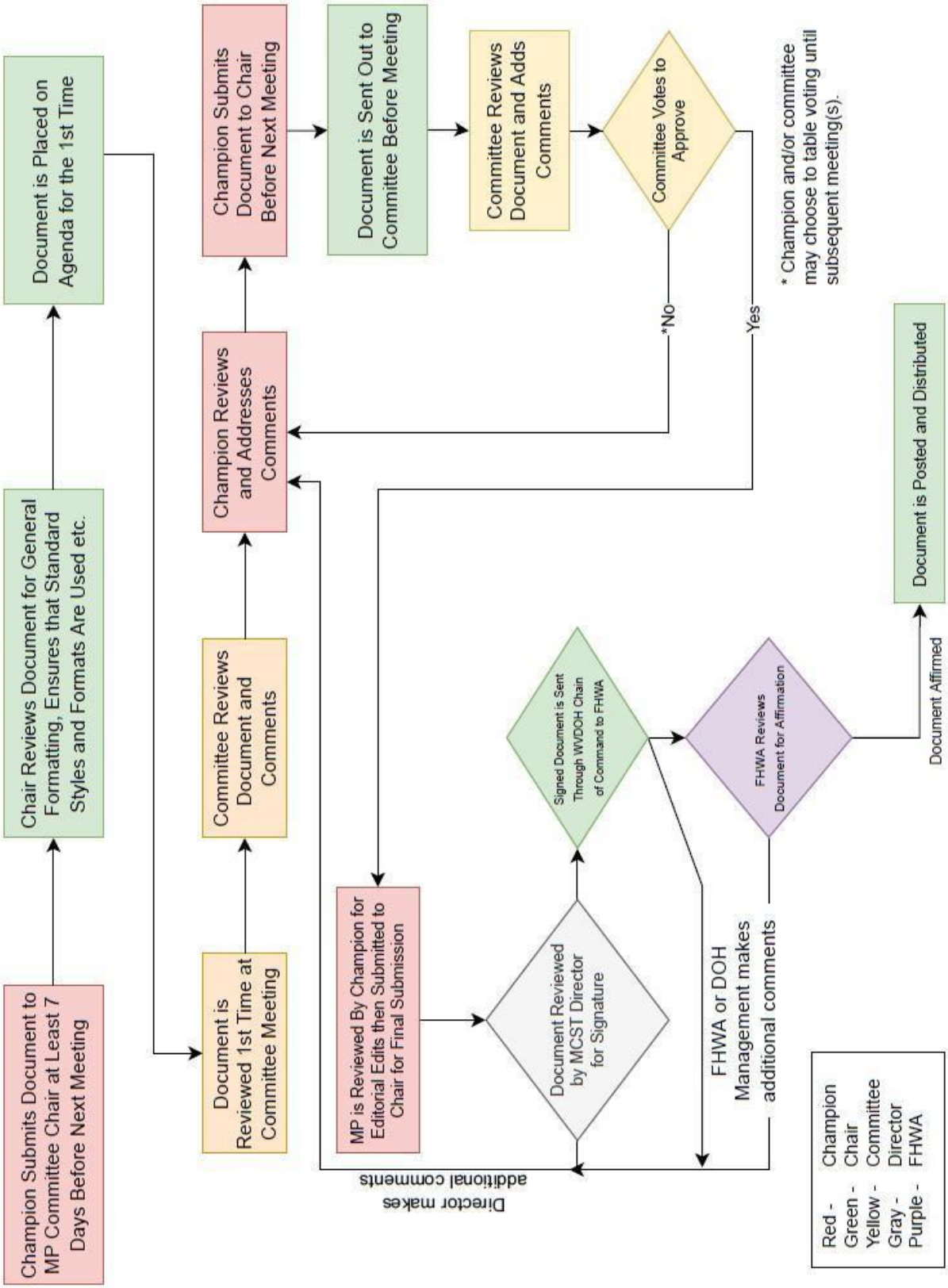
106.00.02 Archive	Procedure for Evaluation of New Products for Use In Highway Construction	November 2016

Figure 4 – MP Committee Webpage Example

10.2 When a document is affirmed by FHWA, the documents will be distributed to applicable Division Directors, District Engineer/Managers and District Material Supervisors.

MP 100.00.00 Steward – Materials Control Section
MM:Bb
ATTACHMENT

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



ATTACHMENT 1 – MP Committee Meeting Flowchart

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

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.

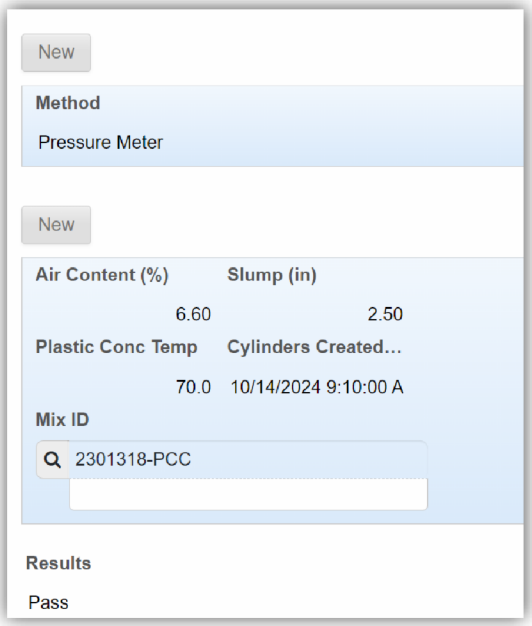
6.1 All applicable data shall be entered into AWP. This shall include all required fields as shown in the live version of the training guides available on the WVDOH MCS&T Webpage. A sample of these guides is provided in Attachment 1.

[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.



Commented [DB1]: MM - Is there any way to enlarge the Figure 1, 2, & 3 that show the screenshots of the AWP pages? They can be enlarged when viewed electronically, but they could be hard to read on a hard copy.

Commented [DB2]: Done

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)

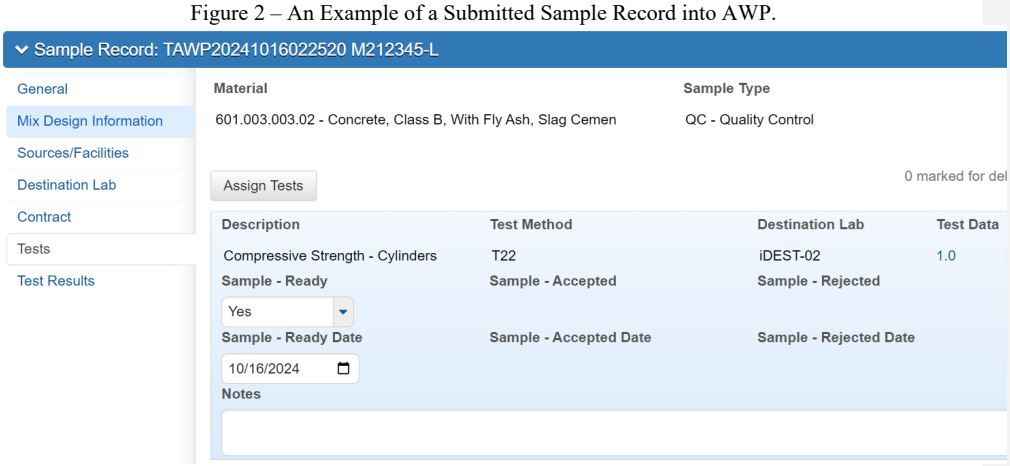
[2] https://transportation.wv.gov/highways/mcst/Pages/tbox.aspx

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.

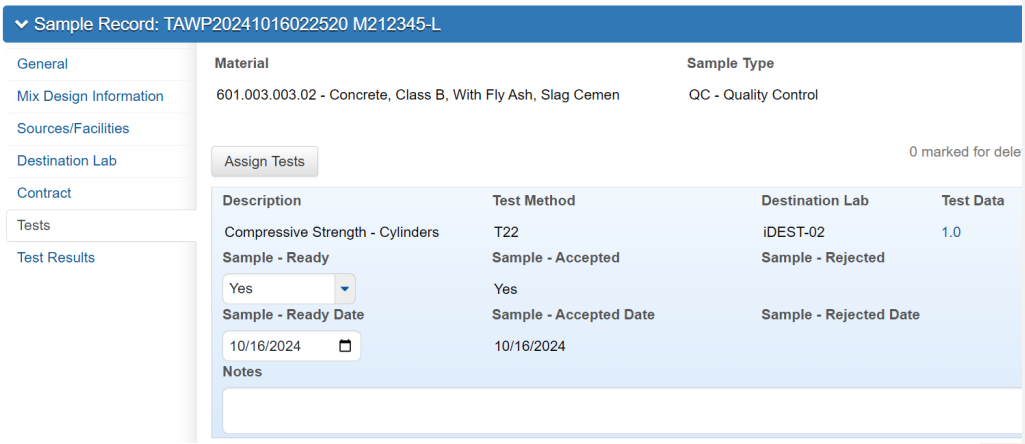


8. RECEIVING OF SAMPLES BY THE WVDOH

8.1 Once the District has received and accepted the sample record, they will "authorize" the sample.

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.

Commented [DB3]: MM Comment - Should we include guidance after Section 8.4 regarding what the Contractor needs to do after the District marks the sample as "rejected" and the timeframe in which the Contractor has to resolve the "rejected" sample?

Commented [DB4]: done

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).

~~8.4.1.1~~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

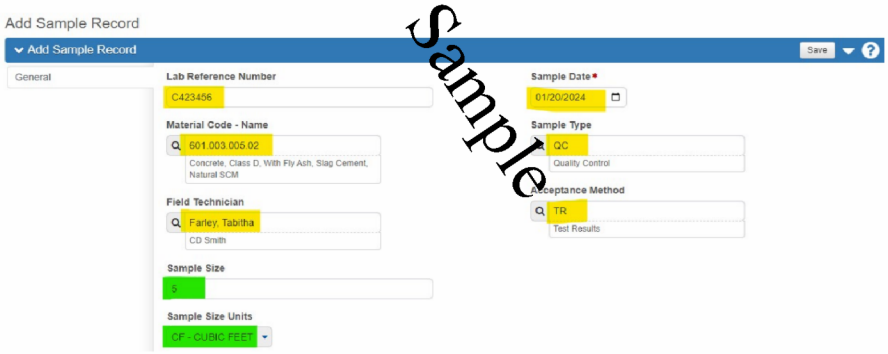
ATTACHEMNT 1

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.

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

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL AND ACCEPTANCE PLANS FOR SUBGRADE, BASE COURSE, AND AGGREGATE ITEMS

1. PURPOSE

1.1 The purpose of this Materials Procedure (MP) is to establish minimum requirements for the Contractor's Quality Control (QC) Program and Acceptance Plan. It is intended that these requirements be used as a procedural guide in detailing the inspection, sampling, and testing deemed necessary to maintain compliance with the material and Specification requirements.

1.2 To establish procedural guidelines for approval and documentation of the Master QC Plan.

2. SCOPE

2.1 This procedure is applicable to Aggregate items placed in the field. It outlines the quality control procedures for items used and includes procedures for approving and using a Master and/or Project Specific Quality Control (QC) Plan. This procedure also aids in documentation and retention of the QC Plan in ProjectWise.

3. REFERENCED DOCUMENTS

3.1 MP 109.00.21 - Basis for Charges for Non-Submittal of Sampling & Testing Documentation by the Established Deadline

3.2 MP 300.00.51 - Procedural Guidelines for Maintaining Control charts for Aggregate Gradations

3.3 MP 700.00.54 - Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results

3.4 MP 700.00.06 - Aggregate Sampling Procedures

3.5 ML-25, Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate

3.6 WV Division of Highways Construction Manual, Current Edition

4. GENERAL REQUIREMENTS

4.1 The Contractor shall provide and maintain a QC system that will provide reasonable assurance that all materials and products submitted to the District for acceptance will conform to the contract requirements whether natural, manufactured or processed by the Contractor or procured from suppliers, subcontractors, or vendors. The Contractor shall perform or have performed the inspections and tests required to substantiate product conformance to contract document requirements and shall also perform or have performed all inspections and tests otherwise required by the contract. The Contractor's QC

inspections and tests shall be documented and shall be available for review by the Engineer/District throughout the life of the contract. The Contractor shall maintain standard equipment and qualified personnel as required by the Specifications to assure conformance to contract requirements. Procedures will be subject to the review of the District before the work is started.

5. QUALITY CONTROL PLAN

5.1 The Contractor shall prepare a QC Plan detailing the type and frequency of inspection, sampling, and testing deemed necessary to measure and control the various properties of materials and construction governed by the Specifications. As a minimum, the sampling and testing plan shall detail sampling location, sampling techniques, and test frequency to be utilized. Attachment #1 shows guidelines for the QC Plan. QC sampling and testing performed by the Contractor may be utilized by the District for acceptance.

5.1.1 A QC Plan must be developed by the Contractor and submitted to the Engineer/District prior to the start of construction on every project. Acceptance of the QC Plan by the Engineer/District will be contingent upon its concurrence with these guidelines.

5.2 As work progresses, an addendum(s) may be required to the QC Plan to keep the QC program current. Personnel may be required to show proof of certification for testing.

5.3 QC Plan Guidelines: The QC plan shall include but not be limited to the following information:

5.3.1 Name of company official responsible for QC program. Contact phone number(s) and email(s) shall be included in the cover letter.

5.3.2 List certified personnel as specified in Section 106 of the Specifications, whether from the submitting company, consultant testing firm, or both.

5.3.3 List of the Aggregate items to be controlled by QC Plan.

5.3.4 Sampling and Testing Plan: As a minimum, the sampling and testing plan should detail sampling locations, test methods, and test frequencies to be used. To facilitate the District's monitoring activities, which are described in Section 7.1, all completed gradation samples must be retained by the Contractor until further disposition is designated by the District Materials Supervisor. The QC Plan should state where and how these samples will be maintained. Applicable sections of Materials Letter ML-25 should be used for guidance.

5.3.5 Testing Facility: The plan shall state the specific location where the samples(s) will be tested and retained.

5.3.6 Documentation Plan: The Contractor's plan to document and distribute test results shall be described.

5.3.7 Forms and Distribution: Approved processing forms available on the MCS&T Webpage[1] shall be used to record the test data. Gradation tests will be recorded on Form T300. The lab

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

oratory reference number will always start with a "C" for all QC samples taken and tested by the Contractor. One copy of each completed form should be retained by the Contractor until the work is completed and accepted. The original signed copy of the test data is to be delivered to the District Materials Supervisor. To be an effective QC function, tests must be completed and results distributed in a regular and timely manner. The plan, therefore, must state what action will be taken in the event that testing and reporting are not completed in a reasonable period of time - preferably within 72 hours after the sample is taken (at the discretion of the District).

5.3.8 Control Charts: The Specifications require the plotting of gradation test results on control charts using the moving average concept as described in MP 300.00.51. The QC Plan should state where and how the charts shall be maintained and made available to District personnel. These charts are part of the District's acceptance procedures and must be available to the District when the project is completed or at the request of the District personnel. At the Contractor's request, the requirement of Control Charts may be waived on a per project basis. The Contractor will submit a written request to the District asking that the Control Charts be waived. The District will make a determination based on the size of the project and the number of gradation tests required.

5.3.9 Disposition of Non-Specification Material: The Contractor shall provide a detailed plan of action for the immediate notification of all parties involved in the event that nonconforming situations are detected.

5.3.10 Delivery Tickets

Each truckload of aggregate delivered at the project shall be accompanied by delivery ticket with all the following information:

1. Ticket number
2. Producer/Supplier Code
3. Producer/Supplier Name
4. Producer/Supplier Location
5. Contract Identification Number (CID #)
6. Federal Project Number (If applicable)
7. State Project Number
8. Date/Time
9. Material Code/Name
10. License Number of Haul Unit or Truck Number
11. Load Number
12. Gross Truck Weight
13. Tare Truck Weight
14. Net Weight
15. Weighperson's Name certifying that all information on the ticket is correct.

The following information shall be documented on the ticket by the project:

1. Contract Item Number
2. Contract Line Number

5.3.10.1 Documentation shall be provided to the project as per the requirements of Section 109.20 of the Specification.

5.3.11 Types of QC Plans

5.3.11.1 QC Plans which are intended for use on more than one project shall be defined as Master QC Plans. Section 6.1 outlines the procedures for Master QC Plan submittal and approval.

5.3.11.2 QC Plans which are intended for use on a single project shall be defined as Project Specific QC Plans. Project Specific QC Plans shall contain a cover letter which includes the following: project description, CID#, and Federal and/or State Project Number.

5.3.11.3 A contractor may submit a project specific cover letter referencing the Master QC plan instead of a Project Specific QC Plan.

5.3.11.4 Once any QC Plan is approved for a project, the key-date shall be entered in Site Manager by the appropriate District Materials personnel. The first date entered shall be the date the Project QC Plan letter is received. The second date shall be when the District approves the QC Plan for use on the project.

6. MASTER QUALITY CONTROL PLAN

6.1 The intent of a Master QC Plan is to facilitate the approval process in a more uniform manner. The Contractor may submit a Master QC when their workload in a given District is routinely repetitive for the year. Testing includes both performing the test and submitting the results as per MP 109.00.21.

6.1.1 The Contractor may submit a new Master Aggregate Items QC Plan each year to each District in which they have or expect to have work (see Attachment #2 for an example). If the Contractor does not have work or does not have a history of work in a given District for the year, then a Master Field QC Plan shall not be submitted to that District.

6.1.2 The District will review the submitted Master QC Plan to see if it meets the requirements for the Aggregate Items in the QC Plan as per Section 5.3. If accepted, the District shall assign a laboratory reference number to the Master QC Plan for future referencing. The District will acknowledge approval of each Master QC Plan to the Contractor by letter (see Attachment #3 for an example), which will include the laboratory reference number and a copy of the approved Master QC Plan. This will then be scanned and placed in ProjectWise under the appropriate District's Org for that Contractor and/or Producer/Supplier.

6.1.3 Once a project has been awarded, if a Contractor elects to use the approved Master Aggregate Items QC Plan on that project, the Contractor shall submit a letter requesting to use the Master QC Plan for that project. This letter must be on the Contractor's letterhead, be addressed to the District Engineer/Manager or their designee, and contain the following information: project number, CID#, project description, type of QC Plan, and the laboratory reference number for the Master QC Plan. (See Attachment #4 for an example).

6.1.4 The District shall review the referenced Master QC Plan to ensure it covers all items in the project. If the referenced Master QC Plan is found to be insufficient for some items on the project, the District shall request the Contractor to submit additional information for QC of those items as an addendum on a project specific basis. When the District is satisfied with the QC Plan for this project, a letter shall be sent to the Contractor acknowledging

approval (see Attachment #5 for an example), with the following attached: the Contractor's project QC Plan request letter and the Master QCP approval letter. This shall then be placed in the project's incoming-mail mailbox in ProjectWise.

6.1.5 A Master QC Plan that has been approved for project use shall be good for the duration of that project, even if that project continues into future calendar years.

6.1.6 For the use of District Personnel, the District approval letter for this project must state the ProjectWise link to the referenced Master QC Plan for that Contractor. For example, WVDOT ORGS > District Organization #> Materials > Year>Master QC Plans, etc.

6.1.7 The Master Aggregate items QC Plan shall be valid for the duration of one calendar year beginning on January 1st and ending on December 31st.

7. ACCEPTANCE PLAN

7.1 Per 307.2 of the Specifications, the acceptance (verification) sampling and testing is the responsibility of the District and QC tests are the responsibility of the Contractor. Acceptance activities (sampled and tested at the frequency given in Section 7.1.2) may be accomplished by conducting verification sampling and testing completely independent of the Contractor and, in some cases, by witnessing tests performed by the Contractor, or by a combination of the two. The following guidelines provide a system, which should result in sufficient confidence in the Contractor's documentation of their QC operations to permit acceptance of the material in accordance with the procedure set forth in the Specifications.

7.1.1 The District shall review all information supplied by the Contractor on the QC Plan. Note, in particular, the qualifications of the sampler, tester, the location, and other qualifying statements about the testing facility. In the event that little qualifying information is supplied or has been demonstrated by the testing facility: Prior to work, the District (or their representative) shall review the availability, type, and suitability of the testing equipment and verify all calibrations. This information should be documented and kept available at the District Materials Section.

7.1.2 The District shall sample and test, completely independent of the Contractor, at a frequency equal to or greater than ten (10) percent of the frequency for testing given in the approved QC Plan. Witnessing the Contractor's sampling and testing activities may also be a part of the acceptance procedure, but only to the extent that such tests are considered "in addition to" the ten (10) percent independent tests.

7.1.3 Plot the results of gradation tests performed by the District on the Contractor's QC charts with a red circle, but do not include these values in the moving average. When the Contractor's tests are witnessed, circle the Contractor's test result on the control chart with red. These values are used in the moving average calculations. The laboratory number will always start with an "M" for all acceptance (verification) samples taken and tested in this manner by the District, and will always start with a "0" for all of the Contractor's tests, which are witnessed by the District.

7.1.4 Evaluate the results of acceptance (verification) tests, whether performed or witnessed by the District, in accordance with MP 700.00.54.

7.2 If the evaluation indicates similarity with the QC test(s), the control chart will be considered acceptable to that point.

7.2.1 If dissimilarity is determined, an immediate investigation shall be conducted in an effort to determine the cause. Until the situation is resolved, any samples held in accordance with ML-25 will be retained and may be used in whatever manner deemed appropriate during the investigation.

7.3 Implement ML-25 for aggregate gradations.

8. ABSENT TESTING OF MATERIAL

8.1 If the Contractor fails to perform testing of the material in accordance with the Contractor's Division Approved Quality Control Plan, payment for the portion of the item represented by the absent test shall be withheld, pending the Engineer's decision whether or not to allow the material to remain in place. Testing includes both performing the test and submitting the results as per MP 109.00.21.

8.1.1 If the Engineer allows the material to remain in place, the Division shall not pay for the material represented by the absent test. However, the Division shall pay for the cost of the placement of the material, including labor and equipment. The invoice or material supplier cost (if applicable), determined at the time of shipment, shall be used to calculate the cost of material when evaluating the total cost of labor and equipment.

_____

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

MP 307.00.50 Steward – Aggregate and Soils Section
MM: R
ATTACHMENTS

ATTACHMENT #1 - GUIDELINES FOR CONTRACTOR'S QUALITY CONTROL

Item Description	Property	Minimum Frequency
207 Subgrade	Gradation	One (1) sample per day of placement. Note 1
	~~Atterburg~~ Atterberg Limits	From an approved aggregate source: one (1) test at the beginning of placement and then each 10,000 tons. Not from an approved aggregate source a minimum of one (1) test per 6 days placement.
212 select Material for Backfill	Gradation	Minimum of one (1) sample per day of Placement. Note 1
307 Crushed Aggregate	Gradation	One (1) sample per each one-half (1/2) day placement. Note 1
	~~Atterburg~~ Atterberg limits	One(1) test at the beginning of placement and then each 10,000 tons thereafter
	Other tests as requested by the Division or required by the contract documents: percent crushed particles, unit weight, etc.	As requested by the Division or required by the contract documents.
307 Aggregate Shoulder course for Resurfacing Projects	Gradation	One (1) sample per day of placement. Note 1
	~~Atterburg~~ Atterberg limits	One (1) test at the beginning of placement and then each 10,000 tons thereafter
	Other tests as requested by the Division or required by the contract documents: percent crushed particles, unit weight, etc.	As requested by the Division or required by the contract documents.

ATTACHMENT #1 GUIDELINES FOR CONTRACTOR'S QUALITY CONTROL (CONTINUED)

315 Trail Surface Aggregate	Gradation	Minimum of one (1) sample per half day of placement.
	Atterberg Limits	From an approved aggregate source: one (1) test at the beginning of placement and then each 10,000 tons. Not from an approved aggregate source a minimum of one (1) test per 6 days placement.
604 Class 1 Aggregate	Gradation	Minimum of one (1) sample per day of placement. Note 1
606 Aggregate for Underdrain	Gradation	Minimum of one (1) sample per day of placement. Note 1
609 Bed Course Material	Gradation	Minimum of one(1) sample per day of placement. Note 1
626 Aggregate	Gradation	Minimum of one (1) sample per day of placement. Note 1
	~~Atterburg~~Atterberg Limits	From an approved aggregate source: one (1) test at the beginning of placement and then each 10,000 tons. Not from an approved aggregate source a minimum of one (1) test per 6 days placement.
636 Aggregate	Gradation	One (1) sample per each one-half (1/2) day of placement. Note 1: Note 2
	~~Atterburg~~ Atterberg Limits	One (1) test at beginning of placement and then each 10,000 tons thereafter. Note 2

Note 1: In the event project activities are such that relatively small quantities of material are being placed per placement date, and to prevent over sampling, the Engineer may approve the following alternate sampling method: A minimum of One (1) sample per six (6) consecutive days shall be taken to represent up to each 170 cubic yards (250 tons). Sampling is to be done on the first day of aggregate placement. In this case the sample shall be taken at a random time and place

Note 2: When Aggregate for maintaining traffic is not to be part of any succeeding base or pavement course, the appropriate aggregate size shall be determined by the Engineer. If the aggregate is from an approved source, then it shall be accepted by visual inspection. If the Contractor elects to use aggregate from an unapproved source, test results shall be provided to show that the liquid limit and plasticity index meet the requirements in Table 704.6.2B

***** ATTACHMENT #2 - EXAMPLE GUIDE FOR AGGREGATE ITEMS QUALITY CONTROL PLAN *****

The Acme Company
20 First St.
Somewhere, WV XXXXXXX

Mr/./Ms/Mrs. _____
WV Division of Highways
District ___ Engineer/Manager
_____, WV

RE: "year"__ Master Aggregate Items QC Plan
DISTRICT: _____

Dear Mr./Ms/Mrs. _____

We are submitting our Master QC Plan for Aggregate Items , developed in accordance with the (year) WVDOH Standards and Specifications, (year)WVDOH Supplemental specifications, MP300.00.51, MP 700.00.54, ML-25, and AASHTO Testing standards.

The Quality Control Program is under the direction of _____ . They can be contacted by telephone number _____, email _____ and/or in person.

1.) All testing will be performed by qualified personnel as per WVDOH Specification Section 106 Control of Materials. Proof of personnel certification shall be provided to WVDOH inspectors upon request.

2.) Specify items to be controlled and the methods by which each item will be tested (For example:207,307…etc) Attachment #1 summarizes the different materials, minimum frequencies, and the appropriate test procedure or method for controlling each material.

- 207 Items - 212 Items -307 Crushed Aggregate Items - ETC>>>>>

3.) List the location (address) and lab where testing will be performed.

4.) State the method and means by which that Contractor will document and distribute test results.

5.) State what forms will be used for tests the time frame for completing testing and distributing of test information to District Materials.

6.) Specify in the QC Plan where and how the charts will be maintained and made available to Division/District personnel. Control Charts will use the moving average concept as described in MP 300.00.51.

7.) Specify a plan of action providing for immediate notification of all parties involved in the event that nonconforming material situations are detected.

Very Truly Yours,

_____

Title

********** ATTACHMENT #3 WVDOH LETTERHEAD **********

ACME Company
20 First St.
SOMEWHERE, WV #####

RE: Aggregate Items Master QC Plan
Description: (Year) Construction Season

Dear Mr./Ms/Mrs. _____,

Your Master Aggregate Quality Control Plan **(M#-#####)** for _____has been reviewed and found to be acceptable for the following items:

- 207 Aggregate Items
- 212 Aggregate Items
- 307 Aggregate Items
- ETC

As work progresses throughout the season, an addendum(s) may be required to this QCP to keep the QC program current. **Also note that personnel may be required to show proof of certification for testing. Please use Lab Reference # M#-###### when corresponding about this QC plan**. Please make sure that all appropriate personnel have a copy of this plan in their possession.

Very Truly Yours,

_____
Title

********** ATTACHMENT #4 - EXAMPLE **********

THE ACME COMPANY INC.
20 First St.
Somewhere, WV XXXX

Mr./Ms/Mrs _____
WV Division of Highways
District ___ Engineer/Manager
_____, WV _____

Subject: Aggregate Items QC plan
For project

Fed. Project No _____
State Project No. _____
Contract ID No. _____
Description _____

Dear Mr./Ms/Mrs. _____,

We would like to use our approved Aggregate Items Master Quality Control Plan, reference number _____ for the project referenced above. We feel that all items on the referenced project are covered by the Master Quality Control Plan for Aggregate Items.

The QC Plan is under the direction of _____, _____(title), and will be the Company's contact representative to the Division of Highways District Materials and Construction Departments. They can be contacted in person at the project, by telephone _____ or at email account _____.

Very Truly Yours,

_____
Title

********** **ATTACHMENT #5 - WVDOH LETTERHEAD** **********

THE ACME COMPANY INC.
20 First St.
Somewhere, WV XXXXX

RE: _____ Aggregate Items QC Plan

Project CID#: ########
Fed/State Project #: ####- ## - ####.##
Description: Falling Slide
County : XXXXXXX

Dear Mr./Ms/Mrs. _____,

Your request to use your Master Aggregate Items Quality Control Plan **(M# - ######)** for Aggregate Items on the project referenced above, has been reviewed and found to be acceptable for the following items:

- 207 Aggregate Items
- 212 Aggregate Items
- 307 Aggregate Items
- ETC

As work progresses throughout this project an addendum(s) may be required to this QCP to keep the QC program current. **Please use M# - ###### when corresponding about this QC plan. Also note that personnel may be required to show proof of certification for testing.** Please make sure that all appropriate personnel have a copy of this plan in their possession.

For Division/District use

The Master Quality Control Plan can be reviewed in ProjectWise at this Link:

WVDOT ORG>D0#>year>MASTER QC PLANS>Contractors or Plant>Contractor Name>Name of Quality Control Plan

Very Truly Yours,

_____
Title

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

MATERIALS PROCEDURE

CALIBRATION OF CONCRETE CONTINUOUS MOBILE MIXER

1. PURPOSE

1.1. To provide a test procedure for the calibration of concrete continuous mobile mixers.

2. SCOPE

2.1. This procedure covers the calibration of continuous type mixers (concrete mobiles) used in producing latex modified concrete.

3. REFERENCE DOCUMENTS

3.1. WVDOH Specifications Roads and Bridges Section 679 - Overlaying Portland Cement Concrete Bridge Decks

4. CALIBRATION

4.1. This calibration procedure shall be performed at the start of every project.

5. PRE-CALIBRATION INSPECTION

5.1. All aggregate and cement bins should be empty and thoroughly cleaned.

5.2. The main conveyor belt should be thoroughly cleaned, including the chain.

5.3. Be certain all bin vibrators function properly.

5.4. Be certain the cement meter-feeder wheel is thoroughly cleaned.

5.5. Check spring tines to make sure they are properly tensioned on cement meter-feeder.

5.6. Be certain that all blades on the cross-auger in the cement bin are in-place and straight.

5.7. Make sure the cement bin aeration system is functioning properly. The control valve should be depressed for about 10 seconds to fluff the cement in the bin prior to the calibration and prior to concrete production at the jobsite.

5.8. Make sure that the connections at both ends of the drive cable connecting the meter register and the cement feeder shaft are tight and the cable is free of kinks.

5.9. Make sure that the concrete mobile is properly grounded. A build up of static electricity may prevent normal flow of the cement.

5.10. Make sure that the cement bin breather hole is open to free atmospheric pressure.

6. CEMENT CALIBRATION

6.1. Check that the aggregate bins are completely empty.

6.2. Fill the cement bin at least one half full of cement being used on the project.

6.3. Check that the discharge tube at bottom of the cement bin is cleaned and clear of residue.

6.4. Run the machine until uniform cement output is achieved.

6.5. Insert designated baffle into the mixer hopper to divert the cement into a container.

6.6. Obtain a container large enough to hold at least two bags of cement.

6.7. Measure the weight of the dry, clean container and place it under the conveyor so that it will catch all the cement discharge.

6.8. Set the counter to 0.

6.9. Run the machine for 100 to 150 continuous counts. Engage the main clutch to make the concrete-mobile operative and start the stopwatch at precisely the same time as starting the machine.

6.10. Watch the cement meter register and when it registers the predetermined count, immediately disengage the main clutch and stop the watch simultaneously.

6.11. Weigh the container and record the net weight of cement, the elapsed time, and the meter count onto Attachment 1.

6.12. Repeat steps 6.7-6.11 at least four additional times to total 5 samples

6.13. Based on the five “runs” calculate the “cement meter count” and “discharge time” for 94 lbs. (1 bag) of cement.

6.14. Follow the calculation on Attachment 1 to determine the dial setting.

6.15. Remove all the remaining cement from the mobile mixer bin.

7. SAND CALIBRATION

7.1. Ensure the clutch is disengaged.

7.2. Fill the aggregate bin with the sand being used on the project.

7.3. Be sure the concrete mobile is operating at the specified operating speed (check the tachometer).

7.4. Obtain the tare weight of the container used to catch the sand.

7.5. Set the gate to 3 for a “low” starting point.

7.6. Charge the belt with sand by allowing at least 5 linear feet of loaded belt to discharge on the ground. Ensure the sand is discharging consistently.

7.7. Position the container under the conveyor discharge so that it will catch the material and reset the counter meter to 0.

7.8. Engage the main conveyor control and allow it to operate for approximately 100 counts.

7.9. Weigh the container and record the gate setting, the net weight of the sand and the meter count on Attachment 1.

7.10. Repeat until consistent counts to consistent weight are achieved.

7.11. Acquire 3 samples for the lower gate setting.

7.12. Reset the gate to 7 for “High” gate setting.

7.13. Charge the belt with sand by allowing at least 5 linear feet of loaded belt to discharge on the ground. Ensure the sand is discharging consistently.

7.14. Repeat until consistent counts to consistent weight are achieved. With the higher gate setting, only 50 counts are necessary.

7.15. Acquire 3 samples for the high gate setting.

7.16. Follow the calculation on Attachment 1 to determine the dial setting.

7.17. Accurately plot on Attachment 1.

7.18. Remove all the remaining sand from the mobile mixer bin.

8. STONE CALIBRATION

8.1. Follow the same procedure as for calibrating the sand discharge.

8.2. Remove all the remaining stone from the mobile mixer bin.

9. WATER CALIBRATION

9.1. Insure all units are empty

9.2. Locate the total gallons of water required on the approved mix design.

9.3. Obtain the tare weight of the container being used to catch the discharge.

9.4. Adjust the flow setting to the best estimate required to discharge the target weight of water in the time found during the cement calibration.

9.5. Position the container so that it will catch all of the water discharge.

9.6. Discharge the water for the calibrated time found during the cement calibration into a suitable container.

9.7. Weigh the container and record the net weight of water.

9.8. Repeat the process at that dial setting until 5 acceptable readings are recorded.

9.9. Determine the net weight of water. The weight of water is required to be accurate within 1%.

10. LATEX CALIBRATION

10.1. Locate the total gallons of latex required on the approved mix design.

10.2. Follow the calculation on Attachment 1 to determine the target weight of latex.

10.3. Adjust the flow setting to the estimated required to discharge the target weight of latex in the time found during the cement calibration.

10.4. Discharge the latex for the calibrated time into a suitable container and determine the weight of the latex.

10.5. Repeat the process at the dial setting until five consecutive, suitable readings are recorded.

10.6. Follow the calculation on attachment 1 to determine the dial setting. If the weight is within the tolerance for latex (1%), then record the flow setting and the weight of the latex. If it is not within tolerance, discard the results and adjust the dial setting accordingly.

11. ADMIXTURE CALIBRATION

11.1. Obtain the cement discharge time, in seconds, found during cement calibration.

11.2. Calculate the cement discharge time in minutes.

11.3. Calculate the dilution rate for the admix.

11.3.1. It is necessary to dilute both admixtures. Admixtures are diluted by mixing 5 parts of water to 1 part of admixture; however; some contractors prefer to dilute the air entraining admixture at the rate of 3 parts of water to 1 part of admixture. The dilution and mixing solution shall be done before the solution is put into the tanks.

11.3.2. The process of diluting admixtures should be observed by the inspector. The dispensing system should be clean and free of admixture solutions from other jobs prior to adding a new admixture solution to tanks.

11.3.3. Fill the admixture system with the proper part solutions to be used on the job.

11.3.4. Set the air pressure regulator gauge at 15 psi for standard units or 25 psi for magnum units.

11.3.5. Using a calibrated vial, with ounce or milliliters and a discharge time of one minute, establish a flowmeter setting that will deliver the calculated flow rate.

11.3.6. If a concrete-mobile handbook is available the flowmeter diagrams for LO-FLOW and HI-FLOW systems can be used to obtain an initial flowmeter setting.

11.3.7. Having established a flowmeter setting, obtain 3 one minute samples and record each volume. If each individual test has no more than 1% variation from the average flow rate, the unit admixture system is acceptable.

11.3.8. Follow the calculations on Attachment 1 to calibrate the liquid admixture.

12. FIBER FEEDER CALIBRATION

12.1. Insert package of fibers into the fiber feeder.

12.2. Extend the cylinder until the fibers engage the finger assembly.

12.3. Measure the height of the tube.

12.4. Measure from the top of the tube to the top of the plunger.

12.5. Complete the calculation on Attachment 1 for the total inches per minute travel rate.

12.6. Divide total inches per minute travel rate by 4.

12.7. Adjust cylinder flow rate to the halfway mark.

12.8. Have one person run the fiber feeder control and stopwatch while another person measure the rate of travel on the cylinder.

12.9. Start the fiber feeder and run for 15 seconds.

12.10. The distance traveled should be the same as the calculated total inches per minute. If less, adjust the flow rate up, if more adjust the flow rate up. Follow the calculation on Attachment 1 to determine the dial setting

12.11. Once the corrected flow rate is established, lock the adjuster in place.

13. YIELD TEST

13.1. There shall be one yield test per truck per day of batching. Also a yield test should be performed by the Contractor prior to deck placement for each mixing unit, when each unit is moved from the job site for recharging, when the source of stockpiled materials is changed and when there is reason to believe the calibration may be erroneous.

13.2. A minimum of 2 cubic yards is required to be batched.

13.3. Fill the mixing unit with project materials, including admixtures.

13.4. Check all gate, valve and flow meter setting for conformance with those established in the calibration steps.

13.5. Determine the cement meter count to deliver the minimum. of 2 cubic yards of concrete using the calculations on Attachment 1.

13.6. Place the box beneath the mix conveyor to catch all the concrete discharged by the unit.

13.7. Set the mix conveyor at an angle of at least 45 degrees.

13.8. Ensure the count meter register is 0.

13.9. Engage the mix conveyor and main conveyor simultaneously to discharge concrete until the meter equals that for 2 cubic yards or the box becomes full.

13.10. Strike off the concrete in the box and record the exact count. The count must be within 2% of the count calculated during calibration.

13.11. Batch a load of concrete using the previously determined calibration settings and total counts.

13.12. Completely fill the box with concrete while noting the total number of counts used.

13.13. This value must be within 1% of the calibrated counts that were determined earlier. If it is within tolerance, then it becomes the new calibrated total count. If they still don't fall within the required range, the calibration process must be redone.

Cement Calibration Sheet

COUNTY		PROJECT No.	
CONTRACTOR		DATE	
TRUCK No.		CALIBRATED BY	
SERIAL #			
UNIT SERIES		CEMENT TYPE	
	(50,100,130,150, or 200)	CEMENT SOURCE	

TRIAL #	COUNTS	GROSS WT	TARE WT	NET WT	TIME (sec.)
1				0.00	
2				0.00	
3				0.00	
4				0.00	
5				0.00	
TOTALS	0.00	0.00	0.00	0.00	0.00
	A			**B**	**C**

Lbs./count = $\frac{\text{Total Lbs.}}{\text{Total Counts}} = \frac{\mathbf{B}}{\mathbf{A}} =$ **#DIV/0!** **(D)**

Counts/bag = $\frac{\text{94 Lbs.}}{\text{Lbs./count}} = \frac{\mathbf{D}}{94} =$ **#DIV/0!** **(E)**

Counts/sec. = $\frac{\text{Total Counts}}{\text{Total Sec.}} = \frac{\mathbf{A}}{\mathbf{C}} =$ **#DIV/0!** **(F)**

Sec./Bag = $\frac{\text{Counts/bag}}{\text{Counts/sec}} = \frac{\mathbf{E}}{\mathbf{F}} =$ **#DIV/0!** **(G)**

Aggregate Calibration Sheet

DATE	
CALIBRATED BY	
TRUCK No.	
SERIAL #	
TYPE OF AGGREGATE	sand

TRIAL #	GATE SETTING	COUNTS	GROSS WT	TARE WT	NET WT	Moisture Content	Adjusted Weight
1. LOW					0.00		0.00
2. LOW					0.00		0.00
3. LOW					0.00		0.00
4. LOW					0.00		0.00
5. HIGH					0.00		0.00
6. HIGH					0.00		0.00
7. HIGH					0.00		0.00
8. HIGH					0.00		0.00

LOW SETTING

Total Counts for Low Setting =	0.00
Total Pounds for Low Setting =	0.00

Lbs./count = Total Lbs. / Total Counts = **#DIV/0!**

HIGH SETTING

Total Counts for High Setting =	0.00
Total Pounds for High Setting =	0.00

Lbs./count = Total Lbs. / Total Counts = **#DIV/0!**

Aggregate Calibration Sheet

DATE _____

CALIBRATED BY _____

TRUCK No. _____

SERIAL # _____

TYPE OF AGGREGATE stone

TRIAL #	GATE SETTING	COUNTS	GROSS WT	TARE WT	NET WT	Moisture Content	Adjusted We
1. LOW					0.00		0.00
2. LOW					0.00		0.00
3. LOW					0.00		0.00
4. LOW					0.00		0.00
5. HIGH					0.00		0.00
6. HIGH					0.00		0.00
7. HIGH					0.00		0.00
8. HIGH					0.00		0.00

LOW SETTING

Total Counts for Low Setting = 0.00

Total Pounds for Low Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

HIGH SETTING

Total Counts for High Setting = 0.00

Total Pounds for High Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

Aggregate Calibration Sheet

DATE _____

CALIBRATED BY _____

TRUCK No. _____

SERIAL # _____

TYPE OF AGGREGATE _____

TRIAL #	GATE SETTING	COUNTS	GROSS WT	TARE WT	NET WT	Moisture Content	Adjusted We
1. LOW					0.00		0.00
2. LOW					0.00		0.00
3. LOW					0.00		0.00
4. LOW					0.00		0.00
5. HIGH					0.00		0.00
6. HIGH					0.00		0.00
7. HIGH					0.00		0.00
8. HIGH					0.00		0.00

LOW SETTING

Total Counts for Low Setting = 0.00

Total Pounds for Low Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

HIGH SETTING

Total Counts for High Setting = 0.00

Total Pounds for High Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

Aggregate Calibration Sheet

DATE _____

CALIBRATED BY _____

TRUCK No. _____

SERIAL # _____

TYPE OF AGGREGATE _____

TRIAL #	GATE SETTING	COUNTS	GROSS WT	TARE WT	NET WT	Moisture Content	Adjusted We
1. LOW					0.00		0.00
2. LOW					0.00		0.00
3. LOW					0.00		0.00
4. LOW					0.00		0.00
5. HIGH					0.00		0.00
6. HIGH					0.00		0.00
7. HIGH					0.00		0.00
8. HIGH					0.00		0.00

LOW SETTING

Total Counts for Low Setting = 0.00

Total Pounds for Low Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

HIGH SETTING

Total Counts for High Setting = 0.00

Total Pounds for High Setting = 0.00

Lbs./count $= \frac{\text{Total Lbs.}}{\text{Total Counts}} =$ **#DIV/0!**

Volumetric Concrete Dispenser Mix Design Worksheet

OWNER | Unit Serial # 0

YOUR MIX DESIGN (This sheet must be filled out for each mix design)

MIX DESIGN | Date

(max 8 characters)

Materials of one cubic yard:

Cement		LBS.		Cement Discharge Speed		**#DIV/0!**	Counts per Bag of Cement
				(In Percent)			
Cement	0.0	BAGS	#DIV/0!	Cubic Yard Discharge Time (Minute)			

Aggregate	**Name**	Aggregate # Desired (enter 1, 2, 3, or 4)		Lbs of Aggregate
1	sand	Aggregate 1		
2	stone	Aggregate 2		
3	0			
4	0			

Latex	Gallons	
	Dilution	Oz/bag
Admix # 1		
Admix # 2		
Admix # 3		

1. Determine the count per cubic yard.

0.0 bags/cubic yard x **#DIV/0!** counts per bag = **#DIV/0!** count per cubic yard.

2. AGGREGATE 1: Divide the lbs. of fine aggregate per cubic yard by the count per cubic yard.

0 lbs. fine aggregate divided by **#DIV/0!** counts per cu. yd.= **#DIV/0!** lbs. per count.

GATE SETTING (from graph) **#DIV/0!**

3. AGGREGATE 2: Divide the lbs. of coarse aggregate per cubic yard by the count per cubic yard.

0 lbs. coarse aggregate divided by **#DIV/0!** counts per cu. yd.= **#DIV/0!** lbs. per count.

GATE SETTING (from graph) **#DIV/0!**

Description		1/0/1900					
Total	**#DIV/0!**	**Counts / Cubic Yard**					
Cement	**#DIV/0!**	**lbs./ Count**			**Dial**		
Aggregate 1	**#DIV/0!**	**lbs./ Count**			**Setting**	**Oz/Min**	
Aggregate 2	**#DIV/0!**	**lbs./ Count**		**Admix # 1**	**#DIV/0!**	**#DIV/0!**	**Low**
Water	**#DIV/0!**	**lbs./ Count**		**Admix # 2**	**#DIV/0!**	**#DIV/0!**	**High**
Aggregate 1 Gat	**#DIV/0!**			**Admix # 3**	**#DIV/0!**	**#DIV/0!**	**High**
Aggregate 2 Gat	**#DIV/0!**						
Latex Setting	**#DIV/0!**						
Water Meter							

Latex Calibration Sheet

DATE	
CALIBRATED BY	
TRUCK No.	
SERIAL #	
TYPE OF FIBER	

Total Gallons Latex Required = (refer to mix design)

Target Weight of Latex

(Total Gallons Latex Required) x (Specific Gravity of Latex) = 0 x 8.4 = #DIV/0!

Number of cement bags required in mix design

Actual Weight of Latex

CONTAINER WT	TARE WT	NET WT	TIME (sec.)
		0.00	

Tolerance: Within 1%

Fiber Calibration Sheet

DATE

CALIBRATED BY

TRUCK No.

SERIAL #

TYPE OF FIBER

Lbs./yard of Fiber **(A)** = (refer to manufacturer)

Discharge Time of a yard of concrete:

$$\frac{\text{(Seconds/Bag of cement) x (bags of cement per yard)}}{60} = \frac{\quad \times \quad}{60} = 0.00 \text{ Minutes/yard}$$

Total Inches of Compressed Fiber in Tube:

Height of tube - Measurement to top of plunger - 1/4" = - - 0.25 = -0.25 Inches of compressed fiber in the tube

Lbs. of Compressed Fiber per Inch:

$$\frac{\text{Total Inches of Compressed Fiber}}{\text{Total Lbs. of Fiber in Tube}} = \frac{-0.25}{} = \text{\#DIV/0!} \text{ Inches/Lb. of Fiber}$$

Inches per Yard:

(Inches per Lb.) x (Lbs. per yard required) = #DIV/0! x 0 = #DIV/0! Inches/ yard

Rate of Cylinder Travel:

$$\frac{\text{Inches per Yard}}{\text{Minutes per Yard}} = \frac{\text{\#DIV/0!}}{0.00} = \text{\#DIV/0!} \text{ Inches/minute}$$

$$\text{Inches per 15 Seconds} = \frac{\text{\#DIV/0!}}{4} = \text{\#DIV/0!} \text{ Inches/ 15 seconds}$$

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

MATERIALS PROCEDURE

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 Appendix G Operating, Emergency, and Security Proceures

~~1.5~~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.

~~1.6~~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 ~~one~~ 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 at ~~558-3045~~ 304-558-3160.

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.

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 work sheets. 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 Construction Division

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 Construction Division 1 copy to District Engineer

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

ML-25 Steward – Aggregate and Soils Section

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.~~ 15. T 197, Standard Method of Test for Time of Setting of Concrete Mixtures by Penetration Resistance
~~16.~~ 16. T 231, Standard Practice for Capping Cylindrical Concrete Specimens

~~17.~~ 17. T 358 Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration ~~T 277, Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration~~
18. T309, Standard Method of Test for Temperature of Freshly Mixed Portland Cement Concrete
~~18.~~19. 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 T277 (ASTM C1202)~~, AASHTO T309 (ASTM C1064),

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

AASHTO T11 (ASTM C117), AASHTO T19 (ASTM C29), AASHTO T27 (ASTM C136), AASHTO T84 (ASTM C128), AASHTO T85 (ASTM C127), ~~and~~ AASHTO R76 (ASTM C702), AASHTO T 358. In addition, all personal performing the SAM test must be certified by the 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 Page2. 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

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

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.

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.

~~4.2.4~~

~~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 trail 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.

~~4.3.1~~4.2.5 Class H concrete, concrete for Ssspecialized Oeverlays, 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. ~~Two rapid chloride permeability~~The surface resistivity tests shall be performed~~, i~~n accordance with AASHTO T ~~277~~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. ~~Two rapid chloride permeability tests specified in Section 679.2.2~~ 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 ~~rapid chloride permeability~~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~~4.3 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~~4.3.1 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~~4.4 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~~4.4.1 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~~4.4.2 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 ~~rapid chloride permeability 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~~4.5 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 ~~rapid chloride permeability~~ 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 ~~rapid chloride permeability~~ 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~~4.5.1 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 ~~rapid chloride permeability~~ surface resistivity specimens (each to be tested at an age of 90 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~~, the average of the two rapid chloride permeability~~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~~1,000 coulombs or less~~ in order for the mix design to be re-approved.

~~7.3.2~~

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 ~~rapid chloride permeability~~ test (Class H, K ~~–~~concrete and specialized concrete overlays as outlined in Section 679), ~~a minimum of one permeability~~ specimens shall be fabricated from each of the batches produced in Section 8.3. The average value of these ~~permeability~~ surface resistivity specimens shall be no ~~more~~ less than ten percent ~~greater than the~~of the mix designs ~~permeability~~ 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 ~~permeability~~ surface resistivity specimens shall be less than or equal to the mix design ~~permeability~~ 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
Interim Director
Materials Control, Soils & Testing Division

MM:Td

ATTACHMENTS

MP 711.03.23
SUPERSEDES: MAY 2024
REVISED: JANUARY 2025
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		

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SUPERSEDES: MAY 2024
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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)	

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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		^{O}F (^{O}C)
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
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.

4.3 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.

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 exposed rebar 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. A minimum 1 in. area of the epoxy coating on the epoxy coated rebar will need to be removed in order 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.

5.4.1.3 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

5.4.2.1 At least 1 location per lane shall be selected to obtain chloride potential 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.

5.4.2.2 Cores obtained in 5.4.2.1 will be cut into one (1) in. thick disc specimens, maintaining their four (4) in. diameters.

5.4.2.3 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 labelled with the core number and the depth it represents.

5.4.2.4 The concrete dust in the labelled sample container will be tested for chloride content following Sections 9 and 10 of ASTM C1152.

5.4.2.5 Record the test results in the format of the table in Attachment 7.

5.5 Crack Mapping

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

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 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). The MIR shall include the following sections: Introduction, Accounting Data, Purpose of Report, Results of Bridge Deck Condition Survey, Conclusion, and Recommendations. Attachments 1 and 2 includes an example Memorandum and MIR.

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, 20XX

M E M O R A N D U M

TO: **NAME**
REGIONAL 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:

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.

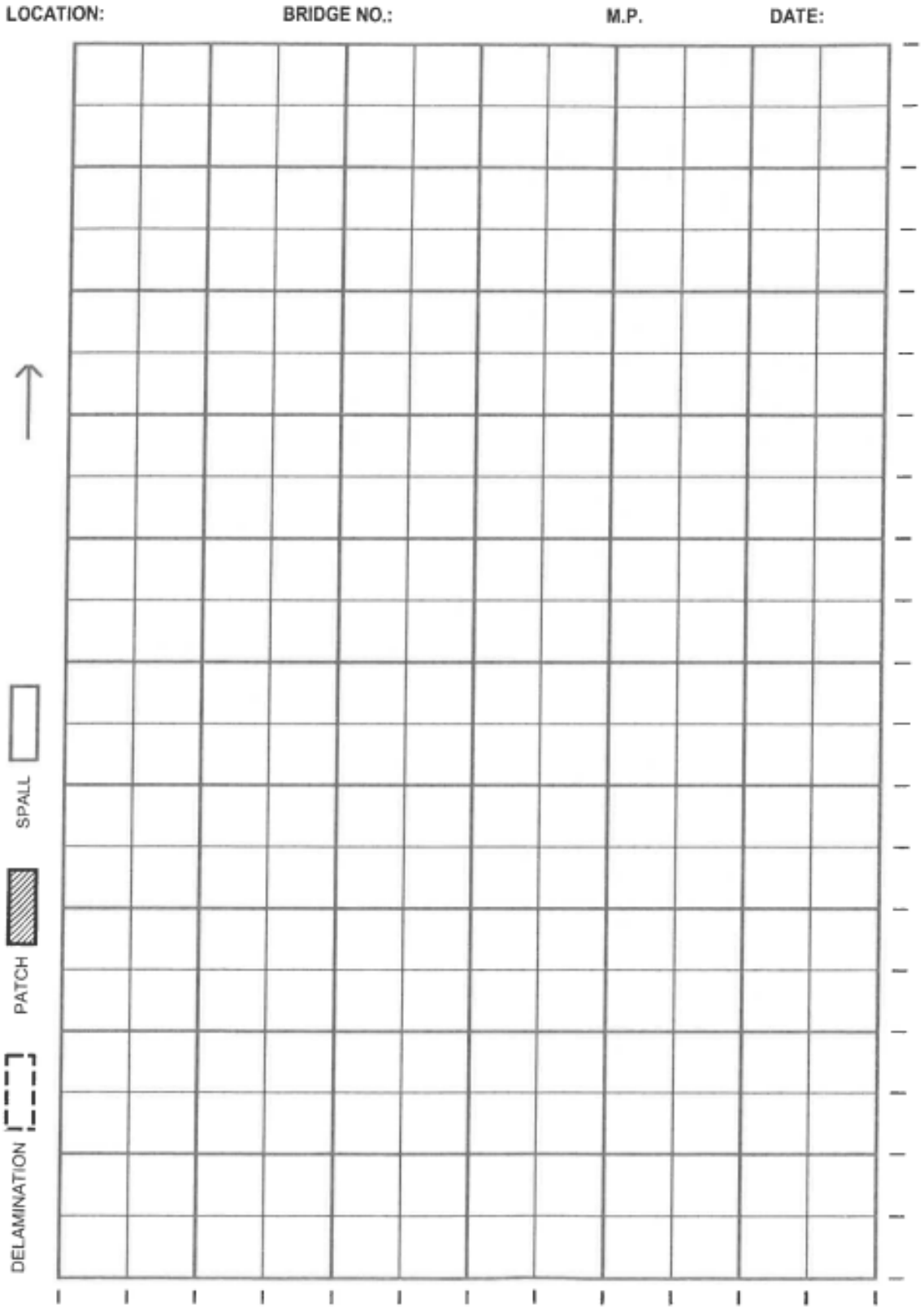
4. **RESULTS OF BRIDGE DECK CONDITION SURVEY**

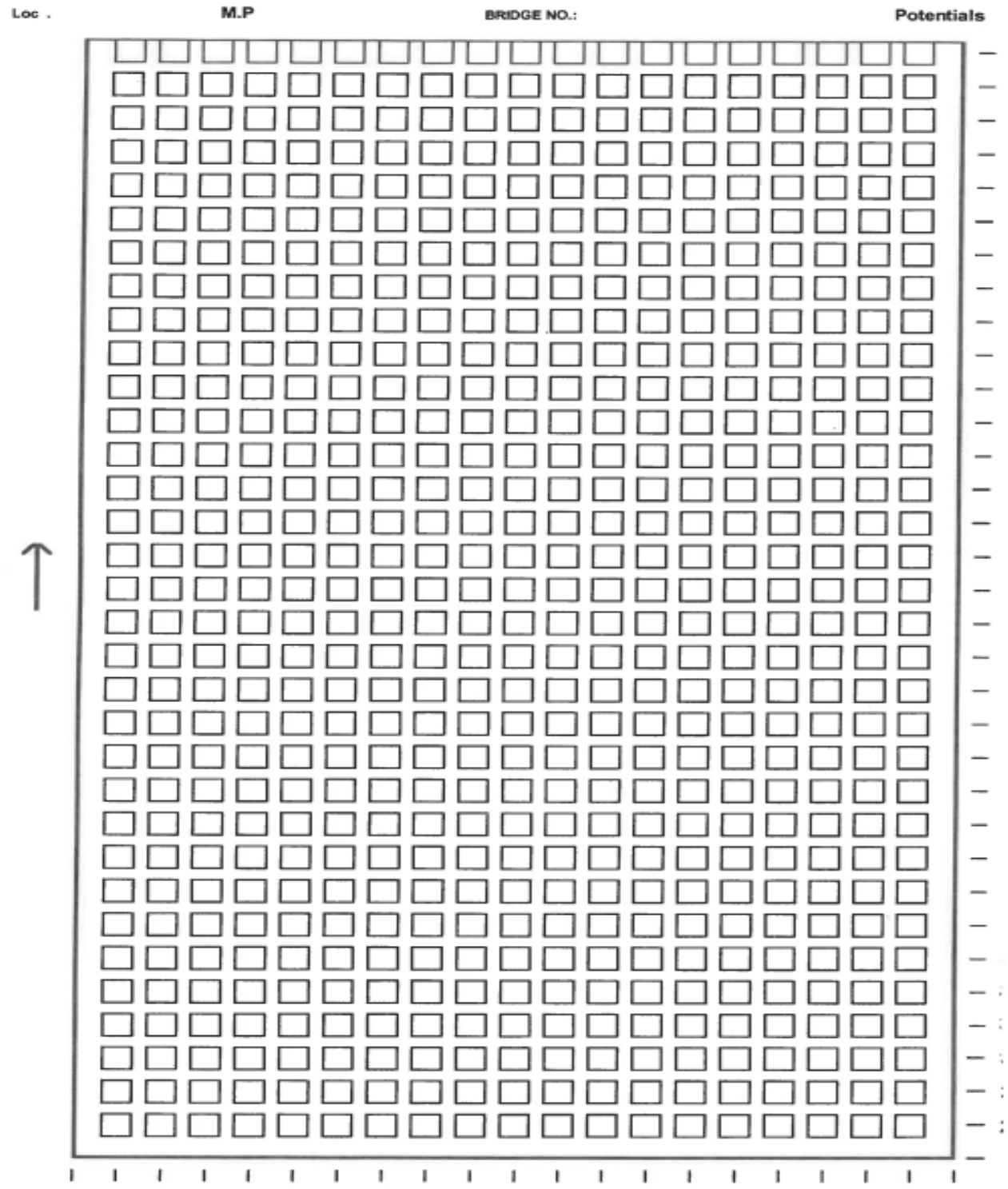
4.1 Surface Condition

4.1.1 The bridge deck surfaces exhibited spalling and delamination.

4.2 Subsurface Condition

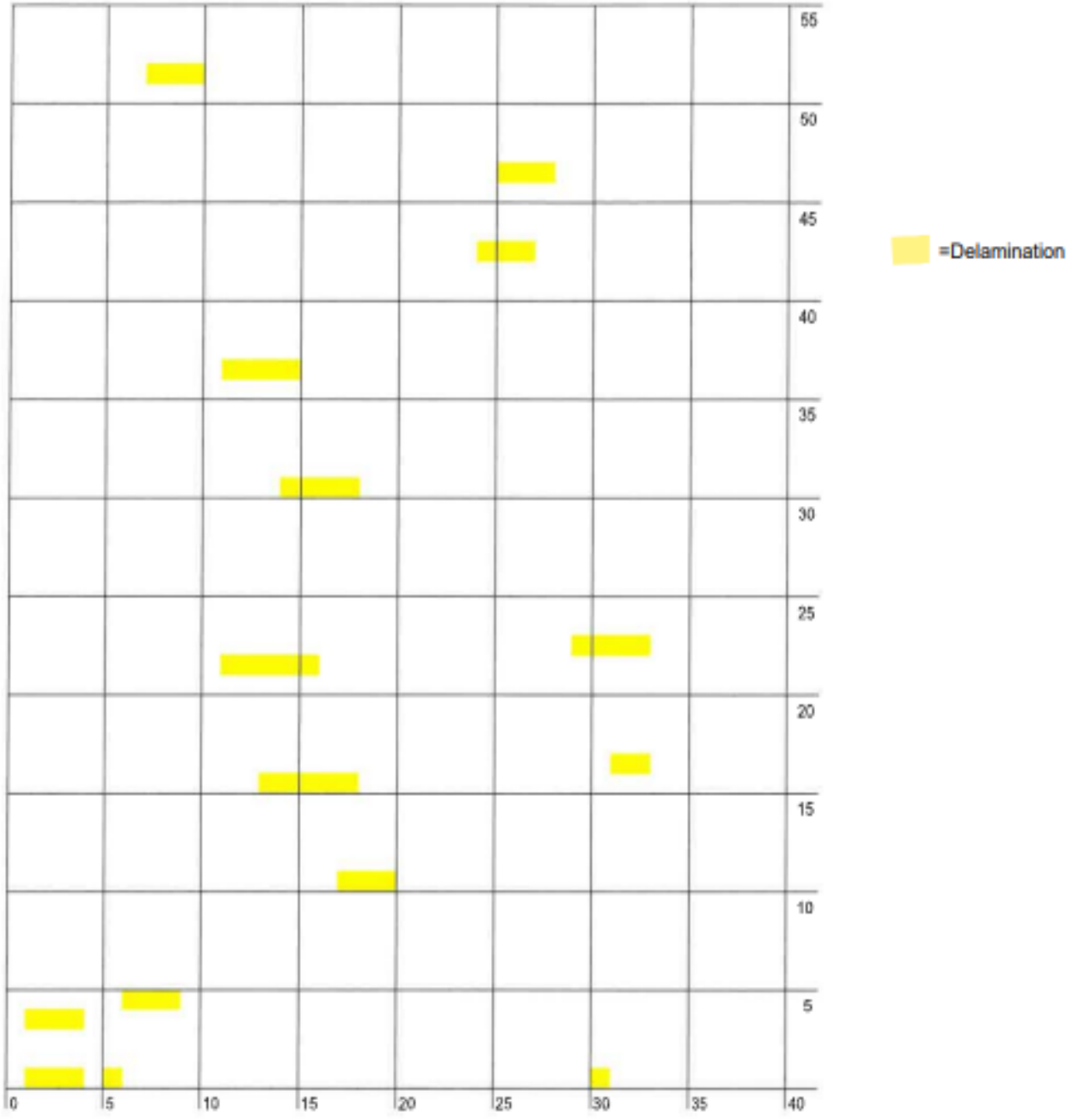
4.2.1 The bridge deck subsurface condition survey was not performed because it was not requested.


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

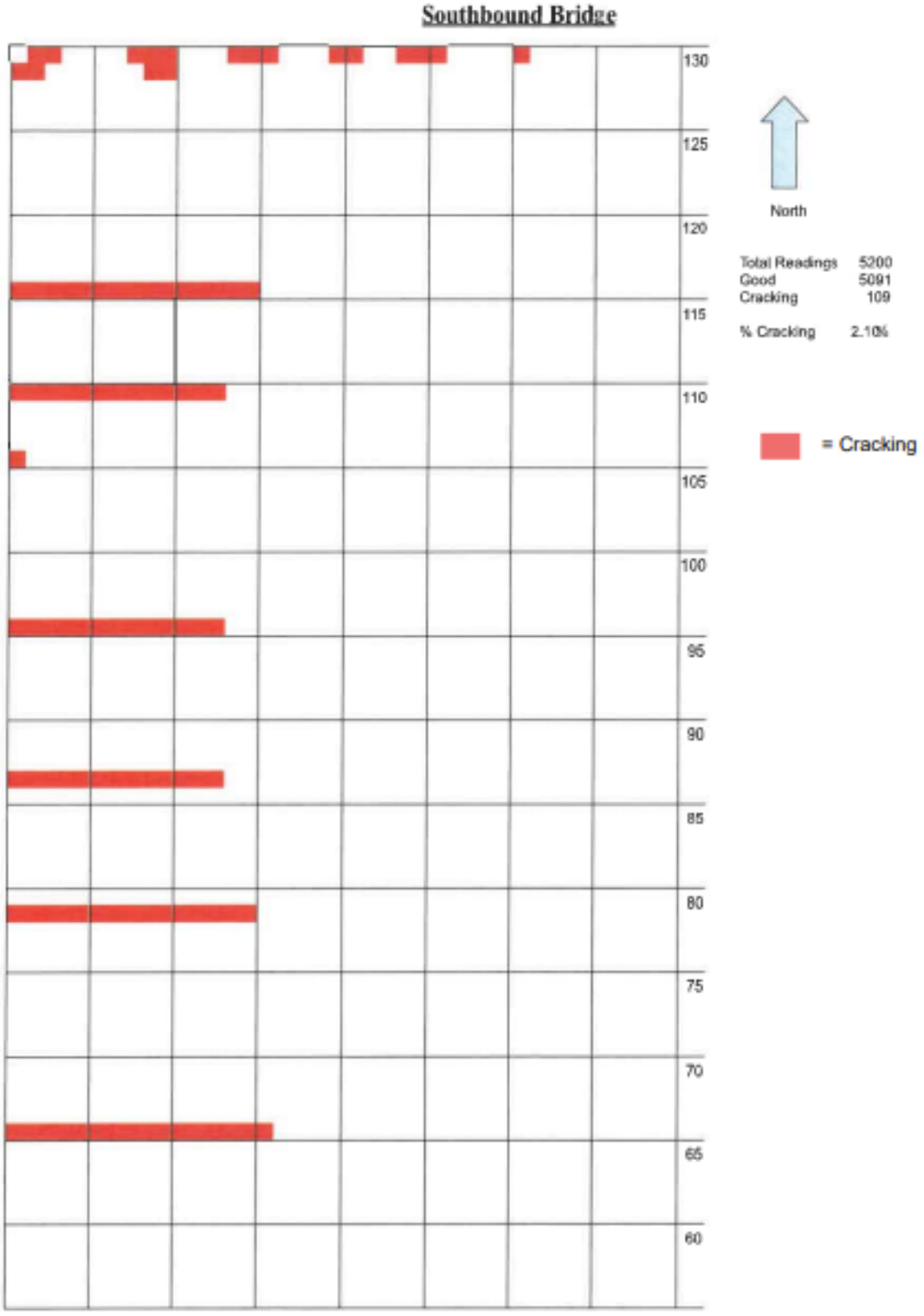

Loc .
M.P
BRIDGE NO.:
Potentials

Delamination Plotting

Southbound Bridge Continue



Crack Mapping

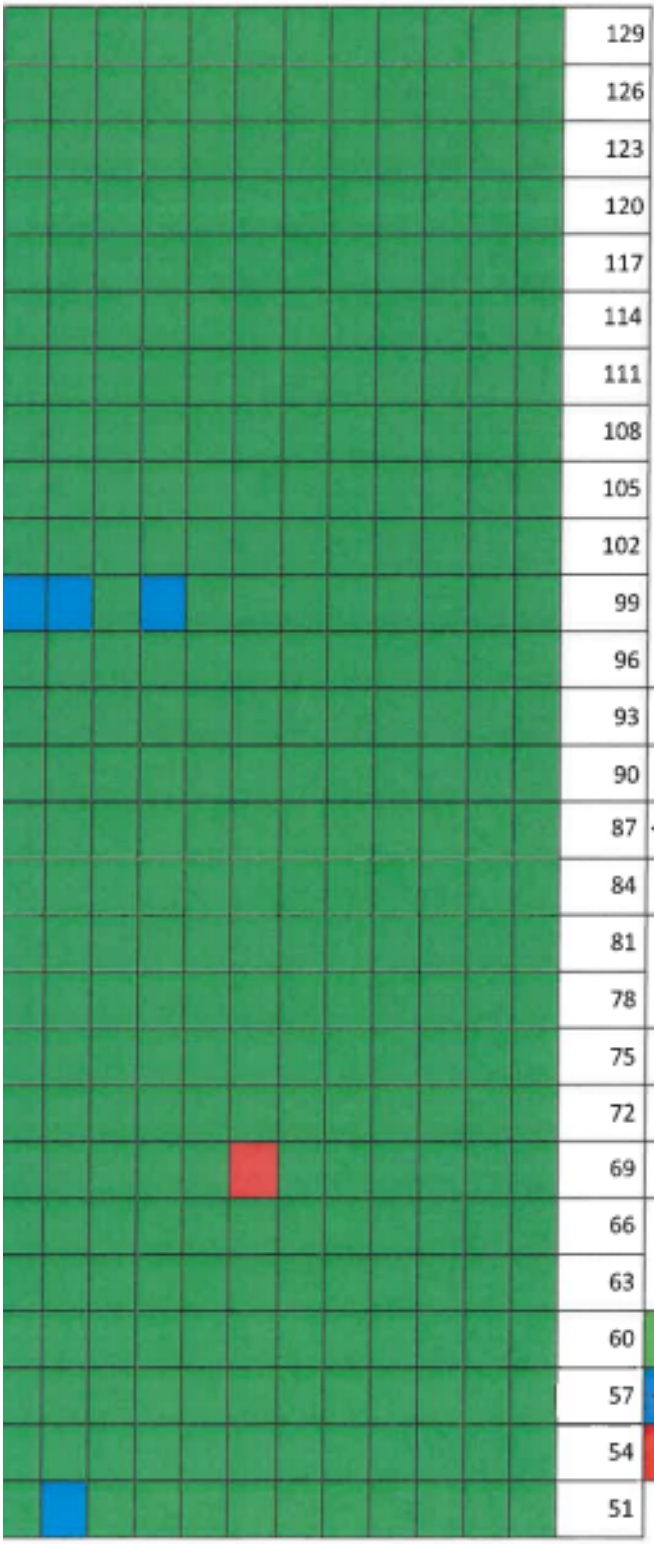


Chloride Potential Results Table

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

Northbound Bridge



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 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 ~~for the comparison of quality~~ Quality ~~control~~ Control (QC) and Quality Assurance (QA) ~~sample test results with verification sample test~~ tests to verify the validity of the QC samples.~~results.~~

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.

~~2.1.~~2.3. Quality Assurance (QA) Sample: Samples performed by the Division to ~~accept~~ evaluate for acceptance, a material on ~~the~~ a Project.

~~2.2.~~2.4. Quality Control (QC) Sample: Samples performed by the Contractor ~~on the Project to demonstrate material compliance~~for a material on a Project to demonstrate the material's compliance with the Specifications.

2.5. Verification ~~Sample~~: ~~A quality assurance sample performed by the District and~~The process of ~~Statistically~~ statistically ~~compared~~ comparing a QA sample to a series of ~~Quality~~ QC~~Control~~ ~~Samples~~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.

~~2.2.1.~~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. This procedure is used to review and evaluate contract quality control samples.~~

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

3.1.1. Aggregate Gradations – Project Approach

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

~~3.2.1.~~

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

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

~~5.~~

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

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

~~3.~~

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

1. Air Content

~~1.~~

2. Consistency
3. Strength

~~2.~~

4. PROCEDURE

~~4.1. The following procedure will be performed by the District Materials Supervisor.~~

4.1. After completion of the QA sample~~verification sample test~~, the test data ~~will~~ shall be entered into the ~~Division approved materials tracking program~~System. The QA sample shall be linked to the appropriate QC sample(s) as specified in Section 4.2. ~~This data will be compared by the software to the applicable quality control sample test results for the same item.~~ Note that all samples being ~~compared~~ linked must contain all respective test results for the material shown in Section 3 and ~~be taken from the same sampling location, e.g., stockpile, roadway, etc., and sampled and tested in the same manner.~~ 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.

4.2. The samples shall be linked based on the total number of QC samples. This will allow the System to create a data set and perform an evaluation (if applicable).

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.

~~4.2.1. If there are more than ten quality control samples, a verification sample shall be done for the first ten samples. Additional verification samples shall be done at the frequency of one in ten.~~

~~4.2.1.1.~~4.2.3.1. For example, if 16 QC samples are taken, there shall be a ~~verification~~ QA for samples 1-10 and then another QA for samples ~~1~~11-16, which would be evaluated as "5-10" QC samples. ~~.~~

~~4.2.1.2. If there are only five to nine quality control samples available, determine the average of all the available consecutive quality control test results. When comparing the grading characteristics of an aggregate, the average ($\bar{X}$) for each sieve will be determined.~~

~~4.2.2. In the event there are less than five quality control samples available when the verification sample is complete, the District Materials Supervisor will review the data. If the data is such that a dissimilarity appears obvious then Section 5.1 of this procedure would apply. If, however, the verification sample results appear to be similar to the quality control sample results then the verification sample would be judged at this point by the District Materials Supervisor to be similar, and the applicable portions of Section 6.1 of this procedure would apply with the following statement: "This verification sample (verification sample number recorded here) has been judged to be similar in accordance with Section 4.2.2 of MP 700.00.54." This statement shall be on the sample record.~~

~~4.2.3. Determine the range (R) of the quality control samples used in Section 4.2.1 by subtracting the smallest test value from the largest test value. When comparing the grading characteristics of aggregate, the range (R) for each sieve will be determined.~~

~~4.2.4. Compute the interval (I) by substituting the values calculated in Sections 4.2.1 and Section 4.2.3 into the proper equation below. When comparing the grading characteristics of aggregate, the interval(I) for each sieve will be determined.~~

No. of Samples Used in Calculating the Average in Section 4.2.1	Equation for Computing the Interval (I)
10	$I = \bar{X}_{10} \pm 0.91 \times R$
9	$I = \bar{X}_{9} \pm 0.97 \times R$
8	$I = \bar{X}_{8} \pm 1.05 \times R$
7	$I = \bar{X}_{7} \pm 1.17 \times R$
6	$I = \bar{X}_{6} \pm 1.33 \times R$
5	$I = \bar{X}_{5} \pm 1.61 \times R$

4.2.5. The interval (I) is determined by first adding the average ($\bar{X}_n$) to the product of the range (R) times the given constant. This determines the upper limit of the interval. 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.

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 deviance. If a significant deviance is noted, appropriate action shall be taken by the District as specified in Section 5.3.2.1. If there is no significant deviance, the report shall indicate: "This sample, <sample number recorded here> has been reviewed in accordance with MP 700.00.54."

4.2.6. If the data is such that a dissimilarity appears obvious then Section 5.1 of this procedure would apply. If, however, the verification sample results appear to be similar to the quality control sample results then the verification sample would be judged at this point by the District Materials Supervisor to be similar, and the applicable portions of Section 6.1 of this procedure would apply with the following statement: "This verification sample (verification sample number recorded here) has been judged to be similar in accordance with Section 4.2.2 of MP 700.00.54." This statement shall be on the sample record.

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".

~~4.2.7. Compare the verification sample test result with the calculated interval. When comparing the grading characteristics of aggregates, a comparison for each sieve will be determined.~~

~~Aggregate Verification Samples.~~

~~4.3. The verification sample will be considered similar if all sieve results fall within the upper (U^I) and lower limits (L^I) of the interval (U^I <= Result <= L^I). Otherwise, the sample will be considered dissimilar.~~

~~Asphalt Verification Samples.~~

~~4.4. The verification sample will be considered similar if the asphalt content and air voids fall within the upper (U^I) and lower limits (L^I) of the interval (U^I <= Result <= L^I). Otherwise, the sample will be considered dissimilar.~~

~~Portland Cement Concrete Verification Samples~~

~~4.5. The verification sample will be considered similar if the air content and consistency fall within the upper (U^I) and lower limits (L^I) of the interval (U^I <= Result <= L^I). Otherwise, the sample will be considered dissimilar.~~

~~**5.** EVALUATION~~

~~5.1.~~5.3.2.1. If the ~~quality control sample data~~data set is ~~dissimilar~~"Non-Similar", ~~to the verification sample~~ the District Materials Supervisor shall perform and document ~~will take~~ the following for QC ~~actions where appropriate~~:

1. Review the ~~quality control~~ sampling procedure.
2. Review the ~~quality control~~ testing procedures.
3. Check testing equipment.
~~4. Review computations.~~
~~5.~~4. Review documentation.
5. Perform any additional investigations that may clarify the discrepancy~~dissimilarity~~.

~~6.~~

6. REPORTING AND SAMPLE SUBMISSION

6.1. Once the evaluation is completed, the result shall be noted 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 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.

~~6.1.~~6.2.1. If the ~~quality control~~data set is ~~samples are~~ found to be "~~similar~~Similar", the QA Sample shall be marked "Similar" in the System ~~to the verification sample, the sample shall be labeled "Similar-Passed" .and submitted to the respective Materials Regional Coordinator for final evaluation using the currently materials tracking software.~~

~~6.2.~~6.2.2. If the data set is found to be "Non-Similar" ~~If the quality control samples are dissimilar,~~ the QA sample shall be ~~labeled~~ marked "Non-Similar" in the System. ~~and~~

~~submitted to the respective Materials Regional Coordinator for final evaluation using the currently materials tracking software.~~

~~6.2.1.~~6.2.2.1. If the Sample is ~~not~~ marked "~~non~~Non-~~similar~~Similar", ~~a note shall be made on the sample record including a brief statement of the action taken to correct the deficiency.~~the documentation from Section 5.3.2.1 shall be submitted with the sample.

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.~~.~~

~~6.2.2.~~6.3. A sample report is shown in Attachment 2.

~~6.3. The results of the investigation as reported will be noted by District Materials in their email submission.~~

~~6.4. The test agency view shall contain the information: "Issued by District (Number) per MP 700.00.54, (Date)."~~

~~6.5. When the sample is completed, it shall be authorized by the respective Materials Regional Coordinator.~~

~~6.6. The testing technician shall be listed on each sample.~~

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

MP 700.00.54 Steward – Materials Control Section
MM: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.

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

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	100	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
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. REFERECED 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. They will be advised by a Board composed of the following members:

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

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

Commented [DB1]: Add reference to Reciprocity and consider adding reciprocity to this document

Commented [DB2]: If we do combine, update the title

Commented [DB3]: Comment - Steve Williamson -

Will the state consider making our program so we can make our technician school become/meet the criteria for an AASHTO acceptance.

Recent AASHTO inspection, re-certify, but we don’t take the practical for all the procedures, just select random ones. If we did all the procedures? Wouldn’t take that much additional effort.

AASHTO Accreditation more common.

Mike Mance - Our process should already qualify.

SW - wouldn’t accept WVDOH because we don’t do all the recertifications, not all the tests, just 2 or 3. Can get that information to us.

If we did all of them that we do in the practical, would be good for AASHTO.

Have to scramble and send people to the ACI classes, in the last couple of months.

MM - They looked at the recertification process.

SW - Initial, was ok, but the recertification was not. In ACI Recertification, every 5 years you need to go through every one of the procedures every year. Missing cylinders.

Further discussion once we get the report.

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 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

Commented [DH4]: No class for this certification

Commented [DH5]: No class for this certification

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 pass a practical examination. The technician must demonstrate the testing common to normal aggregate quality requirements.

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.

9. AGGREGATE SAMPLING INSPECTOR

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

Commented [DH6]: Class or certification?

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

1. Specifications
2. Sampling Fundamentals
3. Sampling Methods and Equipment
4. Gradations
5. T11 Wash Test

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

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

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 Compaction Test Procedures
3. Radiation Safety and Nuclear Gauge
4. Test Procedure Problems

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

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

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

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.

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 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. 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. 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.

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

11.5.3. 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.

Commented [DB7]: VA to review

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

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 106.03.51

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
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 issued. Refer to MP 106.03.51

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

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

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

15. ASPHALT PRESERVATION TECHNICIAN

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

Commented [DH8]: Class or Certification?

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.

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

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

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

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. Proper storage and security of portable nuclear gauges
6. Transportation of portable nuclear gauges
7. Personal safety while operating a portable nuclear gauge.

17. INERTIAL PROFILER OPERATOR

Commented [DB9]: 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.

18. TESTING PROTOCL

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

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

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 [DB10]: Fix header to be consistent.

19. CERTIFICATION, APPRENTICESHIP, AND RE-CERTIFICATION

19.1. Certification

19.1.1. An individual must pass the 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 exam, they will be given another attempt at a later date to score a 70%. This second attempt shall be a subsequent, scheduled make-up exam. Failure to attend any examination counts as a failed exam.

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

19.1.4. 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 Apprenticeship

19.2.1 Upon successful completion of the written exam, the Technician shall work as an apprentice under the supervision of a certified technician for a period of 6 months before becoming a fully certified technician.

19.2.2 The apprenticeship shall be completed before attempting the practical portion of the certification process.

~~19.1.4.~~ 19.2.3 The apprentice shall keep a daily work log that is signed at the end of each workday by the supervising technician. The work log shall be submitted to the Quality Assurance Program Administrator prior to taking their practical exam. 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.~~19.3. Re-Certification

~~19.2.1.~~19.3.1. The responsibility for obtaining re-certification shall lie with the certified individual.

~~19.2.1.1.~~19.3.1.1. Certification holders are responsible to ensure that their certifications stay current. The West Virginia Division of Highways will no longer mail reminder letters to certification holders.

~~19.2.2.~~19.3.2. The renewal of all certifications shall require a written exam and a hands-on practical exam, where applicable.

~~19.2.3.~~19.3.3. 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.

~~19.2.4.~~19.3.4. Any failed recertification examination taken prior to the expiration date of the current certification, either practical or written will not result in termination of any current certification prior to the expiration date of that certification.

~~19.2.5.~~19.3.5. The certification holder is responsible updating their personal information on the online learning website[10].

~~19.2.6.~~19.3.6. 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 [DH11]: Should be 19.3.7

19.4 Instructor's Extended Certification

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

~~19.3.~~

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 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 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.

Commented [DB12]: SJ - What does this mean? What are they referring?

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 Engineer for review. All information including any letter(s) of explanation from the appellant will accompany the documents submitted to the Chief Engineer. The board will mail the decision of the Chief Engineer to the appellant. The decision by the 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
Interim Director
Materials Control, Soils & Testing Division

MP 106.03.50 Steward – Personnel, Payroll Section
MM:h