

## Materials Procedures Committee Regular Meeting

**Meeting Time/Date:** 10:00am, June 21, 2023

**Meeting Location:** MCS&T (Conference Rm.) - 190 Dry Branch Drive, Charleston, WV 25306

**Online Meeting:** Google Meet Video Conference

Online Link - ( <https://meet.google.com/apa-rvti-ndx?authuser=0> )

Files Available on ProjectWise for DOT users – See Invite or Follow P/W path:

[WVDOH ORGS\MCS&T \(0077\) - FM\Materials Procedure Committee\MP Committee Meeting Files\2023\2023 06 21 MP Meeting](#)

Files Available on Webpage:

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

### Materials Procedures approved at the last meeting (5/17/23)

1. 402.02.20 - Rapid determination of the polish Susceptible Carbonate Particle Content in Aggregates
2. 661.20.00 - Procedure for Determining the Torque on Tamper Resistant Hardware
3. 700.00.01 - Sampling and Testing of Materials at the Source (Coverage)
4. 700.00.54 - Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results
5. 711.00.22 - Quality Assurance Testing of Coating Products Listed on WVDOH Approved Product Lists (Apls)
6. 212.02.20 - Procedure for Determining a Reduced Unit Price to Be Paid for Select Material for Backfilling Which Does Not Conform to Grading Requirements of Governing Specifications
7. 207.06.20 - Chemical Analysis for pH of Soil

### Materials Procedures - Old Business

Number	Champion	Title	Description
1 - 658.05.06&	Whitmore	Ancillary Structure Anchor Bolt Tightening	Ted making significant changes to update bolt tightening.
2 - 711.00.20*	Preston	Paint Testing Methods	Reconfirmation with minor edits. Comments have been addressed.
3 - 100.00.02*	Brayack	Method Of Evaluating of Non-Standard or Non-Conforming Materials in Construction Via St-1	Added 25mB limit, updated internal AWP process for ST1
4 - 100.00.03*	Brayack	Method Of Evaluation of Non-Standard or Non-Conforming Materials in Construction Via Dmir	Added 25mB limit, 1 file per submission

5 - 106.00.02*	Brayack	Procedure For Evaluating Products for Use in Highway Construction	Added review time frame, and time frame for non MCST entities
6 - 601.05.50*	Thapa	Quality Assurance Procedures for Portland Cement Concrete	Adds E-Ticketing Requirements
7 - 700.00.56*	Ross	Commercial And Potential Skid Resistant Aggregate Source Approval Procedures	Major Updates
8 - 702.01.25*	Perrow	Method Of Test for Determining Mortar Strength	Adding and updating specs for testing
9 - 714.03.30*	Thaxton	Quality Assurance of Reinforced Concrete Culvert, Storm Drain, And Sewer Pipe	Refine the definition of “Days of Production”
10 - 700.00.50*	Jobs	Method For Acceptance of Compaction Testing	Small grammar changes, removed AASHTO R11 (inactive) and replaced with ASTM E29
11 - 700.03.50*	Jobs	Standard Method of Microscopic Determination of Air-Void Content	Added verbiage to accommodate the newer machines that run the modified point count automatically.
12 - 712.21.26*	Jobs	Procedure For Determining the Random Location of Compaction Tests	Corrected numbering (was out of order before) and removed metric examples, and updated the graphics in the examples, also a few small grammar edits.
13 - 642.03.50*	Preston	Contractor’s Quality Control for Surface Water and Sampling Procedures for Quality Determination	Reconfirmation with no content edits.
14 - 700.01.01*	Preston	Field Sampling and Testing of Surface Water For Quality Determination	Minor Edits

### Materials Procedures – Reconfirmations and Minor Edits

15 - 700.00.22*	Jobs	Procedure For Determining an Adjusted Pay Quantity Resulting from Excess Moisture in Aggregates	Removal of Metric Units, no other content change.
16 - 700.00.51*	Ross	Guide For Quality Control and Acceptance Plans for Purchase Order Contracts for Stone and Aggregate	Minor grammatical changes, reconfirmation.

17 - 702.01.20*	Jobs	Standard Method of Test for Determining the Percentage of Coal and Lightweight Particles in Aggregate	Spec Updates, minor grammatical changes, reconfirmation.
18 - 709.15.50*	Ratchford	Certification Of Fabricators of Corrosion Resistant Coated Dowel Bars in Basket Assembly	Spec Updates, minor grammatical changes, reconfirmation.
19 - 212.01.21*	Thapa	Test Method for Unconfined Compressive Strength of Rock Core Specimens	Reconfirmation with no content edits
20 - 712.05.57*	Hanna	Criteria to Approve Fence Producer/Suppliers and Their Materials.	Minor edits to address comments from management.

### Materials Procedures - New Business with Significant or Process Updates

21 - 212.02.20&	Ross	Procedure For Determining a Reduced Unit Price to Be Paid for Select Material for Backfilling Which Does Not Conform to Grading Requirements of Governing Specifications	Edits corresponding to special investigation and spec updates. Removal of information duplicated in the specifications
22 - 702.01.25&	Perrow	Method Of Test for Determining Mortar Strength	Specification updates, process changed to reflect new procedures.
23 - 661.00.00&	Jones	Chemical Analysis of Aluminum Alloys	Changes to Procedure. Formatting issues need to be addressed before vote.
24 - 615.20.01&	Hanna	Preparing, Recording and Transmitting Information on Approved List of Welded Stud Shear Connectors	Minor process edits.
25 - 701.01.10&	Dickson	Portland Cement and Blended Hydraulic Cement Mill Certification	Update to frequency of testing.

**Note 1:** \* Denotes this MP is up for Vote

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

### Comments

Comments due June 14<sup>th</sup>, so the Champion may review and address them. Submit comments to Adam Nester ([Adam.W.Nester@wv.gov](mailto:Adam.W.Nester@wv.gov))

### Next Meeting

**New or Updated MPs due to the MP Chair 3-weeks before the next meeting:** June 28<sup>th</sup>

**Meeting Time/Date:** 10:00 am, July 19, 2023

**Meeting Location:** MCST

**Online Meeting:** Google Meet Video Conference (Link TBD)

### Additional MP Committee Meeting Information

For details of previous meetings, please visit the MCST MP Committee Webpage  
<https://transportation.wv.gov/highways/mcst/Pages/MP-Committee-Page.aspx>

### Tentative MP Committee Dates for 2023:

August 16, September 20, October 26

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

MATERIALS PROCEDURE

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ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING

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**1. PURPOSE**

- 1.1 To establish equipment, procedure, documentation, and documentation transmittal requirements for the tightening of anchor bolt nuts associated with signing, signal, lighting, and intelligent transportation systems (ITS) related roadway ancillary structures.
- 1.1.1 This Materials Procedure is specifically focused on the procedure to be followed when tightening anchor bolt nuts and does not address all requirements and procedures pertaining to the installation of ancillary structures. Individual component pre-inspection and repair, structure pre-assembly, structure installation preparation, pre-application of protective coatings, overall installation procedure, and proper tightening of structural connection bolts are included as part of the Standard Specifications.

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**2. MATERIALS AND EQUIPMENT**

- 2.1 The mandatory materials and equipment required to properly tighten the anchor bolts include lubricant, snug tightening wrenches, and a hydraulic fastener tightening wrench.
- 2.1.1 Wrenches used for a snug tightening are to have an appropriate handle length in order to achieve a level of initial snug tightening as predictable and uniform as possible. The handle length used for fasteners 3/4-inch to 1-1/4-inches in diameter is to be 23-inches. The handle length used for fasteners 1-1/2-inches to 2-1/4-inches in diameter is to be 36-inches.
- 2.1.2 Beeswax or toilet ring wax may be used as lubricant.
- 2.1.3 Hydraulic wrenches and accompanying documentation are to meet the requirements herein.
- 2.1.3.1 The wrenches are to be capable of generating the necessary torque in order to tighten the anchor bolt nuts as described herein.
- 2.1.3.2 The hydraulic wrench consists of a wrench and a hydraulic power pack to power and operate the wrench.
- 2.1.3.3 Hydraulic wrenches are to have the wrench and the pressure or torque readout gauge associated with the power pack calibrated regularly. Prior to the tightening of any

anchor bolt nuts, the project Engineer is to be provided with separate calibration certificates for the wrench and the gauge. The dates of the calibrations are to be one year or less prior to the date that the bolt tightening is performed. The certificates are to be from a calibration lab that is International Organization for Standardization (ISO) 17025 accredited, with the certificate indicating as such. The certificate for each is to display a serial number matching that shown on the wrench or gauge. If the gauge does not provide readings directly in torque values, the calibration certificate is to be accompanied by calibration charts which equate gauge pressure readings to torque values. Example calibration certificates and charts are included as part of attached ATTACHMENT 2.

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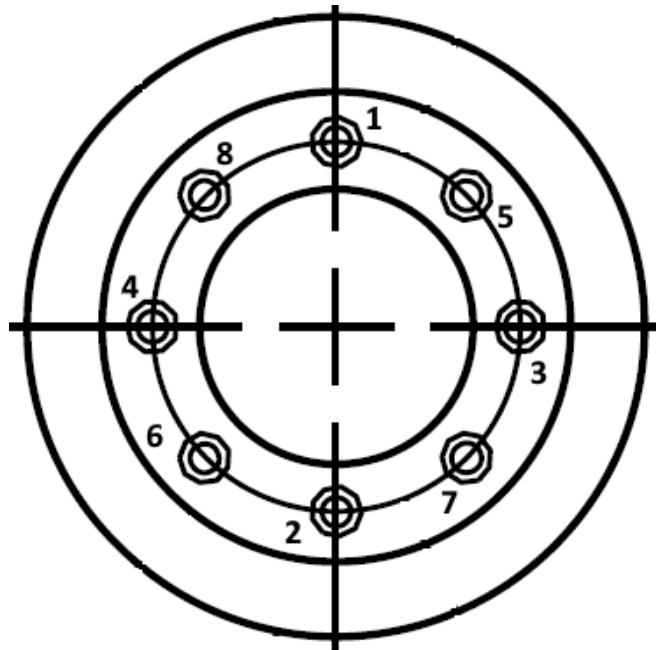
### 3. DOCUMENTATION

- 3.1 The tightening of all anchor bolt nuts is to be documented using the form “WVDOH ANCILLARY STRUCTURE ANCHOR BOLT TIGHTENING RECORD” (documentation form) attached as ATTACHMENT 1, [and available at the MCS&T DOH Webpage.](#)<sup>1</sup>

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### 4. PROCEDURES

- 4.1 Install the top nuts and washers and snug tighten the top nuts using the appropriate handle length wrench. Snug tightening is to proceed from nut to nut in a star pattern and the specific sequence chosen is to be indicated on the base plate by numbering the sequence using a permanent marker (see Figures 1 and 2 below). Snug tightness is considered to be the tightness which exists due to the full effort of a person using a spud wrench with the appropriate length handle for the bolt being tightened.



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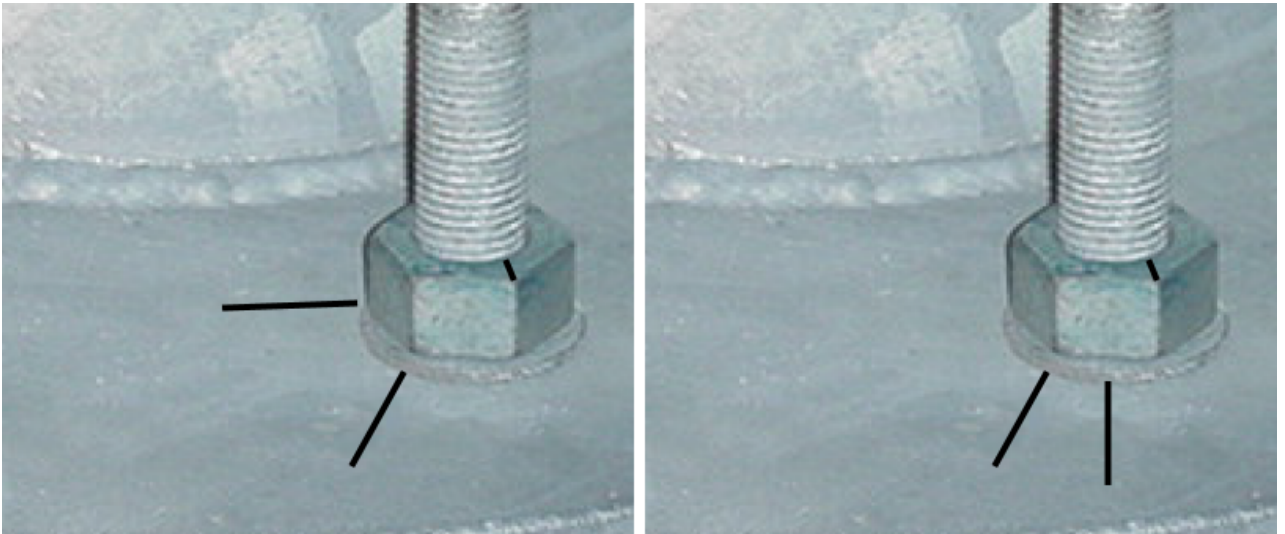
<sup>1</sup> <https://transportation.wv.gov/highways/mcst/Pages/tbox.aspx>

**FIGURE 1 - EXAMPLE NUT TIGHTENING SEQUENCE FOR 8 BOLT BASE PLATE**



**FIGURE 2 -SNUG TIGHTENING SEQUENCE NUMBERING ON BASE PLATE**

- 4.1.1 Snug tighten the leveling nuts following a star pattern.
- 4.2 After verifying that all nuts and washers have been brought into firm contact and the necessity or unnecessary for repeating the snug tightening procedure with beveled washers has been determined and performed if required, snug tight condition reference marks are to be placed on the nut and base plate using a permanent marker to prepare for the full tightening procedure(see Figure 3 below). One reference mark is to be placed on the top of the nut at one of the corners. One reference mark is to be placed on the base plate such that this reference mark and the reference mark on top of the nut will be aligned when the nut is rotated one half of the amount specified in Section 4.3.1. An additional reference mark is to be placed on the base plate such that this reference mark and the reference mark on top of the nut will be aligned when the nut is rotated the complete amount specified in Section 4.3.1. All reference marks are to be placed such that they will remain visible when the tightening wrench is placed on the nut.



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

- 4.3 Fully tighten the top nuts using the hydraulic wrench.
- 4.3.1 Full tightness of each nut is achieved by rotating the nut a prescribed number of flats beyond the reference position. Rotation is to be  $\frac{1}{3}$  (2 flats) beyond the reference position for bolts 1-1/2-inches in diameter or less. Rotation is to be  $\frac{1}{6}$  (1 flat) beyond the reference position for bolts greater than-1-1/2 inches in diameter.
- 4.3.2 Tightening is to proceed from nut to nut in the same star pattern that was used for the snug tightening procedure and is to be achieved over two cycles. Using a structure with 2-inch anchor bolts as an example, each nut is to be tightened  $\frac{1}{2}$  flat. Each nut is to then be tightened an additional  $\frac{1}{2}$  flat. The amount of torque, as indicated on the power pack gauge, at the point when the full rotation of each nut is achieved is to be recorded on the documentation form. If the gauge associated with the power pack does not provide a torque readout, the pressure readout is to be recorded and the associated torque is to be determined from the power pack calibration charts and recorded on the documentation form.
- 4.4 Upon completion of the tightening of all nuts, a verification torque ( $T_v$ ) is to be applied to each nut using the same hydraulic wrench and power pack that was used to tighten the nuts. This step is necessary to verify threads have not been stripped and is not intended to tighten the nuts further. The verification torque should be insufficient to



further turn and tighten the nuts. The required verification torque is to be calculated using the following formula and documented on the documentation form:

$$T_v = 0.12 (D_b) F_i$$

Where:

$T_v$  = verification torque (inch-kips)

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

$F_i$  = 60% of the anchor bolt minimum tensile strength (kips.) For the commonly specified ASTM F1554 Grade 55 bolts, this calculated value is equal to 45

Multiply  $T_v$  by 83.3 to calculate  $T_v$  in ft-lbs

If the gauge associated with the power pack does not provide a torque readout, the pressure readout required to achieve the verification torque is to be determined from the power pack calibration charts.

- 4.4.1 The documentation form is to be marked where indicated to indicate that application of the verification torque did not result in further turning of each nut. If the application of the verification torque results in further turning of any nuts, the Traffic Engineering Division should be notified of this issue.
- 4.5 At least 48-hours after the tightening and verification torque procedures are completed, a torque equal to 110% of the  $T_v$  torque ( $1.10T_v$ ) is to be applied to each nut using the same hydraulic wrench and power pack that was used to tighten the nuts. This step is necessary to verify threads have not been stripped and is not intended to tighten the nuts further. The  $1.10T_v$  torque should be insufficient to further turn and tighten the nuts. If the gauge associated with the power pack does not provide a torque readout, the pressure readout required to achieve a torque of  $1.10T_v$  is to be determined from the power pack calibration charts.
- 4.5.1 The documentation form is to be marked where indicated to indicate that application of the  $1.10T_v$  torque did not result in further turning of each nut. If the application of the  $1.10T_v$  torque results in further turning of any nuts, the Traffic Engineering Division should be notified of this issue.

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## 5. DOCUMENTATION TRANSMITTAL

- 5.1 Upon completion of all procedures described herein and the documentation form being completed in its entirety, the Engineer is to transmit an electronic copy of the documentation form to the email address [DOH.OS.AnchorNutTightening@wv.gov](mailto:DOH.OS.AnchorNutTightening@wv.gov), which is established by the Traffic Engineering Division for this purpose. Prior to transmittal, the calibration certificates for the wrench and power pack pressure or torque readout gauge, as well as the calibration charts for the gauge, should be attached to the documentation form and included with the submittal. The subject line of the email should be named using the following format: *D(District Number)-(Contract ID Number)-(Sign, Signal, Lighting, or ITS) Structure (Structure Number as indicated on the project Plans)*. Examples of this would be D4-2016000994-Sign Structure 6 and D7

-2006001093-Lighting Structure HML1. An example of all documents that should be included as part of a complete transmittal is attached as ATTACHMENT 2.

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

MP 658.05.06 Steward – Traffic Certification Section  
RLS:W  
ATTACHMENTS

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

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**1. PURPOSE**

- 1.1 To set forth the standard test methods to be used in analyzing paint.

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**2. REFERENCED DOCUMENTS**

- a. American Society for Testing and Materials (~~ASMT~~ASTM) Section 6, *Paints, Related Coatings, and Aromatics*.
- b. Federal Test Methods Standard Number 141D, *Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing*.

**Commented [1]:** Was asked to double check this reference. This is the ASTM for Paint Testing

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**3. TESTING METHODS**

- 3.1 Table I, -in this MP, is a list of the paint testing methods. It contains the following information:
- 3.1.1 Test - This is the name of each test,
- 3.1.2 Reference Document - This is the referenced document where you can find each test
- 3.1.3 Test Method Number - This is the number assigned to each federal test method

#### 4. GENERAL INFORMATION

4.1 Adhesion  
(Film thickness greater than 5 mils (125 µm)) ~~3-1~~ASTM D3359  
(METHOD A)

Commented [2]: This should all be on one line.

Adhesion  
(Film thickness 5 mils (125 µm) or less) ~~3-2~~ASTM D3359  
(METHOD B)

Commented [3]: This should all be on one line.

#### 4.2 Test Panel Preparation

4.2.1 Panels for testing shall meet the requirements of Federal Test Method 2011.

4.2.2 Panels that receive hot-dip galvanizing should be blast clean to near white finish (SSPC-SP10) and galvanized in accordance with the AASHTO M111. Average galvanized coating thickness should be 1.8 Mils.

4.2.3 Coating applied over galvanizing will be done in accordance with the manufacturer's product data sheets. If the data sheet does not show how to apply the coating over galvanizing, then the manufacturer shall furnish this information in writing. Failure to provide this information could result in incorrect preparation of the galvanized surface, thus resulting in failure of the paint system.

4.2.4 All coatings shall be applied at the normal field application thickness. Primers will be applied over panels that have been cleaned to a near white (SSPC-SP10) condition. All coatings, which are part of a coating system, shall be applied over the previous coating in the system.

#### 4.3 Curing Conditions

4.3.1 All coatings except zinc primers shall be cured seven days prior to testing. The curing will be done in the laboratory under normal laboratory conditions of temperature and humidity.

4.3.2 Zinc primers shall be cured, as in 4.3.1, except the cure period will be 10 days.

4.3.3 All coatings which require chemical resistance ~~testings~~, will be cured an extra 24 hours at 221°F - 230°F (~~105°C - 110°C~~).

Commented [MMA4]: Typo

4.4 Chemical analyses of pigments shall be conducted by ASTM test methods. In cases where no ASTM test method is available, Federal test methods or a mutually agreed procedure shall be used.

- 4.5 Any test method not included in Table I shall be conducted according to ASTM, Federal Test or mutually agreed to procedures.
- 4.6 Initial approval of a paint requires that all specified tests be conducted. Subsequent batches, at the Division's option, may have randomly selected tests conducted.

**Commented [MMA5]:** There was a space missing between these two words

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

RLS:Mpr

Attachment

TABLE I

	Test	Referenced Document	Test Methods
1.	Density (Weight/Gallon)	<a href="#">3-12.a</a>	D1475
2.	Consistency (Viscosity)	<a href="#">3-12.a</a>	D562
3.	Drying Time	<a href="#">3-12.a</a>	D1640
4.	Drying (Traffic Paint - No Pick Up)	<a href="#">3-12.a</a>	D711
5.	Pigment - Vehicle	<a href="#">3-22.b</a>	4021
6.	Total Solids	<a href="#">3-12.a</a>	D2369
7.	Nonvolatile Vehicle	<a href="#">3-22.b</a>	4051
8.	Coarse Particles	<a href="#">3-12.a</a>	D185
9.	Fineness of Grind	<a href="#">3-12.a</a>	D1210
10.	Flexibility	<a href="#">3-22.b</a>	6221
11.	Condition of Container	<a href="#">3-22.b</a>	3011
12.	Water	<a href="#">3-22.b</a>	4081
13.	Color	<a href="#">3-12.a</a>	D2244
14.	Working Properties	<a href="#">3-22.b</a>	4541, 4321, 4331
15.	Compatibility	<a href="#">3-22.b</a>	4203
16.	Storage Stability	<a href="#">3-12.a</a>	D1849
17.	Specular Gloss (60°)	<a href="#">3-12.a</a>	D523
18.	Skinning	<a href="#">3-22.b</a>	3021
19.	Chemical Resistant (Spot Test)	<a href="#">3-12.a</a>	D1308
20.	Infrared Scan	<a href="#">3-12.a</a>	D2621

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21.	Salt Spray	<del>3-12.a</del>	B117
22.	Accelerated Weathering	<del>3-12.a</del>	G53
23.	Leafing	<del>3-12.a</del>	D480
24.	Adhesion Section	5.1	MP 711.00.20
25.	Chemical Analysis of Pigments	<del>3-12.a</del>	MP 711.00.20
26.	Sampling	<del>3-12.a</del>	D3925

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

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METHOD OF EVALUATING OF NON-STANDARD OR  
NON-CONFORMING MATERIALS IN CONSTRUCTION VIA ST-1

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**1. PURPOSE**

- 1.1 To provide guidelines of sampling, testing, and resolution of all materials that may be addressed in the plans but are not otherwise addressed by the current edition of the Standard Specifications and Supplementals (Standard Specifications) and/or Materials Control, Soils and Testing Division (MCS&T) Materials Procedures.
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**2. DEFINITIONS**

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



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**3. SCOPE**

- 3.1 This procedure applies to all materials that do not have an acceptance, or non-conformance resolution already established in the Standard Specifications, or any other WVDOH documents.
- 3.2 This procedure applies to situations where additional documentation for evaluation is required by the Standard Specifications or other WVDOH documents.

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**4. PROCEDURE**

- 4.1 The ST-1 form shall be submitted to MCS&T with documentation and/or data sheets pertaining to the proposed material. Pre-sampled material cannot be used until authorization is received from MCS&T.
  - 4.1.1 Payment for this material shall be withheld upon MCS&T's non-concurrence with the ST-1, pending a DMIR.
  - 4.1.2 Unless otherwise directed from MCS&T, in the instance where the Specifications refer to multiple component materials in a system and each of these component materials have specific material requirements, each of these component items shall be submitted on a separate ST-1.

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

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

~~5.1.1 The District must electronically send the fillable PDF form. This cannot be hand-written and scanned (Fields must be able to be selected for Copy and Paste). The entire submission shall be 1 file, with a total file size must be less than 25MB. Only one DMIR may be submitted per email.~~

**Commented [BDA1]:** Identical to the update in 100.00.03

~~5.1.1 The District must electronically send the fillable PDF form. This cannot be hand-written and scanned (the Sample ID must be available to be selected for Copy and Paste).~~

~~5.2 The ST-1 shall be submitted by District Construction to the District Materials Supervisor. The District shall then generate the sample in AWP and associate all line items before submitting the ST-1 sample to MCS&T for review and concurrence/non-concurrence. A workflow guideline for this is available in the MCS&T ProjectWise folder (location provided by request.) This file is also located on the Division Webpage.~~

~~5.3.2 The ST-1 shall be sent to the ST-1/DMIR mailbox ([St1dmir@wv.gov](mailto:St1dmir@wv.gov)).~~

**Commented [BDA2]:** MCST starts the sample in AWP.

~~5.3.1.5.2.1 ST-1 Request Email files shall be submitted in the following format for both the subject of the email and the file name for the submission: ST-1-District Lab Number-CID Contract ID. An example follows,~~

~~5.3.2.5.2.2 ST-1-MXZXXXX-CID 2019001346~~

~~5.4.5.3 Upon receipt of the ST-1, MCST will notify the submitter that the submission has been received. The sample shall be logged and sent to the applicable MCS&T section~~

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

to review. If the subject material(s) meets the project requirements, MCS&T will concur with the sample and the reviewer will then authorize the sample in AWP.

[5.4.45.3.1](#) An email will be generated by the District Material Supervisor to the District Materials Supervisor notifying them that the ST-1 has been concurred and authorized. The District will place the ST-1 and MCS&T email into ProjectWise under the Contract ID and associated line item number.

[5.55.4](#) If the material fails to meet the minimum requirements, the reviewer will mark the sample as non-concur, then authorize the ST-1 sample in AWP. MCS&T will send the ST-1 to the District Materials Supervisor stating why the ST-1 was not concurred. The District will place the ST-1 and MCS&T email into ProjectWise under the Contract ID and associated line item number.

[5.65.5](#) In the situation where an ST-1 is non-concurred by MCST, the material shall be evaluated using a DMIR.

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

RLS:B

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

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METHOD OF EVALUATION OF NON-STANDARD OR  
NON-CONFORMING MATERIALS IN CONSTRUCTION VIA DMIR

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**1. PURPOSE**

- 1.1 Provide a method for evaluating material that does not meet the requirements of the Contract Documents.
    - 1.1.1 To evaluate a material when a failure is not otherwise addressed in the Contract Documents.
  - 1.2 Provide guidelines and/or a course of action when a material test has not been performed or has been performed incorrectly.
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**2. DEFINITIONS**

- 2.1 ST-1: Special Testing Form 1- The ST-1 is a historic WVDOH document which has been used to provide an acceptance method for a material that does not have a prescribed acceptance method or is otherwise outside the scope of the normal acceptance procedure. An ST-1 is to be done before the material is placed.
  - 2.2 DMIR: District Materials Inspection Report – A DMIR is a materials investigation, into a situation where the material does not meet the requirements of the Contract Documents.
  - 2.3 AWP: (AASHTOWare Project Management Software) – This is the generic term for the suite of software used by the WVDOH to manage and process projects. This system manages contracts, samples, tests and other aspects of projects.
  - 2.4 Concur/Non-Concur of Sample – This is a technical AWP term in which the reviewer indicates their acceptance of a sample. A “Non-Concur” typically requires additional action to accept the material in the AWP system.
  - 2.5 District Lab Number – This is the tracking number and database field for the WVDOH materials management system.
- 

**3. SCOPE**

- 3.1 This procedure applies to situations where the resolution of a non-conformance is not clearly defined or described by Contract Documents.
  - 3.1.1 The DMIR shall be submitted to MCS&T for consideration and either concurrence/non-concurrence for the following situations:
    - 3.1.1.1 The Material did not meet the Standard Specifications or other Division Testing Requirements.

- 3.1.1.2 The Material is not addressed in the Standard Specifications or other Division Documents and has been placed before testing (ST-1 or evaluation methods were not utilized).
- 3.1.1.3 Sampling and/or testing was not done correctly, samples or documentation was lost, or testing otherwise cannot be used to represent or accept the material.
- 3.1.1.4 The resolution of the material has not been addressed in a change order or other contractual document.
- 3.2 As per Section 105.3 of the Standard Specifications, the Engineer may accept materials that do not conform to Contract Documents. In this instance, material acceptance shall be processed via DMIR.
- 3.2.1 In any event of a DMIR, a change order shall be processed, even if the final evaluation/penalty of the DMIR is \$0.00.
- 3.2.2 A note of each DMIR, regardless of evaluation amount shall be in the final material certifications letter (MC-8).

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

- 4.1 The DMIR form is available on the [WVDOH MCS&T Webpage](#)<sup>1</sup>. All required fields must be completed before submitting the DMIR to MCS&T.
- 4.1.1 The preparer of the DMIR, typically the Materials Supervisor or their designee, shall clearly state all details that initiated the DMIR and shall include the following categories of information:
  - 1. General/Project Information
  - 2. Date or Dates of Incident
  - 3. Date of Report
  - 4. Materials Information
  - 5. Type of Deviation
  - 6. Situation
  - 7. Review
  - 8. Conclusion
  - 9. Review and Signatures from Construction Engineer and Materials Supervisor
  - 10. Supporting Documentation
- 4.1.2 A description of the material, known quantities, technical issues, or any requirement from the applicable Specifications, Contract Proposal, Project Plans, Material Procedures (MPs), Standard Details, Special Provisions, AASHTO, ASTM, or any Non-Specification issues shall be provided.
- 4.1.3 A justification and any supporting and/or relevant detail shall be provided.

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

- 4.1.4 The conclusion shall clearly state and justify the final price assessment resolution (which may be \$0.00), including all applicable fees and penalties.
- 4.1.5 The assessment fees should be listed individually and with a final total price assessment. Justification of the price assessment shall be provided.
- 4.1.6 The supporting documentation shall provide the necessary information and evidence for the materials inspection.
- 4.2 The DMIR shall be sent to the ST-1/DMIR mailbox ([St1dmir@wv.gov](mailto:St1dmir@wv.gov)).
- 4.2.1 DMIR Request Email files shall be submitted in the following format for both the subject of the email and the file name for the submission: DMIR-District Lab Number-CID Contract ID. An example follows:
- 4.2.1.1 DMIR-MXZXXXX-CID 20XX00XXXX
- 4.3 The sample shall be logged in the current materials tracking system and sent to the applicable MCS&T Section to review. If the subject material(s) and the resolution meets the project requirements, MCS&T will concur; otherwise, MCS&T will non-concur.
- 4.3.1 The District must electronically send the fillable PDF form. This cannot be hand-written and scanned (~~the Sample ID Fields~~ must be able to be selected for Copy and Paste). The entire submission shall be 1 file, with a total file size must be less than 25mB. Only one DMIR instance (unique line and material) may be submitted per email.
- 4.4 After MCS&T has reviewed the DMIR (whether be concur or non-concur), the DMIR will be sent to Regional Construction Engineer at the Contract Administration Division. The Regional Construction Engineer will then forward it to the Director of Contract Administration with his/her recommendation. ~~If the DMIR is an AWP Project, MCS&T will be the "Assistant Director – Logistics & Technology who will then forward it to the District with the recommendation."~~
- 4.4.1 ~~If the project is being tracked in AWP, will process the sample by creating a DWR record, as well as a change order, otherwise, the sample record in Site Manager shall be processed by the project.~~
- 4.5 ~~After completing the DMIR has been completed, the Director of Contract Administration, the Regional Construction Engineer will send the DMIR resolution back to MCS&T and the District with their final decision as well as the District.~~
- 4.5.1 ~~If the project is being tracked in AWP, the initiating District Materials Supervisor will document the DWR status on the contract. Otherwise, the sample record in Site Manager shall be processed by the project.~~
- 4.5

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

RLS:B

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

MATERIALS PROCEDURE

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PROCEDURE FOR EVALUATING PRODUCTS FOR USE  
IN HIGHWAY CONSTRUCTION

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**1. SCOPE**

- 1.1 New products are frequently presented to the Division by various manufacturers, suppliers and/or producers (MS&Ps) with a request that they be considered for use in our highway program. To facilitate handling of such requests in a uniform and expeditious manner, this Materials Procedure outlines the steps necessary for such product submittal and evaluation. This Procedure covers the addition of approved submitted products to the Division's Approved Product List (APL).
- 

**2. REFERENCE DOCUMENTS**

- 2.1 MP 106.00.03: Guidelines for Establishing and Maintaining Approved Product Lists of Materials, Systems and Sources.
- 2.2 MP 106.10.50: WVDOH Buy America Acceptance Guidelines.
- 

**3. DEFINITIONS**

- 3.1 MCS&T Reviewing Entity: The applicable Section Supervisor at MSC&T who is responsible for the review and acceptance of a new product.
- 2.23.2 Non-MCS&T Reviewing Entity: A subject matter expert at a WVDOH Division separate from MCS&T.
- 

**3.4. PROCEDURE SUBMISSION OF PRODUCT**

- 3.14.1 Consideration for new product evaluation shall be requested through completion by the MS&Ps of West Virginia Division of Highways (DOH) Form HL-468, "Preliminary Information for New Product Evaluation". Once completed, DOH Form HL-468 shall be submitted to the Materials Control, Soils and Testing Division (MCS&T) via email to the New Products Evaluation email address: [DOHNewProducts@wv.gov](mailto:DOHNewProducts@wv.gov) .

- 3.1.14.1.1 The HL-468 Form can be found on the MCS&T Division's Materials Procedures [Webpage](#)<sup>1</sup>. A sample of this form is shown in Attachment 1. An online form may also be used to meet this requirement.

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<sup>1</sup> <https://transportation.wv.gov/highways/mcst/Pages/MP-100s.aspx>

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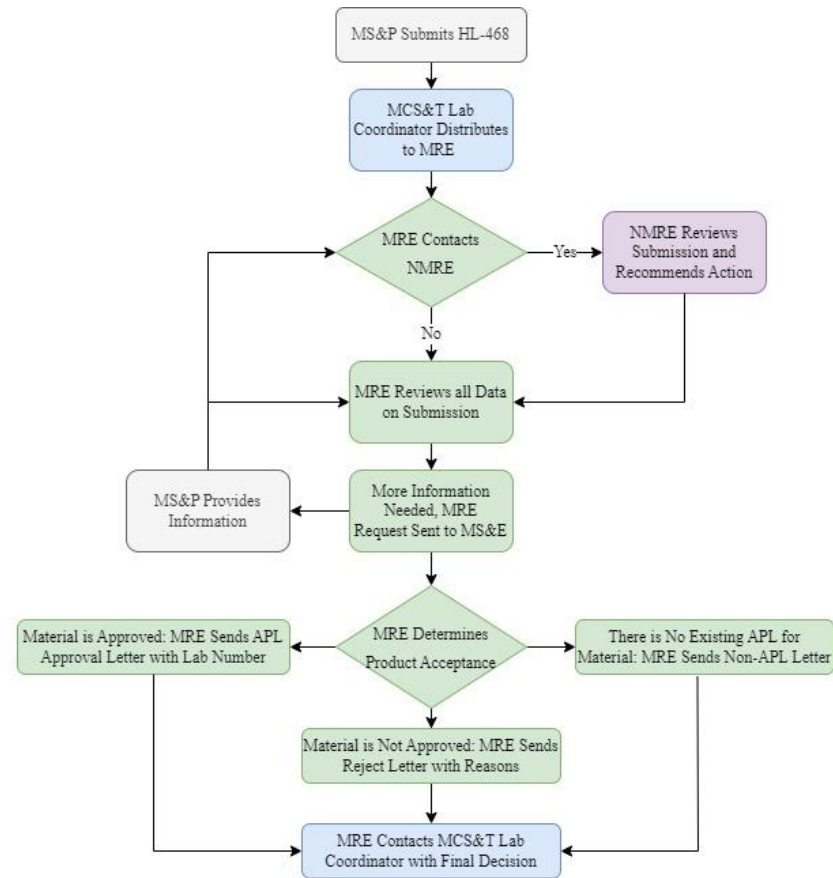
## 5. REVIEW OF SUBMITTED PRODUCT

- 5.1 Upon receipt of the completed Form HL-468, the Materials Control, Soils and Testing Division shall distribute to applicable MCS&T Reviewing Entity parties for preliminary evaluation.
- 5.1.1 Within 30 calendar days of receipt, the MCS&T Reviewing Entity shall review the submittal in accordance with the applicable material requirements and decide if the product is acceptable.
- 5.1.2 This MCS&T party shall ultimately be responsible for the approving of the new product, though they may reach out to Non-MCS&T Reviewing Entity for additional approving criteria.
- 5.1.3 . This preliminary evaluation shall determine the need/usefulness of the product/process for various DOH applications. The Non-MCS&T Reviewing Entity shall be given 7 calendar days to review the submission before making a final decision. If the entity does not respond within that time, their affirmative for the approval will be assumed by the MCS&T Reviewing Entity.
- 3.25.2 If the preliminary review indicates that the product may be accepted without further evaluation, the Product shall be considered accepted and added to the APL.
- 5.3 If the reviewing entity determines that the WVDOH does not currently have any specifications for the submitted product, a “No-APL” letter shall be issued.
- 3.35.4 If the preliminary review indicates that further research or evaluationadditional information is needed-is warranted, the MS&P shall be notified by MCS&T to submit additional types-of information. This may include but not be limited to: samples, product specifications, certified test data, or product demonstrations. Product testing shall be coordinated by the MCS&T Division with the results of any further testing/evaluation being submitted to all appropriate evaluating parties. In the case where additional information has been requested or additional testing is required, the 30-day timeframe shall be reset to the date when the additional information is provided or the testing has been completed.
- 3.45.5 If the evaluation indicates that the product is not acceptable, the Manufacturer/Supplier shall be notified by MCS&T. The MS&P shall not submit the same product for evaluation during the same calendar year.
- 5.6 In the instance where a product has significant approved usage, the Director (or their Designee) of MCS&T may add a product to either a new or existing APL as per MP 106.00.03. If a product is a candidate for being added to the APL in this manner, the MCS&T Lab Coordinator shall contact the MS&P prior to the addition of the product to the APL to request completion of the required HL-468.
- 5.7 Sample language for submission responses is shown in Attachment 2.



5.8 A flow chart for the process is provided in Figure 1

Figure 1: Flow Chart for Approved Products List Process.



Key:  
MRE: MCS&T Reviewing Entity  
NMRE: Non-MCS&T, WVDOH Reviewing Entity  
MS&P: Manufacturers, Suppliers and/or Producers

#### 4.6. DOCUMENTATION OF APPROVED PRODUCTS

6.1 MCS&T shall maintain a directory on the Division's Webpage<sup>2</sup> listing all the current approved products.

6.1.1 Additionally, MCS&T may evaluate the product listing after one year to determine if the performance or functionality of the product/process meets the desired results, goals or intentions of the DOH. Any such evaluation may result in the product being removed from the New Product Evaluation Listing.

4.1 The MCS&T Division shall maintain a New Product Evaluation listing with the status of all requests from the time of receipt. This listing shall include the product evaluation report number, which will provide information such as; the product name,

<sup>2</sup> [https://transportation.wv.gov/highways/mcst/Pages/APL\\_By\\_Number.aspx](https://transportation.wv.gov/highways/mcst/Pages/APL_By_Number.aspx)

~~the Manufacturer/Supplier, date of initial request, and the final action recommended. This listing will be maintained on the Division's website. Where applicable, product evaluation data will also be submitted for inclusion in the AASHTO Product Evaluation List (APEL).~~

~~4.1.1 Additionally, MCS&T may evaluate the product/process after one year to determine if the performance or functionality of the product/process meets the desired results, goals or intentions of the DOH. Please note that any such evaluation may result in the product being removed from the New Product Evaluation Listing. This report will be in the form of a Materials Inspection Report (MIR) and this report will remain as part of the new products evaluation listing.~~

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## **7. REMOVAL OF PRODUCT FROM APL**

~~7.1 If, at any time the approving entity determines that a previously approved product no longer meets the specifications, the product shall be removed from the MCS&T approved product list.~~

~~7.2 In this instance, the approving entity shall notify the MS&P.~~

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## **5.8. BUY AMERICA**

~~5.18.1~~ Each HL-468 submission must include whether the product meets the Federal and State Buy America requirements of Section 106.1 of the Specifications. If the MS&P indicates that their product meets Buy America requirements, the company shall produce a notarized Certificate of Compliance (CoC) signed by a company official with knowledge and authority to certify the product is compliant with applicable Buy America requirements.

~~5.1.18.1.1~~ In the event where the source of materials is changed and is no longer Buy America compliant, the MS&P must notify MCS&T in writing.

~~5.1.28.1.2~~ Under no circumstance shall the CoC described above be used for Buy America compliance on a project. Each project must submit a CoC as described in MP 106.10.50 "WVDOH Buy America Acceptance [Guidelines](#)."

~~5.28.2~~ A notarized CoC shall contain the following information:

~~5.2.18.2.1~~ Title: Certification of Buy America compliance for Source Approval.

~~5.2.28.2.2~~ The Name, Address and Contact Information for the Company.

~~5.2.38.2.3~~ The date of the application

~~5.2.48.2.4~~ A company statement that demonstrates compliance with Buy America.

~~5.2.58.2.5~~ The name of the material and/or material code reference in the CoC. This material name shall be a clear, common name of the material that is comparable to the AWP Material Name. Part Numbers etc. may also be on the document if the company wishes.

~~5.2.68.2.6~~ Signature of the Company Official and date.

~~5.38.3~~ The document must be notarized.

~~8.4~~ A sample of this CoC document is provided in Attachment ~~23~~.

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

MP 106.00.02 Steward – Lab Support Section  
RLS:B  
ATTACHMENTS

ATTACHMENT 1 - SAMPLE HL-468 FORM

<For Committee, No Changes to this Form>

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

Attachment 2: Sample APL Response Language

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**1. NO APL RESPONSE:**

The West Virginia Division of Highways (WVDOH) has evaluated your submittal of <Product Name>, <Product Material> as per Materials Procedure MP 106.00.02. The WVDOH does not currently have a specification which applies to your product and therefore cannot approve this product on an “Approved Product List.

We do feel that the product may be beneficial for use on WVDOH projects. The inclusion of the material into project designs does not rest with this Division, but we have no objections to it being specified by WVDOH Designers or requested to be used by Contractors. If a contractor would propose to use it on a WVDOH project, or if the product is specified in WVDOH Contract Documents, this product may be used, pending evaluation.

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**2. NON-APPROVAL RESPONSE**

This material was submitted to the West Virginia Division of Highways (WVDOH) for consideration in accordance with Materials Procedure 106.00.02.

This letter is to notify you that the WVDOH has elected to not approve this product currently. As per Section <XXX> of the Standard Specifications Roads and Bridges, “<Description of Non-Approval Reason.”

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**3. APPROVAL RESPONSE**

West Virginia Division of Highways (WVDOH) Laboratory Approval Numbers 2XXXXXXX has been issued to your company <Name of Company >, for the above-mentioned product. The approval number, effective Date 15, 20XX, must appear on all shipping documentation for said product supplied to the West Virginia Department of Transportation (WVDOT), Division of Highways projects.

ATTACHMENT 23: SAMPLE COMPLIANCE FORM  
**Certification of Buy America, Build America Compliance  
For Source Approval**

Acme Manufacturing Company  
123 Main Street  
Charleston, WV  
25302

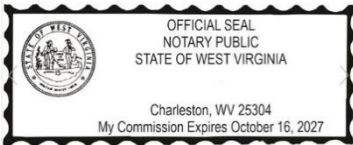
**HL 468 Submission Date:** 10/31/2022

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

**This Certification of Compliance is for the material listed below:**

- 526.003.004 - Widget, Part Qi
- 596.003.004 - Widget, Part Hr

\_\_\_\_\_  
Jonathan Doe, Quality Assurance Manager



WVDOH Use Only

Reviewed by:                      Reviewed Date:                      Status:

\_\_\_\_\_

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

MATERIALS PROCEDURES

QUALITY ASSURANCE PROCEDURES FOR PORTLAND CEMENT CONCRETE

Commented [BDA1]: Need reference to flow chart

1. PLANT AND EQUIPMENT INSPECTION STICKERS

- 1.1 Physical plants and equipment, which prepare materials for, or deliver materials to, State projects shall be regularly inspected and approved by an authorized representative of the Division. The process for this inspection is shown in the Plant Inspection Flow Chart in Attachment 1.
- 1.2 The inspections and approval shall be documented on the MC-4 Form (sample show in Attachment 2 and live form available on the MCS&T webpage) and confirmed by an inspection sticker supplied by the Materials Control, Soils & Testing Division (MCS&T). The inspection sticker will indicate the following:
  1. Name of inspector
  2. Plant or portion thereof, or singular piece of equipment inspected.
  3. Date of inspection
  4. Date of expiration of approval
  5. Lab Number
- 1.3 Inspections may be made at any time at the option of the Division, and the status of the inspected facility shall be determined by the latest inspection. The date of expiration of approval, as noted on latest inspection sticker, shall be the last day on which the facility is considered to be approved by Division, and such facility must have an approved status at time of preparing materials for or delivering materials to State projects.
- 1.4 The sole purpose of the inspection sticker is to inform all concerned that a plant, or portion thereof, or a singular piece of equipment has been inspected and found to meet, substantially, all requirements of the specifications and is, therefore, approved to supply materials to State projects. Said inspection sticker shall therefore be affixed to the equipment or displayed in other manners so that the purpose as above stated will be fulfilled.
- 1.5 The stickers shall be applied, insofar as practicable, and each District shall maintain records of these inspections in ProjectWise. The records shall include all the items listed in 1.2.
- 1.6 A plant or portion thereof, or a singular piece of equipment, shall be approved for a period not to exceed six (6) months. The period of approval shall be determined, in general, by the age, physical condition, or durability of the plant or equipment, and the inspection interval shall be such that the Division will have reasonable assurance that the plant or equipment is maintained in an acceptable manner.

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

~~1.6.1~~ 1.6.2 After each time a plant has been inspected, the District shall notify the Director of MCS&T, or their designee. MCS&T will generate a list of approved plants and post these on the [Division Webpage](#)<sup>1</sup>.

1.7 Additional information regarding inspections and a sample of an inspection sticker is contained in Attachment ~~13~~.

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## 2. QUALITY ASSURANCE IN PORTLAND CEMENT CONCRETE

### 2.1 PURPOSE

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

### 2.2 DEFINITION OF TERMS

#### 2.2.1 QUALITY ASSURANCE

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

#### 2.2.2 QUALITY CONTROL

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

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<sup>1</sup> <https://transportation.wv.gov/highways/mcst/pages/default.aspx>



## 2.3 GENERAL DISCUSSION

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

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

- 2.3.1 Portland cement concrete technicians certification is available in the Contractor-Supplier industry to implement a program of Quality Control.
- 2.3.2 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to do Quality Control of portland cement concrete and to have in his service a Certified Portland Cement Concrete Technician is specified in Sub-articles 501.4.2 and 601.4.2 of the Standard Specifications.
- 2.3.3 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to have a field laboratory which is equipped and maintained in specified manner so as to aid in the conduct of a Quality Control Program is specified in Sub-articles 501.5.1 and 601.5.1 of the Standard Specifications.
- 2.3.4 Concrete batch plants and hauling equipment are regularly inspected by the Division, and their approval as conforming to requirements of governing specification is attested to by an inspection sticker (See Section 1 of this MP for details).
- 2.3.5 The requirement to do concrete design, using the particular sources of materials that are to be used in the work, is specified in articles 501.3 and 601.3.1 of the Standard Specifications. This requirement allows commercial concrete suppliers to have laboratory design work done for the various classes of concrete to be supplied, and it guards against the possibility of source materials changing appreciably and affecting the quality of subsequent concrete work.

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

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

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

to the Department. As previously stated the purpose of this procedure is to establish guidelines which will aid Department personnel in implementing, in a prescribed and uniform manner, such a Quality Assurance Program.

## 2.4 DIRECTIVE

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

Those plants which have a high level of Quality Control will be considered to have a Level 1 Quality Control, and those plants which have a lower level of Quality Control will be considered to have a Level 2. All concrete plants will then be rated with one of the following classification numbers A1, A2 or B.

### 2.4.1 LEVEL 1 QUALITY CONTROL

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

- 2.4.1.1 The compressive strength of the concrete produced by the plant shall have a coefficient of variation of 0.15 or less and the average compressive strength shall be equal to or greater than the specified requirement plus 2 1/2 standard deviations.
- 2.4.1.2 The air content of the concrete produced by the plant shall have a coefficient of variation of 0.18 or less, and the average air content shall not differ from the specified optimum value by more than one standard deviation.
- 2.4.1.3 The consistency of the concrete produced by the plant shall have a coefficient of variation of 0.20 or less, and the average consistency shall not differ from the specified optimum value by more than two standard deviations.
- 2.4.1.4 The plant shall maintain an adequate Quality Control Program for aggregate gradation.

### 2.4.2 LEVEL 2 QUALITY CONTROL

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

### 2.4.3 PHYSICAL PLANT-EVALUATION

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

#### 2.4.4 LEVEL OF QUALITY CONTROL - EVALUATION

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

#### 2.4.5 CLASS A1 PLANTS - TEST AND INSPECTION REQUIREMENTS

Concrete from Class A1 concrete plant shall be sampled and tested by certified personnel on a project-by-project basis, at random, with the frequency specified in Table 1 of MP 601.03.50.

Plant inspection and monitoring of batching operations at Class A1 concrete plants shall be performed by District personnel on a random basis during production for Division Projects.

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

#### 2.4.6 CLASS A2 PLANTS - TEST AND INSPECTION REQUIREMENTS

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

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

#### 2.4.7 CLASS B PLANTS

Concrete purchased by a Contractor for use on Division projects shall be supplied from Class A1 or A2 plants. Concrete purchased through competitive bidding with Purchase order contracts shall be supplied from Class A1 or A2 plants. Class B plants are not considered to be eligible to compete with Class A plants in the furnishing of concrete to State projects.

In the event it is not practical to obtain small quantities of concrete for miscellaneous items (See 2.4.8) from a Class A1 or A2 plant and a survey reveals that a Class B plant is conveniently situated with respect to the construction site, then a direct purchase of concrete by the Division from the Class B plant may be accomplished in conformance

with the applicable Division procedures. The direct purchase of concrete from Class B plants shall also be made to conform to the requirements set out in Subsection 2.5 entitled QUALITY ASSURANCE OF DIRECT PURCHASE CONCRETES FROM CLASS B PLANTS. Plant inspection at Class B plants and the sampling, testing and documentation of concrete from Class B plants shall also conform to the requirements set out in Subsection 2.5.

#### 2.4.8 SMALL QUANTITIES FOR MISCELLANEOUS ITEMS

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

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

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

#### 2.5 QUALITY ASSURANCE OF DIRECT PURCHASE CONCRETE FROM CLASS B PLANTS

##### 2.5.1 PURPOSE

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

##### 2.5.2 DEFINITION OF TERMS

- 2.5.2.1 Direct Purchase - Direct purchase is a formal procedure used to purchase materials for government agencies, including the Division of Highways) when it is not practical or economical to use the procedure of competitive bidding. Direct purchase

requisitions will always specify the name of the proposed supplier as well as product name, quantity, specifications, etc.

2.5.3 GENERAL DISCUSSION

When highway work requiring portland cement concrete is being done by Division forces, and it is found to be impractical or uneconomical to obtain concrete from a Class A1 or A2 plant but that it would be practical to obtain it from a Class B plant, then the purchase of concrete from a Class B plant shall be made to conform to the requirements of article 2.5.4.

2.5.4 INSTRUCTION

The purchase of portland cement concrete from a Class B plant will be permitted only after a field condition survey has been conducted and properly documented which indicates that it would be impractical and uneconomical to obtain concrete from a Class A1 or A2 plant, and that a Class B plant does exist from which a direct purchase of concrete could practically and economically be made.

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

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

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

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**3. PLANT APPROVAL STATUS**

3.1 PLANT CERTIFICATION

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

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

3.2 PLANT DE-CERTIFICATION

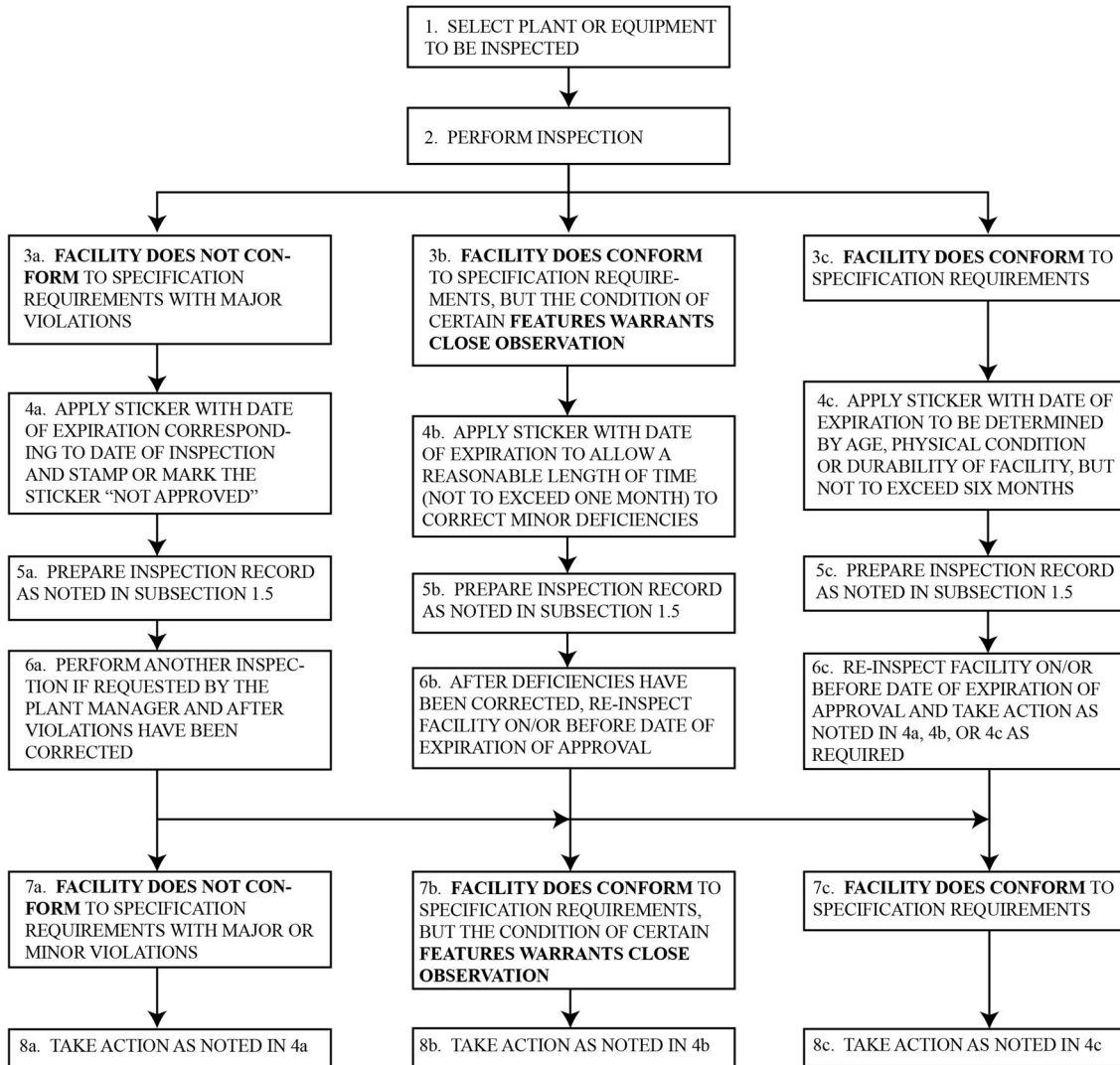
- 3.2.1 When District Personnel determine that a Concrete Plant, which is listed as a Class A1, A2, or B plant on the Division's Approved Source Page, is not complying with the requirements of this MP, the Specifications, or any other applicable Materials Procedure, they shall immediately notify MCS&T Division and provide all applicable documentation and information to MCS&T Division. This information shall include a summary of the reason(s) for the de-certification of the subject Concrete Plant.
- 3.2.2 MCS&T Division shall then immediately notify the subject Concrete Plant and all applicable WVDOH District and Divisions that the subject Concrete Plant is no longer approved to supply concrete for WVDOH projects.
- 3.2.3 If the subject Concrete Plant, which has been de-certified and removed from approved status, desires re-approval, they shall initiate the re-approval process by submitting a plan of corrective action, which addresses all of the reasons for which that Plant was de-certified. This plan of corrective action shall be submitted to the District in which the Concrete Plant is located and to MCS&T Division.

---

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

RLS:M  
Attachment

**Attachment 1: Plant Inspection Flow Chart**



**Attachment 2: MC-4 Plant Inspection Form**

Form MC-4  
 Rev 4/24/23

Page 1

West Virginia Division of Highways  
 Materials Control, Soils and Testing Division  
 Checklist For Inspection of Transit Mix & Central Mix Concrete Plants

Plant Inspected:	Date:	Date Sticker Expires:
Location:	Facility Code:	Sticker No. Assigned:
Plant Officials:		
E-Ticketing Requirements Met: Yes: <input type="checkbox"/> No: <input type="checkbox"/>		

<b>I. Plant Type:</b>	Transit Mix: <input type="checkbox"/>	Central Mix: <input type="checkbox"/>	Combination: <input type="checkbox"/>
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<b>II. Aggregates:</b>			
Are the Stockpiles Segregated:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Any Foreign Matter in the Stockpiles: Yes <input type="checkbox"/> No <input type="checkbox"/>
Stockpiles Properly Separated:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Type of Base:
Method of Handling Aggregates:			
Does Concrete Plant Stockpile Non-specification Materials:			Yes <input type="checkbox"/> No <input type="checkbox"/>
If Yes, Are These Materials Properly Segregated From Specification Materials:			Yes <input type="checkbox"/> No <input type="checkbox"/>
Source of Supply of Fine Aggregate:			
Source of Supply of Coarse Aggregate:			
Are all materials ordered to comply with West Virginia Division of Highways Specifications:			Yes <input type="checkbox"/> No <input type="checkbox"/>

<b>III. Scales:</b>			
Cement:			
Dial <input type="checkbox"/>	Capacity:	Increments:	
Load Cell <input type="checkbox"/>	Capacity:	Increments:	
Do Scales Comply With Specifications:			Yes <input type="checkbox"/> No <input type="checkbox"/>
Aggregates:			
Dial <input type="checkbox"/>	Capacity:	Increments:	
Load Cell <input type="checkbox"/>	Capacity:	Increments:	
Do Scales Comply With Specifications:			Yes <input type="checkbox"/> No <input type="checkbox"/>
Separate Scales for Cement and Aggregates:			Yes <input type="checkbox"/> No <input type="checkbox"/>
Overall Condition of Scales:			
Date Sealed By Dept. of Weights & Measures:	Cement:	Aggregate:	

<b>IV. Bins and Hoppers:</b>			
Number of Bin Compartments for Fine Aggregate:		Number of Bin Compartments for Coarse Aggregate:	
Maximum Size Batch:	Is the Cement Hopper Equipped with a Vibrator:		Yes <input type="checkbox"/> No <input type="checkbox"/>
Is the Aggregate Hopper Equipped with a Vibrator:		Yes <input type="checkbox"/> No <input type="checkbox"/>	
Operation of the Hoppers Satisfactory:	Yes <input type="checkbox"/> No <input type="checkbox"/>	If "No", Why?	
Type of Cement Bin:	Number of Bins:	Capacity of Each Bin:	

<b>V. Water:</b>			
Type of Water Measuring Device:	Scales <input type="checkbox"/>	Meter <input type="checkbox"/>	Truck Mixer Tanks <input type="checkbox"/>
Automatic <input type="checkbox"/>	Manual <input type="checkbox"/>	Does Device Meet Specifications:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Date Sealed by Dept. of Weights & Measures:	Scales:	Meter:	



<b>VI. Admixtures:</b>			
Brands Used:			
Air Entrainment:	Automatic Dispenser:	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Retarder:	Automatic Dispenser:	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Other Admixtures (Name & Type):	Automatic Dispenser:	Yes <input type="checkbox"/>	No <input type="checkbox"/>

<b>VII. Central Mixer:</b>			
Condition of Drum:	Condition of Blades:		
Does Automatic Timing Device Meets Specifications:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Remarks:			

<b>VIII. Truck Mixers:</b>			
Trucks Equipped with Electronic Counters:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Number of Trucks Added to Fleet Since Last Inspection:
Number of Trucks Deleted From Fleet Since Last Inspection:			
Truck Mixers Now Failing to Meet Specifications:			
TRUCK NUMBER	REASON FOR FAILURE		


<b>IX. Testing of Materials:</b>			
Tests of Aggregates Performed at Plant by:	Qualified:	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Does Testing Equipment Comply with Specifications:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
If "No", What Equipment Fails:			
Approved Test Weights Available in the Plant:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Date Last Checked:

<b>X. General Condition of Plant:</b>

<b>XI. Any Further Remarks:</b>

<b>XII. Rating Assigned:</b>	A <input type="checkbox"/>	B <input type="checkbox"/>	Plant Inspected By:
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**Attachment 3:** Sample Plant Inspection Sticker

<b>West Virginia Division of Highways</b>	
<b>CHECKED &amp; ACCEPTED</b>	
<b>INSPECTOR:</b> _____	
<b>DATE:</b> _____	
<b>LAB NUMBER:</b> _____	
<b>DISTRICT:</b> _____	
<b>DATE OF EXPIRATION</b>	
MONTH/DAY/YEAR _____ / _____ / _____	
<b>PLANT / TRUCK</b>	

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

**COMMERCIAL AND POTENTIAL SKID RESISTANT AGGREGATE SOURCE APPROVAL PROCEDURES**

**Commented [MMA1]:** See comment below

**Commented [BDA2]:** DB, MM, where is the quarterly sampling requirement?

**1. PURPOSE**

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

**Commented [MMA3]:** Is this just for the Commercial Source APL? Aren't A-1 Sources (Maintenance Contracts) covered by MP 700.00.52? We should clarify this.

**2. SCOPE**

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

**3. APPLICABLE DOCUMENTS**

- 3.1 West Virginia Division of Highways ~~Standard~~ Specifications, Roads and Bridges, ~~both Current Edition & Supplementary~~.
- 3.2 West Virginia Division of Highways Construction Manual, ~~Current Edition~~.
- 3.3 West Virginia Division of Highways Materials Procedures.

**4. CONSIDERATION FOR THE LIST OF COMMERCIAL AGGREGATE SOURCES**

- 4.1 If an entity wants to be placed on the commercial source list and has had no previous dealings with WVDOH, they shall submit a ~~Letter of Intent (LOI)~~ HL-468 New Products Evaluation form to Materials Control, Soils and Testing Division (MCS&T) describing what they intend on selling, what production process is used, what type of projects they intend on supplying, and when they intend on starting production. The ~~LOI submission~~, upon review by MCS&T, will be forwarded to the nearest adjacent WVDOH District Materials Supervisor for notification purposes.
- 4.2 ~~Test data~~ Data from a ~~minimum~~ total of 20 samples shall be ~~evaluated~~ considered for addition of the new Producer/Supplier to the WVDOH List of Approved Aggregate Sources. Historic data concerning aggregate quality test results signifying compliance with WVDOH specifications shall be available for review. Any data accepted by MCS&T concerning th

**Commented [MMA4]:** Should this be the District Materials Supervisor in the District in which the source is located?

**Commented [MMA5]:** Commercial and Potential Skid Resistant ?

**Commented [MMA6]:** Possibly re-word as: "may be used in this evaluation if it is available"

e quality of the material shall be obtained from an AASHTO re:source accredited laboratory.

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

**Commented [MMA7]:** Do we need to define "quality testing"? (i.e. Soundness, LA Abrasion, Deleterious, etc.)

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

**Commented [MMA8]:** I think that we should discuss this. Is "all" data included or just data from an AASHTO re:source accredited lab? Also, is this an "evaluation" process or an "approval" process?

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

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

4.2.4.2.5 The new Producer/Supplier shall demonstrate that they are capable of producing an E-Ticket as defined in Section 109.20.1 of the Specifications. A sample ticket shall be provided to MCS&T and shall be included on the HL-468 New Products Evaluation form at the time of initial submittal.

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

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

## 5. MAINTENANCE OF THE LIST OF COMMERCIAL AGGREGATE SOURCES

**Commented [BDA9]:** DB, MM, where is the quarterly sampling requirement? How many samples tested per year to remain on the list?

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

**Commented [BDA10]:** Add e-ticketing here.

5.1.1 The Pproducer/Ssupplier shall maintain a consistent and satisfactory compliance-of-the quality of the aggregates according to Sections 702, 703, and 704 of the WVDOH Specifications of Roads and Bridges, Sections 702, 703 and 704 by and shall permitting random, intermittent quality sampling of the aggregate source by MCS&T. This testing will determines if the approved products continually exhibit the same characteristics and quality as the originally approved material. (see MP 700.00.55; Guidelines For Establishing And Maintaining Approved Lists Of Materials And Sources, section-Section 6)

**Commented [MMA11]:** Is this where we want to specify a frequency (i.e. quarterly, annually, etc.)?

**Commented [MMA12]:** Should this be MP 106.00.03 instead?

5.2 If the ~~P~~producer/~~S~~upplier has not provided any ~~material~~products to any WVDOH projects over a period of 5 consecutive years from the same source, that source will be removed from the WVDOH List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources. ~~In the event of If~~ an inactive ~~Producer/Supplier~~source re-establishing production and ~~desires the producer/supplier wishes to~~ regain ~~Division approval~~acceptance, ~~they shall refer to s~~Section 4 of this MP ~~shall apply for~~ reconsideration.

## 6. REMOVAL FROM LIST OF COMMERCIAL AGGREGATE SOURCES

6.1 In the event the ~~P~~producer/~~S~~upplier does not provide materials in compliance with the ~~governing~~sSpecifications, the following actions shall be taken by the ~~P~~producer/~~S~~upplier; and ~~subsequently~~ by MCS&T, up to and including removal from the List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources:

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

Commented [MMA13]: Need to define "quality" tests. See Section 4.2.2.

6.1.2 ~~When If the "split" sample in Section 6.1.1 a material, upon reexamination,~~ fails to meet WVDOH Specifications, ~~MCS&T shall notify the P~~producer/~~S~~upplier ~~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, f~~ollow the same ~~procedure to test~~ ~~in for~~ Section 6.1.1 ~~for the second~~ ~~samples obtained in Section 6.1.2~~. If the second sample does not meet quality ~~requirements~~sSpecifications, at the discretion of MCS&T personnel, a third sample may be obtained from the ~~P~~producer/~~S~~upplier by MSC&T and tested for quality.

6.1.4 ~~For the third Field sample, f~~ollow the same protocol ~~in for~~ Section 6.1.1 ~~for the third sample~~ ~~obtained in Section 6.1.3~~. If the third sample does not meet quality ~~requirements, specifications~~ the following course of action shall be taken:

6.2 Communication of sample information shall be implemented as follows:

6.2.1 The ~~P~~producer/~~S~~upplier shall be notified of ~~what aspect(s) of the samples did not meet~~ ~~Specification requirements~~the deficiency, either in writing or via electronic communication (i.e. email).

6.2.2 The 10 District Material Supervisors, the Regional Construction Engineers, ~~the~~ Director of Contract Administration, and the Director of MCS&T shall be notified of ~~what aspect(s) of the samples did not meet Specification requirements~~ the deficiency via electronic communication (~~i.e. i.e.~~ email).

6.3 The ~~P~~producer/~~S~~upplier of the ~~material in question~~substandard ~~product~~ is then responsible for mitigating the ~~deficiency~~in ~~quality~~ and improving the production quality to comply with the ~~corresponding governing~~sSpecifications. Mitigation of substandard materials is not the responsibility of MCS&T; only the

verification of the quality of material provided by the ~~P~~producer/~~S~~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) ~~6.4.1~~ If the ~~P~~producer/~~S~~supplier was previously included on the List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources, a series of three (3) ~~consecutive~~ samples shall be obtained, either by a WVDOH District technician or if necessary, by a representative of MCS&T. Each ~~of these new~~ samples shall be obtained every six (6) days of production to test the quality of the new material. If there is no constant flow of production, then ~~the~~ samples shall be obtained from each stockpile produced (minimum stockpile ~~size~~ of approximately 2000 tons).

a) ~~6.4.2~~ After three samples have been tested for full quality, and ~~if they~~ 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 ~~determined by up to the discretion of~~ MCS&T.

c) ~~6.4.3~~ If the ~~most recent~~ samples ~~in Section 6.4.1 and 6.4.2 all meet the Specification requirements comply with the corresponding specifications concerning the material,~~ the ~~P~~producer/~~S~~supplier shall be notified of ~~compliance, conformance~~ and ~~they~~ shall be included on the List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources for the next fiscal quarter.

e) ~~6.4.4~~ If the material ~~continues to fail~~ to meet the ~~corresponding~~ specifications requirements, further action shall be taken, up to and including removal of the ~~P~~producer/~~S~~supplier from the List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources.

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 ~~P~~producer/~~S~~supplier will ~~th~~ be removed from the List of Commercial ~~and Potential Skid Resistant~~ Aggregate Sources until the resampling can be completed.

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

## 7. DOCUMENTATION

7.1 All samples obtained by MCS&T shall be assigned a corresponding laboratory reference number for record keeping, ensuring proper access by MCS&T personnel to pertinent information regarding the materials provided by the ~~p~~Producers/~~s~~Suppliers.

**Commented [MMA14]:** District in which the Producer/Supplier is located?

**Commented [MMA15]:** At what point did we remove them from the list? Did we want to remove them in Section 6.2 or 6.3 until they have shown us that they have mitigated the problem, or do we want to say "shall remain on the ..."?

**Commented [MMA16]:** Does this only apply when a Producer/Supplier is removed (Sections 6.4.4 and 6.5) or any time that mitigation is required (Section 6.3)?

7.2 In the event of ~~recurring failure to meet repeat non-conformance of~~ WVDOH ~~s~~Specifications, the following procedure shall be implemented:

~~7.2.1~~ A record of communication between the Division and the ~~P~~roducer/~~S~~upplier's contact shall be retained for future reference.

~~a)~~  
b)a) ~~7.2.2~~ The sample (or samples) failing to meet ~~quality s~~Specifications ~~requirements~~ shall be packaged and stored for later access by MCS&T personnel for future reference. The sample containers shall display the lab reference number, ~~the date on which~~ the tests were conducted, ~~the~~ type of material tested, and data revealing what ~~s~~Specifications ~~requirements~~ were ~~not met/out of compliance~~.

---

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

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

MATERIALS PROCEDURE

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METHOD OF TEST FOR DETERMINING MORTAR STRENGTH

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**1. PURPOSE**

- 1.1 To provide a method of testing to determine the effects of organic impurities in fine aggregate on mortar strength.
- 

**2. SCOPE**

- 2.1 This procedure is applicable to fine aggregate to be used in concrete that has been tested and deemed darker than the standard in accordance ~~to~~ with the guidelines established in AASHTO T21 and Section 702.1.4 of the West Virginia **Standard** Specifications.
- 

**3. APPLICABLE PROCEDURES**

- 3.1 AASHTO T21  
3.2 AASHTO T84  
3.3 ASTM C109  
3.4 ASTM C230  
3.5 ASTM C305  
3.6 ASTM C511  
3.7 ASTM C778  
3.7.3.8 **ASTM C1437**
- 

**4. APPARATUS**

- 4.1 Nonabsorbent pan of sufficient size to hold and manipulate the sample.  
4.2 Drying device with variable temperature control capable of producing a flowing stream of warm air.  
4.3 **Cone Mold** and **tamping rod tamper** conforming to the requirements of Section 6.2.1 of AASHTO T84.  
4.4 Balance having a capacity 5000 grams and sensitive to the nearest 0.1 gram.  
4.5 A variable speed planetary and revolving motion mixer with paddle blades conforming to the requirements of ASTM C305.



- 4.6 Flow ~~T~~table, conical mold, and calipers conforming to the requirements of ASTM C230.
- 4.7 Specimen molds and tamper conforming to requirements ASTM C109.
- 4.8 Moisture cabinet conforming to the requirements of C511.
- 4.9 Compression apparatus capable of at least a 20,000-pound load.
- 4.10 Nonabsorbent containers for holding excess fine aggregate and cement.
- 4.11 Distilled water.

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## 5. PROCEDURE

- 5.1 Approximately 5000 grams is obtained from field sample.
- 5.2 Dry field sample to SSD condition as described in Section 7 of AASHTO T 84, remove and weigh out a portion to be used in the test. This is an estimate of the amount needed to bring the mix to the right consistency. Weigh out additional sandfine aggregate to be added if needed. Place each in an airtight container. Cover remaining sample with a damp cloth.
- 5.3 Pre-measure ~~360~~ 180 ml of distilled water into a total drain (TD) beaker. Add the ~~360~~ 180 ml of distilled water into the mixing bowl and let beaker drain for 30 seconds.
- 5.4 Add ~~600~~ 300 grams of Type ~~III~~ II cement to water in the mixing bowl. Start the mixer and mix at slow speed (140 +/- ~~105~~ r/min) for 30 seconds.
- 5.5 Slowly add ~~the~~ a measured quantity of fine aggregate over the next 30 seconds while continuing mixing at slow speed to provide proper consistency.
- 5.6 Switch the mixer to medium speed (285 +/- 10 r/min) and mix for 30 seconds.
- 5.7 Stop the mixer and let it stand for 90 seconds. During the first 15 seconds quickly scrape the material collected to the side of the bowl into the batch. Cover the bowl.
- 5.8 Remove the cover and mix for 60 seconds at medium speed. If the mix appears too wet, ~~add~~ additional fine aggregate may be added during after the first 30 seconds of this mixing period. To do so, stop the mixer briefly, add the fine aggregate, and then complete the additional 30 seconds of mixing. At the end of 60 seconds stop the mixer and remove bowl.
- 5.9 Perform the flow test on the mixture in accordance with ASTM C~~109~~1437 with the exception that the table will be dropped ~~10~~ 25 times to achieve desired flow of ~~100~~ 110 +/- 5 ~~mm~~ percent.
- 5.10 If the flow is less than the target tolerance, the sample will be discarded and the test started over.

- 5.11 If the flow is greater than the desired target, place the sample back into the bowl and place the bowl in the mixer, add additional sand fine aggregate as needed, then remix for 30 seconds.
- 5.12 Check flow as described in Section 5.9. If the flow is within the target tolerance a set of compressive strength cubes will be made in accordance with ASTM C109. If more than two trials must be made to obtain a flow of  $110 \pm 5$  percent, consider the mortar as a trial mortar, and prepare test specimens from a new batch. The cubes will be tested for compressive strength at three seven days.
- 5.13 A control sample will be prepared of Ottawa sand that meets ASTM C778. Compressive strength cubes will be made in accordance with ASTM C109 with the exception that the sand will not be taken to SSD condition. The preparation of the control sample will follow the procedures as outlined in Sections 5.3 through 5.12. A ~~N~~new control sample shall be performed prepared for test sample with each shipment of cement.

---

## 6. CALCULATION

- 6.1 The average of the compressive strength breaks of the control samples will be divided into the average of the breaks of the fine aggregate being tested.

$$(\bar{X}_t / \bar{X}_c) = \text{relative compressive strength of test sample.}$$

where:  $\bar{X}_c$  = average test results of control sample.

$\bar{X}_t$  = average test results of test sample.

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## 7. REPORTING

- 7.1 The results will be reported out to the nearest 0.1 percent.

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

MATERIALS PROCEDURE

---

QUALITY ASSURANCE OF REINFORCED CONCRETE CULVERT,  
STORM DRAIN, AND SEWER PIPE

---

**1. PURPOSE**

- 1.1 To set forth the procedures which govern the Quality Assurance of Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - 1.2 To set forth manufacturers Quality Control requirements.
  - 1.3 To set forth acceptance inspection procedures.
  - 1.4 To set forth documentation and shipping procedures.
- 

**2. SCOPE**

- 2.1 This procedure will apply to all manufacturers of Reinforced Concrete Culvert, storm pipe, and sewer pipe for use in West Virginia projects.
  - 2.2 This procedure will establish the basis for acceptance of reinforced concrete pipe.
- 

**3. APPLICABLE SPECIFICATIONS**

- 3.1 All standard types of reinforced concrete pipe are to be manufactured and tested in accordance with Section 714.2 of the WVDOH Specifications for Roads and Bridges.
- 3.2 Each LOT of reinforced concrete pipe having a wall thickness of 4.5 inches or less, which is manufactured in accordance with the applicable specifications is treated in the following manner to determine acceptability.
  - 3.2.1 The three-edge bearing test (AASHTO T 280) shall be used to determine the force required to produce the 0.01-inch crack and the minimum specified ultimate load.
    - 3.2.1.1 50% of the LOTs of Class III and Class IV concrete pipe 24 inches in diameter and less, and conforming to WVDOT Specifications, will be accepted based on the Fabricator's certification, provided they are QCast Certified by the American Concrete Pipe Association (ACPA). Testing of Class III and Class IV concrete pipe greater than 24 inches in diameter shall be witnessed by the Division.
    - 3.2.1.2 50% of the LOTs of Class V Concrete Pipe with a diameter less than 24 inches, and conforming to WVDOT Specifications, will be accepted based on the Fabricator's certification, provided they are QCast Certified by the ACPA. Testing of Class V Concrete Pipe, with a diameter greater than or equal to 24 inches, shall be witnessed by the Division.

- 3.2.2 The absorption test (AASHTO T 280) shall be conducted on samples selected from the wall of the pipe.
- 3.2.3 A plant inspection of the finished product is conducted to determine dimensional conformance and freedom from defects.
  - 3.2.3.1 For LOTs of concrete pipe accepted on the Fabricator's certification, the inspection, including the three-edge-bearing test, will be performed and recorded by the Fabricator's Quality Control person. These LOTs shall be as defined in Table 1, but the sizes shall be based on the criteria in the QCast Certification program.
- 3.3 Each LOT of reinforced concrete pipe fabricated with dry cast concrete having a wall thickness greater than 4.5 inches, which is manufactured in accordance with the applicable specifications, is treated in the following manner to determine acceptability.
  - 3.3.1 The compressive strength of the concrete will be determined by testing cores taken from the wall of the pipe. The manufacturer may choose to test this pipe as specified in Section 3.2.1, in which event the requirements for the 0.01-inch crack and the minimum specified ultimate load shall be met. This choice shall not be applied to a LOT (refer to Table 1) of pipe, which has been previously cored and found unacceptable.
  - 3.3.2 The absorption test (AASHTO T 280) shall be conducted on samples selected from the wall of the pipe.
  - 3.3.3 A plant inspection of the finished product will be conducted by the Division to determine dimensional conformance, and freedom from defects.
- 3.4 Each LOT of reinforced concrete pipe fabricated with wet cast concrete can be accepted on the basis of compressive strength from cylinder breaks (cylinders made per AASHTO R 100 and tested per AASHTO T 22) reaching the required 28-day compressive strength or by the three-edge bearing test (AASHTO T 280) as detailed in Section 3.2.1.
  - 3.4.1 The absorption test (AASHTO T 280) for wet cast pipe shall be conducted on samples cored from the wall of the pipe or by making cylinders (4-inch x 8-inch minimum in accordance with AASHTO R 100).
- 3.5 Flared end sections will be accepted by either the inspection method or Fabricator certification method, with the same size criteria as outlined in Section 3.2.
  - 3.5.1 Acceptance by the inspection method of precast concrete flared end sections is to be based on verification of compressive strength of concrete as determined from cylinders or cores. Flared end sections must also meet the dimensional requirements listed on the standard detail and on appearance. The testing frequency for compressive strength cores and steel verification coring is 1 out of every 40 pieces, but cylinders shall be fabricated and tested for each piece, if cylinders are used for strength acceptance instead of cores.
  - 3.5.2 In order to accept flared end sections by the Fabricator certification method, the Fabricator must be QCast Certified by the ACPA. The fabricator will take photos/videos showing correct steel placement and cover for one piece in each LOT. All flared end sections must be fabricated within the dimensions listed on the standard detail and have an acceptable finish free of bug holes, spalls, cracks and other surface defects.

TABLE 1

SAMPLING AND TESTING FREQUENCY FOR REINFORCED CONCRETE PIPE

---

A production "LOT" is defined as follows:

It is a pipe of the same size and class that is manufactured using the same process and similar materials during ~~continuous-consecutive~~ days of production, excluding weekends and holidays. –The production LOT shall not exceed the specified value of 1% of the LOT and the minimum number tested per LOT is as follows:

Number of Pipe Sections in the LOT	Number of Pipe Sections to be Tested
0 to 300	1
301 to 800	2
801 to 1500	3
over 1500	3 plus 1 section per each 600 pieces or fraction thereof over 1500 pc.

When the tests indicate that a production LOT is acceptable for WVDOH use, the LOT should be inspected by the Division's representative.

---

**4. QUALITY CONTROL REQUIREMENTS**

- 4.1 Quality Control is the responsibility of the manufacturer and shall include the following:
  - 4.1.1 Ensure all component materials used in the fabrication of the pipe have been sampled, tested, and approved (MP 603.02.10).
  - 4.1.2 Ensure quality workmanship as well as a quality product throughout the production.
  - 4.1.3 To scribe into each piece of pipe the following:
    - (a) Cast Date
    - (b) Class and Wall Type
    - (c) Manufacturer's Trademark
  - 4.1.4 Notify the Division's representative upon the completion of casting of a LOT (Refer to Table 1) of pipe so the Division may select a representative sample and witness the testing.
  - 4.1.5 To conduct the three-edge bearing test or to secure cores to ensure strength requirements are met (Section 3.2 and 3.3).
  - 4.1.6 To conduct the absorption test (AASHTO T 280) on samples selected from the wall of the pipe.

- 4.1.7 Any LOT of pipe or portion of a LOT of pipe failing to meet the specification requirements will be stored separately from acceptable pipe.
- 4.1.8 Accurate inventory records containing the information required in Section 6.1.2 will be kept and maintained by the manufacturer.

---

**5. ACCEPTANCE CRITERIA**

The Division will:

- 5.1 Sample and test the component materials to be used in the manufacturer of the reinforced concrete pipe in accordance with MP 603.02.10.
- 5.2 Select representative samples of the LOT to be tested and:
- (a) Witness the three-edge bearing test and/or the coring procedure
  - (b) Verify dimensional conformance
  - (c) Verify actual steel placement
  - (d) Determine the steel area
- 5.3 Ensure each piece comprising the LOT is scribed as stated in 4.1.3.
- 5.4 Make a visual inspection of the LOT and designate unacceptable units to be removed or set apart from the approved pipe in the LOT.

---

**6. SHIPPING REQUIREMENTS**

- 6.1 The approved LOT of pipe or portion of the LOT can be shipped by the manufacturer providing the following provisions have been met:
- 6.1.1 The manufacturer will notify the Division's representative prior to each shipment so that the Division may maintain a current inventory with the manufacturing plant.
- 6.1.2 The manufacturer will supply one copy of the shipping invoice to Materials Control, Soils and Testing Division and one copy to the Division's representative at the project site. The invoice shall contain the following information.
- (a) Cast date of the approved LOT
  - (b) Master laboratory reference number
  - (c) Size, class, and wall type
  - (d) Project number
  - (e) Number of pieces

---

**7. ACCEPTANCE PRACTICE**

- 7.1 Ensure the information on the shipping invoice, as required in Section 6.1.2, agrees with the shipment it accompanies. (Number of pieces, class, size, and type, etc.).
- 7.2 Check each piece of pipe for the proper identification markings (Section 5.3) and make a visual inspection of each piece to ensure there is no evidence of damage during shipment.

---

**8. COVERAGE REQUEST FROM PROJECT SITE**

- 8.1 Request for coverage shall include the information as referenced on the shipping invoice, Section 6.1.2

---

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Director  
Materials Control, Soils and Testing Division

MP 714.03.30 Steward – Cement and Concrete Section  
RLS:Mg

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

MATERIALS PROCEDURE

---

METHOD FOR ACCEPTANCE OF COMPACTION TESTING

---

**1. PURPOSE**

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

**2. SCOPE**

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

**3. TESTING**

- 3.1 The minimum frequency for acceptance testing shall be 10% of the contractor's individual tests. Five tests shall be performed in a lot for acceptance testing.
- 3.2 Acceptance testing shall be distributed throughout the placement of material.
- 3.3 The material should be categorized according to the base, subgrade, pipe backfill, embankment, etc.
- 

**4. EVALUATION**

- 4.1 Calculations shall be rounded to the following significant digits according to ~~AASHTO Method R-11~~ ASTM Method E29.

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

- 4.2 Determine the number of lots tested by the contractor for a particular material since the last monitoring including the lot just tested. Record the percent relative densities on the attached form.
- 4.3 Calculate the standard deviation (S) for the percent relative densities.
- 4.4 Calculate the range (R) for plus and minus 1.65 standard deviations (S) from the average (X) for the contractor's tests ( $R = X \pm 1.65 S$ ).
- 4.5 Compare the acceptance tests to the calculated range.
- 4.5.1 If all the acceptance tests are within the range, the testing is similar. When the testing is similar, the degree of compaction for the lots of material represented by the acceptance evaluation ~~may~~ can be accepted.



- 4.5.2 If any of the 5 acceptance tests are outside the range, calculate 3 standard deviations for the contractor's tests ( $R = \bar{X} \pm 3 S$ ).
- 4.5.3 If all acceptance tests are within the range, the testing is considered similar, however, the quality control practices by the contractor should be reviewed for possible problems.
- 4.5.4 Any test outside the standard 3 deviation range indicates that there may be ~~are probably~~ problems with the quality control system and no additional material ~~shall~~should be placed until the problem is resolved. The investigation would include checking such areas as equipment, test procedures, location of tests, variability of materials, compaction techniques, etc. The results of the investigation shall be documented in the project files.

---

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Director

MP 700.00.50 Steward – Asphalt Section  
RLS:J  
ATTACHMENT

Materials Control, Soils and Testing Division

PROJECT NUMBER: \_\_\_\_\_

ITEM NUMBER (S): \_\_\_\_\_

TYPE OF MATERIAL: \_\_\_\_\_

DATE: \_\_\_\_\_

QUALITY CONTROL  
TESTS

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

EVALUATED BY: \_\_\_\_\_

CHECKED BY: \_\_\_\_\_

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

MATERIALS PROCEDURE

---

STANDARD METHOD OF MICROSCOPIC  
DETERMINATION OF AIR-VOID CONTENT

---

**1. PURPOSE**

- 1.1 To obtain quantitative information concerning air voids, matrix, fine aggregate, and coarse aggregate in hardened concrete.
- 

**2. SCOPE**

- 2.1 By using the linear traverse method of point counts, ~~we can determine~~ the relative composition of hardened concrete cylinders or cores on a percentage basis can be determined.
- 

**3. EQUIPMENT**

- 3.1 A large stone saw.
- 3.2 A lapidary grinding apparatus.
- 3.3 A linear traveler apparatus.
- 3.4 A reflecting illumination system.
- 3.5 A binocular microscope with a cross hair type reticle. (Magnification preferably in the 10x, 30x, and 60x range).
- 3.6 Miscellaneous: Silicon carbide grinding material, grit numbers 120, 240, 400 and 600, a set of 4 mechanical specimen counters, or a wet polishing device with similar grit values ranging from 120 to 600, a 305 mm ruler, and a magic-permanent marker.
- 

**4. PROCEDURE FOR PREPARATION OF CONCRETE SPECIMENS**

- 4.1 The concrete specimens ~~should~~ be cut on the large stone saw so as to bisect the cylinder along its longitudinal dimension. Care ~~should~~ be taken in avoiding, if ~~possible~~ possible, the steel reinforcing bars encountered in bridge deck cores.
- 4.2 Select the better half of the specimen and make a cut perpendicular to its long axis, 102 mm below the top surface of bridge deck core specimens. If the specimen is a concrete cylinder a 102 mm section from the middle of the cylinder is cut and used for point counting. These operations are done so that the linear traveler specimen holder can accommodate the specimen.
- 4.3 All portions of the specimen are retained for possible later inspection.

- 4.4 That portion of the specimen prepared in Section 4.2 is now polished, first using silicon carbide grit number 120, in order to obtain a uniform surface, and subsequent polishing by silicon carbide grit numbers 240, 400 and 600 to obtain a smooth, highly polished surface.

---

**5. OPERATIONAL PROCEDURES USING THE LINEAR TRAVELER**

- 5.1 The polished specimen is placed on the specimen holder of the linear traveler.
- 5.2 After the specimen is centered on the specimen holder, the specimen ~~shall~~ be leveled, so as to minimize refocusing.
- 5.3 A right vertical margin and a left vertical margin ~~shall~~ be drawn on the polished surface of the specimen. The placement of each margin is dependent upon the horizontal limits of the linear traveler and the irregularity of the boundaries of the specimen. If an irregularity exists, the corresponding margin is placed along the inner edge of the irregularity.
- 5.4 A light source ~~shall~~ be directed onto the specimen surface for illumination of the visual field.
- 5.5 The ~~bioocular~~binocular microscope assembly ~~should~~-shall be positioned so that the technician can observe the entire distance between margins as the linear traveler moves horizontally.
- 5.6 Horizontal movement of the linear traveler is accomplished by pushing the horizontal motion control switch on a manual linear traveler. The direction of horizontal motion is controlled by the directional selector lever located to the left of the specimen holder and in front of the motor housing. Automated travelers will transition after the previous point is recorded.
- 5.7 Vertical movement of a manual ~~the~~ linear traveler is accomplished by manually cranking the lower ~~left-hand~~left-hand wheel located directly beneath the specimen holder. For automated travelers, the vertical movement will be executed once the horizontal traveler is returned to the home position.
- 5.8 By using the controls of the linear traveler, position the specimen while viewing through the microscope at 10x, 30x or 60x magnification, so that the vertical cross hair is ~~in~~ line with one of the vertical margins and the horizontal cross hair is approximately 3.2 mm below the specimen, or 3.2 mm below the deepest penetration of an irregular edge.
- 5.9 Readjust the light source so as to obtain an adequate field illumination.
- 5.10 Adjust the directional selector lever so that the technician views that portion of the specimen between the margins as the linear traveler moves horizontally.
- 5.11 Focus the microscope on the specimen surface (periodic refocusing may be necessary).
- 5.12 Push the horizontal motion control switch so that the linear traveler moves one unit and stops.

- 5.13 At the intersection of the cross hairs, decide whether the material is an air void, matrix, fine aggregate (-4.75 mm) or coarse aggregate (+4.75 mm) and record the decision on a mechanical specimen counter properly designated.
- 5.14 Repeat procedures set forth in Sections 5.12 and 5.13 for the entire width of the specimen between the margins.
- 5.15 When the vertical cross hair reaches a margin after traversing the specimen, reverse the horizontal direction on a manual traveler using the directional selector lever and crank the vertical control wheel two complete revolutions clockwise. For an automatic traveler, follow the manufacturer prompts to return the horizontal traveler to the beginning of the traverse, and follow the manufacturer prompt to allow the vertical traveler to transition to the next row for testing.
- 5.16 Repeat procedures set forth in Sections 5.14 and 5.15 until the total number of point counts indicated on the mechanical specimen counter equals 600.

---

**6. COMPOSITION PERCENTAGES**

- 6.1 Each category such as air void content, matrix, fine aggregate (-4.75 mm), and coarse aggregate (+4.75 mm), is expressed as a percentage of total number of point counts.

---

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Director  
Materials Control, Soils and Testing Division

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
MATERIALS DIVISION

MATERIALS PROCEDURE

---

PROCEDURE FOR DETERMINING THE RANDOM LOCATION OF COMPACTION TESTS

---

**1. PURPOSE**

1.1 This procedure provides methods for determining the random locations for compaction tests.

---

**2. SCOPE**

2.1 This procedure is applicable for locating all compaction tests.

---

**3. EQUIPMENT**

3.1 Measuring tape, approximately 50 feet.

---

**4. PROCEDURE**

4.1 Compaction test site locations are to be randomly located along the roadway centerline (length) and offset (width) randomly from this reference line. Some test site locations, such as pipe backfill, require random selection of lifts for the tests and a random determination of the side of the pipe backfill to test.

4.2 Selection of random numbers

4.2.1 Determine the number of test sites which will be required for the lot or test section.

4.2.2 The table of random numbers (Table I attached) or a calculator, which will generate random numbers, can be used.

4.2.3 The table of random numbers contains 5 sections with 2 columns of numbers in each section.

4.2.3.1 The first column of numbers in each section is for determining the test site along the centerline. The second column of numbers is for determining the distance from the centerline (offset). Either column of numbers can be used for selecting lifts to be tested.

4.2.3.2 To use the table, select a random point on the table by tossing a pencil upon the page or blindly pointing out a location with the finger. The selection of random numbers will consist of a pair of random numbers. Once the point is located, select the number in the first column for the length and the corresponding number in the right column for the width. When more than one pair of random numbers is needed, continue selecting the pairs of numbers down the page. If the bottom of the page is reached, go to the top of the next section to the right or to the top of the first section on the left side of the page if the bottom of the right most

section of the page is reached. When selecting lifts to be tested, only single random numbers are needed and can be obtained from any of the columns of numbers.

- 4.2.3.3 To use a calculator, which will generate random numbers, select all numbers needed for a test site before selecting numbers for additional test sites.
- 4.3 Location of test sites
  - 4.3.1 There are many variations in the required number of tests and the physical dimensions of the area to be tested.
    - 4.3.2 Random location of tests on a single lift that rectangular in shape (Example 1 of Attachment).
      - 4.3.2.1 Generally, the Materials Procedure used for testing a material and/or Specifications requires a lot, portion of a lot, or a test section to determine the maximum density of a material to be divided into equal sublots or subsections when more than one test is required.
        - 4.3.2.2 Divide the length of the area along the centerline by the number of tests to determine the length of each subplot or subsection.
          - 4.3.2.3 From the beginning station number, add the length of the subsection or subplot to the station number to determine the station number for the beginning of the next subplot or subsection. Next add the length of the subsection or subplot to this station number to determine the station number at the beginning of the next subsection or subplot. Continue this procedure until the beginning station numbers for all subsections or sublots have been calculated.
          - 4.3.2.4 Select the random numbers according to 4.2 through 4.2.3.3.
          - 4.3.2.5 Multiply the length of the subsections or sublots by the random numbers selected for the length.
          - 4.3.2.6 Add the values to the corresponding station numbers for the beginning of each subsection or subplot. The station numbers locate the test sites along centerline.
          - 4.3.2.7 Next multiply the width of the test section or lot by the random numbers selected for the offset.
          - 4.3.2.8 Determine the offset distance of the lot or test section from the centerline when the centerline is not within the area to be tested. This will usually be a constant value. Always calculate the offset by working from the side nearest the centerline. Add each of the values calculated in 4.4.2.7 to the constant value. The values establish the offset distance of each test site from the centerline. Designate rather the offset is left or right of centerline.
          - 4.3.2.9 When the centerline is contained within the area to be tested, the offset can be calculated from the left or right side of the test area and test location designated in relation to centerline.

- 4.3.3 Random location of test sites on a single lift that is irregular in shape (Example 2 attached).
- 4.3.3.1 Determine the dimensions of the area to be tested.
- 4.3.3.2 Determine the minimum dimensions of a rectangle that will contain the area to be tested and has two sides parallel to centerline.
- 4.3.3.3 Divide the rectangle into the desired number of subsections or sublots and randomly locate the test sites locations as in sections 4.3.2 - 4.3.2.8 above. If a test site location falls outside the area to be tested, obtain a new set of random numbers for the test site and recalculate the test site location. Continue this procedure until the test site falls within the area to be tested.
- 4.3.4 Random selection of lifts to be tested (Example 3 attached).
- 4.3.4.1 When testing certain materials, especially backfill material, where an area to be backfilled will constitute a lot of material to be tested, a random selection of lifts to be tested is required.
- 4.3.4.2 Determine the projected number of lifts to be contained in the lot. Divide the number of lifts by the number of tests in the lot. If the value is not an even number, assign an additional lift to the first subplot and continue to assign a lift to each consecutive subplot until all remaining lifts have been assigned to a subplot.
- 4.3.4.3 By starting with the bottom lift, number the lifts in the lot, select a single random number for each test site.
- 4.3.4.4 Multiply each random number by the number of lifts in each subplot and round the values to whole numbers. Each value designates which lift in each subplot that will be tested.
- 4.3.4.5 Once the lifts to be tested have been selected, the random location of the test site on the lift can be determined.
- 4.3.5 Random selection of the side of backfill for pipe culverts.
- 4.3.5.1 When a lot of pipe backfill is being tested, tests should be performed on both sides of the pipe. The side to be tested can be randomly selected by using the random numbers selected for the location of the tests along the pipe. If the random number is less than 0.500, the test is on the left side and greater than 0.500 on the right side of the pipe.

---

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Director  
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TABLE 1 RANDOM NUMBERS

.858	.082	.886	.125	.263	.176	.551	.711	.355	.698
.576	.417	.242	.316	.960	.819	.444	.323	.331	.179
.687	.288	.835	.636	.596	.174	.866	.685	.066	.170
.068	.391	.739	.002	.159	.423	.629	.631	.979	.399
.140	.324	.215	.358	.663	.193	.215	.667	.627	.595
.574	.601	.623	.855	.339	.486	.065	.627	.458	.137
.966	.529	.757	.308	.025	.836	.200	.055	.510	.656
.608	.910	.944	.281	.539	.371	.217	.882	.324	.284
.215	.355	.645	.460	.719	.057	.237	.146	.135	.903
.761	.883	.771	.388	.928	.654	.815	.570	.539	.600
.869	.222	.115	.447	.658	.989	.921	.924	.560	.447
.562	.036	.302	.673	.911	.512	.972	.576	.838	.014
.481	.791	.454	.731	.770	.500	.980	.183	.385	.012
.599	.966	.356	.183	.797	.503	.180	.657	.077	.165
.464	.747	.299	.530	.675	.646	.385	.109	.780	.699
.675	.654	.221	.777	.172	.738	.324	.669	.079	.587
.279	.707	.372	.486	.340	.680	.928	.397	.337	.564
.338	.917	.942	.985	.838	.805	.278	.898	.906	.939
.316	.935	.403	.629	.130	.575	.195	.887	.142	.488
.011	.283	.762	.988	.102	.068	.902	.850	.569	.977
.683	.441	.572	.486	.732	.721	.275	.023	.088	.402
.493	.155	.530	.125	.841	.171	.794	.850	.797	.367
.059	.502	.963	.055	.128	.655	.043	.293	.792	.739
.996	.729	.370	.139	.306	.858	.183	.464	.457	.863
.240	.972	.495	.696	.350	.642	.188	.135	.470	.765

EXAMPLE 1

Length of test section = 100 ft Width of section = 10 ft  
 Number of tests required = 5  
 4 equal subsections  $100/5 = 20$  ft  
 Test section starts at station 5+46

Station number at the beginning of each subsection

1. 5+46
2.  $5+46 + 20 = 5+66$
3.  $5+66 + 20 = 5+86$
4.  $5+86 + 20 = 6+06$
5.  $6+06 + 20 = 6+26$

Random Numbers

Length	Width
1. .869	.222
2. .562	.036
3. .481	.791
4. .599	.966
5. .464	.747

Multiply the length of each subsection by the random numbers for the length.

1.  $20 \times .869 = 17$
2.  $20 \times .562 = 11$
3.  $20 \times .481 = 10$
4.  $20 \times .599 = 12$
5.  $20 \times .464 = 9$

Add the values to the beginning station numbers of each subsection to determine the station number for each test.

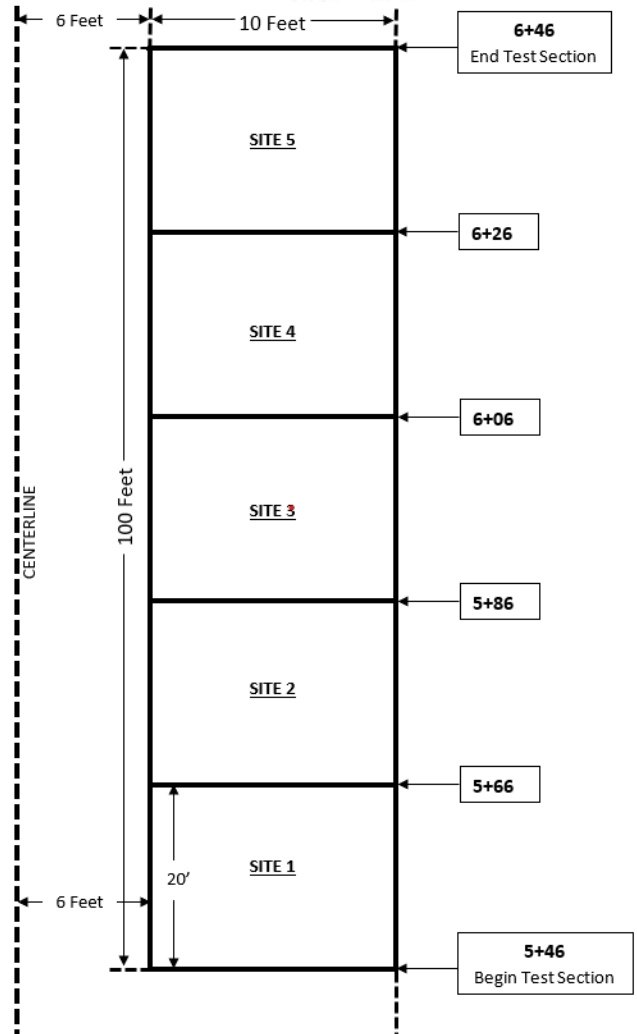
1.  $5+46 + 17 = 5+63$
2.  $5+66 + 11 = 5+77$
3.  $5+86 + 10 = 5+96$
4.  $6+06 + 12 = 6+18$
5.  $6+26 + 9 = 6+35$

Multiply the width of each subsection by the random numbers for the width.

1.  $10 \times .222 = 2$
2.  $10 \times .036 = 0$
3.  $10 \times .791 = 8$
4.  $10 \times .966 = 10$
5.  $10 \times .747 = 7$

Add the values to the constant distance the test section is from the centerline and label the values as right of centerline .

1.  $6 + 2 = 8$  ft right of centerline
2.  $6 + 0 = 6$  ft right of centerline
3.  $6 + 8 = 14$  ft right of centerline
4.  $6 + 10 = 16$  ft right of centerline
5.  $6 + 7 = 13$  ft right of centerline





EXAMPLE 3

21 lifts of material are required to backfill the pipe.

All of the backfill material is included in 1 lot. There are 5 tests required with 1 test in each subplot.

Divide the number of lifts by the number of sublots to determine the number of lifts in each subplot ( $21/5 =$  lifts with 1 lift left over). This includes the lift in subplot number 1.

Sublot Number 1	Lifts 1 – 5
Sublot Number 2	Lifts 6 - 9
Sublot Number 3	Lifts 10 - 13
Sublot Number 4	Lifts 14 - 17
Sublot Number 5	Lifts 18 – 21

Random numbers

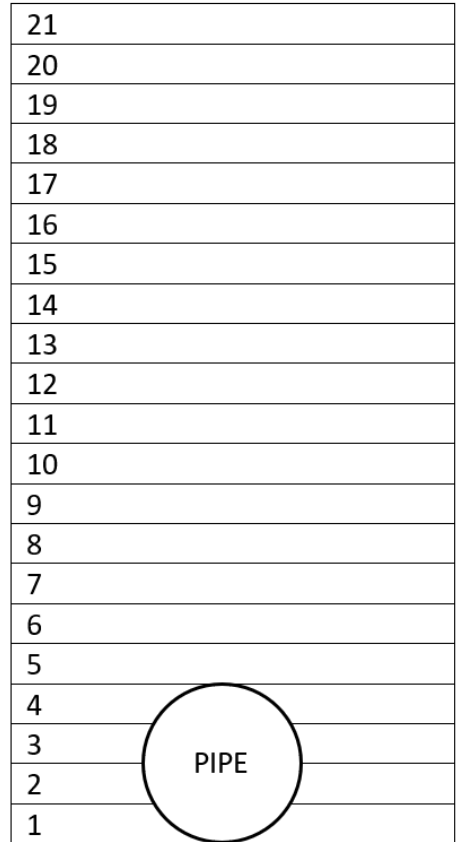
1. .599
2. .464
3. .675
4. .279
5. .338

Multiply the number of lifts in the subplot by the random numbers.

The values determine which lift in each subplot to test.

- |                        |   |
|------------------------|---|
| 1. $5 \times .599 = 3$ | Test lift 3 in subplot number 1, Lift number 3  |
| 2. $4 \times .464 = 2$ | Test lift 2 in subplot number 2, Lift number 7  |
| 3. $4 \times .675 = 3$ | Test lift 3 in subplot number 3, Lift number 12 |
| 4. $4 \times .279 = 1$ | Test lift 1 in subplot number 4, Lift number 14 |
| 5. $4 \times .338 = 1$ | Test lift 1 in subplot number 5, Lift number 18 |

CROSS SECTION OF PIPE BACKFILL



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

MATERIALS PROCEDURE

---

CONTRACTOR'S QUALITY CONTROL FOR SURFACE WATER AND  
SAMPLING PROCEDURES FOR QUALITY DETERMINATION

---

**1. PURPOSE**

- 1.1 The purpose of this procedure is to establish practices for the Contractor's Quality Control System for surface waters. This procedure is intended to be used in designing an adequate Quality Control Plan for the sampling, testing, and evaluation of surface water quality during construction.
- 1.2 This procedure includes the requirements for methods to be used in collecting samples and conducting testing. Also, procedures are established that outline actions to be taken if the water quality is not maintained.

---

**2. REFERENCED DOCUMENTS**

- 2.1 *Other Standards:*
  - a. MP 642..40.20
  - b. West Virginia Administrative Regulations, State Water Resources Board, Chapter 20-5 and 20-5A, Series I
  - c. Environmental Water: Quality Check

---

**3. REQUIREMENTS AND GUIDELINES**

- 3.1 General Requirements: The Contractor will design a Quality Control Plan to include tests, methods, and frequency of sampling. The plan will be submitted to the Engineer at the Pre-Construction Conference and a plan must be approved by the District Materials Section before construction may begin. The Contractor's Quality Control results of the surface water testing, both field and laboratory, will be documented and copies will be provided to the Engineer throughout the life of the contract.
  - 3.1.1 The Quality Control Plans shall be updated as needed during the life of the contract. The updating will be done by the Contractor as directed by the project Engineer/Supervisor. The updating shall be approved by the District Construction Division.

- 3.1.2 The Contractor will assign a qualified technician to each project to perform and document the sampling and testing.
- 3.1.2.1 A qualified technician is defined as a person who is knowledgeable and trained in the sampling and testing of surface waters for those tests as stated in Section 4.3 of this procedure. A resume of the technician's experience in the water quality sampling and testing must accompany the Quality Control Plan. If found inadequate, the technician will be replaced by the Contractor or be given additional training so that sampling and testing is adequately performed.
- 3.2 Quality Control Plan: The plans will clearly describe the methods by which the Quality Control Program will be conducted. As a minimum, and acceptable plan will include the following:
- 3.2.1 Name of company official for the specific project who is responsible for the Quality Control and liaison with the Division project personnel. Also the name of the person(s) actually conducting sampling and testing. Sampling and testing will be conducted by a qualified technician and such duties are to be this person's primary assignment.
- 3.2.2 The tests and type of equipment to be used in sampling and testing will be listed along with accepted methods.
- 3.2.3 The number and locations of sampling points shall be identified. This may need to be updated frequently during the course of the project.

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**4. QUALITY CONTROL BY THE CONTRACTOR**

- 4.1 Quality Control testing of the surface waters will be performed by the Contractor. Sampling and testing will be conducted on those surface waters within the Division of Highways project areas and in adjacent surface waters that may be affected by construction on these projects.
- 4.1.1 The Contractor will ensure that a precipitation gauge is located on the project. A daily record will be kept of precipitation. This record will be submitted to the project with any test results that cover the same time period.
- 4.2 Points of Sampling
- 4.2.1 Water quality will be determined on flowing streams and/or other surface waters to be affected by construction.
- 4.2.1.1 The Contractor will monitor the quality of the water upstream and downstream from the limits of construction.

- 4.2.1.2 In cases of major highway construction, streams will be sampled above and below structures, such as bridges, large sediment control devices, or a series of smaller devices.
- 4.2.1.3 Streams outside the construction limits that receive flow from construction affected streams are to be sampled. This sampling will be conducted on the receiving stream above and below the mouth of the stream affected by construction. Sampling on the receiving stream will not have to be conducted when the distance of the affected stream from the construction limits to the receiving stream is greater than one-half mile, unless it is observed that pollution is carried a greater distance to enter the receiving stream.
- 4.2.2 Samples will be taken approximately 15 m above and 30 m below construction limits, structures, sediment control devices and the confluence of streams.
- 4.2.2.1 When mixing has not created visible homogeneous conditions within approximately 30 m below a confluence, sampling will be conducted at the nearest point where visible homogeneity exists throughout the cross section. This location is to be recorded. When homogeneity does not exist within approximately 304 m below confluence, a minimum of three samples are to be taken along the cross section at this point. Additional samples may be necessary if determined by the Engineer.
- 4.2.3 Samples should not be taken from areas of heavy aeration, agitation, or stagnation, unless for specific circumstances and tests.
- 4.2.4 Under some conditions, points of sampling may have to be located at a specific spot to determine influx of concentrated substances or isolated sources of pollution.
- 4.2.5 Grab samples will be appropriate in most cases. Depth of samples will be from just below the surface to 9 m below depending on the depth of the stream.
- 4.2.5.1 Containers for grab samples may be either soap and water cleaned glass or plastic, fitted with plastic screw caps. Containers will be able to hold at least 500 ml.
- 4.3 Testing
- 4.3.1 The following tests will be conducted using MP 642.40.20:  
pH  
Turbidity
- Testing for pH and turbidity will be conducted within thirty (30) minutes after the samples have been collected. The Engineer will be notified immediately after testing when limits have been exceeded.
- 4.3.1.1 For other tests that may be specified in the contract document, the Contractor will utilize MP 642.40.20.

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- 4.3.2 The Contractor's attention is directed to the "Limits as per W.Va. Administrative Regulations" attachment. Under the turbidity limit it is noted that this control factor may not apply if the sediment control plans are submitted to the appropriate cooperative. This may result in a waiver approval by the cooperative with concurrence of the chief for streams other than trout streams. The cooperative, as mentioned above, is the Soil Conservation District that has control in the area of construction. The chief, as mentioned above, is the head of the Water Resources Division of the Division of Natural Resources.
- 4.3.2.1 The waiver approval may contain limits for turbidity. If the waiver does not contain limits for turbidity, then the following limits shall apply. Turbidity shall not exceed 20 Nephelometric Turbidity Units (NTU) over background (I) turbidity when the background is 50 NTU or less, or have more than a 20 percent increase in turbidity (plus 20 NTU minimum) when the background turbidity is more than 50 NTU.
- 4.3.2.2 The continuation of the waiver, for the duration of the project construction period, will be based on the adherence of the Contractor to the control plan submitted.
- 4.3.2.3 The Engineer shall be monitoring the water quality data to determine compliance with the specifications and sediment control plan to determine if the methods of control need revision, maintenance, or adjustment.
- 4.4 Frequency and Duration of Sampling
- 4.4.1 In normal weather conditions, water quality sampling and testing will be conducted daily at each site, when testing indicates that pollution problems exist, sampling and testing will be conducted once per work shift.
- (1) Background water quality is the quality of water entering the project area or the quality of the receiving body of water upstream from the discharge point of project affected water.
- 4.4.2 During periods of no precipitation (greater than once a week), when it is evident by the Contractor's is testing that pollution is not being created beyond standard limits at a site, and with the concurrence of the Engineer, water quality sampling and testing may be limited to a weekly frequency at these sites. Visual observations are to be made daily to determine that conditions have not significantly changed. If a change is noted visually, testing is to be conducted and the frequency revised as needed.
- 4.4.3 During in-stream construction, when visual inspection indicates possible pollution, water quality sampling and testing will be conducted at least once per work shift.
- 4.4.4 During periods of project shut down, sampling will be conducted at least once per week.
- 4.5 Documentation of Results

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- 4.5.1 Water quality will be maintained on the Division's form entitled "Environmental Water: Quality Check" or on a Contractor's form containing the same information as the Division's form. The completed forms will be provided to the Project Engineer on a daily basis.

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**5. ACCEPTANCE PROCEDURE**

- 5.1 Acceptance shall be the responsibility of the Division. Acceptance may be accomplished by testing a sample obtained by and tested by the Contractor, by observation of Contractor's sampling and testing, or sampling and testing independent of the Contractor's
- 5.1.1 Testing or observation frequency should be equal to approximately 10% of the frequency of the Contractor's sampling and testing listed in the Quality Control Plan. Normally, some sampling and testing shall be independent of the Contractor's testing.
- 5.1.2 When discrepancies exist between the Contractor's data and the Division's findings, the Division and Contractor shall individually test a sample in an attempt to locate and correct the problem. These samples shall be taken at the same times and location. The investigation of the problem is to be mutually cooperative.
- 5.2 Water quality which is affected by actions of the Contractor resulting in violations will require actions to be taken. The water quality requirements are contained in the West Virginia Administrative Regulations, State Water Resources Board, Chapter 20-5 and 20-5A, the limits specified by the cooperative or this Material Procedure. Action will be taken by the Contractor to reduce the pollution to acceptable limits (for such limits, see attachment or section (4.3.2.1)). The action may include, but are not necessarily limited to, the following: (1) Work in the area of influence will be reduced or stopped until the cause, such as rain, had abated to a degree that pollution is within acceptable levels and/or (2) appropriate Best Management Practices will be utilized to reduce the pollution to an acceptable level.
- 5.2.1 If the Contractor does not take action to control the population, the Engineer may stop construction work other than pollution control **work, on** the project until adequate measures are taken to control the pollution.

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

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Attachments

Attachment 1

Limits as Per West Virginia Administrative Regulations,  
State Water Resource Board, Chapters 20-5 and 20-5A

pH - No Value below 6.0 nor above 9.0

Turbidity - No point or non-point source to West Virginia;s waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU over background turbidity when the background is 50 NTU or less, or have more than 10 percent increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTU.

This Limitation shall apply to all earth disturbance activities and shall be determined by measuring stream quality directly above and below the area where drainage from such activity enters the affected stream. Any earth disturbance activity continuously or intermittently carried on the same or associated persons on the same stream or tributary segment shall be allowed a single net loading increase.

This regulation shall not apply to those activities at which Best Management Practices in accordance with the State's adopted 208 Water Quality Management Plan are being utilized on a site specific basis as determined by the appropriate 208 cooperative with concurrence of the chief or an approved Federal or State Surface Mining Permit is in effect. The exemption shall not apply to trout waters.

Attachment 2

ENVIRONMENTAL WATER: QUALITY CHECK

PROJECT \_\_\_\_\_ COUNTY \_\_\_\_\_ DISTRICT \_\_\_\_\_

LAB. NUMBER \_\_\_\_\_

DATE SAMPLED/TESTED \_\_\_\_\_

SAMPLED BY \_\_\_\_\_

SAMPLING OBSERVED BY DISTRICT: YES NO

RAINFALL (24 HRS.) \_\_\_\_\_ "

	SITE#	SITE#	SITE#	SITE#	SITE#
STATION	_____	_____	_____	_____	_____
OFFSET	_____	_____	_____	_____	_____
TURBIDITY	_____	_____	_____	_____	_____
pH	_____	_____	_____	_____	_____
IRON	_____	_____	_____	_____	_____
WATER TEMP. °C	_____	_____	_____	_____	_____
AIR TEMP. °C	_____	_____	_____	_____	_____

REMARKS:

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\_\_\_\_\_  
Technician's Signature

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

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MATERIALS PROCEDURE

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FIELD SAMPLING AND TESTING OF SURFACE WATER FOR  
QUALITY DETERMINATION

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**1. PURPOSE**

- 1.1 This procedure sets forth guidelines for collecting surface water samples within the limits of Division of Highways projects and in adjacent surface waters that may be affected by construction on these projects.
- 1.2 The procedure establishes general and specific methods to be utilized in determination of sampling points, duration of sampling and how to collect samples. Or also discusses necessary equipment and tests.

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**2. REFERENCED DOCUMENTS**

- 2.1 Applicable Documents:
  - a. MP 642.40.20
  - b. MP 642.03.50

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**3. EQUIPMENT**

- 3.1 Chemically inert glass and/or plastic bottles (depending on the test to be performed) or 1 liter capacity fitted with screw caps will be used for chemical analyses samples.
  - 3.1.1 All containers will be machine or hand washed with suitable cleaning compound or biodegradable soap. After washing, containers will be well rinsed with clean tap water and finally with distilled water to remove any residue of the cleaning compound or soap.
- 3.2 Containers used for samples for biological test determination by the Central Laboratory shall be 100 ml plastic bottles with screw caps. The bottles and caps must be able to withstand sterilization procedures.
- 3.3 Plastic or rubber gloves when sampling in certain contaminated waters (for example, sewage waters).
- 3.4 Rubber boots if required for sampling in deep water.

3.5 Materials Control, Soils and Testing (MCS&T) Division personnel will need equipment to determine pH, temperature, dissolved oxygen, specific conductivity, total alkalinity, and total acidity. District personnel will need equipment for determination of pH, temperature, and turbidity.

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**4. SOURCE OF SAMPLES**

4.1 Samples may be obtained from streams, springs, drainage from coal mines and other waste, or other sources that may affect water quality.

4.2 Generally, all perennial streams should be sampled. In certain cases, sources that are of an intermittent nature may require sampling when flows are present and if it is likely that the source will have a significant effect on the quality of receiving water and the stream flow.

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4.3 Drainage from coal mines or coal waste piles should be sampled if this drainage is disrupted, channelized by the highway construction, or it is contributing to the flow of water that passes through the project or proposed project, but is not located within the project limits.

4.4 Springs or other special sources should be sampled especially if the supply is for human consumption and/or other public, recreational or natural resources uses in the immediate area.

4.5 When possible, samples to be taken prior to construction or in the design phase of a project should be obtained when flows are considered to be in low or normal conditions, except as noted in Section 4.2.

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**5. POINTS OF SAMPLING**

5.1 Samples should not be taken from areas of stagnation, heavy aeration, or agitation unless for special circumstances and tests.

5.2 Samples shall not be taken from the confluence of streams. Samples shall be taken a minimum of 15 m above and 30 m below such points. When mixing has not created visible homogeneous conditions within 30 m below a confluence, sampling will be conducted at the nearest spot where visible homogeneity exists.

5.2.1 When conditions are such that homogeneity does not exist within 305 m downstream from confluence, sufficient samples should be obtained to delineate any differences. These points of sampling are to be recorded.

5.3 Under some conditions, to be determined by the sampler, points of sampling may have to be located at a specific spot to determine influx of concentrated substances or isolated sources of pollution.

**6. FREQUENCY AND DURATION OF SAMPLING**

- 6.1 Samples Collected by MCS&T Division Personnel: Sampling will be conducted in the design phase of a project. At least three (3) samples should be obtained at different times prior to construction at each of the sources outlined in Section 4.1 if encountered in the project area.
- 6.2 Samples Collected by District Personnel During Construction: Sampling by District personnel will be conducted as an acceptance procedure when MP 642.03.50 is in effect on a project. See MP 642.03.50 for sampling requirements.
  - 6.2.1 In some cases, MP 462.03.50 may not be in effect on a project. Sampling will be conducted if it is determined that construction activity could result in a disturbance of the water source drainage area. Sampling frequency will be daily.
    - 6.2.1.1 When construction is not active, but conditions are such that erosion and pollution can still occur, sampling will be conducted daily.
    - 6.2.1.2 When construction is not active, but conditions are such that erosion and pollution are not likely to occur, sampling will be conducted weekly.
- 6.3 Monitoring will be continued throughout the life of the project.

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**7. VOLUME OF SAMPLES**

- 7.1 Samples collected for testing in the MCS&T Division Central Laboratory will be on the quantities as set forth in MP 642.40.20 for each test required.
- 7.2 The quantity of water for field testing by MCS&T Division personnel shall be 1 liter.
- 7.3 The quantity of water for District testing shall be a minimum of 500 ml.
- 7.4 A minimum sample for biological testing will be 100 ml.
- 7.5 Appropriate preservation method and quantities for all tests are listed in MP 642.40.20.

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**8. SAMPLING**

- 8.1 Individual grab samples will be appropriate in most cases.
- 8.2 Generally, sampling from the steam bank will be acceptable. In certain cases, however, grab or composite samples collected from a boat or structure may be necessary.
- 8.3 The samples should be taken at least an arm's length in depth or half the steam depth.

- 8.3.1 In some sources too shallow for submerging the sample bottle, water will have to be dipped or a hole dug large enough to allow submergence of a sample bottle. When a hole is dug, a minimum of 15 minutes must pass before the sample is taken. However, in some cases where stream flow and volume is low or turbidity is not equalized, a longer waiting period will be necessary,
- 8.4 The mouth of the sample bottle should be held in such a manner that the flow of water will not pass over the hand before entering the bottle.
- 8.5 The container used for chemical test samples should be rinsed two or three times with the water to be collected before taking the sample. Rinse water is to be poured out downstream of the site.
- 8.6 The sample will be capped and sealed as soon as possible after sampling to limit exposure to the atmosphere.
- 8.7 Containers used for biological test samples will be kept sterile at all times. The bottle will be submerged and the cap taken off underwater when taking the sample. The container will be capped after filling while still underwater.
- 8.8 Samples shall be handled prior to analysis in a manner that protects the substances to be tested.

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**9. TESTING**

- 9.1 The following tests will be conducted by MCS&T Division Personnel in the field at the sample site: 1) pH, 2) dissolved oxygen, 3) specific conductivity, 4) total alkalinity, 5) total acidity, and 6) water temperature.
- 9.2 Tests to be conducted in the field by District personnel will be pH and water temperature.
- 9.2.1 The turbidity of the samples will be determined in the District laboratory.

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**10. SHIPPING SAMPLES**

- 10.1 Samples collected for testing by the Central Laboratory will be delivered to the MCS&T Division.
- 10.1.1 Samples shall be scheduled to arrive within the limits of the holding times as indicated in MP 642.40.20.

**11. DOCUMENTATION**

- 11.1 Water quality results for samples taken by MCS&T Division personnel will be maintained on the Division's appropriate forms.
- 11.2 Water quality results for samples taken by District personnel may be maintained on the Division's form entitled "Environmental Water: Quality Check" (see MP 462.03.50)

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**12. ASSISTANCE**

- 12.1 Personnel from the MCS&T Division will provide training for District personnel in all aspects of the work made necessary by this MP.
- 12.2 Assistance in planning and developing a testing program for a particular project or projects will also be provided by this Division.

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

RLS:Mpp



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

MATERIALS PROCEDURE

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PROCEDURE FOR DETERMINING AN ADJUSTED PAY QUANTITY  
RESULTING FROM EXCESS MOISTURE IN AGGREGATES

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**1. PURPOSE**

- 1.1 To provide a method to determine adjusted pay quantity to be used in those cases where excess moisture in aggregate has been confirmed. In this method, the pay quantity will be considered to be the net weight of the aggregate determined in Tons ~~Megagrams~~ delivered.
- 

**2. SCOPE**

- 2.1 This procedure is applicable to aggregate furnished under Maintenance Purchasing Requisitions.
- 

**3. DEFINITION OF TERMS**

- 3.1 Normal Moisture Content - the moisture content (on the basis of ASTM Method C-566) of stocked aggregate as it would generally exist under field conditions over an extended period of time.
- 

**4. PROCEDURE**

- 4.1 In the event it has been determined by ASTM Method C-566 that an aggregate type has a moisture content in excess of that which is listed and designated as "Normal Moisture Content" for that type in Table 1, the pay quantity represented shall be adjusted in accordance with 4.2.

**TABLE 1- NORMAL MOISTURE CONTENT MOISTURE PERCENTAGE**

TYPE	CLASS 1 & 2	GRADED**	FINE
Limestone	5.0	1.0	5.0
Gravel	3.5	1.0	
Sand			5.0
Sandstone	5.0	1.0	5.0
Slag*	6.0	2.1	7.0
Cinders			10.0
Boiler Slag			10.0
Steel Stag	4.0	1.0	5.0

\*Blast Furnace Slag

\*\*AASHTO Sizes No. 1 through No. 9, Class 7 Gabions and Shot Rock

4.2 The adjusted pay quantity shall be calculated by comparing the normal moisture content with the actual moisture content.

The adjusted pay quantity calculation would be:

$$APQ = \text{MegagramsTons} \times \left( \frac{1 + M_N}{1 + M_A} \right)$$

Where:  $APQ = \text{Adjusted Pay Quantity}$

$\text{MegagramsTons} = \text{Net Weight Delivered}$

$$M_N = \frac{\text{Normal Moisture Content}}{100}$$

$$M_A = \frac{\text{Actual Moisture Content}}{100}$$

4.3 Example

Net weight of graded limestone delivered = 13.6 ~~Megagrams~~

Tons

Actual moisture content = 3 percent

Normal moisture content = 1 percent

$$APQ = 13.6 \times \left( \frac{1 + .01}{1 + .03} \right)$$

$$APQ = 13.6 \times \left( \frac{1.01}{1.03} \right)$$

$$APQ = 13.6 \times (0.98058)$$

$$APQ = 13.3 \text{ ~~Megagrams~~Tons}$$

In this case the adjusted pay quantity would be 13.3 ~~Megagrams~~Tons instead of ~~the 13.6 Megagrams~~Tons.

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

MATERIALS PROCEDURE

---

GUIDE FOR QUALITY CONTROL AND ACCEPTANCE PLANS FOR  
PURCHASE ORDER CONTRACTS FOR STONE AND AGGREGATE

---

**1. PURPOSE**

- 1.1 Testing of highway construction materials has traditionally been a two phased activity; that is, that done by industry in their Quality Control Program and that done by the purchaser to determine the acceptability of the material. In Purchase Order contracts for stone and aggregate, the vendor (whether or not he or she is actually the producer) is by positive statement in the contract specifications responsible for the gradation of all items except abrasives; and the Division of Highways, as purchaser, is responsible for material acceptance. The purpose of this Materials Procedure is to present guideline for adequate Quality Control and Acceptance Plans.
- 

**2. QUALITY CONTROL PLAN**

- 2.1 A quality Control Plan shall be prepared by the vendor and submitted to the Division prior to delivery of any material. The Plan shall clearly describe the methods by which the Quality Control Program will be conducted. As a minimum, the Quality Control Plan should include the following:
- 2.1.1 Name of company official responsible for Quality Control, and name and qualifications of technician conducting the tests.
- 2.1.2 Listing of items to be controlled and tests to be performed. Each item should be listed separately.
- 2.1.3 The Plan should detail the vendor's proposed sampling location, sampling and testing procedure and testing frequency. In the event the vendor is not the producer, sampling location, sampling and testing procedure and test frequency proposed by the producer shall be included.
- 2.1.4 The Documentation Plan: The methods by which the vendor will document and distribute test results shall be described:
- 2.1.4.1 Forms and Distribution: All forms used to record the vendor's test data shall be approved prior to use by the Division. Gradation test data will be recorded on Form T300 in the manner intended. In the event the vendor elects to use a form other than T300 said form must be approved by the Division prior to use. The laboratory number (supplied by the Division) assigned to the vendor's test data document will always begin with a "C" for all quality control sample results. In the event the vendor is not the producer, the vendor shall provide the completed test data forms provided by the producer, and in the proper sequence (consecutive tests) including

quantities thereof. All test data forms shall include the vendor's (and/or the producer's) identification and be legibly signed by the technician that conducted the test. A copy of all forms shall be delivered by the vendor to the Division. Tests results must be delivered as they are finished to assure that all the results for material delivered are completed and distributed by the fulfillment of the State Contract Purchase Order (SCO).

- 2.1.5 A detailed plan of action regarding the disposition of non-specification material: Such a plan shall provide for immediate notification of all parties involved in the event failing material is detected.

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**3. ACCEPTANCE PLAN**

- 3.1 The contract specification states the vendor is responsible for providing test results to the gradation of the materials delivered (except abrasives); acceptance may be ~~on the basis of~~ based on these test results, ~~provided~~ provided, and certified by the vendor. Acceptance may also be accomplished by an independent sampling and testing program conducted by the Division and at the appropriate sampling frequency given in the contract specifications, or a combination of both the vendor's test results and the Division's test results. In this case (combination acceptance), the Divisions independent samples and tests may be directly compared to the vendor's results only if all sampling locations and testing procedures are the same.
- 3.2 Sampling and testing for quality (LA Abrasion , soundness, etc.) of all items is the responsibility of the Division.

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

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

MATERIALS PROCEDURE

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STANDARD METHOD OF TEST FOR DETERMINING THE PERCENTAGE OF  
COAL AND LIGHTWEIGHT PARTICLES IN AGGREGATE

---

**1. PURPOSE**

- 1.1 To provide a standard method of testing for coal and lightweight particles in aggregates by means of a sink-float separation in a heavy liquid with a designated specific gravity.
- 

**2. SCOPE**

- 2.1 This procedure is applicable to fine and coarse aggregates.
- 

**3. APPLICABLE DOCUMENTS**

- 3.1 ASTM E 11 ~~OR AASHTO M 92~~
- 3.2 ASTM E 100
- 3.3 ASTM C 702 OR AASHTO ~~T 248~~R 76
- 3.4 MATERIALS PROCEDURE (MP) 700.00.06
- 3.5 ASTM C 127 OR AASHTO T 85
- 3.6 ASTM C 128 OR AASHTO T 84
- 3.7 ASTM E 617 OR AASHTO M 231
- 

**4. APPARATUS**

- 4.1 Sieves—The following sieve sizes conforming to ~~AASHTO M 92~~ASTM E 11; 4.75 mm (No. 4) and 300  $\mu$ m (No. 50).
- 4.2 Balance—The balance shall have sufficient capacity, be readable to 0.1 percent of the sample mass, or better, and conform to the requirements of AASHTO M 231.
- 4.3 Oven—An oven capable of maintaining a temperature of  $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $230^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ).
- 4.4 Containers—Large vat/tank for storage of heavy liquid with compatible mesh bucket for immersion of coarse aggregate into heavy liquid, buckets for soaking test portion, Pans for surface drying the aggregates, 600 ml Pyrex beakers for containing fine aggregate test portions.

- 4.5 Skimmers—Made of 300  $\mu\text{m}$  (No. 50) sieve cloth conforming to ASTM E 11. Fitting one with a handle for scooping floating particles from heavy liquid. The other must be capable of fitting over 600 ml Pyrex beakers.
- 4.6 Stirring Rods—A glass rod for stirring fine aggregates, a large metal rod for stirring coarse aggregates.
- 4.7 Heavy Liquid—Consisting of a mixture of zinc bromide and water in such proportions so that a designated specific gravity of  $2.00 \pm 0.01$  can be maintained at all times during the test.
- 4.8 Hydrometer—Conforming to the requirements of ASTM E 100 and capable of measuring the liquid specific gravity to within  $\pm 0.01$ .
- 4.9 Safety Equipment—Industrial type rubber gloves, face shield or goggles.

Note: Although there is no particular hazard from the fumes of zinc bromide solution, precautions shall be taken to avoid inhalation of fumes and contact with eyes and skin. Goggles and gloves shall be worn, and the solution should only be used in a laboratory exhaust hood.

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## 5. SAMPLE PREPARATION

- 5.1 Secure a field sample of the aggregate in accordance with MP 700.00.06. Samples shall be representative of the sources from which they are obtained and shall be reduced to an appropriate size by use of a sample splitter or by quartering in accordance with ASTM C 702 or AASHTO ~~T 248~~R 76.
- 5.2 The samples shall be dried in an oven to a constant mass at a temperature of  $110 \pm 5^\circ\text{C}$  ( $230 \pm 9^\circ\text{F}$ ).
- 5.2.1 In the following minimum test portions, the oven-dried sample shall be weighed to the nearest one gram and that weight recorded.

Nominal Maximum Size of Aggregate (Sieve Openings)	Minimum Weight of Test Sample (Grams)
No. 4 (4.75 mm)	200 grams
$\frac{3}{4}$ in (19.0 mm)	3,000 grams
1 $\frac{1}{2}$ in (37.5 mm)	5,000 grams
3 in (75.0 mm)	10,000 grams

- 5.3 The fine aggregate oven dry sample shall be cooled to room temperature and sieved over a 300  $\mu\text{m}$  (No. 50) sieve until less than one percent of the retained material passes through the sieve in one minute of continuous sieving. Discard the minus 300  $\mu\text{m}$  (No. 50) sieve material.

- 5.3.1 Bring the plus 300  $\mu\text{m}$  (No. 50) test portion to a saturated-surface-dry condition as specified in ASTM C 128 or AASHTO T 84. (See Note 1 and Note 2).

Note 1 – If material undergoes degradation in water, the material does not have to be brought to an SSD condition.

Note 2 – Pit derived silica sand commonly contains soft and easily degradable aggregations of sub-bituminous coal. Because of this possible degrading constituent, pit sand shall not be subjected to SSD condition under this procedure.

- 5.4 Coarse aggregates shall be sieved over a 4.75 mm (No. 4) sieve. The plus 4.75 mm (No. 4) material shall be thoroughly washed and oven dried to a constant mass at a temperature of  $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $230 \pm 9^{\circ}\text{F}$ ).

- 5.4.1 Allow oven dry sample to cool to room temperature and weigh a test portion to a minimum test size, to the nearest 1 gram and record weight.

- 5.4.2 Bring sample to a saturated-surface-dry condition as specified in ASTM C ~~127+28~~ or AASHTO T ~~8584~~. (See Note 1 and Note 2).

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## 6. PROCEDURE

- 6.1 Under a ventilation hood or in adequately ventilated area, check the heavy liquid (zinc bromide) for correct specific gravity ( $2.00 \pm 0.01$ ).

- 6.2 Fine Aggregate - weigh a test portion to a minimum of 200 grams to the nearest 0.1 gram and record weight. This test portion shall be placed in a 600 ml beaker and a volume of heavy liquid poured into the beaker until the liquid level is at least 1-inch above the sample level.

- 6.2.1 Agitate the test portion by means of a glass-stirring rod allowing the lightweight particles to float to the surface.

- 6.2.2 Pour the liquid and floating lightweight particles into a second beaker, passing through a 300  $\mu\text{m}$  (No. 50) skimmer, making sure that only the floating particles are poured off with the liquid.

- 6.2.3 Repeat procedure in section -6.2.2 until test portion is free from floating particles, then drain heavy liquid from test portion back into vat. Rinse test portion with water to remove heavy liquid from sample and discard.

- 6.2.4 Wash the decanted particles retained on the 300  $\mu\text{m}$  (No. 50) skimmer with water until all the zinc bromide is removed.

- 6.2.5 Dry decanted particles to a constant weight and weigh to the nearest 0.1 gram.

- 6.3 Coarse Aggregate - Place sample into mesh bucket and place into vat of zinc bromide solution.



- 6.3.1 NOTE: If test portion is sufficiently large, two or more runs may be necessary to complete testing.
- 6.3.2 Agitate test portion by means of a large metal stirring rod allowing the lightweight particles to float to the surface.
- 6.3.3 Remove floating pieces from heavy liquid by scooping with a 300 µm (No. 50) skimmer. Repeat process until test portion is free of floating particles.
- 6.3.4 Raise mesh bucket to drain heavy liquid from test portion into vat. Rinse test portion with water to remove heavy liquid from sample and discard.
- 6.3.5 Wash lightweight particles with water until all the zinc bromide is removed.
- 6.3.6 Dry lightweight particles to a constant weight and weigh to the nearest 1.0 gram.
- 6.4 Slag: Due to the manufacturing process, there is entrapped air in the aggregate. The procedure for slag is the same for any other coarse aggregate; however, a greater number of pieces will come to the surface than with other types of aggregates. The floating particles must be friable before they are considered as deleterious.

---

7. **CALCULATION**

- 7.1 Calculate the percentage of lightweight particles as follows:

~~Fine Aggregates~~

$$L = \frac{W_1}{W_2} \times 100$$

$L$  = Percentage of lightweight particles

$W_1$  = Oven dry mass of lightweight particles

$W_2$  = Oven dry mass of test portion

- 7.2 Report results to nearest 0.1 percent.

---

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

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

CERTIFICATION OF FABRICATORS OF CORROSION RESISTANT COATED DOWEL  
BARS IN BASKET ASSEMBLY

---

**1. PURPOSE**

- 1.1 To establish a procedure for ~~the C~~certification of ~~F~~fabricators of corrosion resistant coated dowel bars in basket assembly, to set fort conditions for certification and to establish inspection and procedures for certified fabricators.
- 1.2 This procedure shall apply to fabricators of corrosion resistant coated dowel bars in basket assembly who furnish material to projects and purchase orders.

**Commented [1]:** The original PURPOSE and SCOPE sections were combined to meet our MP formatting requirements.

---

**2. SPECIFICATIONS REFERENCED DOCUMENTS**

- a. ~~The coated dowel bars in basket assembly shall meet the requirements of Section 709.15 of West Virginia Division of Highways Standard Specifications for Road and Bridges as amended by the Supplemental Specifications, West Virginia Division of Highways Standard Specifications Roads and Bridges Section 709.15 Coated Dowel Bars & Dowel Basket Assemblies.~~

---

**3. DOCUMENTATION OF CERTIFIED COATER**

- 3.1 The fabricator shall obtain the following information from the certified coater:;
  - 3.1.1 Source of Steel
  - 3.1.2 WV Laboratory Number for the Steel
  - 3.1.3 Source of Coating
  - 3.1.4 Type of Coating
  - 3.1.5 WV Laboratory Number for the Coating
  - 3.1.6 Dry Film Thickness of the Coating

3.1.7 Total Number of Lineal Meters (~~Feet~~)

---

**4. WORKMANSHIP**

4.1 The load transfer unit shall be made in accordance with West Virginia Division of Highways Standard Detail Sheet.

4.2 The fabricator shall inspect the coating for the following items:

4.2.1 Saw cut ends of the dowel shall be free of burns and projections.

4.2.2 Flaws, such as perforations, cracks and holidays.

4.2.3 Damage from welding or mechanical fixation shall not extend more than 26 millimeter (~~1.024 inches~~) from the weld or point of fixation.

---

**5. DIVISION SAMPLING AND TESTING**

5.1 The Division may obtain samples at the fabricator's shop and/or at the project site to ensure ~~specifications~~-compliance.

5.2 If for any reason a plant fails to meet the requirements, as set forth above, the plant will be removed from ~~the~~-approved status until such time as corrective action is taken to meet the acceptance criteria.

---

**6. DOCUMENTATION**

6.1 The fabricator will submit the information contained on ~~a~~Attachment #1 with each shipment. Two copies will be required. One copy is sent with the shipment to the project; ~~and~~ the other is sent to ~~the~~ Materials Control, Soils and Testing Division.

6.2 Upon receipt of the coated dowel bars in basket assembly from a certified source, coverage will be obtained by entering on form HL-440 the laboratory number for the source which is found on the list of approved suppliers.

---

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

RLS:Mpr

Attachment

**Attachment 1**

COATED DOWEL BARS IN BASKET ASSEMBLY

PROJECT:

FABRICATOR:

LOCATION:

SOURCE OF STEEL BARS:

WV LABORATORY APPROVAL ~~NO.~~NUMBER:

SOURCE OF STEEL WIRE:

WV LABORATORY APPROVAL ~~NO.~~NUMBER:

COATER:

LOCATION:

SOURCE OF COATING:

WV LABORATORY APPROVAL NUMBER:

QUANTITY OF BASKET ASSEMBLIES

NO. OF LINEAL METERS(FEET):

SHIPPED TO:

DATE SHIPPED:

SIGNED \_\_\_\_\_

DATE \_\_\_\_\_

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

MATERIALS PROCEDURE

---

TEST METHOD FOR UNCONFINED COMPRESSIVE STRENGTH  
OF ROCK CORE SPECIMENS

---

**1. PURPOSE**

- 1.1 To establish a procedure for testing the unconfined compressive strength of rock core specimens.
- 

**2. SCOPE**

- 2.1 This procedure shall apply to nominal 2-inch diameter rock core specimens obtained for the purpose of determining the uniaxial compressive strength of rock.
- 2.2 This procedure will specify the requirements for the apparatus to be used in the test procedure, specimen preparation, and the actual test procedure.
- 

**3. APPARATUS**

- 3.1 Diamond Saw – A manual or automatic rock saw equipped with a circular diamond saw blade, and appropriate cooling and cutting agents.
- 3.2 Feeler Gage – The feeler gage 3 inch “leaves” must include sizes beginning at 0.0015 inches.
- 3.3 Testing Machine – The testing machine shall meet the requirements for the testing machine specified in ASTM C 109.
- 

**4. SPECIMENS**

- 4.1 Test specimens shall be nominal 2-inch diameter rock cores with a length-to-diameter ratio (L/D) of 2.0 to 2.5 and a diameter of not less than 1.88-inches.
- 4.1.1 The field moisture condition of the test specimen shall be preserved until the time of the test unless otherwise specified.
- 4.2 The sides of the specimen shall be generally smooth and free of abrupt irregularities that, as determined by the technician performing the test, would adversely affect the compressive strength result.
- 4.3 Cut the ends of the specimens parallel to each other and at right angles to the longitudinal axis using a diamond saw.

- 4.4 Determine the diameter of the test specimen to the nearest 0.01 inches by averaging two diameters measured at right angles to each other at about mid-height of the specimen. Determine the length of the test specimen to the nearest 0.01 inches at the centers of the end faces.
- 4.5 When the Modified Rock Hardness and Unconfined Compressive Strength (HCSI) of the specimen is 3 or less (average rock – corresponding to an estimated compressive strength of  $\leq 8,000$  psi), the ends of the specimens shall be capped with high-strength gypsum cement paste in accordance with ASTM C 617.
- 4.6 When the Modified Rock Hardness and Unconfined Compressive Strength (HCSI) of the specimen is 4 or greater (hard rock – corresponding to an estimated compressive strength of  $> 8,000$  psi), the ends of the specimens shall be sawed or ground flat to a tolerance not to exceed 0.002 inches.

---

**5. PROCEDURE**

- 5.1 Ensure that the spherically seated block of the testing machine rotates freely in its socket before each test. Wipe clean the bearing faces of the upper and lower bearing blocks and place the test specimen in the testing machine on the lower bearing block below the center of the upper bearing block. Bring the spherically seated block into uniform contact with the surface of the specimen.
- 5.2 Apply the load at a relative rate of movement between the upper and lower platens corresponding to a loading on the specimen within the range of  $35 \pm 7$  psi/s. Obtain this designated rate of movement of the platen during the first half of the anticipated maximum load and make no adjustment in the rate of movement of the platen in the latter half of the loading.
- 5.3 Record the maximum load carried by the specimen. Load readings in pounds (kilonewtons) shall be recorded to the nearest 10 lbs.

---

**6. CALCULATION**

- 6.1 Calculate the compressive strength of the specimen as described in section 6.2 and express the result to the nearest 10 psi.
- 6.2 Calculate the compressive strength of the specimen as follows:

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

Where:

CS = Compressive strength of the specimen

ML = Maximum load carried by the specimen during the test

$\pi$  = Mathematical constant PI

D = Average diameter of the specimen (as determined in section 4.4)

**7. REPORT**

- 7.1 The report shall include the following:
  - 7.1.1 Laboratory number;
  - 7.1.2 Project name, project number, and authorization number;
  - 7.1.3 Date of test;
  - 7.1.4 Core boring number and depth of specimen from the top of the hole;
  - 7.1.5 Station and offset of the core boring;
  - 7.1.6 Specimen diameter and length as determined in section 4.4;
  - 7.1.7 Specimen end preparation method (capping, sawing, or grinding);
  - 7.1.8 Maximum load as determined in section 5.3;
  - 7.1.9 Compressive strength as determined in section 6.2;
  - 7.1.10 Physical description of the rock specimen (type, color, and grain size).
- 7.2 Use Attachment 1 as the format for the report.

---

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

MP 212.01.21 Steward – Aggregate & Soils Section  
RLS:M  
ATTACHMENT

## ATTACHMENT 1

WEST VIRGINIA DIVISION OF HIGHWAYS MATERIALS CONTROL, SOILS AND TESTING DIVISION UNCONFINED COMPRESSIVE STRENGTH OF ROCK CORES			
Laboratory Number:			
Project Name:			
Project Number:		Authorization Number:	
Date of Test:		Core Boring Number:	
Station:		Offset:	
Depth From Top of Hole (ft )			
Diameter (in.)			
Average Diameter (in.)			
Length (in. / mm)			
End Preparation Method			
Maximum Load (lb.)			
Compressive Strength (psi )			
Physical Description of Rock: Type: Color: Grain Size:			
Remarks:			



## MATERIALS PROCEDURE

---

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

---

#### 1. PURPOSE

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

---

#### 2. SCOPE

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

---

#### 3. APPLICABLE DOCUMENTS

- 3.1 WVDOH Standard Specifications for Roads and Bridges and Supplemental Specifications.
- 3.2 UL Underwriters Laboratories specifications

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#### 4. ACCEPTANCE PROCEDURE

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

---

#### 5. ACCEPTANCE PROCEDURE (APPROVED SOURCE)

- 5.1 For a Producer/Supplier to be considered an approved source of fence items as stated in Section 2.1 the supplier must comply with the following requirements where applicable.
- 5.2 The Producer/Supplier is to complete and submit form HL-468 attainable from the [website](#)<sup>1</sup> and be submitted to the WVDOH Materials Control, Soils and Testing Division.
- 5.3 Once form HL-468 form is correctly submitted, an on-site investigation evaluation will be conducted by an Evaluator from the WVDOH at the supply distribution

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

location, to determine if the proposed location should be listed as an approved source for fence items.

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

---

**6. ACCEPTANCE PROCEDURES (NON-APPROVED SOURCE)**

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

---

**7. DOCUMENTATION REPORT**

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

---

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

MP 712.05.57 Steward – Metals Section  
RLS:H  
ATTACHMENTS

Attachment 1

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

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

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

Attachment 2

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

**REPORT NUMBER** 1112458

**LOCATION EVALUATION REPORT**

**SUBJECT:** Location evaluation of:  
  
Wombat Fence Products,  
Producer/Suppliers of fence items,  
located in Metropolis, Illinois

**DATE OF REPORT:** October 27, 2021

---

**1. INTRODUCTION**

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

---

**2. INVESTIGATION**

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

**3. CONCLUSION**

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

---

Nicholas Fury  
Evaluator

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

MATERIALS PROCEDURE

---

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

---

**1. PURPOSE**

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

**2. SCOPE**

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

**3. DEFINITION OF TERMS**

- 3.1 Sublot - The quantity of material represented by a single test value.
- 3.2 LOT - The quantity of material represented by an average test value.
- 3.3 In those cases where only one sample is taken to represent the total quantity the subplot and LOT will be considered the same.
- 

**4. DESIGNATION OF QUANTITIES FOR EQUITABLE PRICE  
ADJUSTMENT**

- 4.1 When an average gradation test value, or three individual test values, fall outside the limits of the Specifications, the LOT of material represented thereby is considered to be nonconforming to the extent that the last of its sublots is nonconforming. When a lot of material is nonconforming, then the last subplot contained therein shall have its price adjusted in accordance with Table 1. In no event, however, shall a subplot of material have its price adjusted more than once, and the first adjustment which is determined shall apply.



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

---

**5. DEGREE OF NONCONFORMANCE**

5.1 When a subplot of material is to have its price adjusted, the percentage point difference between the nonconforming test value and the specification limit shall be determined for each sieve determined to be nonconforming (nonconforming as described in 4.1 above), and this value shall be compared to Table 1. The total measure of the degree of nonconformance is, therefore, the sum of nonconformance on the two sieve sizes of the subplot.

<u>Table 1</u>	
<u>Degree of Nonconformance</u>	<u>Percent of Contract Price to be Reduced</u>
<u>1.0 to 3.0</u>	<u>2</u>
<u>3.1 to 5.0</u>	<u>4</u>
<u>5.1 to 8.0</u>	<u>7</u>
<u>8.1 to 12.0</u>	<u>11</u>
<u>Greater than 12.0</u>	<u>*</u> <u>-</u>

Table 1

Degree of Nonconformance	Designated Action
1.0 to 3.0	Reduced Price 2%
3.1 to 5.0	" " 4%
5.1 to 8.0	" " 7%
8.1 to 12.0	" " 11%

---

**6. DETERMINATION OF EQUITABLE ADJUSTMENT**

6.1 When the total degree of nonconformance has been established and it is 12.0 or less, the designated action shall be initiated from Table 1. When the degree of nonconformance for a subplot is greater than 12.0, a special investigation shall be performed within 14 calendar days of determining the degree of nonconformance. If the special investigation is not performed in 14 calendar days, said subplot will not be incorporated into the project, and in fact, removed from the project as soon as possible.

---

**7. METHOD OF ACCOUNTING AND CHANGE ORDER PREPARATION**

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

- 7.2 Dollar reduction shall be calculated by (A) quantity ~~xx~~ (B) % reduction from Table 1 ~~xx~~ (C) unit contract price. (A sample tabulation sheet is attached).

---

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Director  
Materials Control, Soils and Testing Division

MP 212.02.20 Steward – Aggregate & Soils Section  
RLS:M  
ATTACHMENT

Equitable Reduction Procedure

---

TABULATION OF EQUITABLE REDUCTIONS (partial)

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

Subtotal (1) <sup>(Note 2)</sup>      \$280.00

	1000 FT <sup>3</sup>	1.2	<u>2%</u>	3.50	70.00
	1000 FT <sup>3</sup>	11.7	<u>11%</u>	3.50	<u>385.00</u>

Subtotal (2) <sup>(Note 2)</sup>      \$455.00

---

Total Reduction <sup>(Note 3)</sup>      \$735.00

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

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

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

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

MATERIALS PROCEDURE

---

METHOD OF TEST FOR DETERMINING MORTAR STRENGTH

---

**1. PURPOSE**

- 1.1 To provide a method of testing to determine the effects of organic impurities in fine aggregate on mortar strength.
- 

**2. SCOPE**

- 2.1 This procedure is applicable to fine aggregate to be used in concrete that has been tested and deemed darker than the standard in accordance ~~to~~ with the guidelines established in AASHTO T21 and Section 702.1.4 of the West Virginia **Standard** Specifications.
- 

**3. APPLICABLE PROCEDURES**

- 3.1 AASHTO T21  
3.2 AASHTO T84  
3.3 ASTM C109  
3.4 ASTM C230  
3.5 ASTM C305  
3.6 ASTM C511  
3.7 ASTM C778  
3.7.3.8 **ASTM C1437**
- 

**4. APPARATUS**

- 4.1 Nonabsorbent pan of sufficient size to hold and manipulate the sample.  
4.2 Drying device with variable temperature control capable of producing a flowing stream of warm air.  
4.3 **Cone Mold** and **tamping rod tamper** conforming to the requirements of Section 6.2.1 of AASHTO T84.  
4.4 Balance having a capacity 5000 grams and sensitive to the nearest 0.1 gram.  
4.5 A variable speed planetary and revolving motion mixer with paddle blades conforming to the requirements of ASTM C305.

- 4.6 Flow ~~T~~table, conical mold, and calipers conforming to the requirements of ASTM C230.
- 4.7 Specimen molds and tamper conforming to requirements ASTM C109.
- 4.8 Moisture cabinet conforming to the requirements of C511.
- 4.9 Compression apparatus capable of at least a 20,000-pound load.
- 4.10 Nonabsorbent containers for holding excess fine aggregate and cement.
- 4.11 Distilled water.

---

## 5. PROCEDURE

- 5.1 Approximately 5000 grams is obtained from field sample.
- 5.2 Dry field sample to SSD condition as described in Section 7 of AASHTO T 84, remove and weigh out a portion to be used in the test. This is an estimate of the amount needed to bring the mix to the right consistency. Weigh out additional sandfine aggregate to be added if needed. Place each in an airtight container. Cover remaining sample with a damp cloth.
- 5.3 Pre-measure ~~360~~ 180 ml of distilled water into a total drain (TD) beaker. Add the ~~360~~ 180 ml of distilled water into the mixing bowl and let beaker drain for 30 seconds.
- 5.4 Add ~~600~~ 300 grams of Type ~~III~~ II cement to water in the mixing bowl. Start the mixer and mix at slow speed (140 +/- ~~105~~ r/min) for 30 seconds.
- 5.5 Slowly add ~~the~~ a measured quantity of fine aggregate over the next 30 seconds while continuing mixing at slow speed to provide proper consistency.
- 5.6 Switch the mixer to medium speed (285 +/- 10 r/min) and mix for 30 seconds.
- 5.7 Stop the mixer and let it stand for 90 seconds. During the first 15 seconds quickly scrape the material collected to the side of the bowl into the batch. Cover the bowl.
- 5.8 Remove the cover and mix for 60 seconds at medium speed. If the mix appears too wet, ~~add~~ additional fine aggregate may be added during after the first 30 seconds of this mixing period. To do so, stop the mixer briefly, add the fine aggregate, and then complete the additional 30 seconds of mixing. At the end of 60 seconds stop the mixer and remove bowl.
- 5.9 Perform the flow test on the mixture in accordance with ASTM C~~109~~1437 with the exception that the table will be dropped ~~10~~ 25 times to achieve desired flow of ~~100~~ 110 +/- 5 ~~mm~~ percent.
- 5.10 If the flow is less than the target tolerance, the sample will be discarded and the test started over.

- 5.11 If the flow is greater than the desired target, place the sample back into the bowl and place the bowl in the mixer, add additional sand fine aggregate as needed, then remix for 30 seconds.
- 5.12 Check flow as described in Section 5.9. If the flow is within the target tolerance a set of compressive strength cubes will be made in accordance with ASTM C109. If more than two trials must be made to obtain a flow of  $110 \pm 5$  percent, consider the mortar as a trial mortar, and prepare test specimens from a new batch The cubes will be tested for compressive strength at three seven days.
- 5.13 A control sample will be prepared of Ottawa sand that meets ASTM C778. Compressive strength cubes will be made in accordance with ASTM C109 with the exception that the sand will not be taken to SSD condition. The preparation of the control sample will follow the procedures as outlined in Sections 5.3 through 5.12. A ~~N~~new control sample shall be performed prepared for test sample with each shipment of cement.

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## 6. CALCULATION

- 6.1 The average of the compressive strength breaks of the control samples will be divided into the average of the breaks of the fine aggregate being tested.

$$(\bar{X}_t / \bar{X}_c) = \text{relative compressive strength of test sample.}$$

where:  $\bar{X}_c$  = average test results of control sample.

$\bar{X}_t$  = average test results of test sample.

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## 7. REPORTING

- 7.1 The results will be reported out to the nearest 0.1 percent.

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

MATERIALS PROCEDURE

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

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**1. PURPOSE**

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

**2. SCOPE**

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

**3. PROCEDURE**

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

3.3 Record Keeping

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

3.4 Transmittal of Information

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

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

~~3.4.3~~ 3.4.2 Additions to or deletions from the list shall immediately be sent to all District Materials ~~Engineers and/or~~ Supervisors who turn shall notify any Contractors using such materials.

~~3.4.4~~ 3.4.3 This approved list of manufacturers of welded stud shear connectors shall be available to all Contractors on Department of Highways projects by navigating to the [WVDOH MCS&T Webpage](https://transportation.wv.gov/highways/mcst/Pages/APL_By_Number.aspx)<sup>1</sup>.

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MP 615.20.01 Steward – Metals Section  
RLS:H

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



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

MATERIALS PROCEDURE

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CHEMICAL ANALYSIS OF ALUMINUM ALLOYS

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1.0 PURPOSE

1.1 To provide a method to determine the chemical analysis of Aluminum Alloys by Atomic Absorption Spectroscopy (AAS), ~~Inductively Coupled Plasma-Atomic-Emission Spectroscopy (ICP-AES) and Conventional Wet-Chemistry~~ gravimetric analysis.

2.0 SCOPE

2.1 This procedure is applicable to Aluminum Alloys furnished under Sections 661.2.1.1.1, 661.2.1.1.2, 661.2.1.2, 661.2.1.3 and 661.2.1.4 of the West Virginia Division of Highways Standard Specifications for Roads and Bridges, ~~Adopted 2000.~~

3.0 REFERENCES

ASTM E1024  
ASTM E1479  
~~ASTM E34~~  
ASTM C114

~~Ravenswood Aluminum Technical Method Number 100; Sheet  
Number 1100.00 thru Number 1100.12.~~

4.0 ATOMIC ABSORPTION, ~~INDUCTIVELY COUPLED PLASMA-ATOMIC~~  
~~EMMISION SPECTROSCOPY~~ and ~~WET-CHEMISTRY~~ and gravimetric analysis.

~~All required~~ Chemical analysis under this procedure will be conducted by Atomic Absorption, ~~Inductively Coupled Plasma-Atomic-Emission spectroscopy and / or conventional wet-chemical~~ and gravimetric methods. The Calibration of standards and identification of factors affecting accuracy, precision and sensitivity are in accordance with ~~ASTM E34~~, ASTM E1024 and ASTM E1479. ~~Method ASTM E34 covers the analysis and percentage determination of the following metals; Fe (Iron), Cu(Copper), Mn (Manganese), Cr (Chromium), Zn (zinc), Ti (Titanium), Mg(Magnesium), Ni (Nickel), and Si (Silicon).~~

4.1 Reagents Needed

4.1.1 Hydrochloric Acid (HCl), specific gravity 1.19

4.1.2 Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>), 30 percent solution.

## 4.2 Preparation of Standards

4.2.1 NBS and Alcoa Aluminum Standards are prepared that will bracket alloys received in the laboratory for analysis.

4.2.2 Weigh out 1.0000 plus or minus 0.0005 grams of alloy, place in a 1,000 mL volumetric flask, add 40 mLs 1 plus 1 HCL. After violent reaction ceases, add 2 mLs H<sub>2</sub>O<sub>2</sub> to the flask, ~~place on pad on hot plate and finish dissolution (5 minutes)~~ and heat to dissolve. Cool, dilute to mark, mix thoroughly, and analyze metals by Atomic Absorption or Inductively ~~Coupled Plasma-Atomic Emmision using working standards.~~

## 5.0 GRAVIMETRIC ANALYSIS METHOD FOR SILICON

This method covers the analysis and percentage determination of Silicon. The method used for the analysis is in accordance with ~~the Ravenswood Aluminum Technical Method Number 100; Sheet Number 1100.11 thru Number 1100.12.~~

### 5.1 Reagents and Equipment Needed

5.1.1 Mixed Acid Solution – Mix in order given: 700 mL H<sub>2</sub>O, plus 500 ml 1:1 sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), 400 ml nitric acid (HNO<sub>3</sub>), 400 ml hydrochloric acid (HCl). Let cool after each acid addition. Store in plastic bottles.

5.1.2 Sulfuric Acid (H<sub>2</sub>SO<sub>4</sub>) - 10%

5.1.3 Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>) – 3%

5.1.4 Number 41 Whatman (or equivalent) filter paper

5.1.5 Porcelain Crucible – 15 to 30 mL capacity

5.1.6 Muffle furnace conforming to ASTM C114, ~~Section 4.2.7~~

### 5.2 PROCEDURE

5.2.1 Weigh one gram sample into a 250 mL Erlenmeyer wide mouth flask.

5.2.2 Add 35 ml mixed acid solution slowly (for ½ g sample use 17.5 ml and for 2 g sample use 70 ml of mixed acid solution).

NOTE: Carry through a reagent blank.

5.2.3 Evaporate to fumes after sample is completely in solution. Continue to fume until all heavy fumes have been driven from the bottom of the flask.

**Commented [MMA1]:** This is not longer the correct section (it's now Section 6.2.7). We may just want to say ASTM C114, as the sections are sometimes re-numbered.

NOTE: Blank will go to complete dryness, only if started early.

- 5.2.4 Remove from hot plate and cool to touch.
- 5.2.5 Add 50 ml 10% H<sub>2</sub>SO<sub>4</sub> (80 ml 10% H<sub>2</sub>SO<sub>4</sub> for 2 g sample).
- 5.2.6 Add several drops 3% H<sub>2</sub>O<sub>2</sub>.
- 5.2.7 Place on hot plate and heat until all soluble salts are in solution. (Everything is in solution now but silicon.)
- 5.2.8 Filter through Number 41 Whatman (or equivalent) filter paper.
- 5.2.9 Wash flasks three times with hot water (police if necessary) and pour through filter also.
- 5.2.10 Wash filter papers about ten times with hot water. Wash the papers approximately another five times. ~~or until the papers are acid free to the taste.~~
- 5.2.11 Place filter papers in clean porcelain crucibles.

NOTE: Crucibles should have no pits or traces of previous ignitions.

- 5.2.12 Burn for 45 minutes in a muffle furnace at 982°C.
- 5.2.13 Cool crucibles to room temperature. Carefully empty ash on keyboard, balance pan, and weigh.
- 5.3 CALCULATION

The percent of the silicon content will be calculated as follows:

$$\%Si = \frac{(\text{weight SiO}_2 - \text{blank}) (0.4672) (100)}{\text{Sample Weight}}$$

or use Silicon chart (1.0 G samples only). See Table 1.

TABLE 1  
SILICON

WT ASH %Si WT ASH %Si WT ASH % Si WT ASH %Si WT ASH %Si WT ASH %Si

.0010	.05	.0031	.14	.0052	.24	.0073	.34	.0094	.44	.0115	.54
.0011	.05	.0032	.15	.0053	.25	.0074	.35	.0095	.44	.0116	.54
.0012	.06	.0033	.15	.0054	.25	.0075	.35	.0096	.45	.0117	.55
.0013	.06	.0034	.16	.0055	.26	.0076	.36	.0097	.45	.0118	.55
.0014	.07	.0035	.16	.0056	.26	.0077	.36	.0098	.46	.0119	.56
.0015	.07	.0036	.17	.0057	.27	.0078	.36	.0099	.46	.0120	.56
.0016	.08	.0037	.17	.0058	.27	.0079	.37	.0100	.47	.0121	.57
.0017	.08	.0038	.18	.0059	.28	.0080	.37	.0101	.47	.0122	.57
.0018	.08	.0039	.18	.0060	.28	.0081	.38	.0102	.48	.0123	.57
.0019	.09	.0040	.19	.0061	.28	.0082	.38	.0103	.48	.0124	.58
.0020	.09	.0041	.19	.0062	.29	.0083	.39	.0104	.49	.0125	.58
.0021	.10	.0042	.20	.0063	.29	.0084	.39	.0105	.49	.0126	.59
.0022	.10	.0043	.20	.0064	.30	.0085	.40	.0106	.50	.0127	.59
.0023	.11	.0044	.21	.0065	.30	.0086	.40	.0107	.50	.0128	.60
.0024	.11	.0045	.21	.0066	.31	.0087	.41	.0108	.50	.0129	.60
.0025	.12	.0046	.22	.0067	.31	.0088	.41	.0109	.51	.0130	.61
.0026	.12	.0047	.22	.0068	.32	.0089	.42	.0110	.51	.0131	.61
.0027	.13	.0048	.22	.0069	.32	.0090	.42	.0111	.52	.0132	.62
.0028	.13	.0049	.23	.0070	.33	.0091	.43	.0112	.52	.0133	.62
.0029	.14	.0050	.23	.0071	.33	.0092	.43	.0113	.53	.0134	.63
.0030	.14	.0051	.24	.0072	.34	.0093	.43	.0114	.53	.0135	.63

$$\%Si = \frac{(Wt. Ash) (.4672) (100)}{Wt. Sample}$$

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

MATERIALS PROCEDURE

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PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT MILL  
CERTIFICATION

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**1. PURPOSE**

- 1.1 To provide the Division's acceptance procedures for portland cement and blended hydraulic cements.
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**2. SCOPE**

- 2.1 This procedure shall apply to all portland cement and blended hydraulic cement production mills which furnish cement to Division projects, except that the Division may elect to use other control procedures when special conditions dictate the need for more stringent control.
- 

**3. APPLICABLE SPECIFICATIONS**

- 3.1 All items under this procedure shall meet the requirements of Section 701 of the WVDOH Standard Specifications for Roads and Bridges. This section specifically includes ASTM C150 for portland cement and ASTM C595 for blended hydraulic cements. In addition, samples will be obtained in accordance with ASTM C183.
- 

**4. PROCEDURE**

Cement mills which produce cement for use in Division projects shall be identified as Certified or Non-Certified, as outlined below.

**4.1 CERTIFIED**

To be considered for certification, the manufacturer shall do the following:

- 4.1.1 Submit a certified statement to Materials Control, Soils and Testing Division that all cement shipped to Division projects will conform to the specification requirements. The certified statement shall be signed by a representative of the manufacturer having legal authority to bind the company.
- 4.1.2 Maintain records of production control tests, for each type of cement which may be supplied to WVDOH projects, for a period of at least five years and make them available to the Division upon request.
- 4.1.3 Have mill laboratory facilities inspected by the Cement and Concrete Reference Laboratory (CCRL). A copy of the CCRL report on the mill laboratory inspection shall be provided to the Division, accompanied by documentation of resolution of any discrepancies noted in the CCRL report.

- 4.1.3.1 Each mill shall continue to participate in the CCRL inspection program at the normal inspection frequency scheduled by CCRL, typically 24-36 months. Each mill shall submit a copy of that inspection report to this Division accompanied by documentation of resolution of any discrepancies noted in the CCRL report.
- 4.1.4 Submit to the Materials Division test data developed on the type(s) of cement to be certified. This data must consist of test results developed from each day's production over the most recent fifty production days. The required tests are for all the standard chemical and physical requirements listed in ASTM C150 and/or ASTM C595. Each complete battery of tests shall represent not more than twenty-four hours of continuous production per finish mill.
  - 4.1.4.1 In the case of Type III cement, blended hydraulic cement, or other cement which is not produced on a regular basis, if there are not fifty production days for that type of cement in the previous two-year period, then the data for that type of cement shall consist of test results from at least the last twenty-six production days, unless otherwise approved by the Division.
- 4.1.5 The quality history of a cement plant seeking certification will be determined using the data submitted by the manufacturer as specified in 4.1.4 or 4.1.4.1. Statistical limits, as defined in ASTM C183, will be developed from this data. When an acceptable quality history has been determined, the Division will compare test data developed on production grab samples taken by Division representatives, to the statistical limits established by the mill's production data.
- 4.1.6 When a cement mill has met the above criteria and has been designated by the Division as Certified, the manufacturer will be required to submit test data on a monthly basis in the same manner as described in 4.1.4.
  - 4.1.6.1 As required in Section 4.1.4, all Certified cement mills shall submit test results, for all tests, developed from each day's production, to Materials Division, except for the results for the Insoluble Residue test. Once a cement mill has been Certified, and if, during the previous three-month period, none of the Insoluble Residue test results from that Certified cement mill exceed 0.75%, then that Certified cement mill may reduce the frequency of Insoluble Residue test result submittal to one test per week of production, instead of one test per day of production. If any Insoluble Residue test result from that Certified cement mill (including results from samples obtained by the Division), is greater than 0.75%, then the frequency of Insoluble Residue test result submittal from that Certified cement mill shall immediately be increased back to one test per day of production, until another three-month period has elapsed, with no Insoluble Residue test results greater than 0.75% from that Certified cement mill.
  - 4.1.6.2 When ASTM C1038 testing is performed due to higher SO<sub>s</sub> content, as outlined in Table 1 of ASTM C150 and/or Table 1 of ASTM C595, the Certified cement mill performing that testing shall perform a minimum of one test per month on the sample with the highest SO<sub>s</sub> content for that month.
  - 4.1.6.3 In the case of Type III cement, blended hydraulic cement, or other cement, which is not produced on a regular basis, if no cement of this type was produced in a particular

month(s), then the Cement Manufacturer shall submit a written statement noting this to Materials Division.

- 4.1.7 Division representatives will take paired samples from a certified plant's production at a frequency dependent upon the variability of test data. The frequency will generally be such that the sampling is accomplished at least once ~~a quarter~~ every four-month period, approximately.
- 4.1.7.1 In the case of Type III cement, blended hydraulic cement, or other cement, which is not produced on a regular basis, if no cement of this type was produced in a ~~quarter~~ four-month period, then the Cement Manufacturer shall submit a written statement noting this to Materials Division, and Division representatives will not be required to take paired samples ~~that quarter~~ for that four-month period.
- 4.1.7.2 The paired samples will be obtained, tested, and evaluated in accordance with applicable ASTM procedures.
- 4.1.7.3 Two consecutive pairs of test values failing to meet the statistical control criteria may be considered cause to remove the mill from the certified group.
- 4.1.7.4 If any individual sample fails to meet the requirements of the applicable ASTM Specification, the mill may be removed from the certified group.
- 4.1.7.5 If a certification is removed, it may be reinstated at the discretion of the Division when sufficient sampling and testing has been conducted to ensure statistical control.
- 4.1.8 When all requirements for certification have been met, the manufacturer may ship cement of the type certified to Division projects. Records of quantities of cement shipped to West Virginia projects must be maintained by the manufacturer for a minimum of three years and made available to the Division upon request.
- 4.1.9 The manufacturer and the Division's District Materials offices will be notified of all changes in the status of a mill's certification.
- 4.1.10 Once each ~~quarter~~ month, or anytime the list is updated, the Materials Division will provide the District with a list of all currently certified cement mills.
- 4.2 Non-Certified
- A cement mill defined as non-certified may supply cement to the Division projects from approved LOTs.
- 4.2.1 The Division will sample, test, approve, and seal LOTs of cement for use in Division projects. Samples will be obtained in accordance with ASTM C183 except that one grab sample shall be secured for each 400 tons (360 Mg) in the sampling of bulk storage at points of discharge, while the cement is flowing through the openings. All of the applicable chemical and physical tests noted in ASTM C150 and/or ASTM C595 will be conducted by the Division laboratories.
- 4.2.1.1 Any individual sample failing to meet all of the applicable ASTM requirements will result in rejection of the entire LOT of cement.

- 4.2.2 When a LOT of cement has been sampled, tested, and found to meet all specification requirements, the Division will notify the manufacturer of approval and a WVDOH approval number will be assigned to the LOT.
- 4.2.3 A manufacturer may make shipments from approved LOTs upon notification of Division approval. When such shipments are made, the manufacturer shall provide documentation as follows:
- a) Project to which material is shipped (if available)
  - b) Silo number from which material drawn
  - c) Location of shipping origin
  - d) Contractor (i.e. consignee)
  - e) WVDOH approval number assigned to silo
  - f) Identification of carrier
  - g) Quantity of material in shipment
  - h) Type of material
- 4.2.3.1 This documentation may be provided in the form of bills of lading and shall have the following distribution:
- a) 1 copy sent to Materials Control, Soils and Testing Division
  - b) 1 copy sent to accompany shipment and to be left at the destination to become the property of the Division
- 4.2.3.2 Records of quantities of cement shipped to West Virginia projects must be maintained by the manufacturer for a minimum of three years and made available to the Division upon request.
- 4.2.3.3 A balance sheet shall be maintained by the manufacturer for each LOT of cement approved for shipment to West Virginia projects. This balance sheet shall provide the following information:
- a) The silo number
  - b) The Division approval number assigned to the silo
  - c) The test quantity
  - d) Separate entries for each shipment made from the silo showing bill of lading number and quantity.
  - e) The balance left in the test quantity after each shipment

The manufacturer may not ship material in excess of the test quantity plus five percent (5%).

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