

VIRGINIA DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

MEMORANDUM

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| GENERAL SUBJECT: Notice of Revision to Materials Division's Manual of Instructions Chapter II - VDOT Precast Concrete Products Quality Assurance Program | NUMBER: MD 393-16 |
| SPECIFIC SUBJECT: Revision to VDOT Manual of Instructions Section 204.22(c) qualifications to supply miscellaneous precast products, conditions for removal and an appeal process. | DATE: March 15, 2016 |
| | SUPERSEDES: |
| APPROVED: | Charles A. Babish, PE State Materials Engineer Approved: _____ |

EFFECTIVE DATE

- This memorandum is effective **July 1, 2016**
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PURPOSE

- This memorandum notifies users of the Materials Division's Manual of Instructions that Section 204.22(c) Miscellaneous Precast Units is being revised. VDOT is revising the qualifications for placement on Approved List #34, the qualifications for a Precast Concrete Quality Control (QC) Technician, conditions for removal from Approved list #34, an appeal and referee process for precast producers, VDOT Quality Assurance (QA) nonconformance reports (NCR) and a new appendix L containing examples of unacceptable noncompliance observations with QC plans.
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Changes are **Shaded**

PROCEDURES

- **Section 204.22**

- **(c) Miscellaneous Precast Units**

Precast concrete manholes, box culverts, and other precast concrete products (excluding concrete pipe, and prestressed concrete), conforming to the applicable VDOT specifications or special designs approved by VDOT, will be accepted on the manufacturer's certification based on the requirements of the VDOT Precast Concrete Products Quality Assurance Program as outlined below.

When approving hydraulic cement concrete mix designs, the following items are not required to meet the minimum pozzolan additions as outlined in the Virginia Department of Transportation Road and Bridge Specifications, Section 217.02a: oil grit separators; T-MH-2, cones, grade rings; IS-1 shaping; B-1, B-2, B-3, base units; R-1, R-2, R-3, risers, reducer units; JB-1 and JB-1 A; safety slabs; spring boxes, SB-1; RM-1 right of way monuments; VB-1 valve manholes; SWM-1 storm management; SMH-1 sanitary manholes; and cable concrete erosion control systems.

The following classifications of miscellaneous precast products, such as: 1) Manholes, 2) Box Culvert Systems, 3) Drainage Structures, 4) Barriers (including temporary traffic barriers), 5) Retaining Walls, 6) Sound walls, 7) R/W monuments and 8) other Precast Concrete Products upon approval by VDOT, may be accepted on the manufacturer's certification based on the requirements of the VDOT Precast Concrete Products Quality Assurance Program as outlined below. (Temporary precast traffic barrier service shall be visually accepted at the project site for cleanliness, structural integrity, and functionality).

Approved and reviewed drawing will be maintained in the plant office and made available to the VDOT QA inspector to compare to the shop drawing (production drawings) used in the fabrication shop. The approved drawing should be present during production for easy reference. Fabrication should not begin until the approved drawings have been reviewed by VDOT QA inspector. The precast facility should allow five business days for review of approved drawings before production begins.

In order to supply miscellaneous precast concrete products to a VDOT project, the precast concrete producer must be on the Materials Division Approved List No. 34. The precast concrete producer may qualify for placement on this list by:

The precast concrete producer shall submit a Quality Control (QC) Plan defining its routine business quality control practices. The QC plan is submitted to the Materials Division Quality Assurance Section. After review for completeness and conformance of the producer's QC plan to the Quality Control Plan Checklist found in Appendix H of this chapter, a plant visit will be made to evaluate the producer's conformance to its QC Plan. If during the inspection deficiencies are noted, this will be documented in a report with a follow-up visit scheduled. If no deficiencies are found, the precast concrete producer will be granted probationary approval.

The miscellaneous precast concrete producer will then be added to the Approved List No. 34 with a "p" to denote that the probationary status of the facility.

The probationary status will remain in place for a minimum of six months. After six months and when a precast facility has supplied two consecutive VDOT projects with a quality product without accumulating more than two Non-Conformance Reports (NCR), the probationary status of the facility may be removed by the Quality Assurance Section Manager. If problems are encountered during the production and supply within this probationary period, then additional projects may be necessary for the producer to correct QC Plan conformance issues. After one year, if the precast facility has not supplied two consecutive VDOT projects it will be removed

from the approved list. Once the probationary period has been successfully completed, the “p” will be removed from the precast concrete facility on approved list. The Department will continue to monitor the producer’s facility to ensure conformance to the QC plan and project specifications.

Annually, the Department will review the updated QC plan submitted by the producer and update the Approved List with the latest review date. Updates such as changes in Quality Control personnel, Management, Plant ownership, Mix designs, or changes in items manufactured shall be communicated to the Quality Assurance Section Manager within three business days and the written QC plan shall be updated within two weeks of these actions. The approving/revoking authority is the Quality Assurance Section Manager. Appeals must be submitted to the State Materials Engineer for final disposition.

Each approved facility must have at least one Precast Concrete Quality Control (QC) Technician¹ on staff responsible for ensuring that the QC plan is being followed. To qualify as a Precast Concrete QC Technician one has to have either: a) a current VDOT Concrete Plant and Field Certifications which includes an American Concrete Institute’s Concrete Field Testing Technician Grade I certification or b) a National Precast Concrete Association Production and Quality School Level I Technician certification, an American Concrete Institute’s Concrete Field Testing Technician Grade I certification and VDOT Concrete Plant Certification. Each QC Technician must have a unique quality control stamp for approval of work and documented in QC plan. VDOT specifications and policies over-ride other plant certifications or specifications denoted in the third-party plant certification.

Note 1: In extraordinary circumstances, production personnel may be substituted for QC Technician involved in some quality control activities on a limited basis. The substitute QC Technician is only authorized to be used in this capacity no more than five days in a month and only in order to meet the quality objectives. Production personnel acting in this capacity shall not provide the quality audit or review production practices where they are directly involved. These production personnel must be identified on the QC plan.

(1) Testing

The producer shall perform the following minimum quality control procedures, and the statement "We certify that these items have been tested and conform to the VDOT Precast Concrete Products Quality Assurance Program" shall be on each shipping document and signed by a responsible company representative. The shipping document shall also contain the following information: The plant name, location, telephone number, document number, contractor’s name, and project number. One additional copy of the shipping document shall be provided to the Materials Division Quality Assurance Section for distribution to the District receiving the product.

| Test | Minimum Frequency |
|--|----------------------------------|
| a) Stripping, shipping and 28-day compressive strengths -one per lot Two 6"x12" (150 x 300 mm) or three 4"x8" (100 x 200 mm) cylinders or one 4" (100 mm) core (if maximum aggregate size 1/2" (12.5 mm) two 4"x8" (100 x 200 mm) cylinders may be used) | |
| b) Absorption (Dry Cast only) | See Note below |
| c) Inspection of manufactured product for visual defects | Each unit |
| d) Air Content and Slump - | One test per lot (wet cast only) |

one test per day for Box Culverts, Retaining Walls,
or other precast structural products

e) Soundwall structural concrete – temperature, air, slump from same concrete as control cylinders are made

f) Soundwall panel – sound absorptive material one unit weight per lot

For the purpose of this program, a lot is defined as a maximum of 250 cubic yards (200 cubic meters) or no more than three consecutive calendar days of production (whichever is less) of precast concrete from each batching operation, being of like material, strength and manufactured by the same process. Variations in lot definition will be governed by applicable specifications and approved by the Quality Assurance Section Manager.

If cylinder strength failure occurs, the lot shall be evaluated by cores. If a core fails, two cores shall be taken to recheck the failed core. Both cores must pass for the lot represented to be acceptable. If both cores do not pass, each unit shall be tested individually for acceptance.

Note: The requirements for absorption testing on precast concrete (dry-cast) units are one per lot with no history of test results. If a history of test results is available for a given mix design, then the minimum frequency of absorption testing is as follows:

Frequency of tests = one absorption test per the number of consecutive lots with passing results or a minimum of one test per twenty-five lots of production.

A random sampling process (as defined in the precast concrete producer's approved QC plan on file with the Department) shall be used to determine the lot from which a specimen will be tested. If a failing result is obtained, the frequency of test shall resume at one test per lot as if no history was available.

Examples:

No. 1—If no history is available, the frequency of testing is one per lot. If this test passes, Then over the next two lots, one lot is randomly selected and tested for absorption. If the absorption test passes, then the frequency of testing shall be one randomly selected lot out of the next 3 lots. The process may continue in this manner until twenty-five passing results are obtained.

No. 2—If a precast concrete (dry-cast) producer has 15 consecutive passing test results, then the frequency of absorption tests would be one per 15 lots. If the next random sample test passes, the number of consecutive passing test results increases by one to becomes 16. The process continues in this manner until twenty-five passing results are obtained.

No. 3 – If the number of consecutive passing test results was 35, the frequency of absorption tests would be one per 25 lots. If a failure occurred, then the number of tests would reinitialize to one test per lot.

(2) Test facilities

Producer facilities, equipment and testing personnel shall be adequate to conduct the applicable tests outlined in AASHTO T280, and shall require Department approval. Quality Control procedures shall be performed by or under the direction of a Precast Concrete QC Technician.

To qualify as a Precast Concrete QC Technician one has either: a) current VDOT Concrete Plant and Field certifications or b) a National Precast Concrete Association Production and Quality School Level I Technician certification, an American Concrete Institute's Concrete Field Testing Technician Grade I certification and VDOT concrete plant certification. The Quality Control person operating the batching equipment (batcher) must pass an annual concrete batching exam developed by the precast facility and identified within QC plan.

Entrained air shall be measured with a pressure type meter according to ASTM C231.

Compression cylinders or cores shall be tested with facilities, equipment and personnel sufficient to conduct such tests according to ASTM C39. Compressive strength cylinders may be either 6 inch (150 mm) diameter by 12 inch length (300 mm), or 4 inch (100 mm) diameter by 8 inch (200 mm) length.

Producers shall maintain current calibration certificates on all analytical equipment used in testing.

Producers may elect to use the services of an independent commercial testing laboratory acceptable to the Department in lieu of conducting their own tests.

(3) Shipment

Products may be shipped to VDOT projects under either of the two following conditions:

a) All required testing for all products in the lot has been completed with acceptable results and all of the products to be shipped are at least the age of the test specimens at the time of testing. Acceptable results for shipping are defined as 85% of design compressive strength. Strength testing shall continue until design compressive strength has been attained.

b) Product which otherwise has met all test criteria may be shipped prior to completion of absorption testing if the concrete mix and manufacturing process used have historically produced the required absorption results, and approval is received from the Engineer, with final acceptance pending acceptable results.

(4) Records

All testing and inspection documentation shall be maintained at the producing plant for at least five years, and shall be made available to Department personnel at their request.

Producers will also collect and maintain conformance certificates and/or mill test reports for aggregates, cement, and reinforcing steel, frames, grates, collars, lids, steps, steel angles, and other applicable components intended for use in products to be used on VDOT projects.

Producers shall maintain a Department approved Quality Control Form(s) for each lot, and as a minimum the form(s) shall contain the following:

- Plant identification
- QC Technician Signature
- Lot identification
- Production dates
- Number of units and cubic yards (cubic meters) produced for each lot.
- Reinforcement as per specification or approved drawings
 - Type – Corrosion Resistant, galvanized, black
- Mill Test Reports
- Buy America certification
- Castings as per specifications
 - Mill Test Reports
 - Buy America certification

Compressive strength
 cylinder strength - required/achieved
 core strength - required/achieved
Absorption - required/achieved
Visual inspection performed
Markings verified
Dimensions verified: Applicable Specifications
 Manholes AASHTO M199 (ASTM C478)
 Box Culverts AASHTO M259 (ASTM C789)
 AASHTO M273 (ASTM C850)
 Water and Wastewater (ASTM C913)
 Structures (i.e. DI's, JB's,
 EW's, etc.)
Raw materials
 current certifications from vendors
Repair materials - VDOT approved list

In addition to date, cast date and other required markings, the plant identification and letters "QC" or "NPCA Certified Plant" shall be affixed to each piece of products and on the shipping ticket. This is critical for traceability of each piece and for material documentation on projects. Such markings shall be evidence that the required QC procedures have been performed.

(5) Monitoring

The producer's production and testing facilities, processes, records, and product will be monitored as deemed necessary depending on project-related work by the Department. A checklist of items to be inspected is provided in Appendix E (Precast Concrete Plant Monitor Report). The checklist will be completed in its entirety each quarter. If during the VDOT QA Inspector's inspection, a nonconformance to VDOT specifications, checklist in Appendix E or the producer's QC plan is observed the QA Inspector will issue a Non-conformance Report to the producer's QC Technician and plant manager. The Non-conformance Report will list the violation of the QC plan, checklist in Appendix E or specification and rate the violation on a scale of one (1) to five (5). A one (1) is considered a small infraction within a category and is equal to one point and a five (5) is considered a major infraction within a category and is equal to 5 points. Typical Precast Concrete QC violation categories and points per category are listed in Appendix L.

The QA Inspector will work with the producer's QC Technician in making a resolute effort to resolve non-compliant inspection action items and develop a procedure or process to ensure the violation does not take place again. The accumulation of fifteen nonconformance points or more within a twelve month period will result in the precast facility being placed on probation for six months. If the precast facility accumulates twenty nonconformance points within a twelve month period the facility will be removed from the approved list immediately.

Appeal Process:

A precast producer has five business days upon the notification(s) of NCR issued by the QA Inspector that changes the status of the producer on list #34 to appeal to the Quality Assurance Section Manager. The appeal must be in writing. The Quality Assurance Section Manager will follow the steps below:

1. The Quality Assurance Section Manager will review the QA Inspector's NCR and the precast producer's documentation within five business days of notification. If the Quality Assurance Section Manager can resolve the matter with the precast producer, there will be no need to proceed to step 2.

2. The - Quality Assurance Section Manager will issue a written notice of placing the precast facility on probation for a minimum of six months or removing from the approved list. The Quality Assurance Section Manager's decision on being placed on probation is final.

3. If the decision is to remove the precast producer from the approved list, the precast producer may appeal the decision in writing to the State Materials Engineer within five business days. The State Materials Engineer (or designated representative) decision is final and will be made within five business days after receiving the precast concrete producer's written appeal. If the precast facility is removed from the approved list the facility is not eligible for reinstatement for one year from the date of notification.

Shipment of samples to the Central Office laboratory for testing shall be in accordance with Sec. 203, using Form TL-10 or Form TL-13, as outlined in Sec. 800.

(6) Annual Quality Testing

Quality testing will be performed as deemed necessary by the Department for establishing quality of raw materials. The tests may be performed on the aggregates, cement, mineral admixtures, and all types and sizes of reinforcing materials.

(7) Repairs

Repairs shall be in accordance with **The Precast Concrete Repair Manual** listed in the Appendix I.

• **Appendix L**

Precast Violations (NCR) Categories

1. Improper Vibration Technique: (1 point)
 - Dragging or moving concrete by using the vibrator instead of shoveling it into corners.
 - Casting vibrator across concrete instead of a proper vertical timed motion
 - Leaving vibrator in one spot too long per ACI-309.1R.
 - Excess form oil
2. Concrete Placement: (3 points)
 - Concrete dropped into forms from too great a height.
 - Delays in pouring a unit that may result in a cold joint or poor concrete workability. (Using SCC a pour line may develop that could potentially be confused for a cold joint)
3. Pre-Pour Inspection: (3 points)
 - Failure to check forms dimensionally, gaps in formwork, worn or damaged parts, cleanliness of forms (debris removed)
 - Failure to check correct rebar placement with clearances checked
 - Failure to check forms and any block-outs are secure from moving during pour
4. Post-Pour Inspection: (3 points)
 - Failure to inspect finished product for workmanship, bug holes or honeycombing, exposed rebar, dimensionally within tolerance
 - Excess concrete paste or flashing exceeding specified limits
 - Failure to inspect appearance and color when applicable. (Architectural, detailed on plans, exposed to visual observation in service or above ground)
 - Forms not inspected for damage, concrete debris or adhesion, loose or worn components
5. Workmanship: (3 points)
 - Improper trowelling, smoothing, stamping or architectural finishes per design specifications
 - Patches are not uniform, don't blend in with surrounding area, and color and design don't match. (For architectural products and products exposed to visual observation in service)
 - Concrete patch used is not an approved patch material
 - Surface is not prepared to hold patch and patch is not cured and checked before shipping
 - No patching procedure in place and not submitted to VDOT per QC plan
6. Concrete Mix Design: (4 points)
 - Unable to trace mix design to an approved mix design in the QC plan.
 - Tests not performed as identified in QC plan and/or not in accordance with ASTM procedure
 - Concrete is not the correct design strength for the item produced
 - Test equipment is not calibrated and is not used correctly
 - Concrete is being used without slump, air and temperature tests completed
7. Documentation: (4 points)
 - Pre and Post-Pour sheets not completed
 - Cylinder breaks, slump, air and temperature are not recorded

- Mix designs, admixture certifications, stone and sand certifications, Fly ash certifications, steel certifications including rebar, lifting devices, plastic tie wire and epoxy coated tie wire, welded wire mats and well water tests not maintained on file at the plant
 - Non Compliance with Buy America (5 points)
 - Documentation that is not up to date and not maintained for a period of 5 years
8. Storage and labeling of products: (3 points)
- Products are not stored correctly, not stored with dunnage placed if required.
 - Unacceptable products not stored in a separate area and not marked accordingly.
 - Damaged products not marked accordingly for repairs
 - Products not labeled correctly with the company name, location, description of the piece or size and class in accordance with the QC plan.
9. Material Storage: (4 points)
- Materials used for production shall be stored per manufacturers or VDOT specifications and care shall be taken to avoid cross contamination, weather, including heat and cold, excess moisture, or anything detrimental to the material
 - Steel not stored per VDOT specifications, rebar and wire mesh not off the ground, metal products (castings) approved for VDOT use not separated from non-VDOT material.
10. Approved Stamped Shop Drawings: (4 points)
- Failure to provide the QA Inspector shop drawings for review prior to the beginning of production. Note: All pages shall have an approval stamp and be signed or initialed. Errors or revisions will be re-submitted to the Engineer for approval.
 - The plant QC department operating during production without a set of detailed approved drawings.
11. Shipping Tickets: (3 points)
- A shipping ticket without the QC statement and unsigned
 - Items listed on the shipping ticket that don't include all information ie. designation, location, square or linear feet totals shown if required.
 - Cast date not included on shipping ticket.
12. Shipping: (5 points)
- Shipping products that do not meet shipping strength without the approval of a VDOT Engineer.
 - Shipping products with dimensions that do not conform to design tolerances.
 - Shipping of a QC stamped product without a complete post-pour inspection.
 - Shipping unstamped products for a known state project
13. Non-Professional Conduct: (4 points)
- Contentious disputes, insults, or disrespectful behavior directed towards the VDOT inspector in the performance of his duties.
 - Disregard of safety concerns expressed by the QA Inspector during visits to the plant.
14. Failure to address NCR with 5 business days (one point)
15. One additional point will be accessed for problems discovered by Field inspection staff
16. Violations warranting immediate removal from Approved List No. 34 for one year
- Supplying products not approved by VDOT for known VDOT projects
 - Shipping precast products rejected by QA Inspector
 - Producing products for VDOT project without approved VDOT mix designs
 - Purchasing materials for a VDOT project from a non VDOT approved source

* This is not meant to be an all-inclusive or complete list but an example list of types of violations that could result in an NCR being written by QA Inspector. The QA Inspector will determine the most appropriate category that fits the violation or nonconformance. An additional one point will be accessed to the violation if it is discovered at a VDOT project site.

- See attached [NCR report](#)
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NOTES

- Previously to qualify as a Precast Concrete QC Technician a National Precast Concrete Association Production and Quality School Level I Technician certification and an American Concrete Institute's Concrete Field Testing Technician Grade I certification was an alternative to VDOT Concrete Plant and Field Certifications. The requirement now includes a VDOT Concrete Plant certification.
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REFERENCES

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COPY DISTRIBUTION:

Deputy Chief Engineer
Division Administrators
District Administrators
District Location & Design Engineers
District Construction Engineers
District Maintenance Engineers
District Bridge Engineers
District Traffic Engineers

VDOT Resident Engineers
Federal Highway Administration
Virginia Ready Mix Association
Precast Concrete Association of Virginia
Virginia Transportation Construction Alliance
Virginia Asphalt Association
American Concrete Paving Association Mid-Atlantic Chapter
Old Dominion Highway Contractors Association