

## **Section 8.1**

### **Volume I**

## **QUALITY ASSURANCE PROGRAM OF PRECAST PRESTRESSED CONCRETE PRODUCTS**

### **8.1.1 PURPOSE**

This procedure provides guidance to Florida Department of Transportation (Department) personnel and their designees related to the implementation of quality assurance (QA) programs for precast prestressed concrete products (Products).

### **8.1.2 AUTHORITY**

Sections 20.23(4)(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

Materials Acceptance and Certification system (MAC) QC Program  
Maintenance User Manual

## 8.1.4 SCOPE

Primary offices affected by this procedure include the State Materials Office (SMO), District Materials and Research Offices (DMRO), District Construction Offices (DCO), District Structures Design Offices, State Construction Office (SCO), and State Structures Design Office.

## 8.1.5 GENERAL INFORMATION

The Precast Prestressed Concrete plants (Plants) produce, inspect, test, store, and ship Products meeting the requirements of the **Specifications** and other **Contract Documents**. The DMRO verifies that manufactured Products conform to the requirements of the **Contract Documents**. The DMRO accepts their quality control (QC) Plans and inspects the Plants prior to the commencement of production for Department projects.

## 8.1.6 DMRO RESPONSIBILITIES

### 8.1.6.1 Plant Qualification Review

The Plant submits the proposed QC Plan in compliance with **Materials Manual Volume I, Section 5.6**. The DMRO makes arrangements for the Plant qualification review, including Plants that are submitting their first QC Plan as well as for Plants that have not produced for any Department projects for more than one year.

The DMRO forms the Plant qualification review team (Team) and performs the review. A certified Precast/Prestressed Concrete Institute (PCI) QC technician/inspector Level III from the DMRO will serve as Team leader. The Team will include representatives of the DMRO and SMO. The Team may also include other personnel such as District concrete engineers, technologists or specialists, verification inspectors, representatives of the SCO, DCO, District Structures Design Offices, State Structures Design Office, and the Federal Highway Administration (FHWA).

The Team reviews the Plant's shop drawings, fabrication process, QC testing, inspection, and documentation. The Team may also review the Plant's forming, reinforcing steel placement, concrete placement operations, storage, and shipment of the Products.

During the review, the 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.

Upon the satisfactory Plant qualification review, the DMRO accepts the proposed QC Plan and documents the Plant's status in the Materials Acceptance and Certification system (MAC).

#### **8.1.6.2 Plant Certification**

As a prequalification requirement, the Department verifies that the Plant has the required 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 SMO website.

#### **8.1.6.3 Maintenance of Plant QC Plan and Qualification**

The Plant submits, in writing, any changes to the QC Plan to the DMRO and annually submits the revised QC Plan or its addendum, if there are any changes.

Plants that are on the Department's **Production Facility Listing** may be subject to a Plant qualification review or routine verification inspection at any time. At a minimum, weekly verification inspections will be performed by DMRO personnel, and may include any of the Team members described in 8.1.6.1. If the Team or verification inspectors find any process which would result in products not meeting the **Specifications** and other **Contract Documents**, they will immediately bring it to the attention of the Plant. The Plants with acceptable QC Plans, a satisfactory Plant qualification review, and continued satisfactory weekly verification inspections are considered to be qualified Plants.

#### **8.1.6.4 Routine Inspection and Materials Testing of Qualified Plants**

The DMRO performs weekly inspection and testing functions at all Plants that are located within the District boundaries. Inspection is required when a Plant is producing precast prestressed concrete products or has products for Department use on-site that have not been verified. Inspection of Plants located out of state is the responsibility of the DMRO with QC Plan acceptance authority.

Verification inspectors monitor the Plant's QC process to ensure conformity with the requirements of the **Specifications** and other **Contract Documents**. Verification inspectors do not issue instructions to the Plant's representatives on how to perform their operations. However, the verification inspectors can question or advise against continuation of any operation which may result in non-compliant products.

The DMRO will ensure that the Plants perform all QC sampling and testing of the designated class of concrete in accordance with **FDOT Specifications Section 346**.

If the Plant has not produced for Department projects for three weeks, then verification is not required until production for Department projects resumes. The QC manager is responsible to inform the DMRO at least two weeks before the Plant resumes production for Department projects. The Department may require a Plant qualification review before the Plant resumes production. The frequency will revert back to once per week immediately after the Plant reinitiates production.

In accordance with **Materials Manual Volume I, Section 8.3**, the DMRO will take necessary actions related to the Plant's major product defects.

#### 8.1.6.5 Responsibilities of the Verification Inspector

Following are the general responsibilities of verification inspector:

- A. Ensures that the Plant's QC manager and inspectors are performing inspections in compliance with the requirements of the **Contract Documents** and the Plant's accepted QC Plan.
- B. Reviews the records to ensure that all materials meet the **Specification** requirements. At a minimum frequency of once per week, perform a spot check review of the records of the materials received at the Plant and/or incorporated into the fabrication of the products, including the certified physical property test reports.
- C. Ensures that the repair and materials used for major deficiencies, as defined in **FDOT Specifications Section 450**, follow the approved repair procedure.
- D. Verifies that the concrete meets the requirements of **FDOT Specifications Section 346**.
- E. Selects samples randomly from at least one LOT of reinforcing steel, welded wire reinforcement (WWR), and prestressing strands every six months.
- F. Verifies that the Plant is complying with the Buy America requirements outlined in **Materials Manual Volume II, Section 8.1**.
- G. Takes samples of any material components of the prestressed concrete products, as needed.
- H. Verifies that the QC inspectors maintain the required certification documents, including certification records of the stud welding tests, strand and splice chucks, steel and accessories, and ducts.
- I. Checks the handling and storage of the manufactured products and their material components to ensure that they meet the requirements of the **Specifications**. Visually inspects the condition of steel materials at their storage areas and during manufacturing.

- J. Ensures, for miscellaneous materials, that the Plant either has used a product from the **APL** or has the applicable material certifications to verify **Specification** compliance.
- K. Verifies that the tensioning equipment has valid calibrations and records of their calibration certificates are available at the Plant.
- L. Performs random spot-checks of the dimensions and appearance of the finished products to ensure that they are fabricated in compliance with the requirements of the **Contract Documents**.
- M. Performs weekly in-depth review of all phases of work, as needed. Brings all observed deficiencies to the attention of the Plant's QC manager. The verification inspections must be of sufficient depth to ensure that the Plant's QC manager and inspectors are performing inspections in compliance with the approved QC Plan.
- N. Ensures that all manufactured products are properly stored and each product is marked indelibly with a unique product identification number and cast date that are traceable to the Department project documents and QC records.
- O. Verifies product deficiencies and ensures that the type of deficiency, its magnitude, and extent have been properly described. Sign the required deficiency reports in accordance with **CPAM Chapter 10.2**. Perform spot checks of the repairs.
- P. Verifies that, at the beginning of each project, the Plant provides a notarized certification statement meeting the requirements of **FDOT Specifications Section 450**.
- Q. Ensures that the Plants submit the semiannual compilation of the prestressed concrete plant's major deficiency data for each category and group of products. The verification inspectors submit the compiled defects data to the SMO for further review in accordance with **Materials Manual Volume I, Section 8.3**.
- R. Participates in weekly meetings with the Plant's QC manager and production personnel during each week that work is in progress or according to the reduced frequency schedules, whenever a Plant is manufacturing for a Department project. During the meetings, verification inspector(s) will discuss the product deficiencies that were found during the inspections and suggest improvements in the fabrication process and QC operations.
- S. Ensures that the Plant notifies the verification inspector of planned production schedules for Department projects no less than 24 hours prior to prestressing strand tensioning/detensioning, concrete placement, or shipment operations of the products to the project sites. The Plants shall keep the Department apprised of changes to the schedules as they occur.

The communication related to the notification of these major activities can be provided during the weekly meetings, by emails, or by phone calls.

- T. Documents the results of the inspections in MAC. Verification inspectors will perform Plant inspections in accordance with the QC Program (QCP) checklists in MAC. The results of the inspections will be documented in MAC if the inspector has the access, otherwise verification inspectors will document results of the QCP checklist inspections outside of the MAC system for each required inspection. Copies of the most current QCP inspection checklists can be accessed by anyone at <https://mac.fdot.gov> by clicking the Reports tab link and navigating to the Inspection/Evaluation Checklists under the Production Facility heading, choosing QCP under Checklist type, and selecting the appropriate Checklist Category.

#### 8.1.6.6 Sampling and Testing of Precast Prestressed Concrete Materials Components

The verification inspectors verify the manufacturer's certificates and take verification samples in accordance with the schedule in **FDOT Specifications Sections 346, 450**, and other applicable standards. The verification inspectors will also take IV samples as needed.

The QC and verification sampling and testing of concrete at the Plants are based on mix design, which may represent concrete placed for one or multiple projects. The maximum allowable LOT sizes for the mix design and its reduced frequency for acceptance tests shall meet the requirements of **FDOT Specifications Section 346**, except that the requirements of the test results data being from the same prime contractor/subcontractor are not applicable.

Following are the sampling and testing requirements of precast prestressed concrete materials components:

##### A. Reinforcing steel

Each LOT of reinforcing steel is accepted based on the certified mill analysis from the steel manufacturing plant and Department's verification samples. Select samples randomly from at least one LOT every six months.

A sample shall consist of three seven-foot long bars. Send one of the bars from each LOT to the SMO for testing. Properly identify and tag the remaining two bars as check samples for future testing in the event of a failure.

If the sample meets the requirements of the Specifications, accept the LOT. All reinforcing steel materials subsequent to the previous passing verification tests are considered acceptable.

If the sample fails to meet the requirements of the **Specifications**, send the remaining two check samples for testing. Reject the LOT of reinforcing steel if the results of any two samples of the same LOT fail.

#### B. Welded Wire Reinforcement (WWR)

Each LOT of WWR is accepted based on the certified mill analysis from the steel manufacturing plant and Department's verification samples. Select samples randomly from at least one LOT every six months.

A sample shall consist of three sections, three-foot by three-foot each. Send one of the sections from each LOT to the SMO for testing. Properly identify and tag the remaining two sections as check samples for future testing in the event of a failure.

If the sample meets the requirements of the **Specifications**, accept the LOT. All WWR materials subsequent to the previous passing verification tests are considered acceptable.

If the sample fails to meet the requirements of the **Specifications**, send the remaining two check samples for testing. Reject the LOT of WWR if the results of any two samples of the same LOT fail.

#### C. Prestressing Steel

Each LOT of prestressing steel is accepted based on the certified mill analysis from the steel manufacturing plant and Department's verification samples. Select samples randomly from at least one LOT every six months.

A sample shall consist of three five-foot long strands. Send one of the five-foot long strands from each LOT to the SMO for testing. Properly identify and tag the remaining two strands as check samples for future testing in the event of a failure.

If the sample meets the requirements of the **Specifications**, accept the LOT. All prestressing steel materials subsequent to the previous passing verification tests are considered acceptable.

If the sample fails to meet the requirements of the **Specifications**, send the remaining two check samples for testing. Reject the LOT of prestressing steel if the results of any two samples of the same LOT fail.

#### D. Fiber Reinforced Polymer (FRP) Reinforcing

FRP reinforcing bars and strand are obtained from producers on the Department's **Fiber Reinforced Polymer Production Facility Listing**. FRP reinforcing bar is accepted based on the requirements of **FDOT Specifications Section 932**. FRP strand is accepted based on the requirements of **FDOT Specifications Section 933**.

### 8.1.6.7 Inspection and Testing of Products Prior to and During Their Manufacturing Process

The verification inspector performs the following inspections, prior to and during major phases of production:

- A. Reviews prestressed concrete related sections of the **Plans, Standard Plans**, shop drawings, **Materials Manual, PCI Manual MNL-116**, the Plant's QC Plan, and the **Specifications**.
- B. Performs random reviews of the Plant's fabrication methods, procedures, workmanship, and documented QC inspections. Verification inspections include random reviews and visual inspections of all major phases of work such as formwork, tensioning, reinforcing steel, curing, detensioning, dimensional checks, handling, storage, and shipping.
- C. Inspects delivery, placement, and consolidation process of concrete.
- D. Inspects the finishing and curing process of concrete.
- E. Inspects the storage of materials that will be used for the manufacturing of Products.
- F. Documents the results of the inspections in MAC.

#### **8.1.6.8 Post Inspection and Testing of the Manufactured Products**

The verification inspector performs the following activities during the inspection of stored products at the Plant:

- A. Performs a spot check of the finished products to detect defects as described in **FDOT Specifications Section 450**, which may require repair prior to shipment.
- B. Performs a random inspection of finished products for dimensional and alignment tolerances, handling, storage, and shipping, and periodically checks the records for sweep and camber measurements.
- C. Performs reviews of the QC reports and checks the Plant's documentation for Products prior to shipment.
- D. In the absence of the shop drawings, the verification inspector verifies that a framing plan, tensioning and elongation calculations, and de-tensioning schedules are available.
- E. After the Plant's completion of work and prior to the shipment of the products to the jobsite, the verification inspector visually inspects randomly selected products to ensure that they have the QC manager's stamp on them. The verification inspector will ensure that each shipment of the products to the job site is accompanied by a delivery ticket that provides the list of the products and is signed or stamped by the QC manager or QC personnel working under his/her direct supervision.
- F. Documents the results of the inspections in MAC.

#### **8.1.6.9 Independent Verification (IV)**



The Department may perform IV at any time by sampling and testing any Product or its material ingredients. This is a checking function outside of the verification program.

#### **8.1.6.10 Process Reviews**

The SMO will perform annual process reviews in each District and generate a report. The intent of the process reviews is to ensure consistency in procedures and policy enforcement across the state. The review includes the verification of **Materials Manual Volume I, MAC QC Program Maintenance User Manual**, and any other relevant document requirements. DMRO will respond to any action items outlined in the report within the specified time frame.

### **8.1.7 STATE MATERIALS OFFICE (SMO) RESPONSIBILITIES**

Following are the responsibilities of the SMO:

- A. Provides precast prestressed concrete related technical support to the DMRO and Construction personnel.
- B. Serves as a member of the Plant qualification review Team.
- C. Performs process reviews with DMRO precast prestressed concrete personnel and generates a report.
- D. Provides information regarding specification changes and inspection procedures to the DMRO.
- E. Coordinates with the Plant, DMRO, and Construction personnel to discuss any repeated deficiencies of the manufactured Products.
- F. Reviews the proposed precast prestressed concrete plant certification agency programs and issues the accreditation letters to the qualified providers.
- G. Reviews the proposed precast prestressed concrete inspector training programs and maintains a list of the Department accredited training agencies on its website.
- H. May accompany DMRO personnel during routine Plant inspections or IV testing and inspection.

### **8.1.8 DISTRICT CONSTRUCTION OFFICE RESPONSIBILITIES**

When a precast prestressed concrete product has a major deficiency and the type of repair method for the deficiency is not included in the QC Plan, the QC manager submits a repair proposal to the project administrator (PA). The submittal shall be in accordance with **FDOT Specifications Section 450 and CPAM Chapter 10.2**. The PA may require a credit on any product with deficiencies that require an engineering evaluation, unless the deficiency is design related.

The PA will ensure that the Plant submits a notarized certification in accordance with **FDOT Specifications Section 450** at the beginning of the project and has stamped each product that is delivered to the project site. The PA will review the delivery tickets to ensure that each shipment of the products to the project site is accompanied by a signed or stamped delivery ticket providing the description and list of the products including the project number, shipment date, and serial number of the products.

### **8.1.9 STATE CONSTRUCTION OFFICE (SCO) RESPONSIBILITIES**

The SCO reviews proposed construction related specifications, project contract administration related changes, and performs quality assurance inspections of the projects. Any changes in the project **Specifications** and **Contract Documents** must be approved by the SCO.

### **8.1.10 DISTRICT STRUCTURES DESIGN OFFICE RESPONSIBILITIES**

The District Structures Design Office provides structures-related technical support to their Districts and reviews any structures-related shop drawings and proposed changes. The District Structures Design Office reviews the Plant's proposed repair methods for major structural deficiencies as described in **CPAM Chapter 10.2**.

### **8.1.11 STATE STRUCTURES DESIGN OFFICE RESPONSIBILITIES**

The State Structures Design Office provides technical guidance to all Districts. The State Structures Design Office reviews the Plant's proposed repair methods for major structural deficiencies that are beyond the capability of the District Structures Design Office as described in **CPAM Chapter 10.2**.

### **8.1.12 TRAINING**

#### **8.1.12.1 General**

The SMO accredited training agencies perform the training of personnel involved in the inspection of the precast prestressed concrete products. The training is offered periodically at various locations. The training courses cover the materials that are included in **FDOT Specifications Section 450** and Precast/Prestressed Concrete Institute (PCI) QC technician/inspector Level I and II Training Manual. Application processing, testing, and qualifications are done through FDOT accredited agencies.

Precast/Prestressed Concrete Institute (PCI) schedules the training schools for the PCI QC technician/inspector Level III courses.

The SMO maintains the list of the accredited precast prestressed concrete training agencies and their courses. The list can be found at this link:

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

#### **8.1.12.2 Department Precast Prestressed Concrete Inspectors Qualification**

Verification inspectors assigned by the DMRO will be PCI Level II certified and have taken and passed ***FDOT Specifications Section 450 Examination***. The DMRE will have on staff one certified PCI Level III inspector who has taken and passed ***FDOT Specifications Section 450 Examination***. Verification inspectors assigned by the SMO will be PCI Level III certified and have taken and passed ***FDOT Specifications Section 450 Examination***. The certificate of ***FDOT Specifications Section 450 Examination*** will expire at the end of five years, during which the PCI Levels II and III certified inspectors have the choice of attending the course and retaking the examination or retaking only the examination to be qualified for an additional five years.

#### **8.1.13 FORMS**

None needed.