

## **Section 8.1**

### **Volume II**

## **PRECAST PRESTRESSED CONCRETE PRODUCTS**

### **8.1.1 PURPOSE**

This procedure provides guidance for the development and implementation of the quality control (QC) programs for the manufacture, storage, and transportation of precast prestressed concrete products (Products) for Florida Department of Transportation (Department) projects.

### **8.1.2 AUTHORITY**

Sections 334.044(10)(a) and 334.048(3), Florida Statutes.

### **8.1.3 REFERENCES**

Code of Federal Regulations (CFR), Federal-Aid Policy Guide (FAPG), Subchapter G—Engineering and Traffic Operations, Part 637—Construction Inspection and Approval, Subpart B—Quality Assurance Procedures for Construction Sections

Standard Plans for Road and Bridge Construction, Topic No. 625-010-003, Florida Department of Transportation

Construction Project Administration Manual (CPAM), Florida Department of Transportation Construction Office, Topic No. 700-000-000

Structures Manual, Florida Department of Transportation Structures Design Office, Topic No. 625-020-018

Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, Precast/Prestressed Concrete Institute (PCI) Manual MNL 116

Florida Department of Transportation Standard Specifications for Road and Bridge Construction

American Society for Testing and Materials (ASTM) International Standard Test Methods and Specifications

American Association of State Highway and Transportation Officials (AASHTO), Part I Specifications, and Part II Tests

Approved Products List (APL), Florida Department of Transportation

## 8.1.4 SCOPE

This procedure is used by the Precast Prestressed Concrete Plants (Plants). These requirements and activities pertain to the inspections, measurements, and necessary tests to substantiate materials and Products in conformity with the **Specifications** and **Contract Documents**. The Plant's QC Plan is designed to provide guidelines that are used to manufacture Products in conformance to the **Specifications** and project **Plans**.

## 8.1.5 GENERAL INFORMATION

The Plants are responsible for production, inspection, storage, and shipment of the Products to the project site. Ensure that the delivered Products to the project site meet the requirements of the **Specifications**, **Plans**, and other **Contract Documents**.

## 8.1.6 PLANT QUALIFICATION PROCESS

### 8.1.6.1 General

Prepare the proposed QC Plan in accordance with **FDOT Specifications Section 105**. Submit the proposed QC Plan to the District Materials and Research Office (DMRO) for the District in which the Plant is located. For out-of-state Plants, submit the QC Plan to the nearest DMRO. Upon the Plant's submittal of the QC Plan, the DMRO will review the QC Plan, and make necessary arrangements for the initial Plant qualification review in accordance with **Materials Manual Volume II, Section 8.1.6.4**.

### 8.1.6.2 Plant Certification

As a prequalification requirement, the Plant must have a plant certification and approved QC Plan from a Department-accepted Plant certification agency. The names of those Plant certification agencies that meet the requirements of **Materials Manual Volume I, Section 8.5** are posted on the State Materials Office (SMO) website.

### 8.1.6.3 Review of the Plant's QC Plan

In the QC Plan, include the work experience, qualifications, and responsibilities of the Plant's production and QC personnel. Identify the on-site production manager, general manager, QC inspectors/technicians, and QC manager. Identify the key quality attributes in the QC Plan. Identify the responsibilities for monitoring key quality attributes and QC data. Include the applicable information required in **FDOT Specifications Sections 105, 346, 450, Materials Manual**, the **Standard Plans**, and other **Contract Documents**.

Ensure that the Plant's QC Plan includes the method of compliance with the Buy America provisions, including:

- A. Methods for tracking the placement of all quantities of non-domestic steel and iron.
- B. Methods and locations for segregating non-domestic and domestic steel and iron stockpiles.
- C. Methods for identifying and cataloging finished products containing non-domestic steel and iron.
- D. An example delivery ticket with Buy America compliance statement and dollar amount of non-domestic steel and iron used in the finished products for each delivery.

The Plant may propose alternative detensioning patterns to suit their particular operation, as approved by the Engineer. Specify the method of the stress transfer to be used either in the QC Plan or the construction submittal.

#### **8.1.6.4 Plant Qualification Review**

The Department will perform the initial qualification review of the Plants. An initial review includes an in-depth inspection by the Department of a Plant that submits its first QC Plan and Plants that have not produced for Department projects for more than one year.

Upon the acceptance of the Plant's QC Plan, the Department will perform routine verification inspections at the frequency of at least once per week, and Plant qualification reviews at least annually.

During the review, the Plant qualification review team (Team) will examine the two most recent Plant certification agency inspection reports. The Team will then review Plant documentation including all deficiencies found during the most recent certification agency inspections that have been corrected by the Plant or actions that have been taken to correct the problems.

If the Plant has not produced for Department projects for three consecutive weeks, the verification inspection frequency will be reduced to once every three weeks until the Plant produces for Department projects again. The frequency will revert back to once per week immediately after the Plant reinitiates production. The QC manager is responsible to inform the DMRO when the Plant resumes production for Department projects.

#### **8.1.6.5 Maintenance of Plant Qualification**

Upon the Department's satisfactory review of the proposed QC Plan, in compliance with ***Materials Manual Volume I, Section 5.6***, and a satisfactory Plant qualification review, the DMRO will accept the proposed QC Plan and include the Plant on the Department's ***Production Facility Listing***. Immediately notify the DMRO in writing of any changes to the QC Plan. In case of change(s), revise the QC Plan annually in the form of addenda or complete

revision of the entire document. Submit the revised QC Plan, if there were addenda throughout the year, to the DMRO annually.

Plants that are on the Department's **Production Facility Listing** may be subject to a Plant qualification review at any time. If the Team or verification inspectors find any process which would result in products not meeting the **Specifications**, they will bring it to the attention of the Plant. The Plants with an acceptable QC Plan and current satisfactory Department qualification reviews are qualified Plants.

#### 8.1.6.6 Photographs and Videos

Allow Department representatives to take photographs or videos of disputed infractions occurring within the manufacture of products designated for Department use. Photographs and videos will be taken for documentation and timely resolution of possible concerns observed and disputed by the facility during Department Plant inspections.

If Department inspectors observe a product or action that they feel is in violation of a **Specifications, Materials Manual** or QC Plan requirement and before a photograph or video is taken, the Department representative will attempt to notify the Plant's QC personnel of the existence of any infractions. No photograph or video will be taken if the infraction is immediately resolved to comply with the **Specification** in question.

If Plant personnel cannot be contacted or cannot respond in a timely manner that would otherwise result in a loss of photographic evidence, then a photograph or video may be taken of the specific infraction. The Plant's QC personnel may dispute the existence of the infraction, in such case the Department representative may photograph the questionable infraction. The Plant will be allowed to review and comment on all photographs, videos, and documentation within 48 hours of their receipt by hand delivery or email.

The Department will coordinate with the Plant in advance to make arrangements for photographs and videos that will be taken for educational and/or technical publications.

### 8.1.7 FUNCTIONS AND RESPONSIBILITIES OF PRECAST PRESTRESSED CONCRETE PLANTS

#### 8.1.7.1 General

The Plants are responsible for the quality of the finished Products. Provide facilities and qualified QC personnel to perform specified tests and inspections, and maintain an acceptable QC program in compliance with the requirements specified herein and the **Specifications**.

### 8.1.7.2 Quality Control Manager

The QC manager is responsible to ensure that the quality of the products at each Plant meets the requirements of the **Specifications** and other **Contract Documents**. The responsibilities of the QC manager include, but are not limited to the following:

- A. Maintains the QC approval stamp and applies it to acceptable Products or designates a technician who is working under the direct supervision of the QC manager to apply the Plant QC stamp. The Plant QC stamp mark shall be legible and applied to each Product before its shipment to the project site. The QC stamp shall include the Department's assigned Precast Prestressed Concrete Plant (PCP) number.
- B. Be present at all times during the production of the Products that will be shipped to Department projects. During the temporary absence of the QC manager, a delegate meeting the same qualification requirements and identified in the QC Plan, may perform the QC manager duties.
- C. Performs and/or supervises the QC testing and inspection.
- D. Ensures that the Plant has a sufficient number of QC technician(s)/inspector(s) to maintain adequate inspection and testing during the production of Products for Department projects. In lieu of a permanent staff, the Plant may retain the services of an engineering consulting firm or qualified laboratory meeting the requirements of **FDOT Specifications Section 105**.
- E. Ensures that testing equipment is properly maintained in accordance with the applicable test methods and **Specifications**. Makes readily available, the current certification(s) for testing equipment that requires calibration or verification.
- F. Visually inspects or ensures that a qualified QC technician inspects each Product before shipping to the project site.
- G. Ensures that all materials used to manufacture Products are from a Department approved source.
- H. Maintains a daily production log of the manufactured Products.
- I. Ensures that all Products are properly stored and marked indelibly with the Plant's Department-approved QC stamp, Department project, date of manufacture, and any additional information required by the **Specifications** and other **Contract Documents**.
- J. Maintains QC documents, including material certifications, test data, and inspection results.
- K. Arranges weekly meetings with the Department's verification inspector and representatives of the Plant's QC and production personnel when the Plant is producing for Department projects, or according to the reduced frequency schedules, to discuss any deficiencies and/or QC issues.

When the Plant's assigned QC manager unexpectedly discontinues his/her employment without notice, the Plant is required to notify the DMRO within two working days and employ reasonable efforts to seek a replacement. During such efforts to seek a replacement, the Plant engineer, technician, or other knowledgeable person designated in the Plant's QC Plan may perform the duties of the QC manager for a period established by the District Materials and Research Engineer (DMRE). This will be based on how legitimate the efforts employed by the Plant are in seeking a qualified replacement and/or training another person during the interim period until the next available Department accredited training/certification program is offered.

### **8.1.7.3 Quality Control Inspectors**

QC inspectors perform routine inspection and testing of precast prestressed concrete products, including but not limited to: materials, tensioning, reinforcing steel placement, form alignment, pre-pour inspections concrete placement, curing, detensioning, and post-placement inspections of finished products. QC inspectors may be involved in the design and verification of concrete mixes, and may evaluate the Plant's repair methods and their implementation. QC inspectors must demonstrate understanding of all aspects of the Plant's QC functions within their responsibilities, including but not limited to the familiarity with shop drawings, **Specifications**, **Standard Plans**, and test methods.

### **8.1.7.4 Quality Control of Certified Materials**

#### **8.1.7.4.1 General**

Ensure that all materials used to manufacture Products are from Department approved sources and comply with requirements as specified herein.

#### **8.1.7.4.2 Reinforcing Steel, Welded Wire Reinforcement and Prestressing Steel**

The QC inspector must obtain steel manufacturers' certifications for all reinforcing steel, welded wire reinforcement (WWR), and prestressing steel that is used for the manufacture of Products. These certifications shall indicate compliance with the appropriate ASTM or AASHTO standards for wire, welded wire reinforcement, and for steel bars. The Department verification inspectors will obtain samples of reinforcing steel, WWR and prestressing steel once every six months. Reinforcing steel and WWR shall meet the requirements of **FDOT Specifications Section 415**. Prestressing steel shall meet the requirements of **FDOT Specifications Section 450**.

##### **8.1.7.4.2.1 Source of Supply - Steel**

Plants, prior to the use of non-domestic steel or iron materials on a project, must follow the following process:

- A. Describe in the QC Plan the method of compliance with the Buy America provisions according to Section 8.1.6.3.
- B. After obtaining approval of the QC Plan, and at the beginning of each project, provide a notarized certification on the Plant's letterhead to the Engineer stating that the Products will be manufactured in accordance with the requirements set forth in the **Contract Documents**, the Plant's approved QC Plan, and **FDOT Specifications Section 6** (Source of Supply–Steel).
- C. Implement an accountable system that tracks the monetary value of non-domestic steel or iron used in each product.
- D. In the event of contract modifications in which the use of non-domestic steel or iron is increased, obtain prior authorization from the Engineer.
- E. Each delivery ticket must include the dollar amount of non-domestic steel or iron incorporated in the delivered precast prestressed concrete products, as well as a compliance statement with Buy America provisions.
- F. The stockpile of non-domestic steel or iron shall be identified and segregated from the domestic steel or iron.
- G. The stockpile of product which has non-domestic steel or iron shall be identified and segregated from products containing domestic steel or iron.

The DMRO will verify the Plant's compliance with the Buy America provisions during routine audits.

#### **8.1.7.4.3 Fiber Reinforced Polymer (FRP) Reinforcing Bar and Prestressing Strand**

FRP reinforcing bars and prestressing strand are obtained from producers on the Department's **Fiber Reinforced Polymer Production Facility Listing**. The QC inspector must obtain the FRP manufacturers' Certificate of Analysis (COA) for each LOT of FRP reinforcing bars and prestressing strand that are used for the manufacture of Products. Each COA shall indicate compliance with **FDOT Specifications Section 932** and **933**, as appropriate, for FRP bars and prestressing strand. The Department verification inspectors will obtain samples of FRP reinforcing bars and prestressing strand for testing in accordance with **FDOT Specifications Section 932** and **933**, as appropriate.

#### **8.1.7.4.4 Patching Materials**

All patching compounds shall comply with the applicable **Specifications** and **Contract Documents**. Pre-mixed packaged compounds may be used, when listed on the **APL**. Patching material shall be mixed, applied, and cured in accordance with the manufacturer's recommendations. Cosmetic defects may be repaired in accordance with **FDOT Specifications Section 450**, if approved by DMRO and is included in the Plant's QC Plan.

### 8.1.7.5 Calibration of Equipment

Calibration and verification of stressing jacks shall be in accordance with ***FDOT Specifications Section 450***.

Calibrate or verify all QC testing equipment such as the compressive strength testing machines, portable weighing scales, air meters, density buckets, and temperature recording devices for compliance with the applicable ASTM Test Methods and Specifications, and ***Materials Manual Volume II, Section 9.2***.

### 8.1.7.6 Quality Control of Product Manufacturing

Following are QC inspection and testing requirements, related to operations prior to, during, and after concrete placement.

#### 8.1.7.6.1 Concrete

Unless otherwise shown in the ***Plans*** or required by the ***Specifications***, the concrete produced for the manufacture of Products shall comply with the requirements specified in ***FDOT Specifications Section 346***. When the ***Specifications*** or ***Plans*** reference a class of concrete (Example: Class VI), the concrete shall meet all of the requirements for ***FDOT Specifications Section 346*** and ***Materials Manual Volume II, Section 9.2***. In accordance with ***FDOT Specifications Section 346***, each day's concrete production is comprised of one or more LOTs.

#### 8.1.7.6.2 Reinforcing and Prestressing Steel

All reinforcing steel shall be stored in accordance with ***FDOT Specifications Section 415***. Prestressing steel shall be stored in accordance with ***FDOT Specifications Section 450***.

#### 8.1.7.6.3 Fiber Reinforced Polymer (FRP) Reinforcing Bar and Prestressing Strand

All FRP reinforcing bar shall be stored in accordance with ***FDOT Specifications Section 415*** and the manufacturer's instructions. All FRP prestressing strand shall be stored in accordance with ***FDOT Specifications Section 450*** and the manufacturer's instructions.

#### 8.1.7.6.4 Concrete Forms

Use of concrete forms shall meet the requirements of ***FDOT Specifications Section 450***. Forms used in the manufacture of Products shall be sufficiently rigid and accurate to maintain the Products' designed dimensions and avoid irregularities in their surfaces. Forms not meeting governing document requirements shall be repaired or removed from service.

Ensure that the condition of all forms is of a quality to produce acceptable Products within the dimensional tolerances. The QC inspector shall check



cleanliness of the forms prior to each use. Check the form dimensions prior to its first use and at least annually for dimensional conformance.

#### **8.1.7.6.5 Reinforcing Bar and Prestressing Strand Placement**

Reinforcing bar and prestressing strand placement shall meet the requirements of ***FDOT Specifications Sections 415 and 450***, respectively. Adhere to the additional manufacturer's instructions when placing FRP prestressing strand. QC personnel must check the fabrication, positioning, and minimum cover requirements of reinforcing bar and prestressing strand on all manufactured Products. QC personnel must verify that the reinforcement meets the ***Specification*** requirements. The minimum cross-sectional area requirements for Products shall be checked according to the applicable ***Specifications, Standard Plans***, AASHTO requirements, ASTM requirements, or approved shop drawings.

#### **8.1.7.6.6 Concrete Placement Operation**

The concrete placement method shall assure dense and consistent material meeting performance requirements of ***FDOT Specifications Section 450***. Include placement methods as part of the QC Plan.

#### **8.1.7.6.7 Concrete Curing**

Cure Products in accordance with the applicable curing methods described in ***FDOT Specifications Section 450***. Include curing methods as part of the QC Plan.

### **8.1.8 QUALITY CONTROL TESTING AND INSPECTION OF PRODUCTS**

#### **8.1.8.1 General**

Perform QC inspections and tests at frequencies specified herein along with ***FDOT Specifications Section 346***.

#### **8.1.8.2 Acceptance of Products**

Each LOT of Products is accepted when:

- A. The test results and inspections meet the requirements as specified herein and in the applicable ***Specifications***.
- B. The Plant has completed all patching and repair work.
- C. The QC manager or his/her designated inspector/technician has stamped the Products.
- D. The list of the Products is included with each shipment of the Products to the project site.

#### **8.1.8.3 Appearance and Inspection of Final Finished Products**

The QC manager or his/her designated QC inspector performs final inspections of all finished Products, before the application of the QC approval stamp, to ensure that the Products are free from deficiencies, and meet the specified dimensional tolerances. Products may be repaired if necessitated by occasional imperfections in the manufacture or damage during handling, and will be considered acceptable if the repairs are sound and properly finished to conform to the dimensional tolerances of the **Specifications**. Submit the proposed repair method for Department review and approval. Use the repair material from the **APL** unless otherwise allowed by the **Contract Documents**. Include all Department approved material and methods as part of the Plant's QC Plan. Dimensional tolerances shall comply with the applicable **Specifications** and **Standard Plans**.

The QC inspectors must perform inspection of all finished Products, and maintain a record of the inspections, including the deficiencies. Minor deficiencies may be repaired in accordance with the repair methods included as part of the QC Plan. The repair of major deficiencies to a Product requires engineering evaluation meeting the requirements of **FDOT Specifications Section 450**. The Plant must determine the cause of any repetitive deficiencies and develop a corrective action plan. Submit the revised QC Plan to address the type of deficiencies and corrective action taken to prevent or minimize deficiencies.

#### **8.1.8.4 Repair of Precast Prestressed Concrete Products**

The Plant's QC manager must examine and determine the magnitude of the deficiency. Perform the repair work under the observation of the QC manager or under personnel working under his/her direct supervision. The Plant's QC personnel must document the type of deficiency and the repair method. Major repairs must be processed in accordance with **FDOT Specifications Section 450**.

#### **8.1.8.5 Handling and Storage**

Products shall be handled and stored to prevent damage. QC inspectors must inspect the handling operations and appropriate practices that will prevent damage. The inspectors must monitor Products in storage to ensure that they are stored in the correct stack and are not being damaged by point loading or stacking. Rejected Products shall not be stored in the same area with the acceptable Products.

#### **8.1.8.6 Stamping**

The Plant's QC manager or his/her designee must affix the Plant's QC stamp to each Product, indicating that the manufactured Product meets the requirements of the **Specifications**, **Contract Documents** and Plant's QC Plan. The QC stamp shall include the Plant's assigned Prestressed Concrete Plant (PCP) number. The stamp configuration shall be included in the QC Plan. The QC stamp shall be applied using waterproof paint or indelible ink.

In the QC Plan include a statement that the Plant's QC stamp will be applied only to the Products that are manufactured for Department projects or any other projects that require Department verification inspection.

#### **8.1.8.7 Shipment**

Ensure that at the beginning of each project, the Plant provides a notarized statement to the project administrator (PA) from a responsible company representative certifying that the Plant will manufacture the Products in accordance with the requirements set forth in the **Contract Documents** and Plant's approved QC Plan. The QC manager's stamp on each Product indicates certification that the Product was fabricated in conformance with the **Specifications, Contract Documents**, and QC Plan. Ensure that each shipment of precast prestressed concrete products to the project site is accompanied with a signed or stamped delivery ticket providing the description and the list of the Products.

Each delivery ticket shall include the list of products being shipped, be on the Plant's letterhead and include as a minimum the following information:

- A. Financial Project Number
- B. Date shipped
- C. Cast date
- D. Type of Products
- E. Quantity of Products
- F. Serial number
- G. Buy America compliance statement and dollar amount of non-domestic steel and iron used in the finished products for each delivery.

The QC manager or QC personnel working under the direct supervision of the QC manager must stamp each Product prior to its shipment to the project site. The Plant must address the shipping policy as part of the QC Plan.

#### **8.1.8.8 Documentation**

The QC manager must maintain documentation files in each Plant. Documentation shall include the following items, as a minimum:

- A. Copy of the approved QC Plan and addenda.
- B. Approved shop drawings (if applicable).
- C. Applicable ASTM and AASHTO Standards.
- D. Applicable **Specifications** and **Standards Plans**.
- E. QC personnel training and qualification records.

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- F. Materials certification records for all reinforcement, prestressing strand or any other materials that are used in the manufacturing of the Products.
- G. Concrete mix designs.
- H. Applicable equipment calibration/verifications, including stressing jacks, concrete compression testing machine, laboratory scales and plastic concrete test equipment.
- I. Applicable test data.
- J. Disposition of all manufactured Products.
- K. Record of Material Certification statements sent to each project.
- L. Record of the delivery tickets of each shipment of the products to the job site.
- M. Inspection results of forms, reinforcement, tensioning reports (Pre-pour inspection).
- N. Inspection results of Products after concrete placement (Post-pour inspection).
- O. Record of all deficiencies found during QC inspection and testing or verification inspection and testing and the corrective action taken. A copy of the deficiency reports shall also be maintained in the Plant's permanent file.
- P. Record of minutes from weekly meetings with verification inspector and representatives from the Plant's QC and production personnel.

### 8.1.9 TRAINING

The Plant's QC personnel who are involved in the inspection and testing of Products must have the required qualifications as specified in ***FDOT Specifications Section 105***.

The State Materials Office (SMO) maintains the list of the accredited precast prestressed concrete courses. The list can be found at the following link:

<http://www.fdot.gov/materials/administration/resources/training/structural/index.shtm>

### 8.1.10 FORMS

There are no forms associated with this procedure.