Section 6.2
Volume I

QUALITY ASSURANCE PROGRAM OF PRECAST CONCRETE PIPE

6.2.1 PURPOSE

This procedure provides guidance to the Florida Department of Transportation (Department) personnel and their designees related to the development and implementation of the quality assurance (QA) programs for the manufacture, storage, and transportation of precast concrete pipe (Pipe) for Department projects.

6.2.2 AUTHORITY

Sections 20.23(4)(a) and 334.048(3), Florida Statutes

6.2.3 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 (FDOT)

Florida Department of Transportation Standard Specifications for Road and Bridge Construction

Materials Manual Volume II, Section 6.2 Precast Concrete Pipe, Florida Department of Transportation

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

Approved Products List (APL), Florida Department of Transportation

Materials Acceptance and Certification system (MAC), Florida Department of Transportation

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

6.2.4 SCOPE

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

6.2.5 GENERAL INFORMATION

The Precast Concrete Pipe Plants (Plants) produce, inspect, store, and ship Pipe meeting the requirements of the ***Specifications*** and other ***Contract Documents***. The DMRO verifies that manufactured Pipe conforms to the requirements of the ***Contract Documents***. The DMRO accepts their Quality Control (QC) Plans and inspects the Plants prior to commencement of production for Department projects.

6.2.6 DMRO RESPONSIBILITIES

6.2.6.1 Plant Qualification Review

The Plant submits the proposed QC Plan in compliance with ***Materials Manual 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 and performs the review. The qualification review team shall include the District and State precast concrete representatives. The qualification review team may also include other personnel, including District concrete engineers/technologists, District and State drainage engineers, the verification inspectors and representative(s) of the Federal Highway Administration (FHWA).

The qualification review team reviews the Plant's manufacturing process, QC testing, inspection, and documentation. The qualification review team may also review the Plant's records, forming, reinforcing steel placement, concrete placement operations, storage, and shipment of the products.

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

6.2.6.2 Maintenance of Plant QC Plan and Qualification

During the Plant qualification review, the Plant submits test data representing samples of all Pipe sizes that are manufactured during the preceding year. The Plant submits, in writing, any changes to 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*** will be subject to a Plant qualification review or routine verification inspection at any time. At

a minimum, quarterly verification inspections will be performed by DMRO personnel. If the qualification review team or verification inspectors find any process which would result in products not meeting the ***Specifications***, they shall immediately bring it to the attention of the Plant. The Plants with acceptable QC Plans and satisfactory qualification reviews are considered to be qualified Plants.

6.2.6.3 Routine Inspection and Materials Testing of Qualified Plants

The inspections, sampling, and testing are performed as specified in ***FDOT Specifications Section 449***, except as modified herein. The verification inspector performs the required inspection, sampling, and testing activities as summarized in Table 1.

If the Plant has not produced for Department projects for three consecutive quarters, the verification inspection frequency will be reduced to once every three quarters until the Plant produces for Department projects again. In addition, sampling and testing of materials is waived during periods that the Plant is not producing for Department projects. The minimum verification, sampling, and testing frequencies shall revert back immediately after the Plant reinitiates production for Department projects.

Table 1 – Verification Inspection, Sampling, and Testing Activities

Materials / Activities	Minimum Frequency
Coarse Aggregate	Certification
Fine Aggregate	Certification
Cementitious Materials	Certification
Admixtures	Certification
Water (Chemical Analysis)	Check the Plant's testing record for compliance with ***FDOT Specifications Section 923***
Reinforcing Steel	Sample one LOT every six months, per Plant
Welded Wire Reinforcement (WWR)	Certification
Pipe Gaskets and Gasket Lubricant	Certification
Patching Materials	Certification
Priming Materials for Elliptical Pipe	Certification
Concrete Strength Tests: Core Samples, Test Cylinders, and Three-Edge Bearing Tests	When the acceptability of Pipe is based on core or cylinder tests, at a minimum frequency of once per quarter, sample and test compressive strength cylinders or test core samples, provided by Plant.

	Observe the three-edge bearing test when strength acceptability of Pipe is based on this test.
Absorption Test	Perform absorption of core samples, for each class of Pipe, at the frequency of one sample per quarter. The Plant provides the core sample.
Hydrostatic Test of Pipe Joints	Observe the joint hydrostatic test when a new gasket or joint design is introduced, and during the five-year requalification.

6.2.6.4 Responsibilities of the Verification Inspector

Following are the general responsibilities of the verification inspector:

A. At a minimum frequency of once per quarter, reviews the records for materials received at the Plant and/or incorporated into the fabrication of Pipe, including the certified physical property reports.

B. Verifies that the QC inspectors maintain the required certification documents.

C. Randomly selects samples from at least one LOT of reinforcing steel every six months.

D. Verifies that the Plant is complying with the Buy America requirements outlined in ***Materials Manual Volume II, Section 6.2***.

E. Samples other Pipe material components, as needed.

F. Checks the handling and storage for each material component of Pipe.

G. Visually checks the condition of steel reinforcement.

H. Ensures that the Plant's QC manager and inspectors are performing inspections in compliance with the QC Plan.

I. Performs random spot-checks of the finished Pipe to ensure that they are fabricated in compliance with the requirements of the ***Contract Documents***.

J. Performs in-depth review of some phases of work, as needed.

K. Advises the QC manager of any observed deficiencies.

L. Performs spot checks of repair methods.

M. Advises the QC manager of the acceptability status of QC test results.

N. Documents the results of the inspections in MAC. Verification inspectors shall perform plant inspections in accordance with the QC Program (QCP) checklists in MAC. The results of the inspections shall be documented in MAC if the inspector has the access, otherwise verification inspectors shall document results of the QCP checklist inspections outside of the MAC system for each required inspection. Copies of the most current 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 tab, choosing QCP under Checklist type, and selecting the appropriate Production Facility.

6.2.6.5 Sampling and Testing of Pipe Material 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. Certified Materials

Accept Welded Wire Reinforcement (WWR), aggregates, cementitious materials, chemical admixtures, Pipe gaskets, gasket lubricant, patching materials, and priming materials for elliptical Pipe based on certification. As described in ***Materials Manual Volume II, Section 6.2***, ensure that that the Plants use only the admixtures that are listed on the ***APL*** or approved by the DMRO as part of their QC Plan. The ***APL*** includes only the admixtures that are listed in ***FDOT Specifications Section 924***. Similarly, the Plants may propose Pipe repair methods and repair materials as part of the Plant's QC Plan.

The verification inspector checks that the QC inspector maintains the required documentation.

At the DMRO's discretion, the verification inspector may take samples of any certified materials.

6.2.6.6 Inspection and Testing Prior to and During Pipe Manufacturing Process

The verification inspector performs the following inspections, prior to and during concrete placement:

A. Reviews the ***Plans***, ***Standard Plans***, shop drawings, ***Specifications***, and performs a random review of the Plant's fabrication methods, procedures, workmanship, and QC inspection records.

B. Checks the Plant's basis for acceptance of miscellaneous Pipe materials.

C. Performs a random review and visual inspections of all other major phases of work, such as formwork, and reinforcing steel placement.

D. Inspects delivery, placement, and consolidation process of concrete.

E. Takes concrete test cylinders from a randomly selected LOT, at a frequency of one sample per quarter, during concrete placement, if the acceptability of Pipe is based on the cylinder test. A LOT of Pipe is defined as the greater of one day's production or 300 sections of Pipe, which are produced within a 30-day time period. If a LOT is composed of Pipe with different strength requirements, the highest strength requirement will be applicable for the acceptance of all Pipe in the LOT. Note: In lieu of test cylinders, take core samples or observe three-edge bearing tests from a randomly selected LOT of manufactured Pipe during post-manufacturing inspection and testing, if acceptability of the Pipe is based on these tests.

F. Inspects the finishing and curing process of concrete.

G. Inspects the storage of materials that will be used for the manufacturing of Pipe.

H. Documents the results of the inspections in MAC.

6.2.6.7 Post-Manufacturing Inspection and Testing of Pipe

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

A. Verifies the QC testing and inspection records of manufactured Pipe.

B. Takes core samples or observes the three-edge bearing tests, from a randomly selected LOT of manufactured Pipe, if acceptability of the Pipe is based on these tests.

C. Inspects any finished manufactured Pipe, including the products that are stored in the Plant and have been stamped.

D. Visually inspects the manufactured Pipe and randomly selects at least one of the stamped LOTs to determine if the Pipe are free from deficiencies. Checks the dimensions of the Pipe to verify they meet the specified dimensional tolerances.

E. Visually inspects all stored manufactured Pipe and measures the dimensions of at least 5% of the randomly selected Pipe in the LOT.

F. Advises the QC manager to reject any Pipe that does not fully comply with the requirements of the ***Specifications*** or other ***Contract Documents***.

G. Advises the Plant to remove the acceptance stamps from rejected Pipe.

H. Visually inspects the repaired Pipe and repair methods.

I. Compares verification test results to the QC acceptance test results.

J. Documents the results of the inspections in MAC.

6.2.6.8 Acceptance Status of QC Test Results

The verification inspector performs quarterly inspection and testing. Use the QC test results for acceptance of Pipe, when the QC results compare favorably with the verification test results. Consider the QC and verification tests as favorable when the results of both tests are either both passing or both failing. Consider the test results not favorable when one of the test results passes and the other one fails. If the comparison is not favorable, the Department and the Plant proceed to the resolution inspection and testing.

6.2.6.9 Close-out Meeting and Documentation

Following are the responsibilities of the verification inspector upon completion of each inspection:

A. Meets with the QC manager at the completion of each inspection. During the meetings, the verification inspector discusses deficiencies found during the inspections.

B. Maintains the documentation of the inspection activities, as well as key discussions with the Plant personnel.

C. Maintains a record of the verification testing and disposition of all material samples taken for testing.

D. For each component, the verification inspector assures that the QC manager maintains documents indicating compliance with the QC Plan.

E. Documents the deficiencies that have caused suspension of the Plant's QC Plan and maintains documentation of the Plant's corrective actions.

F. Documents the results of the inspections in MAC.

6.2.6.10 Resolution Procedure

The DMRO initiates the resolution procedure. The resolution procedure may consist of Independent Assurance (IA) inspection, sampling, and testing of the products. Upon review of the records, test procedures, and additional inspection, sampling and testing, the resolution inspector reports the cause of the non-comparable results.

If the resolution testing compares favorably with the Plant's QC data, accept the QC data. If the resolution testing compares favorably with the verification data, use the verification data for acceptance. The test results of a LOT are considered to be non-comparable when one result passes and the other result fails.

Based on the resolution results, the DMRO determines the disposition of any failed LOT and the LOTs subsequent to the previous verification test. The investigations may consist of verification/resolution sampling and testing of the

two available LOTs of the Pipe that have been manufactured immediately prior to the failed LOT. If any of the LOTs fail, the verification inspector tests two more available LOTs and continues testing backward until the results of the two verification LOTs compare favorably with the results of the QC testing. The verification inspector advises the Plant to reject all failed verification/resolution LOTs. The resolution and verification inspectors will use the same type of tests that QC inspectors are using.

6.2.6.11 Independent Assurance (IA) Inspection and Testing

IA sampling and testing are performed in accordance with ***Materials Manual Section 5.5***.

6.2.6.12 Independent Verification (IV)

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

6.2.6.13 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.

6.2.7 SMO RESPONSIBILITIES

A. Provides precast concrete materials technical support for the DMRO and Construction personnel.

B. Serves as a member of the Plant qualification review team.

C. Performs process reviews with DMRO precast concrete personnel and generates a report.

D. Provides information regarding specification changes and inspection procedures to the DMROs.

E. Coordinates with the Plant, DMRO, and Construction personnel to discuss any repeated deficiencies of the manufactured Pipes.

F. Reviews the proposed personnel training and qualification programs and issues the accreditation letters to the qualified providers.

G. Maintains the list of accredited precast concrete courses.

H. May accompany DMRO personnel during quarterly Plant inspections and Independent Verifications.

6.2.8 STATE DRAINAGE OFFICE RESPONSIBILITIES

The State Drainage Engineer reviews the plans for modified or special designs requested by the Plant. The State Drainage Office reviews and approves the Plant's proposed modifications and distributes them to the Plant, DCO, DMRO, and the SMO.

6.2.9 DISTRICT CONSTRUCTION OFFICE RESPONSIBILITIES

Project personnel accept only Pipe that are properly marked by the Plant's approved QC stamp. Project personnel will not accept any Pipe that has been severely damaged during delivery or unloading.

The personnel at the project site will ensure that a legible stamp mark is affixed to each Pipe that is received at the job site and the material was produced at a production facility listed on the Contractor's QC Plan in MAC.

Ensure that at the beginning of each project, the Plant provides a notarized statement to the project administrator (PA) from a responsible company designated representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the ***Contract Documents*** and the Plant's approved QC Plan. The sample certification statement may be viewed at the SMO website.

Ensure that each delivery ticket of the shipped products includes the Financial Project Number, manufactured date and serial number of each product.

6.2.10 TRAINING

6.2.10.1 General

Ensure that the Plant's QC personnel and Department inspectors who are involved in the inspection and testing of precast concrete Pipe have the required qualifications as specified in ***FDOT Specifications Section 105.***

Ensure the Plant's QC Plan includes a copy of the certificates of their qualified QC personnel.

6.2.10.2 Department Inspectors of Precast Concrete Pipe

Department inspectors who are involved in the testing and inspection of the precast concrete Pipe shall be Level II Quality Control Inspectors.

6.2.11 FORMS

None needed.