

Materials Procedures Committee Meeting

Meeting Date: 9/24/20

WVDOH MCS&T
190 Dry Branch Drive

					Votes					
					MCST	CA	TED	OPP	EGR	Total
MP Number	Champion	MP Title	Up for Vote?							
1*	401.02.25	Dan Phipps	CERTIFICATION OF ASPHALT SHIPPING TERMINALS	y						
2a	307.00.50	Dave Matics, Mike Mance	GUIDE FOR QUALITY CONTROL AND ACCEPTANCE PLANS FOR SUBGRADE, BASE COURSE, AND AGGREGATE ITEMS	n						
2b	401.03.50	Dave Matics, Mike Mance	GUIDE FOR QUALITY CONTROL PLANS FOR ASPHALT CONCRETE	n						
2c	601.03.50	Dave Matics, Mike Mance	GUIDE FOR QUALITY CONTROL AND ACCEPTANCE REQUIREMENTS FOR PORTLAND CEMENT CONCRETE	n						
2d	717.04.21	Dave Matics, Mike Mance	GUIDE FOR QUALITY CONTROL OF COMPACTION	n						
3	711.03.23	Suman Thapa	MIX DESIGN FOR PORTLAND CEMENT CONCRETE	n						
4	700.00.56	Randy Shuman	AGGREGATE SOURCE APPROVAL PROCEDURES	n						
	*Up for Vote									
	&New									

Voting Members

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

CERTIFICATION OF ASPHALT SHIPPING TERMINALS

1. PURPOSE

1.1 To establish procedures and conditions for certifying asphalt shipping terminals and to establish inspection and shipping procedures for certified terminals.

2. SCOPE

2.1 This procedure applies to liquid asphalt products furnished to state projects and purchase orders for use in highway construction and maintenance. However, Materials Control, Soils and Testing (MCS&T) may elect to use other control procedures when special conditions dictate the need for more stringent control.

3. GENERAL

3.1 This standard may involve hazardous materials, operations and equipment. It does not address all of the safety problems associated with their use. The user of this standard will be responsible for appropriate safety and health practices.

3.2 The materials covered by this Material Procedure and the applicable specification requirements are as follows:

Material	WVDOH Specification Section	Applicable AASHTO Specification
Performance Graded Asphalt Binders	705.5	AASHTO M-332
Asphalt Emulsions (Anionic)	705.4	AASHTO M 140 and M 316
Asphalt Emulsions (Cationic)	705.11 and 705.12	AASHTO M 208 and M 316
Asphalt Plastic Cement	708.9	None

4. TERMINOLOGY

4.1 AASHTO - The American Association of State Highway and Transportation Officials.

4.2 AASHTO:resource - The AASHTO Materials Reference Laboratory formerly AMRL.

4.3 COA - Certificate of Analysis.

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4.4 HMA – Hot Mix Asphalt.

4.5 Lot – A batch of material produced.

4.6 MCS&T – Materials Control, Soils and Testing.

4.7 MP – Material Procedure.

4.8 WVDOH - West Virginia Department of Highways

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5. SIGNIFICANCE AND USE

5.1 This Material Procedure (MP) sets forth a method for the quality control of liquid asphalt products. This is accomplished by a certification system that uses test data from both the supplier and the Division.

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5.2 This MP provides information on the following activities:

5.2.1 General requirements that the supplier must satisfy for approval under the certification program.

5.2.2 Minimum requirements to be included in the Supplier's quality control plan.

5.2.3 Procedures for shipping asphalt.

5.2.4 Procedure for MCS&T monitoring of the system.

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5.2.5 Procedure for evaluating monitor, supplier, and field sample test data.

6. PROCEDURE

6.1 QUALITY CONTROL PLAN - The supplier will submit a quality control plan, to ensure that the material in stock complies with AASHTO:resource specification requirements. The plan will include the following:

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6.1.1 Facility type (refinery, terminal, in-line blending, or HMA plant, etc.), location, person responsible for quality control at the facility.

6.1.2 The tests to be conducted, the name and location of the laboratory, or laboratories conducting the tests and the frequency at which the tests are to be conducted. The supplier will include test data that will be sent to Materials Control, Soil and Testing (MCS&T), and how often it is to be submitted. Suggested frequency is weekly, or monthly, during the time when the terminal is in operation.

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6.2 LABORATORY - The supplier will provide a laboratory with the necessary test equipment and personnel to test the asphalt for specification compliance. The testing may be done at more than one location, for example: terminal laboratory and refinery laboratory and the supplier may elect to have all or part of the tests conducted by a commercial laboratory.

6.2.1 The principal laboratory must be accredited by the [AASHTO:resource](#), or have applied for such inspection and shall participate in the [AASHTO:resource](#) Proficiency Sample Testing Program. Exceptions will be made for those materials for which [AASHTO:resource](#) does not provide accreditation or a proficiency sample testing program. In such cases [MCS&T](#) may conduct its own inspection as a substitute for the [AASHTO:resource](#) inspection.

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7. SAMPLING AND TESTING

7.1 Sampling and testing shall consist of Quality Control tests by the supplier and testing of monitor samples and field samples by [MCS&T](#). [MCS&T](#) field samples, when available, will also be used in the evaluation.

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7.2 The supplier will obtain samples of all materials to be shipped to [West Virginia Department of Highway \(WVDOH\)](#) projects, at a minimum sampling frequency of one sample each time the tank is filled, or new material is added. [All tests required by the specifications will be conducted on each batch.](#)

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7.3 The supplier will evaluate the test results. If any [lot](#) of asphalt does not meet specifications, it must be reworked or rebled until it does meet specifications, or that [lot \(batch\)](#) of material must not be shipped to [WVDOH](#) projects. The test data will be submitted to [MCS&T](#).

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7.4 [MCS&T](#) will obtain and test monitor samples, of all materials to be shipped to [WVDOH](#) projects. [An MCS&T inspector or consultant](#) will visit each supplier approximately [three](#) times per year for the purpose of [collecting liquid asphalt](#) samples. The inspector [or consultant](#) will obtain samples of each material for which the supplier is certified, or wishes to become certified, and has in stock. Additional visits to obtain samples may be made if additional data is needed to evaluate a specific material. These samples will be tested for compliance with all requirements of the governing specifications. [Suppliers must include a Certificate of Analysis \(COA\) for all materials certified at the time of sampling.](#)

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7.5 [MCS&T](#) will evaluate the Quality Control data, monitor sample data and any field sample data that may have been obtained, at intervals of approximately 30 days. If the asphalt does not meet the required criteria, a review will be made of the entire system. This may include sampling and testing procedures, and resampling and testing of both Quality Control and [MCS&T](#) samples. If this does not resolve the problem and the asphalt still does not meet the criteria, future shipments of that asphalt must be made using the procedure given for Level Two, in Section 8.3 of this MP, until [the criteria is met.](#)

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7.5.1 [If the material continues to not meet specifications or if the supplier has not manufactured a certified material or materials for a maximum of 2 years, then MCS&T retains the right to remove the certification from that material\(s\).](#)

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7.6 Performance Graded Binders, Asphalt Emulsions and Asphalt Plastic Cement shall adhere to the WVDOH Specifications 705 and/or AASHTO:resource.

7.7 FIELD SAMPLES - Field samples will be tested for compliance with the governing specifications. If the material does not meet these criteria, it will not be shipped under Level Two procedures until the criteria is met.

7.8 The percent within tolerance for field samples is defined as the percent of the material statistically predicted to be within the specification limits. It may be based on either the normal distribution, or the t-distribution, as applicable for the sample size. The minimum number of samples for statistical evaluation is four. For fewer samples the evaluation of failing samples will be made on an individual basis.

7.9 When the requirements for certification have been met, the Division will notify the supplier. Shipments may then be made using the procedure given for Level One Quality Procedure, in Section 8.1 of this MP.

8. SHIPPING PROCEDURES

8.1 LEVEL ONE - To qualify for Level One shipment, the material must be from a certified terminal, or refinery, and must be included on the current list of approved Asphalt Materials. Shipments may be made at any time.

8.2 The supplier will prepare a shipping invoice containing the following information: name and location of company, type and grade of asphalt, quantity and date shipped, and a statement that the asphalt meets specifications. In addition, for material shipped by tanker, the invoice will contain a statement that the transport vehicle has been inspected for contamination and has been found to be acceptable for the type of material being shipped.

8.3 LEVEL TWO - Level Two shipments will consist of shipments of asphalt that are not included in the current list of Certified Asphalt Materials, or shipments that are made from unapproved terminals.

8.4 Each lot will be sampled by MCS&T or its consultant. The quantity represented by the sample will be the quantity in the storage tank at the time the sample is taken. A new sample must be taken when new material is added to the tank. In the case of materials stored in drums, or pails, the quantity represented by the sample will be the quantity of that lot on hand when the sample was taken.

8.5 If the sample meets specifications, shipments may be made until the entire lot has been shipped, or in the case of materials stored in tanks, until new material is added to the tank.

8.6 Shipments may be made in accordance with paragraph 8.2 of this MP, except that the specific lot of material must have been tested and must meet specifications. The

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following additional information is required with the invoice: lot or tank number, date shipped and destination.

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Asphalt that does not meet specifications may not be shipped until it has been reworked or reblended and meets specifications.

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Ron Stanevich, P.E.
Director of Materials Control, Soils and Testing

Text Added to the following QC MPs:

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401.03.50

601.03.50

717.04.21

1.1 If the contractor fails to test the material in accordance with their 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.

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1.1.1 If the Engineer allows the material to remain in place, the Division will not pay for the material represented by the absent test. However, the Division will still 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.

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If the contractor fails to test the material in accordance with their Division Approved Quality Control Plan, and the Engineer allows the material to remain in place, the Division will not pay for the material represented by the absent test. However, the Division will still 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.

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

MATERIALS PROCEDURE

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

1. PURPOSE

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

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

- a) MP 300.00.51 - Procedural Guidelines for Maintaining Control charts for Aggregate Gradations
 - b) MP 700.00.54 - Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results
 - c) MP 700.00.06 - Aggregate Sampling Procedures
 - d) ML-25, Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate
 - e) WV Division of Highways Construction Manual, Current Edition
 - f) WV Division of Highways Standard Specifications, Current Edition & Supplementary
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4. GENERAL REQUIREMENTS

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

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

5. QUALITY CONTROL PLAN

- 5.1 The Contractor shall prepare a QC Plan detailing the type and frequency of inspection, sampling, and testing deemed necessary to measure and control the various properties of materials and construction governed by the Specifications. As a minimum, the sampling and testing plan should detail sampling location, sampling techniques, and test frequency to be utilized. Attachment #1 shows guidelines for the QC Plan. QC sampling and testing performed by the Contractor may be utilized by the District for acceptance.
- 5.1.1 A QC Plan must be developed by the Contractor and submitted to the Engineer/District prior to the start of construction on every project. Acceptance of the QC Plan by the Engineer/District will be contingent upon its concurrence with these guidelines.
- 5.2 As work progresses, an addendum(s) may be required to the QC Plan to keep the QC program current. Personnel may be required to show proof of certification for testing.
- 5.3 QC Plan Guidelines: The QC plan shall include but not be limited to the following information:
 - 5.3.1 Name of company official responsible for QC program. Contact phone number(s) and email(s) shall be included in the cover letter.
 - 5.3.2 List certified personnel as specified in Section 106 of the Specifications, whether from the submitting company, consultant testing firm, or both.
 - 5.3.3 List of the Aggregate items to be controlled by QC Plan.
 - 5.3.4 Sampling and Testing Plan: As a minimum, the sampling and testing plan should detail sampling locations, test methods, and test frequencies to be used. To facilitate the District's monitoring activities, which are described in Section 7.1, all completed gradation samples must be retained by the Contractor until further disposition is designated by the District Materials Supervisor. The QC Plan should state where and how these samples will be maintained. Applicable sections of Materials Letter ML-25 should be used for guidance.
 - 5.3.5 Testing Facility: The plan shall state the specific location where the samples(s) will be tested and retained.
 - 5.3.6 Documentation Plan: The Contractor's plan to document and distribute test results shall be described.

- 5.3.7 Forms and Distribution: Approved processing forms available on the [MCS&T Webpage](#)¹ shall be used to record the test data. Gradation tests will be recorded on Form T300. The laboratory reference number will always start with a "C" for all QC samples taken and tested by the Contractor. One copy of each completed form should be retained by the Contractor until the work is completed and accepted. The original signed copy of the test data is to be delivered to the District Materials Supervisor. To be an effective QC function, tests must be completed and results distributed in a regular and timely manner. The plan, therefore, must state what action will be taken in the event that testing and reporting are not completed in a reasonable period of time - preferably within 72 hours after the sample is taken (at the discretion of the District.)
- 5.3.8 Control Charts: The Specifications require the plotting of gradation test results on control charts using the moving average concept as described in MP 300.00.51. The QC Plan should state where and how the charts shall be maintained and made available to District personnel. These charts are part of the District's acceptance procedures and must be available to the District when the project is completed or at the request of the District personnel. At the Contractor's request, the requirement of Control Charts may be waived on a per project basis. The Contractor will submit a written request to the District asking that the Control Charts be waived. The District will make a determination based on the size of the project and the number of gradation tests required.
- 5.3.9 Disposition of Non-Specification Material: The Contractor shall provide a detailed plan of action for the immediate notification of all parties involved in the event that nonconforming situations are detected.
- 5.3.10 Types of QC Plans
- 5.3.10.1 QC Plans which are intended for use on more than one project shall be defined as Master QC Plans. Section 6.1 outlines the procedures for Master QC Plan submittal and approval.
- 5.3.10.2 QC Plans which are intended for use on a single project shall be defined as Project Specific QC Plans. Project Specific QC Plans shall contain a cover letter which includes the following: project description, CID#, and Federal and/or State Project Number.
- 5.3.10.3 A contractor may submit a project specific cover letter referencing the Master QC plan instead of a Project Specific QC Plan.
- 5.3.10.4 Once any QC Plan is approved for a project, the key-date shall be entered in Site Manager by the appropriate District Materials personnel. The first date entered shall be the date the Project QC Plan letter is received. The second date shall be when the District approves the QC Plan for use on the project.

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

6. MASTER QUALITY CONTROL PLAN

- 6.1 The intent of a Master QC Plan is to facilitate the approval process in a more uniform manner. The contract may submit a Master QC when their workload in a given District is routinely repetitive for the year.
- 6.1.1 The Contractor may submit a new Master Aggregate Items QC Plan each year to each District in which they have or expect to have work (see Attachment #2 for an example.) If the Contractor does not have work or does not have a history of work in a given District for the year, then a Master Field QC Plan shall not be submitted to that District.
- 6.1.2 The District will review the submitted Master QC Plan to see if it meets the requirements for the Aggregate Items in the QC Plan as per Section 5.3. If accepted, the District shall assign a laboratory reference number to the Master QC Plan for future referencing. The District will acknowledge approval of each Master QC Plan to the Contractor by letter (see Attachment #3 for an example), which will include the laboratory reference number and a copy of the approved Master QC Plan. This will then be scanned and placed in ProjectWise under the appropriate District's Org for that Contractor and/or Producer/Supplier.
- 6.1.3 Once a project has been awarded, if a Contractor elects to use the approved Master Aggregate Items QC Plan on that project, the Contractor shall submit a letter requesting to use the Master QC Plan for that project. This letter must be on the Contractor's letterhead, be addressed to the District Engineer/Manager or their designee, and contain the following information: project number, CID#, project description, type of QC Plan, and the laboratory reference number for the Master QC Plan. (See Attachment #4 for an example.)
- 6.1.4 The District shall review the referenced Master QC Plan to ensure it covers all items in the project. If the referenced Master QC Plan is found to be insufficient for some items on the project, the District shall request the Contractor to submit additional information for QC of those items as an addendum on a project specific basis. When the District is satisfied with the QC Plan for this project, a letter shall be sent to the Contractor acknowledging approval (see Attachment #5 for an example), with the following attached: the Contractor's project QC Plan request letter and the Master QCP approval letter. This shall then be placed in the project's incoming-mail mailbox in ProjectWise.
- 6.1.5 A Master QC Plan that has been approved for project use shall be good for the duration of that project, even if that project continues into future calendar years.
- 6.1.6 For the use of District Personnel, the District approval letter for this project must state the ProjectWise link to the referenced Master QC Plan for that Contractor. For example, WVDOT ORGS > District Organization #> Materials > Year>Master QC Plans, etc.
- 6.1.7 The Master Aggregate items QC Plan shall be valid for the duration of one calendar year beginning on January 1st and ending on December 31st.

7. ACCEPTANCE PLAN

- 7.1 The Specifications state that acceptance (verification) sampling and testing is the responsibility of the District and QC tests are the responsibility of the Contractor. Acceptance activities (sampled and tested at the frequency given in Section 7.1.2) may be accomplished by conducting verification sampling and testing completely independent of the Contractor and, in some cases, by witnessing tests performed by the Contractor, or by a combination of the two. The following guidelines provide a system, which should result in sufficient confidence in the Contractor's documentation of their QC operations to permit acceptance of the material in accordance with the procedure set forth in the Specifications.
- 7.1.1 The District shall review all information supplied by the Contractor on the QC Plan. Note, in particular, the qualifications of the sampler, tester, the location, and other qualifying statements about the testing facility. In the event that little qualifying information is supplied or has been demonstrated by the testing facility: Prior to work, the District (or their representative) shall review the availability, type, and suitability of the testing equipment and verify all calibrations. This information should be documented and kept available at the District Materials Section.
- 7.1.2 The District shall sample and test, completely independent of the Contractor, at a frequency equal to or greater than ten (10) percent of the frequency for testing given in the approved QC Plan. Witnessing the Contractor's sampling and testing activities may also be a part of the acceptance procedure, but only to the extent that such tests are considered "in addition to" the ten (10) percent independent tests.
- 7.1.3 Plot the results of gradation tests performed by the District on the Contractor's QC charts with a red circle, but do not include these values in the moving average. When the Contractor's tests are witnessed, circle the Contractor's test result on the control chart with red. These values are used in the moving average calculations. The laboratory number will always start with an "M" for all acceptance (verification) samples taken and tested in this manner by the District, and will always start with a "0" for all of the Contractor's tests, which are witnessed by the District.
- 7.1.4 Evaluate the results of acceptance (verification) tests, whether performed or witnessed by the District, in accordance with MP 700.00.54.

8. ABSENT TESTING OF MATERIAL

- 8.1 If the contractor fails to test the material in accordance with their 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.
- 8.1.1 If the Engineer allows the material to remain in place, the Division will not pay for the material represented by the absent test. However, the Division will still 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.
- 8.2 If the evaluation indicates similarity with the QC test(s), the control chart will be considered acceptable to that point.
- 8.2.1 If dissimilarity is determined, an immediate investigation shall be conducted in an effort to determine the cause. Until the situation is resolved, any samples held in accordance with ML-25 will be retained and may be used in whatever manner deemed appropriate during the investigation.
- 8.3 Implement ML-25 for aggregate gradations.

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

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ATTACHMENTS

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

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL PLANS
FOR ASPHALT CONCRETE

1. PURPOSE

- 1.1 This procedure presents uniform Quality Control (QC) guidelines for Contractor (and/or Producer(s)) to develop their QC Plan. All items listed are believed necessary to assure adequate product QC.
- 1.2 This procedure also creates a more uniform process for District Materials to review and approve Quality Control Plans for use on projects.

2. SCOPE

- 2.1 This Material Procedure (MP) is applicable to, but not limited to the following Asphalt Concrete Items:
 - a. Base
 - b. Wearing
 - c. Patching and Leveling Courses
 - d. All P.W.L. Items
 - e. Skid

3. GENERAL REQUIREMENTS

- 3.1 As stated in the Specifications, a QC Plan must be developed by the producer and submitted to the Engineer prior to construction. Acceptance of the Quality Control Plan by the Engineer will be contingent upon its concurrence with these guidelines. For this reason, the plan should clearly describe the methods by which the Quality Control Program will be conducted. For example, the items to be controlled, tests to be performed, testing frequencies, sampling locations and techniques all should be included and each item should be listed separately. Also, a detailed plan of action regarding disposition of non-specification material should be included. Such a plan should provide for immediate notification of all parties involved in the event non-conforming situations are detected. Attachment #1 may be used as an example Quality Control Plan for plant operations using all items that are applicable to the specific type of plant items produced. Attachment #2 may be used as an example Quality Control Plan for field operations using all items that are applicable to field work.
- 3.2 Inspection and testing records shall be maintained, kept current, and made available for review by the Engineer throughout the life of the contract. All other documentation, such as date of inspections, tests performed, temperature measurements, and any accuracy, calibration, or re-calibration checks performed on production or testing equipment should be recorded.

- 3.3 The Contractor shall maintain standard calibrated equipment and certified personnel in accordance with contract and specification requirements for the item(s) being produced.
- 3.4 The Division reserves the right to review all pertinent documents concerning equipment calibration used for testing and proof of certified personnel performing tests.

4. MASTER QUALITY CONTROL PLAN

- 4.1 The intent of a Master QC Plan is to facilitate the approval process in a more uniform manner. The contract may submit a Master QC when their workload in a given District is routinely repetitive for the year.
 - 4.1.1 The Contractor may submit a new Master Asphalt Items QC Plan each year to each District in which they have or expect to have work. If the Contractor does not have work or does not have a history of work in a given District for the year, then a Master Field QC Plan shall not be submitted to that District.
 - 4.1.2 The District will review the submitted Master QC Plans to see if they meet the requirements for the Asphalt Items in the QC Plan as per Section 5.3. If accepted, the District shall assign a laboratory reference number to the Master QC for future referencing. The District will acknowledge approval of each Master QC Plan to the Contractor by letter (see Attachment #3 for an example), which will include the laboratory reference number and a copy of the approved Master QC Plan. This will then be scanned and placed in ProjectWise under the appropriate District's Org for that Contractor and/or Producer/Supplier.
 - 4.1.3 Once a project has been awarded, if a Contractor elects to use the approved Master Asphalt Items QC Plan on that project, the Contractor shall submit a letter requesting to use the Master QC Plan for that project. This letter must be on the Contractor's letterhead, be addressed to the District Engineer/Manager or their designee, and contain the following information: project number, CID#, project description, type of QC Plan, and the laboratory reference number for the Master QC Plan. (See Attachment #4a and 4b for Plant and Field operations respectively for examples.)
 - 4.1.4 The District shall review the referenced Master QC Plan to ensure it covers all items in the project. If the referenced Master QC Plan is found to be insufficient for some items on the project, the District shall request the Contractor to submit additional information for QC of those items as an addendum on a project specific basis. When the District is satisfied with the QC Plan for this project, a letter shall be sent to the Contractor acknowledging approval (see Attachment #5 for an example), with the following attached: the Contractor's project QC Plan request letter and the Master QCP approval letter. This shall then be placed in the project's incoming-mail mailbox in ProjectWise.
 - 4.1.5 A Master QC Plan that has been approved for project use shall be good for the duration of that project, even if that project continues into future calendar years.
 - 4.1.6 For the use of District Personnel, the District approval letter for this project must state the ProjectWise link to the referenced Master QC Plan for that Contractor. For example, WVDOT ORGS > District Organization #> Materials > Year>Master QC Plans, etc.

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

5. ASPHALT CONCRETE FOR MAINTENANCE

5.1 The provisions of this MP will also apply to asphalt concrete plant run purchase orders that is picked up at the plant by the Division's Maintenance forces. Yearly Master Plant and Field QCP's apply to Laydown Asphalt Concrete Purchase Orders awarded to vendors. Exceptions to this are as specified in the Purchase Order Maintenance Contract.

6. ACCEPTANCE PLAN

6.1 The Asphalt Concrete Material shall be accepted in accordance with material's specific MP and the Standard Specifications.

6.2 Key Dates for Site Manager

6.2.1 Once the Quality Control Plan is approved for the project the key date shall be entered into the current AASHTOWare software by the appropriate District Materials personnel. The first date entered shall be the date the Project Quality Control Plan letter is received. The second date shall be when the district approves the quality control plan for use on the project.

7. ABSENT TESTING OF MATERIAL

7.1 If the contractor fails to test the material in accordance with their 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.

7.1.1 If the Engineer allows the material to remain in place, the Division will not pay for the material represented by the absent test. However, the Division will still 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.

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

RLS: CBe
ATTACHMENTS

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Deleted: <#>If there is no test data representing the material, payment for the entire item shall be withheld, pending the Engineer's decision whether or not to allow the material to remain in place. <#>If the contractor fails to test the material in accordance with their Division Approved Quality Control Plan, and the Engineer allows the material to remain in place, the Division will not be pay for the material represented by the absent test. However, the Division will still 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.

MP 601.03.50 P
SUPERCEDES: SEPTEMBER 9, 2018
REVISED: JULY 2020

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

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL AND ACCEPTANCE REQUIREMENTS FOR
PORTLAND CEMENT CONCRETE

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.
-

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.
-

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.
-

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 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. 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. All Division Approved Laboratories shall provide the Division with the CCRL Lab Number for their laboratory and agree to allow DOH, CCRL, and AASHTO re:source to freely share information about assessment reports, proficiency samples, corrective actions, quality management system, and personnel competency and certification records.
- 4.2.5 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
- π = Mathematical constant PI
- D = Diameter of the cylinder being tested (in accordance with AASTO 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 π 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 yd³ (19 m³) 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 Site Manager. 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 (yd^3/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 Weight(s) (ounces), 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 nonagitator 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 (yd^3/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), 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 yd³ (0.01 m³). 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 Site Manager by the appropriate District Materials personnel. The first date entered shall be the date the Project QC Plan letter is received. The second date shall be when the district approves the QC Plan for use on the project.

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 1st and ending on December 31st. The Master Plant QC Plan will also cover maintenance purchase order concrete for the year.

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.

6. ABSENT TESTING OF MATERIAL

6.1 If the contractor fails to test the material in accordance with their 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 will not pay for the material represented by the absent test. However, the Division will still 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.

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Director
Materials Control, Soils and Testing Division

RLS:Fm

Attachments

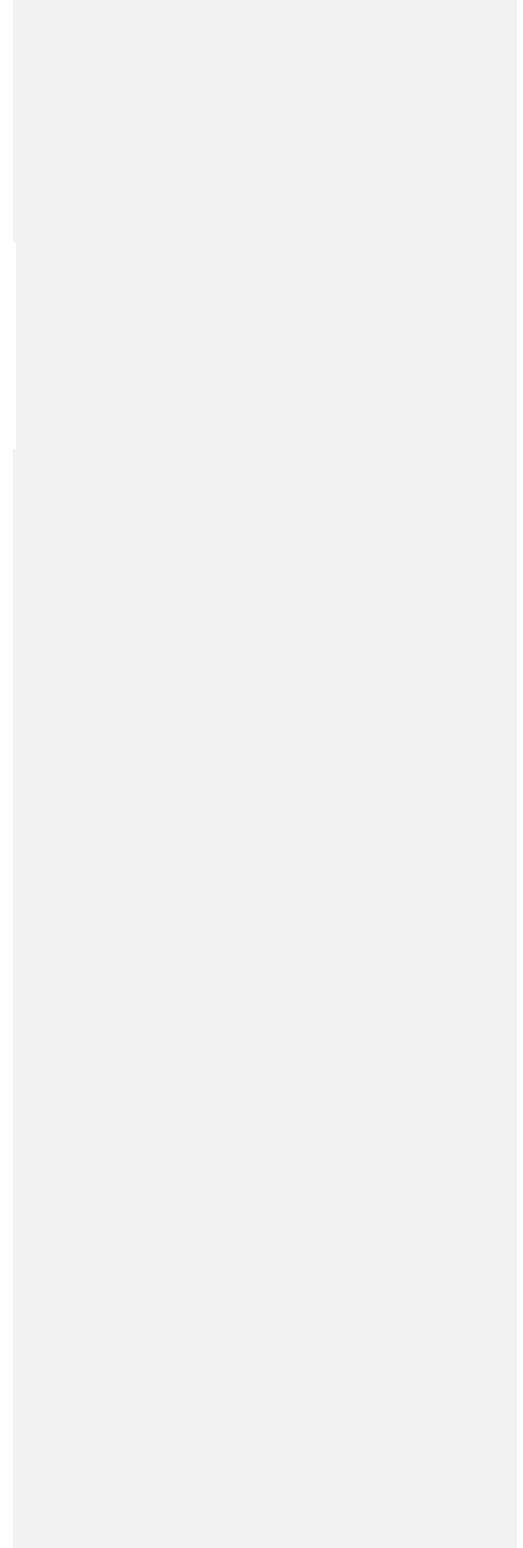


TABLE 1

**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. 75mm | Daily |
| c. \bar{A} for Combined Coarse Aggregates
Fine Aggregates and Cement | Per section 601.3.2.4 of the Specifications |
| d. Moisture | Daily |

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 ³ (380 m ³) or fraction thereof, with a minimum of two per day |
| Structural Concrete
(except Bridge Superstructure) | One per 100 yd ³ (75 m ³) 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 ³ (380 m ³) or fraction thereof, with a minimum of two per day |
| Structural Concrete
(except Bridge Superstructure) | One per 100 yd ³ (75 m ³) 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 ³ (75 m ³) 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 ³ (75 m ³) 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.

** 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.

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

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

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

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

GUIDE FOR QUALITY CONTROL OF COMPACTION

1. PURPOSE

- 1.1 This procedure sets forth minimum guidelines for the Contractor's Quality Control (QC) Plan for embankment, subgrade, pipe and random fill used as structure backfill material and aggregate base courses. It is intended that these requirements be used as a procedural guide in detailing the inspection, sampling, and testing necessary to maintain compliance with the specification requirements.
- 1.2 To establish procedural guidelines for approval and documentation of a Master QC Plan.

2. SCOPE

- 2.1 This procedure is applicable to all items requiring compaction control except bituminous concrete pavements. This outlines the QC procedures Compaction items 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.

3. REFERENCED DOCUMENTS

- a) MP 207.07.20 - Nuclear Field Density - Moisture Test for Random Material Having Less Than 40% of +3/4 Inch Material
- b) MP 700.00.24 - Nuclear Density Test By The Roller Pass Methods Revised December 2008
- c) MP 700.00.50 - Procedure for Monitoring the Contractor's Compaction Testing of Bituminous Concrete, Base Course, Embankment, Sub-Grade and Pipe and Structural Backfill
- d) MP 712.21.26 - Procedure for Determining Random Location of Compaction Tests
- e) WV Division of Highways Construction Manual, Current Edition
- f) WV Division of Highways Standard Specifications, Current Edition & Supplementary

4. GENERAL REQUIREMENTS

- 4.1 The Contractor shall provide and maintain a QC system that will provide assurance that all materials submitted to the Division for acceptance will conform to the contract requirements whether natural, manufactured or processed by the

Contractor, or procured from suppliers. The QC Plan should clearly describe the methods by which the QC Program will be conducted. For example, the items to be controlled, tests to be performed, testing frequencies, sampling locations and techniques all should be included etc. Each item should be listed separately.

- 4.1.1 A detailed plan of action regarding disposition of non-specification material shall be included. Such a plan shall provide for immediate notification of the Division in the event a non-conforming situation or instance.
- 4.2 Inspection and testing records shall be maintained, kept current, and made available for review by the Engineer throughout the life of the contract. All other documentation, such as date of inspections, tests performed, temperature measurements, and any accuracy, calibration, or re-calibration checks performed on production or testing equipment shall be recorded and kept.
- 4.3 The Contractor shall maintain standard calibrated equipment and qualified personnel in accordance with the contract and Specification requirements for the applicable material.

5. QUALITY CONTROL PLAN

- 5.1 The Contractor shall prepare a QC Plan detailing the type and frequency of inspection, sampling, and testing necessary to measure and control the compaction 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. QC sampling and testing performed by the Contractor may be utilized by the Division for acceptance.
 - 5.1.1 A QC Plan shall 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 as listed in section 5.2 thru 5.4.5.2.
 - 5.1.2 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.
- 5.2 QC PLAN MINIMUM REQUIREMENTS
 - 5.2.1 The QC Plan should be on Company Letterhead, be addressed to the District which it pertains, and include the items to be controlled. An example/template is provided in **Attachment 1**.
 - 5.2.2 Provide the name of the Person who is responsible for the Company's QC program and will be liaison with the Division's personnel.
 - 5.2.3 List all inspectors' names performing compaction tests on the project and their date becoming a Certified Soils Compaction Inspector as per WVDOH Specification Section 106 Control of Materials.

- 5.2.4 Compaction field tests will be performed according to MP 207.07.20, MP 700.00.24, and Standard Specification 716.32.3
- 5.2.5 Soft shale tests are to be done as per Section 716 of the Standard Specifications.
- 5.2.6 Specify in the plan the methods by which each item will be tested. Table A and Table B summarizes the different materials, minimum frequencies, and the appropriate test procedure or method for controlling each material.

Table A- COMPACTION CONTROL OF AGGREGATE BASE COURSES

TEST PROCEDURE	LOT SIZE	NUMBER OF TEST	MATERIAL TYPE			
			PORTLAND CEMENT TREATED AGGREGATE BASE COURSE	CRUSHED AGGREGATE BASES AND SUBBASE COURSES	HOT-MIX HOT-LAID BITUMINOUS TREATED BASE COURSE	SOIL CEMENT BASE COURSE
MP 700.00.24	2000 FEET	1 PER SUBLOT 5 PER LOT	X	X	X	
MP 207.07.20	2000 FEET	1 PER SUBLOT 5 PER LOT				X

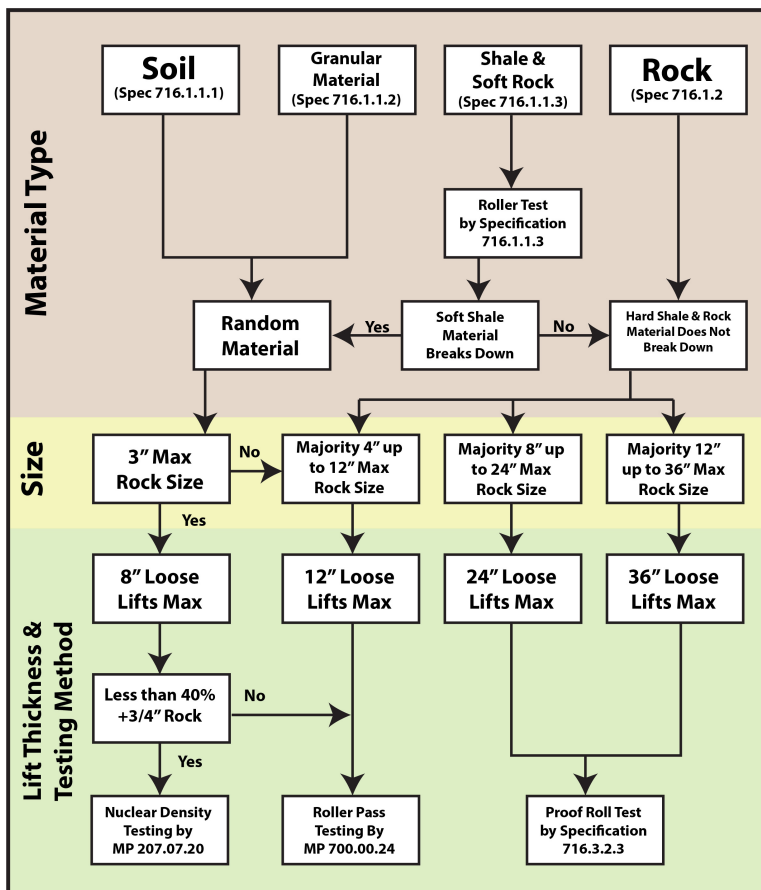
Table B - COMPACTION CONTROL OF EMBANKMENT BACKFILL AND SUBGRADE

TEST	LOT SIZE	NUMBER OF TESTS	MATERIAL WITH LESS THAN 40% RETAINED ON 3/4" (19.0 mm) SIEVE	MATERIAL WITH 40% OR MORE RETAINED ON 3/4" (19.0 mm) SIEVE AND CAN BE PLACED IN A 12" (300 mm) LOOSE LIFT OR LESS		MATERIAL THAT CAN BE PLACED IN A LOOSE LIFT GREATER THAN 12" (300 mm)		GRANULAR SUBGRADE	SELECT MATERIAL FOR BACKFILLING AND CLASS I AGGREGATE
				UNIFORM	NON-UNIFORM	ROCK	HARD SHALE		
MP 207.07.20	SEE STD. SPECS.	1 PER SUBLOT 5 PER LOT	X						
MP 700.00.24	SEE STD. SPECS.	1 PER SUBLOT, 5 PER LOT		X [1]	X [1], [2]			X	X
PROOF Rolling		1 REPORT PER LIFT				X	X		

1. If a hole for a direct transmission density reading cannot be readily made due to the coarse material, proof roll the lift.
2. If density readings are varying above 105 percent or below 95 percent and the material appears to be non-uniform, proof roll the lift.

5.2.7 A flow chart for embankment material, Table C, shall serve as a guide for identifying material types, maximum rock size, lift thickness and compaction test method. This table shall be included in the QC Plan for making field decisions to ensure that each type of material is properly placed and compacted.

Table C – Guide for Quality Control of Embankment Material



5.2.8 The plan shall include a statement that all necessary testing equipment will be provided to perform the procedures MP 700.00.24, MP 207.07.20, and Specification 716.3.2 and lists the required testing equipment for compaction tests. The plan shall list the make and model of equipment for proof rolling and its weight per Specification 716.3.2. The plan shall list the make and mole and operating weight of the roller(s) to be used for the soft shale tests and per Specification 716.1.1.3.

- 5.2.9 List the type of gauge to be used (...i.e., Troxler 3430, etc). The calibration frequency must be acceptable to the Division. Gauges must be calibrated as per the manufacture's requirements. This information shall be given to the Division upon their request.
- 5.2.10 If applicable, outline the procedure for performing a stability check on gauges that are not within the tolerance range for standard counts during the interval between calibrations. Standard counts derived during the stability check for stable gauges may be used in lieu of the manufacturer's standards. Gauges found to be unstable cannot be used until repaired and calibrated.
- 5.2.11 Include in the plan the lot and subplot sizes to be used for testing each type of installation. During construction, some flexibility in lot sizes may be made if the situation warrants in order to maintain a workable system. For example, two or more areas containing small quantities of embankment material might be combined into one lot at the Contractor's option and subject to the Division's approval.
- 5.2.12 Specify the maximum time period for completion of a lot of embankment material. As a guide, if the desired lot size cannot be obtained within seven calendar days, then the material placed up to that time would constitute the lot and the specified number of tests for a lot would still be performed.
- 5.2.13 Specify in the plan when quality control tests for base and subgrade will be performed. QC tests are to be performed after the material has been shaped and final rolling has been completed.
- 5.2.14 The Contractor is responsible for the accuracy of their individual testing and calculations.
- 5.2.15 List the forms and method of distribution for tests and measurements.
- 5.2.16 Compaction test results are reported on forms specified in MP 207.07.20 and MP 700.00.24. The forms are supplied by the Division and available on the [MCS&T Webpage](#)¹. Each form consists of an original and one copy. The original of a completed form is submitted to the Division's project supervisor and the other copy is for the Contractor's records.
- 5.2.17 Indicate the length of time after tests and measurements are completed that documentation will be provided.
- 5.2.17.1 Test results and measurements are made available to project personnel for review on a daily basis. Formal submission of measurements should be made within 24 hours after the measurements are taken and test results within 24 hours after testing of a lot is completed.

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

- 5.2.17.2 Tests performed in a lot before final rolling is completed should be submitted to the Project Supervisor and retained in the project files. This includes test documents for failing lots and moisture checks.
- 5.2.18 List the compaction equipment giving the quantity, make, model, and weight or applied force at which each roller will be operated. If ballast will be added to a roller, indicate the type and quantity of ballast and the method for verifying the gross weight. Attach the manufacturer's specifications for compaction capabilities for each roller to the plan or state the procedure for verifying the compaction capabilities of each roller in cases where the manufacturer's specifications are not available. This equipment shall meet the requirements as per 207.7.5 of the Standards and Specifications
- 5.2.19 Indicate in the plan that a minimum of a 10-ton (9.07 Mg) roller will be used for testing as per MP 700.00.24 for soil and granular material only.
- 5.2.20 Rollers used to breakdown soft shale shall be in accordance with 716.1.1.3 of the Standard Specifications and shall have a minimum of 1.5 tons per linear foot of roller or drum.
- 5.2.21 Specify the method by which proof rolling will be conducted on embankment materials. The materials to be proof rolled are summarized in Table B (attached).
- 5.2.22 List the number of passes to be made and corrective measures if soft areas are detected. Documentation should include the type of material, number of passes, and corrective action if soft areas are detected.
- 5.2.23 For equipment used for proof rolling explain how the gross weight will be determined for any ballast added to the operating weight. For alternate proof rollers, attach to the QC Plan the calculations used to determine that the roller meets specifications. Also, attach the manufacturer's specifications for all proof rollers to the Plan. The following calculation is used to determine if an alternate proof roller meets specifications:

ENGLISH	Metric
$c = \frac{\pi(ab\pi)}{2}$	$c = \frac{\pi(ab\pi)}{50.8}$

Where:

a = weight (force) on a single tire = pounds (kg x .009807 = kN)

b = operating tire pressure = psi (kPa)

c = weight (force) per inch (mm) width of tire = pounds per inch (Nm)

The weight (force) per inch (mm) width of tire must be equal to or greater than 1315 pounds (9.067 kN/mm).

- 5.2.24 Outline the procedure for notifying the Division when the test section in MP 700.00.24 will be performed. The Division should be notified a minimum of 24 hours in advance unless other arrangements acceptable to the Division can be made.

- 5.2.25 Laboratory testing for random material is not required unless the material has unusual characteristics or differs from the soil and rock data used to develop the design. Testing to develop density curves, specific gravities, organic content, etc. may be required.
- 5.2.26 A list of test procedures is contained in Section 716 of the WVDOH Standard Specifications as a guideline for required testing should the need arise for random material.
- 5.2.27 Design a plan of action for the disposition of non-specification material, such as material with excessive moisture, excessive organic content, etc. These materials shall be stockpiled away from the embankment or fill placement areas. The Project Supervisor should be immediately notified in the event a nonconformance situation is detected.
- 5.2.28 List the method(s) and frequencies per Table E (attached) by which lift thickness measurements will be taken. If surveying of compacted lifts is not utilized, then the maximum loose lifts per Table C shall be measured.
- 5.3 TYPES OF QC PLAN
- 5.3.1 QC Plans which are intended for use on more than one project shall be defined as Master QC Plans. Section 5.4 outlines the procedures for Master QC Plan submittal and approval.
- 5.3.2 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 name/description, CID#, Federal and/or State Project Number.
- 5.3.3 A contractor may submit a Master QC Plan for field operations instead of a Project Specific QC Plan.
- 5.3.4 Once any QC Plan is approved for a project, the key date shall be entered in ASSHTOWare software 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.
- 5.4 MASTER QUALITY CONTROL PLAN
- 5.4.1 The intent of Master QC Plans is to facilitate the approval process in a more uniform manner. A Master QC Plan can be submitted to the Division/District by the Contractor when their work in a given District is routinely repetitive for the year. The Master Quality Control Plan is applicable for only the calendar year for which it has been approved.
- 5.4.2 The Contractor shall submit the Master Compaction QC Plan yearly to each District in which they have work in. If the Contractor does not have work in a given District for the year then no Master QC Plan shall be submitted to that District.

- 5.4.3 The District will review the submitted Master QC Plan and assign a laboratory reference number upon approval for future referencing. The District will acknowledge approval of Master QC Plan to the Contractor by letter (see **Attachment #2** for an example), which will include the laboratory reference number and a copy of the approved Master QC Plan attached. This will then be scanned and placed in ProjectWise under the appropriate District's Org for that Contractor.
- 5.4.4 Once a project has been awarded, if a contractor elects to use the approved Master Compaction QC Plan on that project, the Contractor shall submit a letter requesting to use the Master QC Plan for that project. This letter must be on the Contractor's letterhead, be addressed to the District Engineer/Manager or their designee, and contain the following information: project number, CID#, project name/description, type of Quality Control Plan and the laboratory reference number for the Master QC Plan (See **Attachment #3** for an example).
- 5.4.5 The District shall review the referenced Master QC Plan to ensure that it covers all items in the project. If the referenced Master QC Plan is found to be insufficient for some items on the project, the District shall request the Contractor to submit additional information for QC of those items as an addendum on a project specific basis. When the District is satisfied with the QC Plan for this project, a letter shall be sent to the Contractor acknowledging approval (see **Attachment #4** for an example), with the following attached: the Contractor's project QC Plan request letter and the Master QCP approval letter. This shall then be placed in the project's incoming-mail mailbox in ProjectWise.
- 5.4.5.1 A Master QC Plan that has been approved for project use shall be acceptable for the duration of that project, even if that project continues into subsequent calendar years, unless otherwise directed by the District.
- 5.4.5.2 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. (i.e., WVDOT ORGS > District Organization #> Materials > Year>Master QC Plans...)

6. CERTIFICATION & ACCEPTANCE SAMPLING AND TESTING

- 6.1 The Contractor shall certify that compaction testing and sampling is in conformance with the approved QC plan, referenced MP's and referenced Standard Specifications in a letter format on the company's letterhead. The certification shall summarize what materials were encountered and the compaction method/lift thickness utilized. The letter shall state whether any deviations from the requirements of the QC plan, MP's, and Standard Specifications exist, and why.
- 6.2 Acceptance sampling and testing is the responsibility of the Division. QC tests by the Contractor may be used for acceptance.
- 6.3 The Division shall sample and test for applicable items completely independent of the contractor at a frequency equal but not limited to approximately ten (10)

percent of the frequency for testing given in the approved Quality Control 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.

6.4 MP 700.00.50, MP 207.07.20, and Standard Specification 716.3.2.3 outlines the procedures to be followed for acceptance of compaction testing.

7. ABSENT TESTING OF MATERIAL

7.1 If the contractor fails to test the material in accordance with their 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.

7.1.1 If the Engineer allows the material to remain in place, the Division will not pay for the material represented by the absent test. However, the Division will still 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.

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

RLS : Bbe
Attachments

Commented [DB1]: Chad Miller - Combine the two, less gray area, start out with one-subsection. If the contractor fails to...

Deleted: <#>If there is no test data representing the material, payment for the entire item shall be withheld, pending the Engineer's decision whether or not to allow the material to remain in place. ¶
<#>If the contractor fails to test the material in accordance with their Division Approved Quality Control Plan, and the Engineer allows the material to remain in place, the Division will not be pay for the material represented by the absent test. However, the Division will still 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.¶

Source:		Source Code:	
Source Location:		Producer/Supplier Code:	
Class of Concrete:		Materials Code:	
		SiteManager Mat. Code:	
Design Laboratory:		Date:	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Material (SCM) 1	Supplementary Cementitious Material (SCM) 2
Name			
Type			
Materials Code			
SiteManager Mat. Code			
Source			
Source Location			
Source Code			
Producer/Supplier Code:			
Specific Gravity			

Admixture Data				
Data	Air Entrainment	Additional Admixture 1	Additional Admixture 2	Additional Admixture 3
Name				
Type				
Materials Code				
SiteManager Mat. Code				
Source				
Source Location				
Source Code				
Producer/Supplier Code:				

Aggregate Data		
Data	Coarse Aggregate	Fine Aggregate
Class/Size		
Type		
Materials Code		
SiteManager Mat. Code		
Source		
Source Location		
Source Code		
Producer/Supplier Code:		
Specific Gravity		
A-Bar		
Absorption		
Fineness Modulus		
Unit Weight		

Source: _____
 Source Location: _____
 Design Laboratory: _____
 Class of Concrete: _____
 Date: _____

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

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

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

Compressive Strength, psi (MPa)			
Specified Test Age:	Actual Test Age (hours)	6" x 12" (150 x 300 mm) Strengths	4" x 8" (100 x 200 mm) Strengths
24 ± 2 Hours			
3 Days			
7 Days			
14 Days			
28 Days			
28 Days			
28 Days			
Avg. 28 Day Strength		#DIV/0!	#DIV/0!

Rapid Chloride Permeability Testing (When Applicable)		
Method of Curing (Check Applicable Box)	Standard	Accelerated
	Age at Time of Test (Days)	Total Adjusted Charge Passed (Coulombs)
Test 1		
Test 2		
Average		#DIV/0!

SUMMARY

Source: _____
 Source Location: _____
 Design Laboratory: _____
 Class of Concrete: _____
 Corresponding Design 28-day Compressive Strength from Table 601.3.1A (psi): _____
 Corresponding Maximum Water Content from Table 601.3.1A: _____
 Date: _____

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

Compressive Strength, psi (Mpa)	Minimum Cement Factor Batch		Minimum Cement Factor + 1 Bag Batch	Minimum Cement Factor with Different w/c
	6" x 12" Cyl. (150x300 mm)	4" x 8" Cyl. (100x200 mm)		
1 Day				
3 Days				
7 Days				
14 Days				
28 Days				
28 Days				
28 Days				
Avg. 28 Day Strength	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
If applicable, are 4" x 8" (100 x 200 mm) cylinders permitted in the field:				#DIV/0!
Plant Standard Deviation at time of Mix Design Approval (psi):				
Average Value of Rapid Chloride Permeability Test (Coulombs):				

MP 711.03.23
 SUPERSEDES: SEPTEMBER 2018
 REVISED: MAY 2020
 ATTACHMENT 4

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

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

MP 711.03.23
 SUPERSEDES: SEPTEMBER 2018
 REVISED: MAY 2020
 ATTACHMENT 5

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

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

Class of Concrete, Precast/Prestress Member	
--	--

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

Aggregate Material Data		
Data	Reactivity	Most Reactivity
Coarse Aggregate		
Fine Aggregate		

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

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

For Evaluation of the Effectiveness of SCM (ASTM C1567), skip 2,3,4, and 6.

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

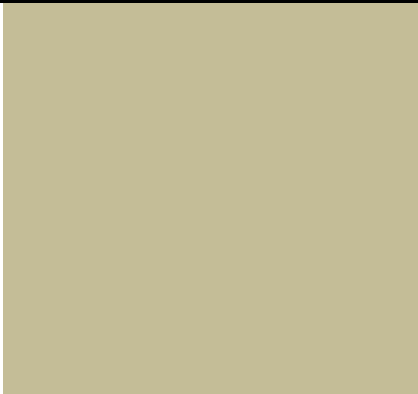
4	For Prevention Level "Z" Only		
	Alkali Content of Concrete		%
	Replacement Level of SCM		%

5	Evaluation of the Effectiveness of SCM (ASTM C1	
	Data	Evaluation with Reactive Fine Aggregate
	Expansion results (%)	
	SCM (%)	
	Replacement of SCM in Mix Design (%)	

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



Supplementary Cementitious Materials (SCM) 2



567)
Evaluation with Reactive Coarse Aggregate



MP 711.03.23
 SUPERSEDES: SEPTEMBER 2018
 REVISED: MAY 2020
 ATTACHMENT 1 S-P

Source:		Source Code:	
Source Location:		Producer/Supplier Code:	
Class of Concrete:		Materials Code:	
		SiteManager Mat. Code:	
Design Laboratory:		Date:	

Cementitious Material Data			
Data	Cement	Supplementary Cementitious Material (SCM) 1	Supplementary Cementitious Material (SCM) 2
Name			
Type			
Materials Code			
SiteManager Mat. Code			
Source			
Source Location			
Source Code			
Producer/Supplier Code:			
Specific Gravity			

Admixture Data				
Data	Air Entrainment	Additional Admixture 1	Additional Admixture 2	Additional Admixture 3
Name				
Type				
Materials Code				
SiteManager Mat. Code				
Source				
Source Location				
Source Code				
Producer/Supplier Code:				

Aggregate Data		
Data	Coarse Aggregate	Fine Aggregate
Class/Size		
Type		
Materials Code		
SiteManager Mat. Code		
Source		
Source Location		
Source Code		
Producer/Supplier Code:		
Specific Gravity		
Absorption		
Fineness Modulus		
Unit Weight		

Source: _____
 Source Location: _____
 Design Laboratory: _____
 Class of Concrete: _____
 Date: _____

Check the Appropriate Box for the Designated Batch:	Batch 1	Batch 2	Additional Batch		
Material	Mass		Units	Volume	Units
Cement			lb (kg)		ft ³ (m ³)
SCM 1			lb (kg)		ft ³ (m ³)
SCM 2			lb (kg)		ft ³ (m ³)
Water			lb (kg)	gal (L)	ft ³ (m ³)
Air Content, by volume			%		ft ³ (m ³)
Coarse Aggregate 1			lb (kg)		ft ³ (m ³)
Coarse Aggregate 2			lb (kg)		ft ³ (m ³)
Fine Aggregate			lb (kg)		ft ³ (m ³)
Total			lb (kg)		ft ³ (m ³)
Air Entrain. Admixture			oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 1			oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 2			oz/Cwt (mL/100kg)		fl. oz. (mL)
Chemical Admixture 3			oz/Cwt (mL/100kg)		fl. oz. (mL)

Mixture Test Data at T ₀							
W/C Ratio	Cement Factor, ft ³ (m ³)	Concrete Temperature, °F (°C)	Slump Flow, in. (mm)	Air Content, %	Unit Weight, lb/ft ³ (kg/m ³)	Yield, ft ³ (m ³)	T _{50,seconds}
VSI	J-Ring, in. (mm)	Rpd. Asmnt. of Static Seg. Resist. in. (mm)	Segregation Resistance, %	Workable Period, minutes			

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

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

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

Rapid Chloride Permeability Testing			Freeze-Thaw Resistance		
	Age at Time of Test (days)	Total Adjusted Charge Passed (coulombs)		# of Cycles Completed	Durability Factor
Specimen 1			Specimen 1		
Specimen 2			Specimen 2		
Specimen 3			Specimen 3		
Average Total Charge Passed (coulombs):			Average Durability Factor:		
#DIV/0!			#DIV/0!		

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

SUMMARY

Source: _____
 Source Location: _____
 Design Laboratory: _____
 Class of Concrete: _____
 Date: _____

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

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

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

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

MATERIALS PROCEDURE

MIX DESIGN FOR PORTLAND CEMENT CONCRETE

1. PURPOSE

- 1.1 To establish a procedure for testing the physical properties of a proposed mix design.
 - 1.2 To establish criteria for evaluating the test data to arrive at acceptable batch proportions for an approved mix design.
-

2. SCOPE

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

3. 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](#)¹. 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.

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

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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, <u>Alkali Content</u>
Supplementary Cementitious Material (SCM):	Type, Materials Code, Sitemanager Materials Code, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, <u>Alkali Content</u>
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, <u>ASR Aggregate Reactivity Class</u>
Fine Aggregate:	Type, Materials Code, Sitemanager Materials Code, Source and Location, Source Code, Producer/Supplier Code, Specific Gravity, Absorption, A-Bar, Fineness Modulus, <u>ASR Aggregate Reactivity Class</u>

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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.

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, 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. (± 12 mm) of slump; Yield, ± 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), 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 .

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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.

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- 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.

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.

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 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.

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.
 - 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 yd³ (4.6 m³) 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 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)

σ = 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.

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 yd³ (2.3 m³), 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.
- 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 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

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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.

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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, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 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)

σ = 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 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 yd³ (2.3 m³), 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, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 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.

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

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District Materials personnel. Both of these batches of concrete shall be tested in the plastic state for air, consistency, and yield. Each batch shall have an air content, consistency, and yield equal to the specified value plus or minus the following tolerances: Air content, ± 1 percent; Consistency, ± 1 in. (± 25 mm) of slump; Yield, ± 2 percent.

- 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.

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- 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.

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

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Attachments

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

AGGREGATE SOURCE APPROVAL PROCEDURES

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.

2.0 SCOPE

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

3.0 APPLICABLE DOCUMENTS

- 3.1 West Virginia Division of Highways Standard Specifications, Roads and Bridges
- 3.2 West Virginia Division of Highways Construction Manual
- 3.3 West Virginia Division of Highways Materials Procedures

4.0 CONSIDERATION FOR APPROVED MATERIAL SOURCE/PRODUCT LIST

- 4.1 If an entity wants to be placed on the commercial source list and has had no previous dealings with WVDOT, they shall submit a Letter of Intent to 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.
- 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 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. This quality testing data shall be acquired from tests completed in an AASHTO re:source accredited laboratory. Historic data concerning aggregate quality test results signifying compliance with other states' specifications shall be available for review.
- 4.2.3 Manufacturing and quality control processes, geologic features, and independent quality testing data shall be verified by MCS&T to ensure compliance with governing specifications.
- 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.
- 4.4 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.
- 4.5 Acceptance of any material submitted for approval from any potential producer/supplier is left to the discretion of MCS&T.
- 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.

5.0 MAINTENANCE OF APPROVED MATERIAL SOURCE/PRODUCT LIST

- 5.1 To remain on the DOH Approved Material Source/Product list, the following criteria shall apply:
- 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 through 704 by permitting yearly quality sampling of the source/supplier 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)

6.0 REMOVAL FROM APPROVED MATERIAL SOURCE/PRODUCT LIST

- 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 Approved Material Source/Product List:
- 6.1.1 If the quality test results do not meet the minimum specifications, then a second test portion will be split from the same field sample and shall be retested, and the test methods shall be reviewed for accuracy.
- 6.1.2 When a material, upon reexamination, fails to meet DOH 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, a third sample shall be obtained from the producer/supplier by MSC&T.
- 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 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 engineers/managers, and the directors 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.
- 6.4 A supplemental sampling program shall be implemented to confirm the mitigation of the deficiency, and shall be coordinated as follows:
- a) If the producer/supplier was previously included on the Approved Material Source/Product List, a series of three (3) consecutive samples shall be obtained. Each new sample shall be obtained every seven (7) 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 Approved Material Source/Product List 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 Approved Material Source/Product List.

- 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 approved list until the resampling can be completed.

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 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.
- 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.