

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

MATERIALS PROCEDURE

INSPECTION AND ACCEPTANCE PROCEDURES
FOR PRECAST CONCRETE PRODUCTS

1. PURPOSE

- 1.1 To set forth procedures for the inspection and acceptance of precast concrete products, including inlets, manholes, box culverts, 3-sided bridge units, retaining wall panels, headwalls, wingwalls, lagging, junction boxes, and any other precast products, and the approval of the plants at which they are fabricated.

2. SCOPE

- 2.1 This procedure will apply to all precast concrete products supplied for use on West Virginia Division of Highways projects and to all precast concrete product fabricators that supply material for use on West Virginia Division of Highways projects.
- 2.2 For prestressed concrete members refer to MP 603.10.40 "Inspection and Acceptance Procedure for Prestressed Concrete Bridge Beams."

3. FABRICATOR APPROVAL

- 3.1 All precast concrete product fabricators (hereafter referred to as the Fabricator) shall be approved by Materials Control Soils and Testing MCS&T Division prior to the start of any work for the WVDOH. If not listed on the WVDOH Approved List of Precast Concrete Fabricators, a Fabricator shall contact MCS&T Division a minimum of six weeks prior to the planned date on which fabrication is to begin to initiate the approval process.
- 3.2 In order for a Fabricator to be approved and listed on the WVDOH Approved List of Precast Concrete Fabricators, they must be NPCA (National Precast Concrete Association) certified, QCAST (American Concrete Pipe Association) Certified, or have an equivalent type of certification.
- 3.3 The process for approving a Fabricator shall include, but not be limited to, an on-site visit to the fabrication plant by a WVDOH representative from MCS&T Division. During this visit, the WVDOH Quality Assurance (QA) personnel shall inspect the fabrication facility and Quality Control (QC) lab, meet with QC and other key personnel from the Fabricator, and sample component materials which will be used in the fabrication of precast items.

- 3.3.1 Sampling and testing of component materials shall be done in accordance with MP 603.02.10. Copies of recent component delivery tickets should be presented on the day of sampling. All component materials must be approved prior to the start of fabrication.
- 3.3.1.1 Any Fabricator which does not produce for the WVDOH for a period of 2 years shall be removed from the Approved Fabricator list. After removal from the approved list, before a Fabricator can again produce for the WVDOH, they must repeat the approval process. Sampling of component materials will not continue when the plant is not listed on the Approved Fabricator list.
- 3.3.2 Personnel from the Fabricator required to be present during the initial on-site visit and meeting between WVDOH and Fabricator shall include representatives from Production and Quality Control. Any questions and concerns regarding WVDOH requirements, including applicable Specifications, Materials Procedure (MP's), Standard Details, and QC/QA Inspections shall be addressed at this meeting.
- 3.3.3 The Fabricator must submit the Quality Control Manual/Plan for review at this meeting.
- 3.4 All Concrete Mix Designs which will be used on products fabricated for the WVDOH must be submitted for review & approval, prior to the start of fabrication. Any design mix with an aggregate(s) that has a reactivity classes R1, R2, or R3, as shown as in Approved Aggregates Source List, shall be developed in accordance with WVDOH specifications, subsection 601.3.1.1. If an aggregate Source is not listed on the Approved Aggregates Source List, the Division will test the fine and coarse aggregate from the Source, in accordance with AASHTO T 303, to determine the reactivity class of the aggregate prior to its use on any WVDOH project. The Division will inform the Fabricator of the reactivity class of aggregates that they are proposing to use. If a cement Source and/or a SCM Source are not listed on the Approved Source List, the Division will test cement and/or SCM from that Source prior to its use on any WVDOH project.
- 3.5 The Fabrication Plant QC Personnel, as a minimum, shall be a certified ACI Grade I Concrete Field Testing Technician and/or a WVDOH PCC Inspector. In addition, if Self-Consolidating Concrete (SCC) is used, Fabrication Plant QC Personnel shall be a certified ACI SCC Testing Technician.

3.6

All Precast Concrete items shall be accepted by Direct or Master Coverage except when a Fabricator is certified as an Approved Source of concrete lagging as defined in Section 7.0.

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4. **FABRICATION & INSPECTION OF PRODUCTS FOR DIRECT & MASTER COVERAGE**

4.1 Prior to beginning fabrication of any precast concrete products, the Fabricator shall provide written or email notification to MCS&T Division at least one calendar week in advance of the date on which fabrication is to begin.

4.1.1 Depending upon the precast items being fabricated, MCS&T Division may choose to monitor fabrication. Fabrication of structurally significant products such as box culverts and 3-sided bridge units shall be monitored. Other items may be monitored at the discretion of MCS&T.

4.1.2 After fabrication has begun, the Fabricator shall keep MCS&T Division and the Inspector (whether a WVDOH employee or a contract employee representing the WVDOH) informed in advance of the days on which fabrication will take place.

4.2 Shop Drawings must be approved by the West Virginia Division of Highways prior to the start of any work by the Fabricator. The Inspector must have a copy of these approved shop drawings prior to start of any work by the Fabricator.

4.3 Concrete cylinders shall be made for compressive strength testing with 6-inch by 12-inch (150 mm by 300 mm) or 4-inch by 8-inch (100 mm by 200 mm) molds. The cylinders are to be cured in the same area as the products for which they represent (Field Cured as outlined in AASHTO T23) until tested to create a curing environment similar to the product that they represent. A compressive strength test shall consist of the average result of a set of cylinders, which is at least two cylinders. Form removal for wet cast concrete is not permitted until concrete has reached 50% of the design strength, unless otherwise specified. If forms are stripped from box culverts at 50% of the design strength, another curing method from section 601.12, or ASTM C1577 must be used until 70% of the design strength is obtained. Form removal limitations do not apply to elements fabricated with dry cast concrete. Dry cast concrete is defined as concrete with a slump less than 1-inch.

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4.3.1 For both conventional wet cast concrete and SCC mixes, a minimum of one set of compressive strength cylinders shall be fabricated from every 7 yards of concrete, or fraction thereof, with a minimum of one set per day per mix design. Both the form removal strength and the 28-day strength must be confirmed by a set of cylinders. Cylinders shall be the same size as those used in the initial approved mix design. For conventional concrete, slump, temperature, and air content tests shall be conducted on the first batch of concrete each day and every time that cylinders are fabricated. For SCC mixes, spread, temperature, and air content tests shall be conducted on every batch. For all types of concrete, unit weight and yield tests shall be conducted on the first batch of concrete each day and thereafter as deemed necessary by Quality Control and Quality Assurance Personnel.

4.3.2 For dry cast mixes, the 28-day strength shall be confirmed by a set of compressive strength cylinders. Compressive strength testing for form removal is not required for dry cast mixes. A minimum of one set of compressive strength cylinders shall be

fabricated for each item fabricated. The cylinders are to be fabricated in the molds on the vibration table in accordance with ASTM C497. For dry cast mixes, slump testing is not required, and concrete temperature testing shall be performed on the first batch of concrete each day and every time that cylinders are fabricated.

4.4 For precast manholes fabricated with wet cast and SCC mixes, absorption tests are to be conducted in accordance with ASTM C642. Tests should be conducted on a weekly basis for each mix design used, at a minimum, unless otherwise specified.

4.5 For precast products fabricated with dry cast mixes, absorption tests are to be conducted in accordance with ASTM C642, and tests should be conducted should be conducted on on a weekly basis for each mix design used. The maximum allowable absorption shall be 9%.

4.6 Unless otherwise specified, for conventional wet cast and SCC mixes, plastic concrete shall have an air content measured at $7.0 \pm 2.0\%$. For dry cast concrete, the air content test requirement is waived.

4.6.1 Prior to the use of Self-Consolidating Concrete in precast items all mix designs must be submitted to MCS&T for approval and meet the requirements of the following table. Test results from trial batches produced by the laboratory which designed it shall be included in the submittal. The compressive strength of the design mix shall be at least 15% above the specified design strength.

Table 4.5.1 - SCC Mix Design Acceptance

Fresh Property	Mix Design Batch Acceptance Criteria
Air Content	$7.0 \pm 1.5\%$
Spread (ASTM C1611)	Target ± 1.5 inches (38 mm) 2 seconds $\leq T_{50} \leq 7$ seconds Visual Stability Index ≤ 1.0
Passing Ability (ASTM C1621)	J-Ring Value ≤ 1 inch (25 mm)
Segregation Resistance (ASTM C1610)	Segregation $\leq 12\%$
Unit Weight and Yield	$\pm 2\%$ of Theoretical

4.6.2 The following table lists the criteria for SCC production.

Table 4.5.2 - SCC Production Acceptance

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Fresh Property	Production Acceptance Criteria
Air Content	7.0± 2.0%
Spread (ASTM C1611)	Target ± 2 inches (50 mm) 2 seconds ≤ T ₅₀ ≤ 7 seconds Visual Stability Index ≤ 1.0
Concrete Temperature	<90°F (32°C)
Unit Weight and Yield	±2% of Theoretical

4.6.3 SCC should only be given minimal vibration; and shall not be dropped from a distance greater than 4 feet relative to the top of the form.

4.6.4 Precast products fabricated with dry cast concrete shall be limited to a maximum wall thickness of 12 inches when single sided vibration is used and 18 inches when double sided vibration is used.

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5. FINAL INSPECTION

5.1 After fabrication is completed and prior to shipment, the precast items will be stored on dunnage. The Fabricator shall provide MCS&T Division with a written or email request for final inspection a minimum of one calendar week prior to the desired date of inspection. Effective communication from the Fabricator to MCS&T Division and Consultant Inspection Agency is the key to avoiding any scheduling conflicts regarding final inspection.

5.2 At the final inspection, the fabricator shall provide the inspector with documentation of required data pertinent to the product(s) being produced. Attached to this document is a sample inspection sheet to be used as a guide for presenting this information. This documentation is also available on the MCS&T Division Website¹.

5.2.1 For the final inspection, the Inspector may witness compressive strength tests if required, inspect repairs as needed, and conduct a thorough visual examination of each member. A copy of the Inspector's daily reports, a copy of the final inspection report, and all other pertinent information provided to the Inspector by the Fabricator shall be kept on file by MCS&T Division.

5.2.2 For box culverts, trial fitting of adjacent pieces, prior to shipping, will be required as part of the final inspection process. Each adjacent box culvert will be trial fitted in pairs horizontally or vertically; the gaps between each pair will be measured. Dunnage will be placed on a smooth level surface below the bottom of the culvert to prevent damage.

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

The maximum gap between the adjacent pieces shall not exceed ½ inch (13 mm), unless otherwise stated in the construction plans.

6. ACCEPTANCE & REJECTION

- 6.1 Upon completion of final inspection, if a precast product meets all specification requirements and does not contain any defects, the Inspector will stamp the precast product as accepted by MCS&T Division and provide a 7-digit Laboratory Reference Number for shipment.
- 6.2 If, however, the precast product does not meet all specification requirements due to damage, defect, or dimensional tolerance, the product must be further evaluated before potential acceptance by the MCS&T Division or the District for which the product was produced, as discussed further in the next sections.
- 6.2.1 Minor damage and/or defects may be repaired in accordance with the pre-approved repair procedures which should be incorporated within the Fabricator QC Plan. For cracks 4 mils (0.1 mm) or less a silane treatment may be used. Cracks between 4 mils (0.1 mm) and 16 mils (0.4 mm) shall be repaired by epoxy injection in accordance with Section 603.10.2. Products with cracks exceeding 16 mils (4 mm) shall be rejected by MCS&T. If repairs appear satisfactory and all other specifications are met, the Inspector shall stamp the product as approved for shipment. MCS&T Division will issue a 7-digit Laboratory Reference Number for acceptance.
- 6.2.2 Major damage and/or defects shall be evaluated on a case-by-case basis. If a product is approved for repair and if repairs appear satisfactory, the Inspector shall stamp the product as approved for shipment.
- 6.2.3 If a product does not meet specification requirements due to dimensional measurements not within tolerance, the product must be evaluated by the contractor and or District as to its potential acceptance. If the decision is made to accept the product, acceptance shall be provided by the District through a DMIR. If, however, the product will not be accepted, the Inspector will reject the product, and MSC&T Division will apply a Laboratory Reference Number documenting the rejected product.

7. PROCEDURE FOR APPROVED SOURCE OF PRECAST CONCRETE LAGGING

- 7.1 Precast concrete Fabricators may be classified as an Approved Source of precast concrete lagging if they have met the requirements of Section 3 and are producing lagging which is made in accordance with the relevant WVDOT Standard Details. Once classified as an Approved Source of precast concrete lagging, an Approved Source Lab Number will be assigned to the Fabricator for material tracking.
- 7.2 MCS&T Division may perform regular quality assurance inspections prior to shipment and/or, monitor fabrication of lagging from a Fabricator that is an Approved Source. The Approved Source Lab Number shall be noted on all shipping documents from the

fabricator, and material coverage will be requested under the assigned Approved Source Lab Number. All relevant concrete test data, component material information, QC inspection data, and shipping information shall be kept on file at the Fabricator for the last three years of fabrication and be shall available upon request by the Division. Failure to produce requested documentation may result revocation of the Fabricator's Approved Source certification status.

7.3

Approved Sources will be evaluated by the Division by random audits. Audits will be conducted on the material that is available to the Inspector at the time of the audit. All documentation and records for the pieces must be made available to the Inspector on the day of the audit and must be complete, current, and accurate. Failure to produce records shall be a cause for decertification.

7.3.1

All shipping documentation, concrete test data, and component material certifications shall be made available to the Inspector for review. These documents shall include all documents from material that has been shipped to state projects since the last audit. If data indicates that any material did not conform to this MP, the applicable Specifications, or Standard Detail; and was used in a state project, then the Fabricator will be de-certified as an Approved Source of precast concrete lagging.

7.3.2

In addition to documentation, the audit will consist of fabrication monitoring, test observance, and a visual inspection of material that is stocked for shipping on the day of the audit.

7.3.2.1

Each material test monitored during the audit must be performed in accordance with the applicable Standards, and Specifications. Visual inspection of stocked material will include quality checks of surface finish for cracks, spalls, and other surface blemishes after all repairs have been performed and dimensional checks. The material shall be properly stored to avoid handling damage and be accessible to the Inspector. Audits shall be graded on a point system deducted from 100 and weighted based on the Non-Conformance Points found per Table 7.3. A minimum score of 75 shall be considered passing.

TABLE 7.3

<u>Audit Category</u>	<u>Non-Conformance Points</u>
<u>Material Test Data Review</u>	<u>10 (per error)</u>
<u>Component Material Certification Review</u>	<u>10 (per error)</u>
<u>Shipping Documentation</u>	<u>10 (per error)</u>
<u>Stocked Material Visual Inspection</u>	<u>15 (per defect)</u>
<u>Dimension Check</u>	<u>20 (per error)</u>
<u>Test Performance Check</u>	<u>15 (per Test)</u>

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7.3.4

When a Fabricator, which is an Approved Source, fails an audit, the Fabricator must submit a written corrective action plan to bring their QC program back into compliance with this MP and corresponding Specifications during a probationary period of one month during which time the fabricator must prove they have fulfilled the corrective actions they submitted before supplying the material again. If the Fabricator fails to bring their material back into compliance within the probationary period, the Approved Source status will be revoked for a minimum of one year from the date of the end of the probationary period, or until the Fabricator has corrected the nonconformances listed during the failed audit. Two failing audits in a year shall result in revocation of the Fabricator's Approved Source status for one year from the date of the last failed audit. Any evidence of document falsification shall result in immediate loss of Approved Source status, and removal from the Approved List of Concrete Fabricators for a minimum 2 years. Depending on the severity and the legality of the falsified documents the removal may be permanent.

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7.3.5

Non-Conforming material received by WVDOT projects and reported to MCS&T shall result in an immediate failing audit and will require the Fabricator to submit corrective actions. If the Fabricator fails the subsequent audit, it will result in the loss of their Approved Source status.

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