

## **Section 8.1**

### **Volume I**

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

## **8.1.1 PURPOSE**

This procedure provides guidelines related to the implementation of quality control and quality assurance programs for precast/prestressed concrete products.

## **8.1.2 AUTHORITY**

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  
334.044(2), 334.044(10)(a), and 334.048 Florida Statutes

## **8.1.3 REFERENCES**

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

Structures Design Guidelines, Florida Department of Transportation Structures Design Office

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

Standard Specifications for Road and Bridge Construction, 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 **Contract Documents**. The Plant's quality control plan is designed to provide guidelines that are used by Plants to produce Structures in conformance to **Specifications** and project plans. The primary offices affected by this procedure include the State Materials Office, District Materials Offices, District Construction Offices, District Structures Design Offices, Office of Construction, and State Structures Design Office.

## **8.1.5 DISTRICT MATERIALS OFFICE RESPONSIBILITIES**

### **8.1.5.1 General**

The District Materials Office performs qualification reviews of precast prestressed concrete plants (Plants) to ensure that the quality of manufactured products meets the requirements of the **Specifications** and other **Contract Documents**.

### **8.1.5.2 Plant Qualification Review Process**

#### **8.1.5.2.1 General**

Each Plant interested in manufacturing products for the Florida Department of Transportation (Department) must submit a quality control plan in accordance with Specifications Section 105. The District Materials Office then verifies the certification status of the Plant; reviews the submitted quality control plan; and performs initial and routine Plant qualification reviews.

#### **8.1.5.2.2 Plant Certification**

As a prequalification requirement, the Department verifies that the Plant has the required plant certification and approved quality control plan from a Department-accepted Plant certification agency. The names of those Plant certification agencies that meet the requirements of **Materials Manual Section 8.5 Volume I** are posted on the State Materials Office website.

#### **8.1.5.2.3 Plant's Proposed Quality Control Plan Review**

The District Materials Office reviews the quality control plan submitted by the Plant to ensure that it meets the requirements of **Materials Manual Section 5.6**. The District Materials Office schedules the Plant's initial qualification review. The qualification review will include Plants that are submitting their first quality control plan as well as those Plants that have not produced for any Department projects for more than a year.

The District Materials Office ensures that the names and qualification of the Plant's quality control personnel are included in the quality control plan and their qualifications meet the requirements of **Specifications Section 105**.

#### 8.1.5.2.4 Plant Qualification Review

The District Materials Office must form a Plant qualification review team (Team) to perform the Plant's initial and routine qualification reviews. The Team shall include representatives of the District and State Materials Offices. The Team may also include other personnel such as: District Concrete Engineers Technologists or Specialists; verification inspectors; Precast/Prestressed Concrete Institute (PCI) Level III certified Quality Control Inspectors; representatives of the Office of Construction; District Construction Offices; District Structures Design Offices; State Structures Design Office; and the Federal Highway Administration. The District Materials Office certified PCI Level III Quality Control Inspector will serve as Team leader.

The Team reviews the Plant's shop drawings, fabrication process, quality control testing, inspection, and documentation to ensure that they meet the requirements of the Department's established standards.

The Team evaluation may include a review of the Plant's records; forming operations; reinforcing steel placement; concrete placement operations; tensioning and detensioning of the prestressing strands; storage; and shipment of the products. The Team will perform initial and, at a minimum, annual Plant qualification reviews.

During the review, the Team will examine the two most recent Plant certification agency inspection reports, if applicable. 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.

#### **8.1.5.2.5 Maintenance of Plant Qualification**

When the Plant informs the District Materials Office, in writing, of any changes to the previously approved quality control plan, the District Materials Office reviews and accepts satisfactory changes. The Plant must then incorporate all approved modifications into the revised quality control plan or its addendum annually and submit the revised document to the District Materials Office.

When the Plant's assigned Quality Control Manager unexpectedly discontinues his/her employment without advanced notice, the Plant is required to notify the District Materials Office 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 quality control plan, may perform the duties of the Quality Control Manager for a period established by the District Materials and Research Engineer. 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.

During the temporary absence of the Quality Control Manager, a delegate meeting the same qualification requirements and identified in the QCP, may perform the QCM duties until the return of the Quality Control Manager.

Plants that are on the Department's list of Producers with Accepted Quality Control Programs 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 specifications, they should immediately bring it to the attention of the Plant. The Plants with acceptable quality control plans and current satisfactory Department qualification reviews are considered to be qualified Plants.

### 8.1.5.3 Routine Inspection and Materials Testing of Qualified Plants

#### 8.1.5.3.1 General

The District Materials Office provides 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 product for Department use on-site. Inspection of plants located out of state is the responsibility of the DMO with Quality Control Plan acceptance authority.

The District Materials and Research Engineer assigns verification inspectors to perform verification inspections and testing of the products at the Plants producing precast/prestressed concrete products. Verification inspectors are required to have PCI Level II Quality Control Inspector certification and a certificate of completion for the **FDOT Section 450 Specification** examination.

Verification inspectors monitor the plant's quality control process to ensure conformity with the **Contract Documents and Specifications**. 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.

In addition to verification inspections, the District Materials Offices perform independent verification and independent assurance inspections at the precast prestressed concrete plants.

In accordance with **Materials Manual Section 8.3**, the District Materials Office will take any actions deemed necessary related to the Plant's major product defects.

#### 8.1.5.3.2 Responsibilities of Verification Inspectors

### 8.1.5.3.2.1                    **General**

The Verification Inspectors shall perform the following functions:

- (1) Ensure that the Plant's Quality Control Manager and inspectors are performing inspections in compliance with the requirements of the **Contract Documents** and the Plant's accepted quality control plan.
- (2) Review 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.
- (3) Verify that the concrete meets the requirements of the **Specifications Section 346**.
- (4) Verify reinforcing steel, welded wire reinforcement, and prestressing strands certifications by randomly selecting and sampling from at least two LOTs per year.
- (5) Verify the prestressed concrete material components by reviewing the manufacturer's certification records. Take samples of any material components of the prestressed concrete products, as needed.
- (6) Verify that the quality control inspectors maintain the required certification documents, including certification records of the stud welding tests, strand and splice chucks, steel and accessories, and ducts.
- (7) Check the handling and storage of the manufactured products and their material components to ensure that they meet the requirements of the specifications. Visually inspect the condition of steel materials at their storage areas and during manufacturing.
- (8) For miscellaneous materials, ensure that the plant either has used a product from the **Approved Product List (APL)** or has

- the applicable material certifications to verify **Specification** compliance.
- (9) Verify that the tensioning equipment has valid calibrations and records of their calibration certificates are available at the Plant.
  - (10) Perform 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.
  - (11) Perform in-depth review of some phases of work, as needed. Bring all observed deficiencies to the attention of the Plant's Quality Control Manager.
  - (12) Ensure 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 quality control records.
  - (13) Verify the product deficiencies and ensure 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.
  - (14) At the beginning of each project, verify that the Plant provides a notarized certification statement meeting the requirements of **Specifications Section 450 (subarticle 450-16.3)**.
  - (15) Ensure 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 State Materials Office for further review in accordance with **Materials Manual Section 8.3**.
  - (16) Whenever a Plant is manufacturing for a Department project and during the week that work is in progress on the Department project, the verification inspector(s) will attend weekly meetings with the Plant's Quality Control Manager and production personnel. 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 quality control operations.

- (17) Ensure the Plant notifies the verification inspector at least two days in advance of the planned starting date of the prestressing strand tensioning/detensioning, concrete placement, or shipment operations of the products to the project sites. The Plants shall notify the Department immediately of any changes to the planned starting dates of these operations. The communication related to the starting dates of these major activities can be provided during the weekly meetings, by emails, or by phone calls.

#### 8.1.5.3.2.2

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

##### (1) General

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

The quality control and verification sampling and testing of concrete at the Plants are based on design mix, which may represent concrete placed for a project or multi projects. The maximum LOT sizes for the design mix and its reduced frequency for acceptance tests shall meet the requirements of **Specifications Section 346 (subarticle 346-9.2)** except that the same prime contractor and subcontractor, on a given contract do not have to be met.

##### (2) Reinforcing steel

Each LOT of reinforcing steel is accepted based on the certified mill analysis of the steel manufacturing plant and the Department's verification samples. The verification inspectors will take steel samples from at least two LOTs per year. From each of the randomly selected LOT of reinforcing steel, three, seven-foot long samples shall be taken.



The verification inspectors will send one of the samples from each LOT to the State Materials Office for testing. The remaining samples shall be properly identified and tagged for future testing in the event of failure of the first sample.

If the first sample meets the specified requirements, the LOT will be accepted. Subsequent to the previous passing verification tests, all reinforcing steel materials are considered acceptable.

If the first sample fails to meet the specified requirements, the verification inspector will send the second sample for testing. If both samples fail to meet the specified requirements, the verification inspector will reject the LOT of steel.

If one sample fails and one sample passes, the verification inspector will send the third sample to confirm material acceptability. The LOT of the reinforcing steel will be rejected by the Verification Inspector, if the results of any two samples of the same LOT fail.

### (3) Welded Wire Reinforcement

Welded wire reinforcement is accepted based on certified mill analysis from the welded wire reinforcement manufacturer.

The verification inspector will take randomly selected samples of welded wire reinforcement from at least two LOTs per year or at any time when there is a concern related to the validity of the certification test data. From each of the two randomly selected LOTs of welded wire reinforcement, three samples will be taken in accordance with ASTM A 1064. The verification inspector will send one of the samples from each LOT to the State Materials Office for testing. Properly identify, tag, and store the remaining samples for future testing in the event of failure of the first sample.

If the first sample passes, the LOT is accepted based on the welded wire reinforcement manufacturer's certification and verification test results. Subsequent to the previous verification test, all welded wire reinforcement deliveries to the Plant, are considered acceptable.

If the first sample fails to meet the specified requirements, the State Materials Office will test the second sample. If both samples fail to

meet specified requirements, the LOT of material will be rejected and replaced with a material that meets the requirements. If one sample fails and one sample meets the specified requirements, the State Materials Office will test the third sample to confirm material acceptability. The LOT of the welded wire reinforcement will be rejected by verification Inspector if the results of any two samples of the same LOT fail.

The verification inspector will reject each LOT of material that does not conform to the requirements of the **Specifications** and other **Contract Documents**.

#### (4) Prestressing Steel

Each LOT of the prestressing steel is accepted based on the manufacturer's certified mill analysis and the Department's verification samples from at least two LOTs per year. The verification inspector will randomly select the LOTs and take three five-foot long samples of prestressing strands from each of the two randomly selected LOTs.

One sample of each LOT will be tested by the State Materials Office. The remaining samples will be properly identified, tagged, and stored for future testing in the event of loss or failure of the first sample to meet minimum requirements. If the first sample fails to meet the specified requirements, the second sample will be tested by the State Materials Office. If both samples fail to meet specified requirements, the LOT of material shall be rejected and replaced by the Plant with material meeting the requirements. If one sample fails and one sample meets the specified requirements, the third sample will be tested to confirm material acceptability. If the third sample fails to meet specified requirements, the LOT of material shall be rejected by the Verification Inspector and replaced by the Plant with material meeting the requirements.

The verification inspector shall reject each LOT of material that does not conform to the requirements of the contract documents.

#### (5) Certified Materials

The verification inspector will verify that the aggregates, cementitious materials, chemical admixtures, and patching materials have valid certifications.

The Verification Inspector will ensure that the Plants use only the admixtures that are listed on the **APL**. Similarly, the Plants may propose the structures repair methods as part of the Plant's quality control plan and in accordance with **Specifications Section 450**.

The Verification Inspector will verify that the quality control inspectors maintain the required documentation.

At the District Materials and Research Engineer's discretion, the verification inspector may take samples of any certified materials.

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

##### **(1) General**

The verification inspector reviews prestressed concrete related sections of the **Materials Manual**; the plans; shop drawings; PCI Manual MNL-116; the Plant's quality control plan; and the **Specifications**. The verification inspector performs random reviews of the Plant's fabrication methods; procedures; workmanship; and documented quality control inspections. Verification inspections include random reviews and visual inspections of all major phases of work such as formwork; reinforcing steel; stressing; curing; detensioning; dimensional checks; handling; storage; and shipping. The verification inspector documents the inspections.

##### **(2) Depth of Inspection**

The verification inspection should be of sufficient depth to ensure that the Plant's Quality Control Manager and inspectors are performing inspections in compliance with the approved quality control plan. The Verification Inspector performs random spot checks to ensure that the observed precast/prestressed concrete products are being fabricated in compliance with the requirements of the specifications. The verification inspector can perform a more in-depth review of some phases of work as needed.

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

The verification inspector performs a spot check of the finished products to detect defects such as cracks, spalls, chips, and honeycombs, which may require repair prior to shipping. Periodically, the verification inspector checks the measurement records for sweep and camber. The verification inspector performs a random inspection of finished products for dimensional and alignment tolerances, handling, storage, and shipping.

#### **8.1.5.3.2.5 Quality Control Documents**

The verification inspector performs reviews of the quality control reports and checks the Plant's documentation for products prior to shipment.

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.

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 Quality Control 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 Quality Control Manager or quality control personnel working under his/her direct supervision.

#### **8.1.5.3.3 Independent Verification**

The Department may perform an independent verification on any product or its component materials at any time. This is a process in which sampling is not performed on a random basis and is outside of the verification program.

#### **8.1.5.3.4 Independent Assurance Program**

The Independent Assurance Program is used to check if the technician's inspection work, sampling, test methods, and testing equipment are in compliance with applicable requirements of ***Materials Manual Section 5.5.***

The District Materials Offices or State Materials Office may perform the independent assurance sampling and testing procedure of the testing technicians. The Independent Assurance Inspector checks the test methods and concrete testing equipment used by Quality Control and Verification Inspectors

In accordance with **Materials Manual Section 5.5**, prior to or concurrent with the first plastic property acceptance tests, the Precast/Prestressed concrete quality control technicians should contact the District Materials Office's Concrete Engineer so that their names will be included on the list of concrete testing technicians. Based on this information, the District Materials Office's concrete independent assurance inspectors will include the names of the technicians on the list for randomly selected annual Independent Assurance evaluations. The verification inspectors shall verify that the names of quality control technicians are included on the list for Independent Assurance evaluations.

### **8.1.6 STATE MATERIALS OFFICE RESPONSIBILITIES**

The State Materials Office is responsible for the review and acceptance of the precast prestressed concrete plant certification agency programs and the posting of the list of accepted certification agencies on its website.

The precast prestressed concrete training agencies submit their precast prestressed concrete inspector training program to the State Materials Office for review. Upon a satisfactory review, the State Materials Office accepts the qualified programs and posts the names of the Department accredited training agencies on its website.

The State Materials Office provides prestressed concrete related technical support to the Districts. When requested by the District Materials Offices, a representative of the State Materials Office will accompany the District personnel during independent assurance and independent verification testing and inspection programs.

A representative of the State Materials Office will accompany the Team during the initial and annual Plant qualification reviews.

### **8.1.7 CONSTRUCTION OFFICES 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 quality control plan, the Quality Control Manager submits a repair proposal to the Project Administrator. The submittal shall be in accordance with ***the Specifications Section 450*** and ***CPAM Chapter 10.2***. The Project Administrator may require a credit on any product with deficiencies that require an engineering evaluation, unless the deficiency is design related.

The Project Administrator will ensure that the Plant submits a notarized certification in accordance with the ***Specifications Section 450*** at the beginning of the project and has stamped each product that is delivered to the project site. The Project Administrator 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, project number, shipment date, and serial number of the products.

### **8.1.8 OFFICE OF CONSTRUCTION RESPONSIBILITIES**

The Office of Construction reviews proposed construction related specifications; project contract administration related changes; and performs quality assurance inspections of the projects. Any changes in the project specification and contract documents must be approved by the Office of Construction.

### **8.1.9 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 the major structural deficiencies as described in ***CPAM Chapter 10.2***.

### **8.1.10 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***.

## 8.1.11 TRAINING

### 8.1.11.1 General

The Florida Prestressed Concrete Association (FPCA), or any other agency accredited by the State Materials Office, organizes the training and testing 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 Section 450 of the FDOT Specifications and Precast/prestressed Concrete Institute (PCI) Quality Control Technician/Inspector Level I and II Training Manual. Application processing, testing, and qualifications are done through FPCA. The Plants are required to have qualified personnel who meet the requirements of **Specifications Section 105**.

Precast/prestressed Concrete Institute (PCI) schedules the training schools for the PCI Level III Quality Control Inspectors.

### 8.1.11.2 Department Prestressed Concrete Inspectors Qualification

Verification inspectors assigned by the District Materials Office will be PCI Level II certified and have taken and passed **Section 450** of the **FDOT Specification** examination. The District Materials and Research Engineer will have on staff one certified PCI Level III quality control inspector who has taken and passed **Section 450** of the **FDOT Specification** examination. The certificate **of Section 450** of the **FDOT Specification** will expire at the end of five years, during which, the PCI Levels II and III certified inspectors have the choices of attending the course and retaking the examination or retaking only the examination to be qualified for an additional five years.

## 8.1.12 FORMS

There are no forms associated with this procedure.