



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

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SUBMISSION AND PROCESSING OF BILLS OF ELECTRICAL EQUIPMENT,  
SIGNAL EQUIPMENT, AND ELECTRICAL MATERIALS

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**1. PURPOSE**

- 1.1 To provide a standardized method for identifying for evaluation and documenting proposed and installed location, quantity, description, make, type, grade, capacity, and manufacturer's catalog number of all electrical equipment, signal equipment, and materials installed on West Virginia Division of Highways projects in order to comply with subsection 631.2 of the West Virginia Department of Transportation, Division of Highways, Standard Specifications for Roads and Bridges and Supplementals (Standard Specifications) and/or Materials Control, Soils and Testing Division (MCS&T) Materials Procedures.
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**2. SCOPE**

- 2.1 This procedure applies to all electrical equipment, signal equipment, and materials.
- 2.2 This procedure applies to all documents listing electrical, signal equipment, and materials on submittals, shop drawings, bills of electrical and signal equipment and material including materials previously approved on submittals, shipping documents, and on records of completion plans in order to create an as built record of materials.
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**3. DEFINITIONS**

- 3.1 **Electrical, Signal Equipment, and Materials Bill of Materials (ESBOM):** Shall be submitted in a spreadsheet format as directed in this Materials Procedure and made part of the Electrical Submittal.
- 3.2 **Electrical Submittal (ES)-** The Electrical Submittal (ES) form shall be in a text searchable Portable Document Format prepared as directed in this Materials Procedure and submitted to the project and made a part of the Electrical Submittal Bill of Materials.
- 3.3 **Bill of materials item number-** Bill of materials item numbers shall be sequential and unique to one and only one individually described item within a project. Duplicated items from the same vendor shall have the same bill of materials item number; however, duplicated items from different vendors may have different bill of materials item numbers. Bill of materials line and bill of materials item numbers shall be sequential and shall not be duplicated in the same project; therefore, the contractor should assign blocks of bill of materials line and bill of materials item numbers to each vendor. Bill of materials item numbers for each item shall be

permanent on all documents from the same vendor (ESBOM, ES, shipping documents) throughout the project and shall not be changed.

- 3.4 **Itemized Bill of Electrical Equipment and Materials-** Itemized Bills of Electrical Equipment and Materials shall include an Electrical Equipment, Signal Equipment, and Materials Bill of Materials (ESBOM), and an Electrical Submittal (ES) submitted simultaneously as attachments to one email to the project.
- 3.5 **File Names-** ESBOM and ES form files shall be named as such: ContractReference#ESBOM##R##.pdf and ContractReference#ES##R##Item##D##.pdf. The initial ESBOM ContractReference#ES1R0.xlsx and the initial ES shall be named ContractReference#ES1R0Item1D1.pdf for the first electrical submittal, first item, and first document, the ES number, Revision Number, and Document Numbers shall increase sequentially for each Electrical Submittal and revision; document numbers shall increase incrementally for each document submission for each item, such that there will be a new text searchable PDF file for each document submitted for each item included in the ESBOM. These form files shall be submitted electronically to the construction engineer's designee and material shall not be accepted on the project without a valid approval number on the shipping documents.
- 3.6 **PDF file-** A PDF file is a type of file that contains a bitmapped image of a document to appear as the original document permitting the document to be archived digitally.
- 3.7 **Shipping Documents-** Shipping documents are documents accompanying a shipment of material to document the contents of the shipment and shall accompany each delivery of material and equipment and shall be the abbreviated ESBOM with the items shipped listed sequentially by bill of materials item number including only bill of materials item number, quantity, description, manufacturer, manufacturer's catalog number, and the approval number for each item.
- 3.8 **Substitutions-** Should substitution of items on the Electrical Submittal (ESBOM) form be made, the contractor shall strike through those items substituted and initiate a new ES and ESBOM with new bill of materials item numbers for the substituted items. A note shall be made in the comments column on the ESBOM indicating the bill of materials item number the substitutions are made for.
- 3.9 **Text searchable PDF file-** A text searchable PDF file is a PDF file that includes a bitmapped image of a document to appear as the original document with textual content stored as hidden text. The hidden text allows other programs to search the file and is useful for archiving content critical documents.

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**4. ELECTRICAL BILL OF MATERIALS COMPLETION**

- 4.1 All material used on the project shall have a complete ESBOM prior to installation on the project. Material shall be listed on a separate ESBOM for each pay item number.
- 4.2 The ESBOM shall be submitted by completing the spreadsheet titled Example Electrical ESBOM###.xlsx. on the WVDOH MCS&T Website and naming the spreadsheet in this format: Contract Reference#ESBOM###.xlsx.
- 4.3 The manufacturer's documentation for all items on the Electrical Bill of Materials of the electrical submittal (ES) shall be submitted in a text searchable portable document format ES with the file name in the following format: Contract ID#ES#Item#page# "example:202100195#ES#item#0001p001.pdf.
- 4.4 Shop drawings, circuit diagrams, and photograph images may be submitted as an image type PDF file.

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**5. ELECTRICAL SUBMITTAL COMPLETION**

- 5.1 The Electrical Submittal (ES) shall include documentation and/or data sheets defining and certifying the manufacturing standards of the electrical equipment, signal equipment, and materials described and listed in the Electrical, Signal Equipment, and Materials Bill of Materials (ESBOM).
- 5.2 The Electrical Submittal (ES) shall be in a text searchable Portable Document Format as directed in this Materials Procedure.
- 5.3 The ESBOM shall be completed as directed in this Materials Procedure.
- 5.4 All material delivered to the project shall be listed on a completed and approved ES prior to delivery to the project and listed on shipping documents as directed in this Materials Procedure.

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**6. ST-1 DOCUMENTATION AND SUBMISSION TO MCS&T**

**7. PROCEDURE**

- 7.1 The contractor shall submit an ESBOM and ES [in the correct electronic format](#) to the District Construction Engineer's designee for all materials before electrical equipment, signal equipment, or [materials](#) are purchased or installed in order to comply with Section 631 of the West Virginia Department of Transportation,

Division of Highways, Standard Specifications for Roads and Bridges and Supplementals (Standard Specifications).

- 7.2 The Construction Engineer's designee shall complete an ST-1 as a text searchable PDF and attach the ES to and make it a part of the ST-1 as a text searchable document.
- 7.3 The ST-1 and the ESBOM shall be transmitted to the Materials Control, Soils, and Testing Division's ST-1 email address DOT.St1dmir@wv.gov as a file folder named the ST-1 "ST-1 number#".
- 7.4 The Traffic Materials Engineer shall evaluate or forward the ES and ESBOM to the Traffic Division for evaluation as needed. Should the Traffic Division evaluate any portion of an ES and ESBOM the evaluated ES and ESBOM shall be returned to the Traffic Materials Engineer with comments. The Materials Traffic Engineer shall transmit the approved ES and ESBOM to the District Construction Engineer's designee after affixing an approval number or the non-concurred ES with comments.
- 7.5 No materials may be accepted at the project without completed shipping documents.
- 7.6 No materials shall be accepted at the project without shipping documents with approval numbers.
- 7.7 Any deviation from this procedure shall initiate a District Materials Inspection Report.

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

SAMPLE ID# \_\_\_\_\_  
 DATE \_\_\_\_\_  
 CONTRACT ID \_\_\_\_\_  
 LINE NUMBER(S) \_\_\_\_\_  
 LAB NUMBER \_\_\_\_\_  
 AUTHORIZATION # \_\_\_\_\_  
 STATE PROJ # \_\_\_\_\_  
 FED. PROJ. # \_\_\_\_\_

LINE NUMBER	STRUCTURE DESCRIPTION	PAY ITEM	MATERIAL CODE	FEATURE CODE (SECT 639)	ITEM NUMBER	SUBJECTI ON	QUANTITY	DESCRIPTION	GRAD E	MAKE	STYLE	TYPE	MANUFAC Turer's CATALOG NUMBER	APPROVAL NUMBER
1	SIGNAL CONTI	660001-001		DOH_CNST.		1 715.42.8.9	1	CIRCUIT BREAKER		SQUARE D			QO230	
2	SIGNAL CONTI	660001-001		DOH_CNST.		2 715.42.8.9	1	CIRCUIT BREAKER		SQUARE D			QO120	

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

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MATERIALS PROCEDURE

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STANDARD METHOD FOR DETERMINATION  
OF OPTIMIZED AGGREGATE GRADATION IN  
PORTLAND CEMENT CONCRETE

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**1. PURPOSE**

- 1.1 To establish a procedure for determination of optimized aggregate gradation in portland cement concrete.
- 1.2 To establish a uniform definition of optimized aggregate gradation.

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**2. SCOPE**

- 2.1 This procedure shall apply in all cases where the specification allows the combined aggregate gradation test in portland cement concrete.
- 2.2 The combined aggregate gradation test is used to determine if the optimized aggregate gradation has been achieved.

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**3. DEFINITIONS**

Optimized aggregate gradation characterizes the proportions of different sizes of aggregates in concrete mix designs. Optimized aggregate gradation helps to improve aggregate packing which involves minimizing the paste content while still producing a workable mixture.

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**4. PROCEDURE**

- 4.1 Since the aggregates in a portland cement concrete mix consist of coarse and fine aggregates, this procedure will address the determination of optimized aggregate gradation through the combined aggregate gradation test.
  - 4.1.1 The mass of each aggregate used in the concrete mix shall be used to determine the percent of each constituent aggregate in the optimized aggregate gradation.

- 4.1.1.1 Determine the total mass of aggregate:

$$M_{ca(I)} + M_{ca(II)} + M_{fa(I)} + M_{fa(II)} = M_t$$

Where:

$M_{ca(I)}$  = mass of coarse aggregate (I) (SSD) used in one cubic yard of concrete.

$M_{ca(II)}$  = mass of coarse aggregate (II) (SSD) used in one cubic yard of concrete.

$M_{fa(I)}$  = mass of fine aggregate (I) (SSD) used in one cubic yard of concrete.

$M_{fa(II)}$  = mass of fine aggregate (II) (SSD) used in one cubic yard of concrete

$M_t$  = mass of total aggregate used in one cubic yard of concrete.

- 4.1.1.2 Determine the relative percent ( $R_A$ ) of each type of aggregate.

$$\text{Coarse aggregate (I) percent} = \frac{M_{ca(I)}}{M_t} * 100$$

$$\text{Coarse aggregate (II) percent} = \frac{M_{ca(II)}}{M_t} * 100$$

$$\text{Fine aggregate (I) percent} = \frac{M_{fa(I)}}{M_t} * 100$$

$$\text{Fine aggregate (II) percent} = \frac{M_{fa(II)}}{M_t} * 100$$

- 4.1.2 Determine the gradation of each type of aggregate using AASHTO T 27 and T 11. Submit gradation reports showing the combined percent passing and the combined percent retained as shown in the attached example. Include in the report, each individual aggregate gradation starting the largest appropriate sieve for that material and including all the consecutive smaller sizes through the No. 200 sieve. The passing percent of each type of aggregate shall be reported to nearest hundredth percent.

Commented [DME1]: Should this be 'starting with'?

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## 5. CALCULATIONS

- 5.1 Calculate the combined % passing on each sieve using the following equation:

$$C_P = \sum \{ (P_A)(R_A) \} / 100$$



where:

$C_P$  = Combined % Passing  
 $P_A$  = % Passing of each type of Aggregate  
 $R_A$  = Relative % of each type of Aggregate (See Section 4.1.1.2)

5.2 Calculate the combined % retained on each sieve using the following equation:

$$C_R = C_{RX} - C_P$$

Where:

$C_R$  = Combined % Retained  
 $C_{RX}$  = Combined % Passing of next larger sieve size  
 $C_P$  = Combined % Passing

5.3 The attached spreadsheet shall be used to calculate the values of the mass of total aggregate ( $M_t$ ), relative percent ( $R_A$ ) of each type of aggregate, combined percent passing ( $C_P$ ), and combined percent retained ( $C_R$ ). Once the percent passing of each type of aggregate is entered into the attached spreadsheet, the spreadsheet will automatically perform all the required calculation for optimized aggregate gradation. The spreadsheet will also plot the tarantula chart for optimized aggregate gradation.

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## 6 EVALUATION

6.1 If the combined aggregate gradation meets the requirements of Section 601.3.2.4.1, the combined aggregate gradation shall be considered as Optimized Aggregate Gradation.

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Director  
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RLS:Mtd

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EXAMPLE OF DETERMINATION OF  
OPTIMIZED AGGREGATE GRADATION  
IN PORTLAND CEMENT CONCRETE

1. Total mass of aggregates in one cubic yard of concrete:

$M_{ca(I)}$  = Mass of SSD Coarse Aggregate (I) = 1511 lb.

$M_{ca(II)}$  = Mass of SSD Coarse Aggregate (II) = 265 lb.

$M_{fa(I)}$  = Mass of SSD Fine Aggregate (I) = 1260 lb

$M_{fa(II)}$  = Mass of SSD Coarse Aggregate = 0

$M_t$  = Total mass of aggregates

- 1.1 Enter the mass of each type of aggregate in the attached spreadsheet. The spreadsheet will calculate the relative percent ( $R_A$ ) of each type of aggregate.
2. Percent Passing of each type of aggregate from individual gradation.

Sieve Size	Coarse Aggregate (I)	Coarse Aggregate (II)	Fine Aggregate (I)
2 in	100.00	100.00	100.00
1½ in	100.00	100.00	100.00
1 in	98.00	100.00	100.00
¾ in	70.31	100.00	100.00
½ in	45.21	100.00	100.00
¾ in	21.93	96.31	100.00
No. 4	4.93	19.18	99.12
No. 8	1.00	3.12	85.63
No. 16	1.00	1.00	65.32
No. 30	1.00	0.00	31.02
No. 50	1.00	0.00	12.21
No. 100	1.00	0.00	1.62
No. 200	0.80	0.90	0.60

- 2.1 Enter the percent passing of each type of aggregate in the attached spreadsheet. The spreadsheet will calculate the combined % passing ( $C_P$ ) on each sieve, the combined % retained ( $C_R$ ) on each sieve, Coarse Sand % Retained (#8 - #30 Sieve), and Fine Sand % Retained (#30 - #200 Sieve). The spreadsheet will also plot the tarantula chart.

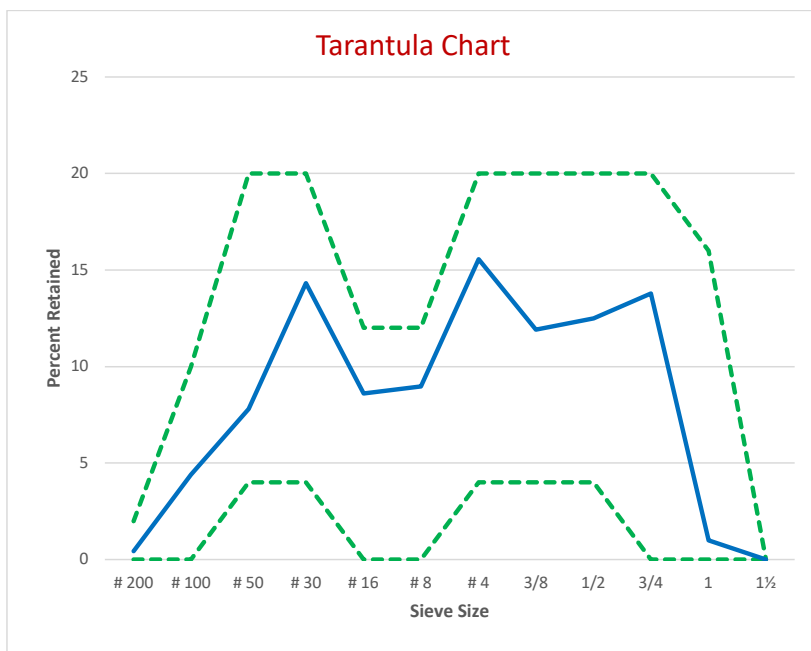
Table 1A

Aggregate Classification				
	Coarse Aggregate (I)	Coarse Aggregate (II)	Fine Aggregate (I)	Fine Aggregate (II)
Mass (lb)	1511	265	1260	0
Total Mass ( $M_T$ ) (lb)	3036			
Relative ( $R_A$ ) (%)	49.77	8.73	41.50	0.0

Table 1B: Sieve Analysis Example

Sieve Size	Coarse Aggregate (I)	Coarse Aggregate (II)	Fine Aggregate (I)	Fine Aggregate (II)	Combined % Passing ( $C_P$ )	Combined % Retained ( $C_R$ )	Meet Spec
Relative ( $R_A$ ) %	49.77	8.73	41.50	0.00			
% Passing ( $P_A$ )							
2 in	100.00	100.00	100.00	0.00	100.00	0.00	Yes
1½ in	100.00	100.00	100.00	0.00	100.00	0.00	Yes
1 in	98.00	100.00	100.00	0.00	99.00	1.00	Yes
¾ in	70.31	100.00	100.00	0.00	85.22	13.78	Yes
½ in	45.21	100.00	100.00	0.00	72.73	12.49	Yes
¾ in	21.93	96.31	100.00	0.00	60.82	11.91	Yes
No. 4	4.93	19.18	99.12	0.00	45.26	15.56	Yes
No. 8	1.00	3.12	85.63	0.00	36.31	8.96	Yes
No. 16	1.00	1.00	65.32	0.00	27.69	8.61	Yes
No. 30	1.00	0.00	31.02	0.00	13.37	14.32	Yes
No. 50	1.00	0.00	12.21	0.00	5.57	7.81	Yes
No. 100	1.00	0.00	1.62	0.00	1.17	4.40	Yes
No. 200	0.80	0.90	0.60	0.00	0.73	0.44	Yes

<b>Coarse Sand % Retained (#8 - # 30 Sieve)</b>	<b>31.89</b>	Yes
This range amount is a minimum of 15%		
<b>Fine Sand % Retained (#30 - #200 Sieve)</b>	<b>27.0</b>	Yes
This allowable range amount is between 24 - 34%		



WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
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MATERIALS PROCEDURE

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GUIDE FOR QUALITY CONTROL AND ACCEPTANCE REQUIREMENTS FOR  
PORTLAND CEMENT CONCRETE

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**1. PURPOSE**

- 1.1 To establish minimum requirements for Contractor's Quality Control (QC) system and the Division's Acceptance Plan. It is intended that these minimum requirements be followed in detailing the inspection, sampling, and testing deemed necessary to maintain compliance with all Specification requirements.
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**2. SCOPE**

- 2.1 This Materials Procedure (MP) is applicable to all Portland Cement Concrete (PCC) items, and it outlines the quality control procedures for both plant and field operations and includes procedures for approving and using Master and/or Project Specific QC Plans. This procedure also aids in documentation and retention of QC Plans in ProjectWise.
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**3. GENERAL REQUIREMENTS**

- 3.1 The Contractor shall provide and maintain a quality control system that will provide reasonable assurance that all materials and products submitted to the Division for acceptance will conform to the contract requirements whether 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 quality control inspections and tests shall be documented and shall be available for review by the Engineer 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 Division before the work is started.
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**4. QUALITY CONTROL PLAN**

- 4.1 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 should detail sampling location, sampling techniques, and test

frequency to be utilized. Quality control sampling and testing performed by the Contractor may be utilized by the Division for acceptance.

- 4.1.1 A QC Plan must be developed by the Contractor and submitted to the Engineer prior to the start of construction on every project. Acceptance of the QC Plan by the Engineer will be contingent upon its concurrence with these guidelines.
- 4.1.2 As work progresses, an addendum(s) may be required to a QC Plan to keep the QC program current. Personnel may be required to show proof of certification for testing.
- 4.2 Quality Control Plan Guidelines
- 4.2.1 The Plan shall identify the personnel responsible for the Contractor's quality control. This should include the company official who will act as the liaison with Division personnel, as well as the Certified Portland Cement Concrete Technician who will direct the inspection program at the plant or in the field depending if it is a plant or field QC Plan. Their phone number and email address must also be included as a means for contact by the Division personnel.
- 4.2.2 All classes of concrete and corresponding mix design numbers, which may be used, shall be listed on the Plant QC Plan. All classes of concrete, which may be used, shall be listed on the Field QC Plan.
- 4.2.3 Process control sampling, testing, and inspection should be an integral part of the contractor's quality control system. In addition to the above requirements, the Contractor's QC Plan should document the process control requirements shown in Table 1 of Attachment 1. The process control activities shown in Table 1 are considered to be normal activities necessary to control the production and placement of a given product or material at an acceptable quality level. To facilitate the Division's activities, the Contractor, as per ML-25, shall retain all completed gradation samples until further disposition is designated by the Division.
- 4.2.4 All sampling and testing shall be in accordance with the methods and procedures required by the Specifications. Measuring and testing equipment shall be standard and properly calibrated as per the specified test procedures. If alternative sampling methods, procedures, and inspection equipment are to be used, they shall be detailed in the QC Plan.
  - 4.2.4.1 Any individual who samples or tests plastic concrete for quality control purposes shall be certified as a WVDOH PCC Inspector.
  - 4.2.4.2 Any Laboratory which tests the hardened concrete cylinders for the Contractor, for quality control purposes, shall be listed in the Contractor's QC Plan for field operations. This Laboratory shall provide evidence that it meets the applicable requirements in ASTM C1077, pertaining to testing hardened concrete cylinders, for a concrete testing

laboratory, including curing facilities, testing equipment, technician proficiency, participation in the CCRL Concrete Proficiency Sample Program (PSP), Quality Management System documentation, and recordkeeping. The only test required for these laboratories, in the CCRL Concrete PSP, is ASTM C39 (AASHTO T22), but it is recommended that the laboratory perform all the field test portions of these Proficiency Samples and maintain the results of these tests, in order to evaluate any root cause issues pertaining to compressive strength. Each Laboratory shall be inspected and evaluated initially, and at least once every regular inspection tour cycle (approximately 30 months) by the Cement and Concrete Reference Laboratory (CCRL). The ASTM standards pertaining to testing concrete cylinders, with which the subject laboratory must comply, include ASTM C39 (AASHTO T22), ASTM C617 (AASHTO T231) or ASTM C1231, and ASTM C511 (AASHTO M201). The Personnel Qualification requirements in Section 6 of ASTM C1077 regarding PE direction, Laboratory Supervisors, and concrete laboratory personnel testing certifications also apply, except that a Laboratory Supervisor with at least five years experience in construction materials testing shall be a permissible substitution for the licensed professional engineer. Subsequent documentation shall be provided to the Division showing that the subject Laboratory and personnel meet the applicable requirements of ASTM C1077, pertaining to testing concrete cylinders, for a concrete laboratory.

- 4.2.4.3 Any Laboratory which desires to test Contractor hardened concrete QC specimens on WVDOH projects shall submit the evidence/documentation, required in Section 4.2.4.2, confirming compliance with ASTM C1077, with regards to testing concrete cylinders, to MCS&T Division at the following e-mail address: [DOHMCSnTconcretelab@wv.gov](mailto:DOHMCSnTconcretelab@wv.gov). MCS&T Division will review this submittal. In this submittal, the subject Laboratory shall also explain how all deficiencies noted in the CCRL Laboratory Inspection Report have been addressed. All deficiencies noted in the CCRL Laboratory Inspection Report shall be resolved to the satisfaction of the Division within 90 days from the date of the CCRL Laboratory Inspection Report. Once MCS&T Division determines that the subject Laboratory is in compliance with the applicable requirements of ASTM C1077, and all deficiencies have been adequately resolved, that Laboratory will be placed on the Division's Approved List of Concrete Cylinder Testing Labs. All laboratories which test contractor hardened concrete QC specimens on WVDOH projects must be listed on the Division's Approved List of Concrete Cylinder Testing Labs. A listing of these laboratories is available on the WVDOT internet site at the following link: [https://transportation.wv.gov/highways/mcst/Pages/APL\\_By\\_Number.aspx](https://transportation.wv.gov/highways/mcst/Pages/APL_By_Number.aspx). All Division Approved Laboratories shall provide the Division with the CCRL Lab Number for their laboratory and agree to allow DOH, CCRL, and AASHTO resource to freely share information about assessment reports, proficiency samples, corrective actions, quality management system, and personnel competency and certification records.

- 4.2.5 When calculating the compressive strength of concrete cylinders in accordance with AASHTO T22, the following procedure shall be used:

$$CS = \frac{ML}{0.25 \times \pi \times D^2}$$

Where:

- CS = Compressive Strength of the specimen  
ML = Maximum load carried by the specimen during the test  
 $\pi$  = Mathematical constant PI  
D = Diameter of the cylinder being tested (in accordance with AASHTO T 22)

Note: The calculation for CS shall be performed in one continuous step (without any rounding), either by the testing machine, or by calculating device, and only the final value (CS) is permitted to be rounded (to the accuracy specified in AASHTO T 22). The value for  $\pi$  shall be the manufacturer's pre-programmed value in a calculating device or the testing machine.

4.2.6 Miscellaneous Concrete:

The contractor is not required to perform the process control testing required by Part C of Table 1 of the Attachment on miscellaneous concrete (as defined in section 4.2.6.1), provided that the concrete in question is being supplied by an A1 or A2 plant (as defined in MP 601.05.50, formerly numbered as IM-18), and provided that the requirements of section 4.2.6.2 are met for each project on which the reduced testing of miscellaneous concrete is applied.

- 4.2.6.1 Miscellaneous concrete shall be defined as relatively small quantities, not exceeding 25 yd<sup>3</sup> (19 m<sup>3</sup>) per day, incorporated into items that will not adversely affect the traffic carrying capacity of a completed facility. Such items would not include any concrete intended for major structures, permanent mainline or ramp pavements, or any other structurally critical items part of, or adjacent to the roadway.

The following items are suggested as a guideline in establishing items that may be categorized as miscellaneous concrete:

Note: Concrete testing for certain items below is waived, in some cases, by the referenced section of the specifications.

- 1 Sidewalks
- 2 Curb and Gutter
- 3 Slope walls for under drain outlet pipes
- 4 Temporary pavements and pipe crossings
- 5 Building floors



6. Slope paving and headers
7. Paved ditch or gutter
8. Small (less than 36" diameter) culvert headwalls
9. Catch basins, manhole bases, inlets, and junction boxes (and adjustments of such items) not located in the roadway
10. Foundations for breakaway supports
11. Utility trench fills
12. Cast-in-place survey markers

4.2.6.2 One sample per two days of production (for the same project) shall be tested (beginning on the first day of production) for compressive strength, air content, and consistency. On a minimum of ten percent of the samples outlined above, the Division will observe the batching operation at the plant (that is producing the concrete to be sampled) and check the operational control.

4.2.6.3 When placing miscellaneous concrete and no testing is required, an Approved Source Sample will be generated in SiteManager. The C##### representing the test from the previous day of production shall be entered in the intended use field. Miscellaneous Concrete will be entered in remarks. Miscellaneous Concrete will be written on all batch tickets for which testing is not required, per the miscellaneous concrete provisions of this MP, prior to scanning and placing in ProjectWise.

4.2.7 Documentation:

The Contractor shall maintain adequate records of all inspections and tests. The records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities approved and rejected, and the nature of corrective action taken as appropriate. The Contractor's documentation procedures will be subject to the review and approval of the Division prior to the start of the work and to compliance checks during the progress of the work.

4.2.8 Charts and Forms:

All conforming and non-conforming inspections and test results shall be kept complete and shall be available at all times to the Division during the performance work. Forms shall be on a computer-acceptable medium where required. Batch ticket data shall be documented in accordance with the applicable section of MP 601.03.50, with a copy to be submitted to the District Materials Section within 72 hours of the concrete placement. Gradation data shall be documented on WVDOH form T300 using the material codes listed in the online computer systems user guide. The original gradation data shall be submitted to the District Materials Section within 72 hours of obtaining the gradation sample. Test data for Portland Cement Concrete shall be charted in accordance with the applicable requirements of MP 601.03.52. Gradation test data shall be plotted in accordance with the applicable requirements of MP 300.00.51. The Contractor may use other types of control charts as deemed appropriate by the Division.

It is normally expected that testing and charting will be completed within 48 hours after sampling. The Contractor shall also ensure that all Material Suppliers prepare and submit the HL-441 form (weekly supplier report) in a timely manner

4.2.8.1 All charts and records documenting the Contractor's quality control inspections and tests shall become property of the Division upon completion of the work.

4.2.9 Batch Tickets

Each batch of Structural Concrete, including miscellaneous concrete (as defined in section 4.2.6.1), delivered at the project shall be accompanied by one batch ticket with all of the items of information listed in Section 4.2.9.1 pre-printed on the ticket. In the case of Portland Cement Concrete Pavement, each batch of concrete delivered at the project on which a test in accordance with Table 1 of Attachment 1 is to be performed shall be accompanied by a batch ticket. This batch ticket shall have all of the items listed in section 4.2.9.1 pre-printed on the ticket unless non-agitator trucks or truck agitators are used. In this case, the batch ticket shall have all of the items listed in section 4.2.9.2 pre-printed on the ticket.

4.2.9.1 All batch tickets for Structural Concrete and Portland Cement Concrete Pavement Concrete transported by truck mixers shall have all of the following items pre-printed on the ticket: Producer/Supplier Code, Producer/Supplier Name, Producer/Supplier Location, Mix Design Laboratory Reference Number, Date, Sequence Number, Volume ( $\text{yd}^3/\text{m}^3$ ), Time Batched, Time Unloaded, Contract Identification Number (CID #), Federal and/or State Project Number, Material Code, Material Name, Water Allowed (Gallon/Liter), Water at Plant (gallon/liter), Weight of Ice at Plant (lb/kg), Water at Job (Gallon/Liter), Weight of Cement (lb/kg), Weight(s) of Pozzolan(s) (lb/kg), Weight of Fine Aggregate (lb/kg), Weight of Coarse Aggregate (lb/kg), Admixture Name(s) and Dose (ounces/mL), Temperature ( $^{\circ}\text{F}/^{\circ}\text{C}$ ), Cylinder I.D., Initial Counter, Final Counter, Target Consistency (in/mm), Actual Consistency (in/mm), Target Air (%), Actual Air (%), Truck Number.

4.2.9.2 All batch tickets for concrete delivered by means of non-agitator trucks or truck agitators shall have all of the following items pre-printed on the ticket: Producer/Supplier Name, Mix Design Laboratory Reference Number, Date, Sequence Number, Volume ( $\text{yd}^3/\text{m}^3$ ), Time Batched, Time Unloaded, CID#, Federal and/or State Project Number, Material Code, Material Name, Water Allowed (Gallon/Liter), Water at Plant (Gallon/Liter), Weight of Ice at Plant (lb/kg), Weight of Cement (lb/kg), Weight of SCM (lb/kg), Weight of Fine Aggregate (lb/kg), Weight of Coarse Aggregate (lb/kg), Admixture Name(s) and Weight(s) (ounces/grams), Temperature ( $^{\circ}\text{F}/^{\circ}\text{C}$ ), Target Consistency (in/mm), Actual Consistency (in/mm), Target Air (%), Actual Air (%), Truck Number.

4.2.9.3 The batch ticket in the case of either type of concrete shall be a pre-printed batch ticket prepared by the plant. This ticket may be either computer generated or a standard

pre-printed form with blank spaces provided in which all of the required data shall be recorded. The data items listed above that are completed in the field (such as Time Unloaded, Actual Consistency, etc.) must have a space on the batch ticket for completion. Volume is to be reported to the nearest 0.01 yd<sup>3</sup> (0.01 m<sup>3</sup>). Consistencies are to be reported to the nearest 0.25 inch (5 mm). Target and Actual Air are to be reported to the nearest 0.1% (to the nearest 0.25% if the volumetric method is used).

4.2.10 Corrective Action:

The Contractor shall take prompt action to correct conditions, which have resulted, or could result, in the submission to the Division of materials and products, which do not conform to the requirements of the Contract documents.

4.2.11 Non-Conforming Materials:

4.2.11.1 The Contractor shall establish and maintain an effective and positive system for controlling non-conforming material, including procedures for its identification, isolation and disposition. Reclaiming or reworking of non-conforming materials shall be in accordance with procedures acceptable to the Division. All non-conforming materials and products shall be positively identified to prevent use, shipment, and intermingling with conforming materials and products. Holding areas, mutually agreeable to the Division and the Contractor shall be provided by the Contractor.

4.2.12 Types of QC Plans:

4.2.12.1 QC Plans which are intended for use on more than one project shall be defined as Master QC Plans. Section 4.3 outlines the procedures for Master QC Plan submittal and approval.

4.2.12.2 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#, Federal and/or State Project Number.

4.2.12.3 A Contractor may submit a Master QC Plan for Plant and/or Field operations instead of a Project Specific QC Plan.

4.2.12.4 Once any QC Plan is approved for a project, the key date shall be entered in SiteManager 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.

4.3 Master QC Plan

- 4.3.1 The intent of Master QC Plans is to facilitate the approval process in a more uniform manner. Master QC Plans can be submitted to the Division by the Contractor when their workload in a given District is routinely repetitive for the year.
- 4.3.2 The Contractor shall submit a Master Field QC Plan yearly to each District in which they have work (see Attachment 2). If the Contractor does not have work in a given District for the year, then a Master Field QC Plan does not need to be submitted to that District.
- 4.3.3 The Producer/Supplier shall submit a Master Plant QC Plan at the beginning of each year to the District in which their plant is located (see Attachment 3).
- 4.3.4 The District will review the submitted Master QC Plans to see if they meet the applicable requirements of Sections 4.2 thru 4.2.11.1 and assign a Laboratory Reference Number to each QC Plan upon approval, for future referencing. The District will acknowledge approval of each Master QC Plan to the Contractor and/or Producer/Supplier by letter (see Attachment 4), 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.
- 4.3.5 Once a project has been awarded, if a contractor elects to use the approved Master Plant and Master Field QC Plans on that project, the Contractor shall submit a letter requesting to use the Master QC Plans 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 Quality Control Plan and the laboratory reference number for the Master QC Plan. See Attachment 5 for an example of a plant letter and Attachment 6 for an example of a field letter.
- 4.3.5.1 The District shall review the referenced Master QC Plans to ensure they cover all items in that project. If the referenced Master QC Plan is found to be insufficient for some items on that project, the District shall request the Contractor to submit additional information for quality control of those items as an addendum on a project specific basis. When the District is satisfied with the QC Plan for that project, a letter shall be sent to the Contractor acknowledging approval (see Attachment 7), with the following attached: the contractor's project QC Plan request letter and the Master QC Plan approval letter. This shall then be placed in the project's incoming-mail mailbox in ProjectWise.
- 4.3.5.2 A Master QC Plan that has been approved for project use shall be good for the duration of that project.

- 4.3.5.3 For the use of Division 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).
- 4.3.6 The Master Field and Plant QC Plans shall be valid for the duration of one calendar year beginning on January 1<sup>st</sup> and ending on December 31<sup>st</sup>. The Master Plant QC Plan will also cover maintenance purchase order concrete for the year.

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**5. ACCEPTANCE SAMPLING AND TESTING**

- 5.1 Acceptance sampling and testing is the responsibility of the Division. Quality control tests by the Contractor may be used for acceptance.
- 5.2 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.
- 5.3 Results from independent tests conducted by the Division for gradation, entrained air, consistency, and strength will be plotted on the Contractor's quality control charts with a red circle, but are not to be included in the moving average. When the Contractor's tests are witnessed, the results are circled on the control chart in red, and are to be included in the moving average calculations.
- 5.4 Results from both independent tests and witnessed tests will be evaluated in accordance with MP 700.00.54. If a dissimilarity is detected, an investigation shall be immediately initiated to determine the cause of the dissimilarity.

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**6. ABSENT TESTING OF MATERIAL**

- 6.1 If the Contractor fails to perform testing of the material in accordance with the Contractor's Division Approved Quality Control Plan, payment for the entire item shall be withheld, pending the Engineer's decision whether or not to allow the material to remain in place.
  - 6.1.1 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.

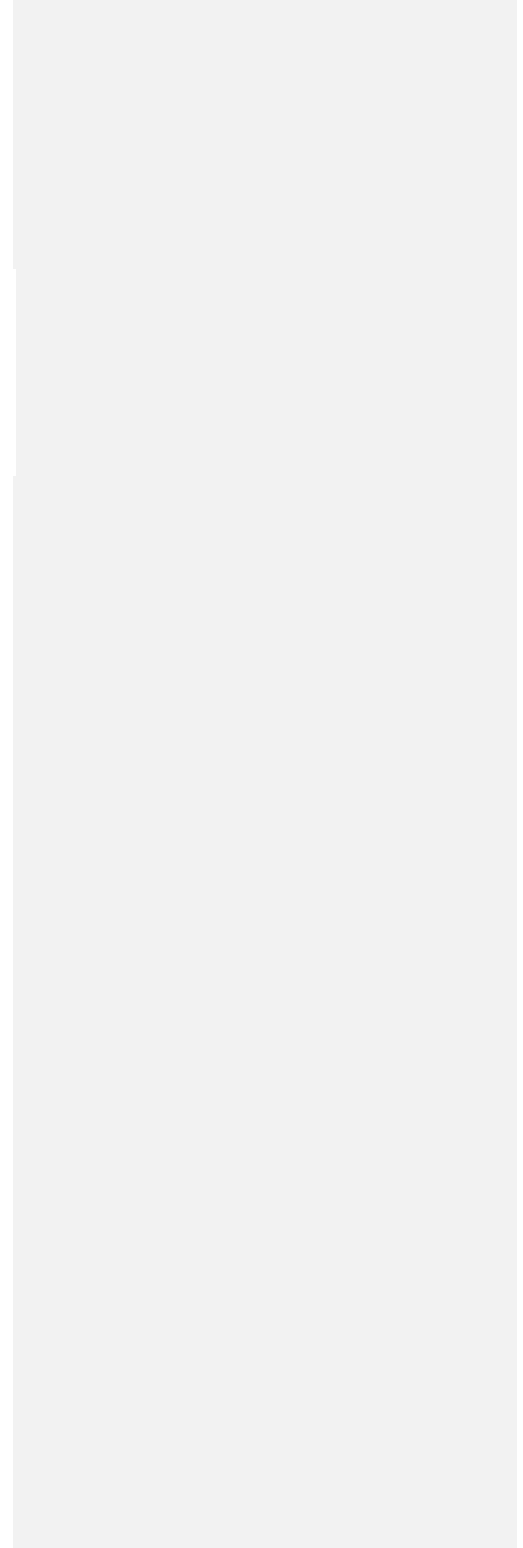
MP 601.03.50  
SUPERCEDES: JULY 2020  
REVISED: DECEMBER 2020  
PAGE 10 OF 10

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

RLS:Fm

Attachments



**TABLE 1**

**CONTRACTORS PROCESS CONTROL  
REQUIREMENTS**

**STRUCTURAL CONCRETE AND  
PORTLAND CEMENT CONCRETE PAVEMENT**

Minimum frequency\*

**A. PLANT AND TRUCKS**

- |                                      |                                  |
|--------------------------------------|----------------------------------|
| 1. Mixer Blades                      | Prior to Start of Job and Weekly |
| 2. Scales                            |                                  |
| a. Tared                             | Daily                            |
| b. Calibrate                         | Prior to start of Job            |
| c. Check Calibration                 | Weekly                           |
| 3. Gauges and Meters-Plant and Truck |                                  |
| a. Calibrate                         | Yearly                           |
| b. Check Calibration                 | Weekly                           |
| 4. Admixture Dispenser               |                                  |
| a. Calibrate                         | Prior to Start of Job            |
| b. Check Operation and Calibration   | Daily                            |

**B. AGGREGATES**

- |                   |   |
|-------------------|---|
| 1. Fine Aggregate |   |
| a. Gradation      | Per section 601.3.2.4 of the Specifications |
| b. Moisture       | Daily                                       |

2. Coarse Aggregates

- |   |   |
|---|---|
| a. Gradation  | Per section 601.3.2.4 of the Specifications |
| b. Percent passing No. 75 $\mu$ m   | Daily                                       |
| c. $\bar{A}$ for Combined Coarse Aggregates<br>Fine Aggregates and Cement | Per section 601.3.2.4 of the Specifications |
| d. Moisture   | Daily                                       |

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3. Optimized Aggregates

- |              |   |
|--------------|---|
| a. Gradation | Per section 601.3.2.4.1 of the Specifications |
| b. Moisture  | Daily   |

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**C. PLASTIC CONCRETE**

1. Entrained Air Content

- |   |  |
|---|--|
| Pavement Concrete                                     | Two at the beginning of the paving operation, per Section 501.4.2, then one per 500 yd <sup>3</sup> (380 m <sup>3</sup> ) or fraction thereof, with a minimum of two per day |
| Structural Concrete<br>(except Bridge Superstructure) | One per 100 yd <sup>3</sup> (75 m <sup>3</sup> ) or fraction thereof, with a minimum of one per ½ day of operation   |
| Bridge Superstructure                                 | One per batch  |

2. Consistency\*\*

- |                   |  |
|-------------------|--|
| Pavement Concrete | One per 500 yd <sup>3</sup> (380 m <sup>3</sup> ) or fraction thereof, with a minimum of two per day |
|-------------------|--|



Structural Concrete (except Bridge Superstructure)	One per 100 yd <sup>3</sup> (75 m <sup>3</sup> ) or fraction thereof, with a minimum of one per ½ day of operation
Bridge Superstructure	One for first batch and one for every fifth batch thereafter
3. Temperature	Per Specification
4. Yield	
Pavement Concrete	Per Section 501.3 of the Specifications and one for each five days of operation after the first five days of operation
Structural Concrete	Per Section 601.3.2.3 of the Specifications and one for each ten sets of cylinders after the first ten
5. Compressive Strength***	
Pavement Concrete	One set of concrete cylinders for each 350 yd <sup>3</sup> (75 m <sup>3</sup> ) or fraction thereof
Structural Concrete	For each class concrete delivered and placed on a calendar day from a single supplier, one set of concrete cylinders for each 100 yd <sup>3</sup> (75 m <sup>3</sup> ) or fraction thereof
6. Permeability	
Pavement Concrete	N/A
Structural Concrete	Per Section 601.4.5 of the Specifications
Specialized Concrete Overlays	Per Section 679.2.2 of the Specifications

\* Frequency for Process Control will vary with the size and type of aggregate or mixture and the batch-to-batch variability of the item.

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\*\* When superplasticizer is added to the concrete in the field, additional consistency testing is required as per Section 601.3.2.1 of the Specifications.

\*\*\* All cylinders shall be made, cured, and shipped to the Laboratory in accordance with AASHTO T 23 and MP 601.04.20. They shall be tested in accordance with AASHTO T 22 and the applicable section of the Standard Specifications.

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\*\*\*Example\*\*\*  
COMPANY LETTERHEAD

Mr./Ms./Mrs. \_\_\_\_\_  
West Virginia Department of Highways  
District \_\_\_ Engineer/Manager  
\_\_\_\_\_, WV #####

RE: Master PCC Field QC Plan

Dear \_\_\_\_\_,

We are submitting our PCC Field Quality Control Plan, developed in accordance with Sections 501 and 601 of the (year) WVDOH Standard Specifications, the (year) WVDOH Supplemental Specifications, and MP 601.03.50.

1. The Quality Control program is under the direction of \_\_\_\_\_, who can be contacted in Field/Office, by telephone number \_\_\_\_\_, cell# \_\_\_\_\_, and/or e-mail address \_\_\_\_\_.
2. Sampling and testing will be performed by qualified personnel as per WVDOH specifications Section 106.
3. Class(es) of Concrete to be controlled are listed as follows:
  - All types Class A      - All types Class B      - All types Class C
  - All types Class D      - All types Class K      - All types Class H
  - Etc.
4. All items in this QC Plan will be sampled at a minimum frequency as specified in Table 1 of Attachment 1. We acknowledge that additional sampling may be required by the Division in addition to the minimum frequency stated.
5. All sampling and testing will be in accordance with the methods and procedures required by the specifications. All measuring and testing equipment shall be standard and properly calibrated as per the specified test procedure. *(If alternative sampling methods, procedures and inspection equipment are to be used please state in detail what they are and how they will be utilized.)*

6. Batch ticket data shall be documented in accordance with the applicable section of MP 601.03.50, with a copy to be submitted to the District Materials Section within 72 hours of the concrete placement.
7. Calculation of the compressive strength of concrete cylinders will be done as shown in Section 4.2.5 of MP 601.03.50.
8. Testing of Miscellaneous Concrete will be as specified in Section 4.2.6 and Sub-Sections 4.2.6.1 thru 4.2.6.3 of MP 601.03.50.
9. We will maintain adequate records of all inspection and tests. The records will indicate the type of test, number of observations made, the amount and type of deficiency's found, the quantities approved and rejected, and the nature of corrective actions taken as appropriate. Our documentation procedures will be subject to the review and approval of the Division prior to the start of the work and to compliance checks during the progression of the work.
10. **Our company** will take prompt action to correct conditions, which have resulted or could result, in the submission to the Division/District of materials and products, which do not conform to the requirements of the contract documents.
11. **Non-Conforming Materials** -- *State how you will establish an effective and positive system for controlling non-conforming material. This shall include the following:*

- *procedures for non-conforming material identification*
- *isolation and disposition of this material*

Reclaiming or reworking of non-conforming materials shall be in accordance with procedures acceptable to the Division.  
Our company will specify and provide holding areas, which shall be mutually agreeable by the Division and Contractor.

Very Truly Yours,

---

Company Official, Title

---

\*\*\*Example\*\*\*  
COMPANY LETTERHEAD

Mr./Ms./Mrs. \_\_\_\_\_  
West Virginia Department of Highways  
District \_\_\_ Engineer/Manager  
\_\_\_\_\_, WV #####

RE: Master PCC Plant QC Plan

Dear \_\_\_\_\_,

We are submitting our PCC PLANT Quality Control Plan, developed in accordance with Sections 501 and 601 of the (year) WVDOH Standard Specifications, the (year) WVDOH Supplemental Specifications, and MP 601.03.50.

1. The Quality Control program is under the direction of \_\_\_\_\_, who can be contacted in Field/Office, by telephone number \_\_\_\_\_, cell# \_\_\_\_\_, and/or e-mail address \_\_\_\_\_.
2. Sampling and testing will be performed by qualified personnel as per WVDOH specifications Section 106.
3. The PCC Mix Designs and class of concrete to be controlled are listed below:

Mix Design Number	Class of Concrete
1. #####	Class B
2. _____	_____
3. _____	_____
4. _____	_____
Etc.	

4. All items in this QC Plan will be sampled at a minimum frequency as specified in Table 1 of Attachment. We acknowledge that additional sampling may be required by the Division in addition to the minimum frequency stated.
5. All sampling and testing will be in accordance with the methods and procedures required by the specifications. All measuring and testing equipment shall be standard and properly calibrated as

per the specified test procedure. *(If alternative sampling methods, procedures and inspection equipment are to be used please state in detail what they are and how they will be utilized.)*

6. Charts and forms

**Our Company** will make sure all conforming and non-conforming inspections and test results shall be kept complete and shall be available at all times to the Division during the performance work. Forms shall be on a computer-acceptable medium where required. Gradation data shall be documented on WVDOH form T300 using the material codes listed in the online computer systems user guide. The original gradation data shall be submitted to the District Materials Section within 72 hours of obtaining the gradation sample. Test data for Portland cement concrete shall be charted in accordance with the applicable requirements of MP 601.03.52. Gradation test data shall be plotted in accordance with the applicable requirements of MP 300.00.51. We may use other types of control charts as deemed appropriate by Division. It is normally expected that testing and charting will be completed within 48 hours after sampling. **Our Company** shall also ensure that all Material Suppliers prepare and submit the HL-441 form (weekly supplier report) in a timely manner. All charts and records will be turned over to the Division upon completion of work for a given project.

7. *State that batch tickets will conform to requirements of MP601.03.50 Section 4.3.9 and its applicable subsections.*

8. **Our company** will take prompt action to correct conditions, which have resulted or could result, in the submission to the Division of materials and products, which do not conform to the requirements of the contract documents.

9. Non-Conforming Materials - *State how you will establish an effective and positive system for controlling non-conforming material. This shall include the following:*

- *procedures for non-conforming material identification*
- *isolation and disposition of this material*

Reclaiming or reworking of non-conforming materials shall be in accordance with procedures acceptable to the Division.

Our company will specify and provide holding areas, which shall be mutually agreeable by the Division and Contractor.

Very Truly Yours,

\_\_\_\_\_  
Company Official, Title

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WVDOH District Master QCP Approval Letter  
\*\*\* EXAMPLE \*\*\*  
WVDOH LETTERHEAD

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

RE: PCC Plant or PCC Field (*whichever is applicable*)  
Master QC Plan  
Description: (YEAR)  
P/S code: (only if a plant QCP)

Dear Sir,

Your Quality Control Plan (M#-#####) for \_\_\_\_\_ has been reviewed and found to be acceptable for the following items:

- All WVDOH approved Designs for PCC Classes of Concrete controlled by the referenced QC plan.

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,

\_\_\_\_\_  
Name, Title

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\*\*\*Example\*\*\*  
COMPANY LETTERHEAD

Mr./Ms./Mrs. \_\_\_\_\_  
WV Department of Highways  
District \_\_\_ Engineer/Manager  
\_\_\_\_\_, WV #####

RE: PCC Quality Control Plan  
for Plant ---- Project

Federal Project No. \_\_\_\_\_  
State Project No. \_\_\_\_\_  
Contract ID No. \_\_\_\_\_  
Description \_\_\_\_\_

Dear Mr./Ms./Mrs. \_\_\_\_\_,

We would like to use our **Producer/Supplier's name** Master PCC Plant QC Plan, reference number \_\_\_\_\_ for the project referenced above. All PCC items on the referenced project are covered by the Master PCC Plant QC Plan. *(if needed state the Special Provision and that the addendum is attached for Quality Control of Special Provision Item)*

The Quality Control 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. He/She can be contacted in person at the plant, by telephone \_\_\_\_\_ or at e-mail at \_\_\_\_\_.

Very truly yours,

\_\_\_\_\_  
Company Representative



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\*\*\*Example\*\*\*  
COMPANY LETTERHEAD

Mr./Ms./Mrs. \_\_\_\_\_  
WV Department of Highways  
District \_\_\_ Engineer/Manager  
\_\_\_\_\_, WV #####

Re: PCC Quality Control Plan  
for Field ---- Project

Federal Project No. \_\_\_\_\_  
State Project No. \_\_\_\_\_  
Contract ID No. \_\_\_\_\_  
Description \_\_\_\_\_

Dear Mr./Ms./Mrs. \_\_\_\_\_,

We would like to use our approved Master PCC Field QC Plan, reference number \_\_\_\_\_ for the project referenced above. All PCC items on the referenced project are covered by the Master PCC Field QC Plan. *(if needed state the Special Provision and that the addendum is attached for Quality Control of Special Provision Item)*

The Quality Control 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. He/She can be contacted in person at the plant, by telephone \_\_\_\_\_ or at e-mail at \_\_\_\_\_.

Very truly yours,

\_\_\_\_\_  
Company Representative

---

WVDOH District Master QCP Approval Letter  
\*\*\* EXAMPLE \*\*\*  
WVDOH LETTERHEAD

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

RE: PCC Field or PCC Plant (*whichever is applicable*) QC Plan

Project CID#: #####  
Fed/State Project #: NHPP- ## - #####-##  
Description: Falling Slide  
County: XXXXXXXX  
P/S Code: (If a Plant)

Dear Sir,

Your request to use Master Quality Control Plan (**M# - #####**) for **PCC Plant or PCC Field** (*whichever is applicable*) on the project referenced above, has been reviewed and found to be acceptable for the following items:

- All WVDOH approved designs and classes of PCC controlled by this QCP listed below:
- Class B      - Class B modified      - Class K      -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 Reference:** The Master Quality Control Plan can be reviewed in ProjectWise at the folder shown below:

WVDOT ORG>D0#>year>MASTER QC PLANS>Contractors or Plant>Company  
>folder>Name of file (i.e.: 2016 04 05 M#160001 PCC Plant QCP)

Very truly yours,

---

Name, Title

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

---

MATERIALS PROCEDURE

---

MIX DESIGN FOR PORTLAND CEMENT CONCRETE

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**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.

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**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. TEST PROCEDURE**

- 3.1 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), 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). A listing of these laboratories, that are approved to develop concrete mix designs for the Division, is available on the WVDOH, MCS&T Web Page<sup>1</sup>. 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.

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<sup>1</sup> [https://transportation.wv.gov/highways/mcst/Pages/APL\\_By\\_Number.aspx](https://transportation.wv.gov/highways/mcst/Pages/APL_By_Number.aspx).

3.2 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. Attachments 1 S-P and 6-ASR shall be used for SCC produced in accordance with Section 603.

3.2.1 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 S-P shall be used for SCC produced in accordance with Section 603.

3.2.2 The aggregate correction factor, as defined in AASHTO T 152, shall be listed in Attachment 3. Attachment 3 S-P shall be used for SCC produced in accordance with Section 603.

3.2.3 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 WVDOH form XXX, Optimized Aggregate Gradation worksheet, shall be included in the mix design submittal package.

3.2.4 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,

**Commented [TS1]:** I think we should create another form similar to T301E. We Would need to know Minus No.200 from the gradation. What do you think? Do you have editable form T301E?

**Commented [MMA2R1]:** I agree that we should create another form similar to T301E. I don't have an editable copy of that form. Please check with Kelly Chapman and Dave Matics about that.

maximum load applied to the cylinder, type of fracture, and compressive strength of the cylinder.

- 3.3 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) than 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 w/c than the previous four batches. The slump tolerance in Section 3.4 shall not apply to this fifth batch.

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

The batches for Class H concrete shall be produced at the cement factor for Class H concrete that is required in the specifications. Two rapid chloride permeability tests, in accordance with AASHTO T 277, 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 of 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 shall be performed, at the same test age, on each of these batches, and the same method of curing shall be used for all of the test specimens.

The information (i.e. raw data), from which each rapid chloride permeability 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.

- 3.4 Each batch of concrete shall be tested in the plastic state for air, consistency and yield. Each batch shall be adjusted as necessary to produce a plastic concrete having an air content, consistency, and yield equal to the specified value plus or minus a reasonable laboratory working tolerance. The following tolerances shall be used as a guide for all classes of concrete except SCC produced in accordance with Section 603: Air Content,  $\pm \frac{1}{2}$  percent; Consistency,  $\pm \frac{1}{2}$  in. ( $\pm 12$  mm) of slump; Yield,  $\pm 2$  percent.

- 3.4.1 For SCC produced in accordance with Section 603, testing shall begin at the time immediately after the mixing sequence is completed. This time shall be designated as  $T_0$ . Temperature, air content, consistency,  $T_{50}$ , VSI, passing ability, rapid assessment of static segregation resistance, segregation resistance, unit weight, and yield tests shall

be conducted on these batches and shall be within the tolerances set forth in Table 603.6.2.1A.

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

- 3.5 When the properties of a concrete batch have been established within acceptable limits, seven 6 by 12 in. (150 by 300 mm) cylinders shall be made from each batch produced in Section 3.3 (or 3.3.1) and tested in compression at the following ages: one cylinder at age 24 hours  $\pm$  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 3.3 (or 3.3.1) 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 w/c. 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.
- 3.5.1 For any class of concrete other than SCC produced in accordance with Section 603, if it is desired to use 4 by 8 in. (100 by 200 mm) cylinders as the basis for acceptance or early strength determination in the field, in accordance with Section 601.4.4, then seven 4 by 8 in. (100 by 200 mm) cylinders shall be fabricated and tested as outlined in Section 3.5 for the first two trial batches at the minimum cement factor in addition to the seven 6 by 12 in. (150 by 300 mm) cylinders.
- 3.5.1.1 If the average compressive strength of the six 28-day 4 by 8 in. (100 by 200 mm) cylinders for the batches at the minimum cement factor is not more than 10.0 percent greater than the average compressive strength of the six 28-day 6 by 12 in. (150 by 300 mm) cylinders for the batches at the minimum cement factor, then 4 by 8 in. (100 by 200 mm) cylinders will be permitted to be used in the field. Otherwise, any cylinders fabricated in the field for acceptance or early strength determination must be 6 by 12 in. (150 by 300 mm) cylinders.

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- 3.5.1.2 The following formula shall be used during the mix design approval process to determine if the average compressive strength of the three 28-day 4 by 8 in. (100 by 200 mm) cylinders is greater than 110.0 percent of the average compressive strength of the three 28-day 6 by 12 in. (150 by 300 mm) cylinders:

If  $\bar{X}_{4 \times 8} > \bar{X}_{6 \times 12} \times 1.10$ , then 4 by 8 in. (100 by 200 mm) cylinders are not permitted to be used in the field.

Where:

$\bar{X}_{6 \times 12}$  = Average 28-day compressive strength of 6 by 12 in. (150 by 300 mm) cylinders.

$\bar{X}_{4 \times 8}$  = Average 28-day compressive strength of 4 by 8 in. (100 by 200 mm) cylinders.

- 3.5.2 The following properties of each batch of concrete produced in Sections 3.3 (or 3.3.1) shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature.

- 3.5.3 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 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.

- 3.6 Mix design submittal packages including Attachments 1, 2, 3 and 6-ASR, A-bar worksheet(s) [or optimized aggregate gradation worksheet](#), and raw data pertaining to the compressive strength and rapid chloride permeability 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](mailto: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.

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

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**4. ACCEPTANCE CRITERIA**

- 4.1 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 6 by 12 in. (150 by 300 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.
- 4.2 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.
- 4.2.1 Note that the "Design 28-Day Compressive Strength" required by the Specifications is the minimum field strength sought in 6 by 12 in. (150 by 300 mm) or 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 4.1 or 4.2 for mix design approval, shall be noted as the "Mix Design Approval Strength".
- 4.3 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, with the exception of 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.

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**5. PROPORTIONING DESIGN MIX**

- 5.1 If the average of the batches produced in Section 3.3 (or 3.3.1), with the specified minimum cement factor, satisfies the acceptance criteria of Section 4, then it will be considered acceptable as the mix design for the class of concrete being designed.
- 5.2 If the average of the batches produced in Section 3.3 with the specified minimum cement factor does not satisfy the acceptance criteria of Section 4, then a linear compressive strength-cement factor relationship will be established using the average



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28-day compressive strength, based on the 6 by 12 in. (150 by 300 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. (2.2 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.

- 5.2.1 If neither of the averages of the batches produced in Section 3.3 satisfies the acceptance criteria of Section 4, then that proposed mix design cannot be considered as acceptable, and a new mix design will be required.
- 5.2.2 Section 5.2 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 3.3.1 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.
- 5.3 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 w/c (i.e. fifth batch), when applicable. 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 of the 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 3.4.1, shall be submitted also.
- 5.4 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.

- 5.4.1 Using the three different water-cement ratios from the batches produced in Section 3.3 and the corresponding 28-day compressive strengths from Section 3.5, the Excel file in Attachment 4 of this MP shall be used to create a best-fit line through these three points.
- 5.4.2 The water-cement ratio (w/c) that corresponds to the Mix Design Approval Strength, as outlined in Section 4.1 or 4.2, 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 w/c (i.e. the w/c 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 w/c in Table 601.3.1A be exceeded).
- 5.4.3 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.
- 5.4.4 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.

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**6. MIX DESIGN RE-APPROVAL**

- 6.1 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 6.2 and conducted at the Concrete Producer or a Division Approved Laboratory, meeting the requirements of Section 3.1. 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.

- 6.1.1 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 number. The WVDOH District

Materials personnel shall verify whether or not there are a minimum of fifteen air content, slump, and compressive strength tests for that mix design in the previous three-year period.

- 6.1.2 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 6.1. MCS&T Division shall then update the approval date of the subject mix design.
- 6.1.3 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 6.2.
- 6.2 The following procedures shall be used to re-approve concrete mix designs that do not meet the criteria in Section 6.1.
- 6.2.1 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.
- 6.2.2 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 lieu 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.
- 6.2.3 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<sup>3</sup> (4.6 m<sup>3</sup>) of the concrete mix subject for re-approval. This batch shall be tested for air content, slump, unit weight and yield. Also, three 6 by 12 in. (150 by 300 mm) 28-day compressive strength specimens, and if applicable, two rapid chloride permeability 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.
- 6.2.3.1 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

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**Commented [MMA4R3]:** It's used, along with the fineness modulus, in developing mix designs.

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**Commented [MMA5]:** Don't we still need to conduct fineness modulus testing even if we're doing optimized gradations? Isn't it still used to develop mix designs?

**Deleted:** and fineness modulus (fine aggregate)

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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 6.2.2.

- 6.2.4 If a Concrete Producer desires to have the option of using 4 by 8 in. (100 by 200 mm) cylinders in the field for a mix design which has already been approved, then at the time of mix design re-approval, or at any time prior to that time three additional 6 by 12 in. (150 by 300 mm) 28-day compressive strength specimens and six 4 by 8 in. (100 by 200 mm) 28-day compressive strength specimens shall be fabricated and tested from the batch produced in Section 6.2.3 or 6.2.3.1. The six 6 by 12 in. (150 by 300 mm) cylinders shall then be compared to the six 4 by 8 in. (100 by 200 mm) cylinders as outlined in Section 3.5.1.1 in order to determine if 4 by 8 in. (100 by 200 mm) cylinders will be permitted in the field for the subject mix design.
- 6.3 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 6.2 in the applicable sections of Attachments 1, 2, and 3. The Concrete Producer or Division Approved Laboratory Personnel shall then submit those attachments, along with the test data required in Section 6.2.2 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.
- 6.3.1 For mix design re-approval purposes, the compressive strength of the representative batch produced at the Producer, as outlined in Section 6.2.3, 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 4.
- 6.3.1.1 If a laboratory batch is produced in lieu of a batch at the Producer, as outlined in Section 6.2.3.1, 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 4.1.

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

Where:

$f'_{cr}$  = Required compressive strength of the batch produced in Section 6.2.3.1 (expressed in psi)

$f'_c$  = Design 28-Day Compressive Strength (expressed in psi)

$\sigma$  = Concrete Plant Standard Deviation (outlined in Section 4.1)

- 6.3.2 For mix design re-approval purposes, the average of the two rapid chloride permeability test results from the representative batch produced in Section 6.2.3 or 6.2.3.1 must be 1,000 coulombs or less in order for the mix design to be re-approved.
- 6.3.3 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.

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## 7. CHANGING A COMPONENT MATERIAL USED IN A MIX DESIGN

- 7.1 Whenever more than one component material in an approved mix design is changed simultaneously, a new laboratory mix design, in accordance with Section 3 shall be required. This option is not permitted for SCC mix designs produced in accordance with Section 603.
- 7.1.1 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 in order for that component material change to be approved, are outlined in the following sections.
- 7.2 The changes, outlined below, to any of the following component materials are permitted provided the requirements in Section 7.3 are met. Only one component material may be changed at a time, otherwise a new laboratory mix design in accordance with Section 3 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, in order 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.

- 7.2.1 Cement: The source of cement may be changed provided the requirements of Section 7.3 are met.
- 7.2.2 Supplementary Cementitious Material (SCM): The source and/or type of SCM may be changed provided the requirements of Section 7.3 are met.
- 7.2.3 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 7.3 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.)
- 7.2.4 Latex Admixture: The source of latex admixture may be changed provided the requirements of Section 7.3 are met.
- 7.2.5 Fine Aggregate: The source of fine aggregate may be changed provided the requirements of Section 7.3 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.
- 7.2.6 Coarse Aggregate: The source of coarse aggregate may be changed provided the requirements of Section 7.3 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 3 shall be required.
- 7.3 When a change to any individual component material in an approved mix design, as outlined in Sections 7.1.1 and 7.2, 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<sup>3</sup> (2.3 m<sup>3</sup>), 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.
- 7.3.1 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 lieu of solid A-bar of the new material, A-bar of total solids, and fineness modulus (fine aggregate) for those mix designs with the optimized aggregate gradation. The results of these tests shall be used by a WYDOH certified PCC Technician at the Concrete Producer to establish a new target for the mix, if necessary, to adjust any batch volumes.

**Commented [MMA6]:** Can we discontinue fineness modulus testing when using optimized gradation?

7.3.2 In lieu of the two batches produced at the Producer's facility, as outlined in Section 7.3, two batches may be produced at a Division Approved Laboratory, meeting the requirements of Section 3.1. These batches do not need to be witnessed by WYDOH 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 7.3.1.

7.3.3 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 3.2.

7.3.4 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,  $\pm 1$  percent; Consistency,  $\pm 1$  in. ( $\pm 25$  mm) of slump; Yield,  $\pm 2$  percent.

7.3.4.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 7.3.2, then the batch tolerances specified in Section 3.4 shall apply.

7.3.5 When the properties of a concrete batch have been established within acceptable limits, 3 - 6 in by 12 in. (150 by 300 mm) cylinders shall be made from each batch produced in Section 7.3 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 7.3. 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 7.3 shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature.

7.4 When it is desired to change a component material in a mix which requires the rapid chloride permeability test (Class H concrete and specialized concrete overlays as outlined in Section 679), a minimum of one permeability specimen shall be fabricated from each of the batches produced in Section 7.3. The average value of these permeability specimens shall be no more than 10 percent greater than the mix design permeability value, required in the applicable specification, when tested at the time frame specified in the applicable specification.

7.4.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 7.3.2, then the average value of these permeability specimens shall be less than

or equal to the mix design permeability value required in the applicable specification, when tested at the time frame specified in the applicable specification.

- 7.5 If 4 by 8 in. (100 by 200 mm) cylinders were approved for use with the mix design which was approved prior to the component material change, then 4 by 8 in. (100 by 200 mm) cylinders shall also be approved for use with the new mix (with the component material change) with no further testing required.
- 7.5.1 Otherwise, if it is desired to use 4 by 8 in. (100 by 200 mm) cylinders as the basis for acceptance or early strength determination in the field with the new mix (with the component material change) then three 4 by 8 in. (100 by 200 mm) 28-day compressive strength specimens shall be fabricated and tested from each of the batches produced in Section 7.3. The six 6 by 12 in. (150 by 300 mm) cylinders from these batches shall then be compared to the six 4 by 8 in. (100 by 200 mm) cylinders from these batches as outlined in Sections 3.5.1.1 and 3.5.1.2 in order to determine if 4 by 8 in. (100 by 200 mm) cylinders will be permitted in the field for the subject mix design.
- 7.6 The average compressive strength of the two batches produced at the Producer in Section 7.3 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 4.1.

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

Where:

$f'_{cr}$  = Required average compressive strength of the batches produced in Section 7.3 (expressed in psi)

$f'_c$  = Design 28-Day Compressive Strength (expressed in psi)

$\sigma$  = Concrete Plant Standard Deviation (outlined in Section 4.1)

- 7.6.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 7.3.2, 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 4.1.

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

- 7.6.2 If the average compressive strength of the two batches produced in Section 7.3 ( $f'_{cr}$ ) 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 7.7 are met.
- 7.7 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 7.3 are being produced. These two additional batches shall be acceptable to both the Producer and



MP 711.03.23  
SUPERSEDES: JULY 2020  
REVISED JUNE 2021

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<sup>3</sup> (2.3 m<sup>3</sup>), 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.

- 7.7.1 In lieu of the two batches produced at the Producer's facility, as outlined in Section 7.7, 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 3.1. 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.
- 7.7.2 Production of these two additional batches is not an option for Class H concrete or specialized overlay concrete.
- 7.7.3 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,  $\pm 1$  percent; Consistency,  $\pm 1$  in. ( $\pm 25$  mm) of slump; Yield,  $\pm 2$  percent.
- 7.7.3.1 If laboratory batches are produced in lieu of batches at the Producer, as outlined in Section 7.7.1, then the batch tolerances specified in Section 3.4 shall apply.
- 7.7.4 When the properties of a concrete batch have been established within acceptable limits, three 6 by 12 in. (150 by 300 mm) cylinders shall be made from each batch produced in Section 7.7 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 7.7. These values shall be listed in the column for the mix with the "Minimum Cement Factor + 1 Bag" in Attachment 3.
- The following properties of each batch of concrete produced in Section 7.7 shall be listed in Attachment 2: A-bar of total solids, consistency, air content, unit weight and yield, water-cement ratio, and temperature.
- 7.7.5 If the average of the batches produced in Section 7.3, with the specified target cement factor, does not satisfy the acceptance criteria set forth in Section 7.6, then a linear compressive strength-cement factor relationship will be established using the average 28-day compressive strength [based on the 6 by 12 in. (150 by 300 mm) cylinder results] of the batches with the target cement factor (Section 7.3) and the average 28-day compressive strength of the batches with the target cement factor plus one bag of cement (Section 7.7). This relationship will be interpolated to determine a cement factor [to the nearest 1 lb. (2.2 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.

- 7.7.6 If neither of the averages of the batches produced in Sections 7.3 or 7.7 satisfy the acceptance criteria in Section 7.6, then that proposed component material change cannot be considered as acceptable, and a new laboratory mix design will be required in order to make a change in component materials.
- 7.8 The submittal for a proposed mix design change, as outlined in Section 7, 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 7. All pertinent information supporting these attachments and pertaining to the information in them shall be submitted also. 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.
- 7.9 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 7.

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

- 8.1 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.
- 8.1.1 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.
- 8.2 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.

- 8.2.1 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.
- 8.3 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,  $\pm 1$  percent; Consistency,  $\pm 1$  in. ( $\pm 25$  mm) of slump; Yield,  $\pm 2$  percent.
- 8.3.1 Three 6 by 12 in. (150 by 300 mm) cylinders shall be made from each batch outlined 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 fly ash replacement) 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.
- 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.
- 8.4 The average compressive strength of the two batches produced in Section 8.3 must have an average compressive strength, which exceeds the "Design 28-Day Compressive Strength" required by the specifications.
- 8.5 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 8, 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 8.3. 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.

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**9. ADDITION OF HYDRATION CONTROL STABILIZING ADMIXTURES TO EXISTING MIX DESIGNS**

- 9.1 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.
- 9.2 Two separate batches of concrete shall be produced as outlined in Section 7.3. These concrete batches shall be tested as outlined in Sections 7.3 and 7.4.
- 9.2.1 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 in order to verify that the allowable concrete discharge time may be extended.
- 9.3 If the requirements set forth in Section 7.6 are met, then the procedures set forth in Sections 7.8 and 7.9 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.
- 9.4 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.

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

RLS:Mtd

Attachments

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

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METHOD OF ACCEPTANCE OF NON-STANDARD OR  
NON-CONFORMING MATERIALS IN CONSTRUCTION

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**1. PURPOSE**

- 1.1 To provide guidelines of sampling, testing and resolution of all materials that may be addressed in the plans, but are not otherwise addressed by the current edition of the Standard Specifications and Supplementals (Standard Specifications) and/or Materials Control, Soils and Testing Division (MCS&T) Materials Procedures.
  - 1.2 Provide a method for accepting material that does not meet the requirements of the above-mentioned documents and is not otherwise addressed in those documents.
  - 1.3 Provide guidelines and/or course of action/inaction when a material test has not been performed or has been performed incorrectly.
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**2. DEFINITIONS**

- 2.1 ST-1: Special Testing Form 1- The ST-1 is a historic WVDOH document which has been used to provide an acceptance method for a material that does not have a prescribed acceptance method, or is otherwise outside the scope of the normal acceptance procedure. This form has evolved over the years, but is still used for the original purpose. An ST-1 is to be done before the material is placed.
- 2.2 DMIR: District Materials Inspection Report – A DMIR is an investigation typically into a material failure or any other situation where there is no prescribed method for the resolution of a material on a project. A DMIR can have several outcomes including, but not limited to: Remove and replace, a price reduction, or accept in place etc.
- 2.3 AWP: AASHTOWare Project Management Software – This is the generic term for the suite of software used by the WVDOH to manage and process projects. This system manages contracts, samples, tests and other aspects of projects.
- 2.4 Authorize a Sample – This is a technical AWP term in which the user closes, or locks the sample. Authoring a sample indicates that the sample has been resolved in the system and the system will allow the project to proceed through certification. This does not have any indication of whether the sample has passed or failed.
- 2.5 Concur/Non-Concur of Sample – This is a technical AWP term in which the reviewer indicates their acceptance of a sample. A “Non-Concur” typically requires additional action to accept the material in the system.
- 2.6 Sample ID – This is a technical AWP term which refers to the “key” field for a record in the AWP database.

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**3. SCOPE**

- 3.1 This procedure applies to all materials that do not have an acceptance, or non-conformance resolution already established in the Standard Specifications, or any other WVDOH documents.
- 3.2 This procedure applies to situations where the resolution of a non-conformance issue is not clearly defined or described by the Standard Specifications or other WVDOH documents, or if District wishes to diverge from these documents.
- 3.3 This procedure applies to situations where additional documentation for acceptance is required by the Standard Specifications or other WVDOH documents.

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**4. PROCEDURE**

- 4.1 The ST-1 form shall be submitted to MCS&T with documentation and/or data sheets pertaining to the proposed material. Pre-sampled material cannot be used until authorization is received from the MCS&T Division or the non-conformance has been resolved.
- 4.1.1 Payment for this material shall be withheld upon MCST's non-concurrence with the ST-1, pending a DMIR.
- 4.2 DMIR – A District Materials Inspection Report (DMIR) shall be submitted to MCS&T for consideration and either concurrence/non-concurrence for the following situations:
- 4.2.1 The Material did not meet the Standard Specifications or other Division Testing Requirements.
- 4.2.2 The Material is not addressed in the Standard Specifications or other Division Documents and has been placed before testing (ST-1 or acceptance methods were not utilized).
- 4.2.3 Sampling and/or testing was not done correctly, samples or documentation was lost, or testing otherwise cannot be used to represent or accept the material.
- 4.2.4 The resolution of the material has not been addressed in a change order or other contractual document.

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**5. ST-1 DOCUMENTATION AND SUBMISSION TO MCS&T**

- 5.1 The live ST-1 Form is available as a fillable pdf file on the Division Webpage<sup>1</sup>. A sample of this form is attached. This form shall be filled out with all the listed information pertaining to the material that the contractor proposes to use or has used. All required fields must be completed before submitting the ST-1 to MCS&T.

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<sup>1</sup> <https://transportation.wv.gov/highways/mcst/Pages/tbox.aspx>

- 5.1.1 The District must electronically send the fillable PDF form. This cannot be hand-written and scanned (the Sample ID must be available to be selected for Copy and Paste).
- 5.2 The ST-1 shall be submitted by District Construction to the District Materials Supervisor. The District shall then generate the sample in AWP and associate all line items before submitting the ST-1 sample to MCS&T for review and concurrence/non-concurrence. A workflow guideline for this is available in the MCS&T ProjectWise folder (location provided by request.)
- 5.3 The ST-1 shall be sent to the ST-1/DMIR mailbox ([St1dmir@wv.gov](mailto:St1dmir@wv.gov)).
- 5.3.1 ST-1 Request Email files shall be submitted in the following format for both the subject of the email and the file name for the submission: ST-1-District Lab Number-CID Contract ID. An example follows,
- 5.3.2 ST-1-MXZXXXXX-CID 2019001346
- 5.4 The sample shall be logged and sent to the applicable MCS&T section to review. If the subject material(s) meets the project requirements, MCS&T will concur with the sample and the reviewer will then authorize the sample in AWP.
- 5.4.1 An email will be generated by the District Material Supervisor to the District Materials Supervisor notifying them that the ST-1 has been concurred and authorized. The District will place the ST-1 and MCS&T email into ProjectWise under the Contract ID and associated line item number.
- 5.5 If the material fails to meet the minimum requirements, the reviewer will mark the sample as non-concur, then authorize the ST-1 sample in AWP. MCS&T will send the ST-1 to the District Materials Supervisor stating why the ST-1 was not concurred. The District will place the ST-1 and MCS&T email into ProjectWise under the Contract ID and associated line item number.

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## **6. DMIR DOCUMENTATION AND SUBMISSION TO MCS&T**

- 6.1 The live DMIR form is available on the WVDOH MCS&T Webpage<sup>1</sup>. A sample of this form is attached. All required fields must be completed before submitting the DMIR to MCS&T.
- 6.1.1 The preparer of the DMIR, typically the Materials Supervisor, or their designee, shall clearly state all of the details that initiated the DMIR and shall include the following categories of information:
1. General/Project information
  2. Materials information
  3. Type of deviation
  4. Situation
  5. Review
  6. Conclusion
  7. Review and Signatures from Construction Engineer and Materials Supervisor
  8. Supporting Documentation

- 6.1.2 A description of the material, known quantities, technical issues, or any requirement from the applicable Specifications, Contract Proposal, Project Plans, Material Procedures (MPs), Standard Details, Special Provisions, AASHTO, ASTM, or any Non-Specification issues shall be provided.
- 6.1.3 A justification and any supporting and/or relevant detail shall be provided.
- 6.1.4 The conclusion shall clearly state and justify the final price assessment resolution (which may be \$0.00), including all applicable fees and penalties.
- 6.1.5 The assessment fees should be listed individually and with a final total price assessment. Justification of the price assessment shall be provided.
- 6.1.6 The Supporting Documentation shall provide the necessary information and evidence for the materials inspection.
- 6.2 The District shall generate the sample and associate all line items before submitting the DMIR sample to MCS&T for review and concurrence/non-concurrence. A workflow guideline for this is available in the MCS&T ProjectWise folder (location provided by request.)
- 6.3 The DMIR shall be sent to the ST-1/DMIR mailbox ([St1dmir@wv.gov](mailto:St1dmir@wv.gov)). The sample shall be logged and sent to the applicable MCS&T section to review. If the subject material(s) meets the project requirements, MCS&T will concur with the sample and the reviewer will then authorize the sample in AWP.
- 6.3.1 The District must electronically send the fillable PDF form. This cannot be hand-written and scanned (the Sample ID must be able to be selected for Copy and Paste).
- 6.4 After MCS&T has reviewed and authorized the DMIR sample (whether be concur or non-concur), the DMIR will be sent to Contract Administration.

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

RLS:Bc  
Attachments



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

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AGGREGATE SOURCE APPROVAL PROCEDURES

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**1.0 PURPOSE**

- 1.1 To provide a uniform procedure for the following:
- a) Approval of producers/suppliers of aggregates for the West Virginia's Department of Transportation's Division of Highways (WVDOH) Approved Material Source/Product List; and
  - b) Monitoring of producers/supplier's ongoing compliance with the governing specifications for use of their products in WVDOH projects.

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**2.0 SCOPE**

- 2.1 This procedure shall apply to any aggregate producers/suppliers intending on supplying aggregates to projects conducted by the WVDOH.

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**3.0 APPLICABLE DOCUMENTS**

- 3.1 West Virginia Division of Highways Standard Specifications, Roads and Bridges, [both Current Edition & Supplementary](#)
- 3.2 West Virginia Division of Highways Construction Manual, [Current Edition](#)
- 3.3 West Virginia Division of Highways Materials Procedures

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**4.0 CONSIDERATION FOR THE LIST OF COMMERCIAL AGGREGATE SOURCES**

- 4.1 If an entity wants to be placed on the commercial source list and has had no previous dealings with WVDOH, they shall submit a Letter of Intent (LOI) to Materials Control, Soils and Testing Division (MCS&T) describing what they intend on selling, what production process is used, what type of projects they intend on supplying, and when they intend on starting production. The LOI, upon review by MCS&T, will be forwarded to the nearest adjacent WVDOH District Materials Supervisor for notification purposes.

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4.2 Data from a total of 20 samples shall be considered for addition of the new Producer/Supplier to the WVDOH List of Approved Aggregate Sources. Historic data concerning aggregate quality test results signifying compliance with WVDOH specifications shall be available for review. Any data accepted by MCS&T concerning the quality of the material shall be obtained from an AASHTO re:source accredited laboratory.

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4.2.1 At their discretion, MCS&T may sample stockpiles currently in production for quality testing. If the material sampled meets the quality specifications, the stockpile can be approved for use in WVDOH projects. This data will be included with the required 20 sets of data for source approval in the future, if necessary. Any material submitted for use in WVDOH projects shall meet the criteria described in Sections 702, 703 and 704 of the WVDOH specifications for that particular material.

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4.2 → To be considered for the WVDOH Approved Material Source/Product list, one or more of the following criteria shall be considered:¶  
4.2.1 → Recent acceptance of the potential source in another State's Approved Source may be reviewed and verified by Materials Control, Soils and Testing Division (MCS&T) to highlight the potential for producing an acceptable product for use in WVDOH projects.

4.2.2 Independent quality testing data shall be verified by MCS&T to ensure compliance with governing specifications. All data submitted will be reviewed in the verification process and may be included in the quality testing data compiled by MCS&T.

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4.2.3 Records of both the geologic features of the source and historical quality testing data of the products compiled by the producer/supplier, if available, may be submitted to MCS&T for review.

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4.2.4 Manufacturing and quality control processes, and pertinent, historical data shall be made available for review by MCS&T, if requested.

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4.3 → Verification shall include all data acquired from quality testing of the materials by AASHTO re:source accredited laboratories. All data submitted will be reviewed in the verification process, and may be included in the quality testing data compiled by MCS&T.

4.3 Subsequent to the review of historical and geologic data concerning the material in question, a sampling regimen shall be implemented to continually evaluate the quality of the material over the course of production.

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4.4 Acceptance of any material submitted for approval from any potential producer/supplier is left to the discretion of MCS&T.

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**5.0 MAINTENANCE OF THE LIST OF COMMERCIAL AGGREGATE SOURCES**

5.1 To remain on the WVDOH List of Commercial Aggregate Sources, the following criteria shall apply:

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4.6 → Any material submitted for use in WVDOH projects shall meet the criteria described in the 2017 West Virginia Division of Highways Standard Specifications, Roads and Bridges for that particular material. ¶

5.1.1 The producer/supplier shall maintain consistent satisfactory compliance of the quality of the aggregates according to the WVDOH Specification of Roads and Bridges, Sections 702, 703 and 704 by permitting random, intermittent quality sampling of the aggregate source by MCS&T. This testing determines if the approved products continually exhibit the same characteristics and quality as the originally approved material. (see MP700.00.55; GUIDELINES FOR ESTABLISHING AND MAINTAINING APPROVED LISTS OF MATERIALS AND SOURCES, section 6.0)

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5.2 If the producer/supplier has not provided any products to any WVDOH projects over a period of 5 consecutive years from the same source, that source will be removed from the WVDOH List of Commercial Aggregate Sources. In the event of an inactive source reestablishing production and the producer/supplier wishes to regain acceptance, they shall refer to section 4 of this MP for reconsideration.

## 6.0 REMOVAL FROM LIST OF COMMERCIAL AGGREGATE SOURCES

6.1 In the event the producer/supplier does not provide materials in compliance with the governing specifications, the following actions shall be taken by the producer/supplier, and subsequently by MCS&T, up to and including removal from the List of Commercial Aggregate Sources:

6.1.1 Upon sampling of an aggregate source by MCS&T, if the quality test results do not meet the minimum specifications, then a second test portion shall be split from the same field sample and be retested. The test results and methods of testing shall then be reviewed for accuracy and precision.

6.1.2 When a material, upon reexamination, fails to meet WVDOH Specifications, the producer/supplier shall be notified of the failing results and a second field sample shall be obtained by MCS&T and tested for quality. The results from this sample will determine if further action is needed.

6.1.3 For the second Field sample, follow the same protocol for Section 6.1.1. If the second sample does not meet quality specifications, at the discretion of MCS&T personnel, a third sample may be obtained from the producer/supplier by MSC&T and tested for quality.

6.1.4 For the third Field sample, follow the same protocol for Section 6.1.1. If the third sample does not meet quality specifications the following course of action shall be taken:

6.2 Communication of sample information shall be implemented as follows:

6.2.1 The producer/supplier shall be notified of the deficiency, either in writing or via electronic communication (i.e. email).

6.2.2 The 10 district material supervisors, the Regional Construction Engineers, Director of Contract Administration, and the Director of MCS&T shall be notified of the deficiency via electronic communication (i.e. email).

6.3 The producer/supplier of the substandard product is then responsible for mitigating the delinquency and improving the production quality to comply with the corresponding governing specifications. Mitigation of substandard materials is not the responsibility of MCS&T; only the verification of the quality of material provided by the producer/supplier shall be the responsibility of MCS&T.

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6.4 A supplemental sampling program shall be implemented to confirm the mitigation of the deficiency and shall be coordinated as follows:

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- a) If the producer/supplier was previously included on the List of Commercial Aggregate Sources, a series of three (3) consecutive samples shall be obtained, either by a WVDOH District technician or if necessary, by a representative of MCS&T. Each new sample shall be obtained every six (6) days of production to test the quality of the new material. If there is no constant flow of production, then samples shall be obtained from each stockpile produced (minimum stockpile of approximately 2000 tons).
- b) After three samples have been tested for full quality and are found to comply with the governing specifications, random, intermittent sampling of the material shall be performed by the adjacent District and sent to MCS&T for verification of quality. The frequency of the intermittent sampling of the material shall be up to the discretion of MCS&T.
- c) If the most recent samples comply with the corresponding specifications concerning the material, the producer/supplier shall be notified of conformance and shall be included on the List of Commercial Aggregate Sources for the next fiscal quarter.
- d) If the material continues to fail to meet the corresponding specifications, further action shall be taken, up to and including removal of the producer/supplier from the List of Commercial Aggregate Sources.

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6.5 If any of the aforementioned quality samples fail quality testing and a new field sample cannot be obtained due to the source not being accessible (due to seasonal closure, lack of material for sampling, etc.), then the producer/supplier will be removed from the List of Commercial Aggregate Sources until the resampling can be completed.

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6.6 Acceptance protocol detailed in section 4 of this MP shall be re-implemented once the deficiency has been mitigated to WVDOH specification minimums and the new materials will be considered for testing.

## 7.0 DOCUMENTATION

7.1 All samples obtained by MCS&T shall be assigned a corresponding lab reference number for record keeping, ensuring proper access by MCS&T personnel to pertinent information regarding the materials provided by the producers/suppliers.

7.2 In the event of repeat non-conformance of WVDOH specifications, the following procedure shall be implemented:

- a) A record of communication between the Division and the producer/supplier's contact shall be retained for future reference.

b) The sample (or samples) failing to meet quality specifications shall be packaged and stored for later access by MCS&T personnel for future reference. The sample containers shall display the lab reference number, date the tests were conducted, type of material tested, and data revealing what specifications were out of compliance.

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7.3 → Acceptance protocol detailed in section 4.0 shall be re-implemented once the deficiency has been mitigated to specification standards and the new materials will be considered for testing.