VOLUME I

SECTION 6.2

QUALITY ASSURANCE PROGRAM OF PRECAST CONCRETE PIPE

6.2.1 PURPOSE

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

6.2.2 AUTHORITY

Sections 20.23(3) (a) and 334.048(3), Florida Statutes (F.S.)

6.2.3 REFERENCES


Design Standards, Topic No. 625-010-003, Florida Department of Transportation.

Florida Department of Transportation Standard Specifications for Road and Bridge Construction.


American Association of State Highway and Transportation Officials (AASHTO), Part I Specifications, and Part II Tests, Washington, D.C.
6.2.4 SCOPE

Primary offices affected by this procedure include the State Materials Office, District Materials Offices, District Construction Office, and the State Drainage Office.

6.2.5 GENERAL INFORMATION

The Precast Concrete Pipe Plants (Plants) produce, inspect, store, and ship Precast Concrete Pipe (Pipe) meeting the requirements of the Specifications and other Contract Documents. The District Materials Offices verify that manufactured Pipe conforms to the requirements of the Contract Documents. The District Materials and Research Office accepts (approves) their quality control plans and inspects the plants prior to commencement of any work.

6.2.6 DISTRICT MATERIALS AND RESEARCH OFFICE RESPONSIBILITIES

6.2.6.1 Plant Qualification Review Process

6.2.6.1.1 Plant’s Initial and Annual Qualification Reviews

The Plant submits the proposed quality control plan in compliance with Materials Manual Section 5.6. The District Materials and Research Office (DMRO) makes arrangements for the Plant’s initial and routine annual qualification reviews, including Plants that are submitting their first quality control Plan as well as the 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.
The qualification review team reviews the Plant’s manufacturing process, quality control 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. The review team checks the Plant’s production process.

Upon the satisfactory plant qualification reviews, the DMRO accepts (approves) the proposed quality control plan and documents the Plant’s status as “A” on the Department’s Pipe Production Facility Listing.

6.2.6.1.2 Maintenance of Plant Quality Control Plan and Qualification:

During the annual Plant qualification reviews, 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 quality control plan to the District Materials Office and annually, submits the revised quality control plan or its addendum, if there are any changes.

Plants that are on the Department’s Pipe Production Facility Listing will be subject to a Plant qualification review at any time. If the qualification review team or Verification Inspectors find any process which would result in products not meeting Specifications, they shall immediately bring it to the attention of the Plant. The Plants with acceptable quality control plans and satisfactory qualification reviews are considered to be qualified Plants.

6.2.6.2 Routine Inspection and Materials Testing of Qualified Plants

6.2.6.2.1 General

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

<table>
<thead>
<tr>
<th>Activities</th>
<th>Minimum Inspection, Sampling and Testing Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate</td>
<td>Certification</td>
</tr>
</tbody>
</table>

TABLE 1- VERIFICATION INSPECTION, SAMPLING, AND TESTING ACTIVITIES
<table>
<thead>
<tr>
<th>Material Type</th>
<th>Certification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Aggregate</td>
<td>Certification</td>
</tr>
<tr>
<td>Cementitious Materials</td>
<td>Certification</td>
</tr>
<tr>
<td>Admixtures</td>
<td>Certification</td>
</tr>
<tr>
<td>Water Chemical Analysis</td>
<td>Check the Plant’s testing record for compliance with Section 923</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>Sample from two LOTs per year per Plant</td>
</tr>
<tr>
<td>Welded-wire reinforcement</td>
<td>Certification</td>
</tr>
<tr>
<td>Pipe gaskets and gasket lubricant</td>
<td>Certification</td>
</tr>
<tr>
<td>Patching materials</td>
<td>Certification</td>
</tr>
<tr>
<td>Priming materials for elliptical Pipes</td>
<td>Certification</td>
</tr>
<tr>
<td>Concrete strength tests:</td>
<td>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.</td>
</tr>
<tr>
<td>core samples,</td>
<td>Observe the three-edge bearing test when strength acceptability of Pipe is based on this test.</td>
</tr>
<tr>
<td>Test cylinders, and</td>
<td></td>
</tr>
<tr>
<td>Three-edge-bearing test</td>
<td></td>
</tr>
<tr>
<td>Absorption test</td>
<td>Perform absorption of core samples, for each class of pipe, at the frequency of one sample per quarter. Plant provides the core sample.</td>
</tr>
<tr>
<td>Hydrostatic Test of Pipe Joints</td>
<td>Verify that joint hydrostatic tests are performed in the presence of a representative from State Materials Office. The test is required for approval of new gasket or joint design.</td>
</tr>
</tbody>
</table>

### 6.2.6.2.2 Responsibilities of Verification Inspector

#### 6.2.6.2.2.1 General

The following are the general responsibilities of 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 quality control Inspectors maintain the required certification documents.

(C) Randomly selects two Lots of reinforcing steel and takes sample from each LOT.

(D) Samples other Pipe material components, as needed.

(E) Checks the handling and storage for each material component of Pipe.

(F) Visually checks the condition of steel reinforcement.

(G) Ensures that the Plant’s quality control manager and inspectors are performing inspections in compliance with the quality control plan.

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

(I) Performs in-depth review of some phases of work, as needed.

(J) Advises the quality control manager of any observed deficiency.

(K) Performs spot checks of the repair methods.

(L) Advises the quality control manager of the acceptability status of quality control test results.

6.2.6.2.2.2 Sampling and Testing of Pipe Material Components

(A) Reinforcing Steel

Each LOT of the reinforcing steel is accepted based on the certified mill analysis of the steel manufacturing plant and Department’s Verification samples. Take steel samples from at least two LOTs per year. From each of the randomly selected LOT of reinforcing steel, take three seven-foot long samples.

Send one of the samples from each LOT to the State Materials Office for testing. Properly identify and tag the remaining samples for future testing in the event of failure of the first sample.
If the first sample meets the requirements of the specification, accept the LOT. All reinforcing steel materials subsequent to the previous passing Verification tests are considered acceptable.

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

If one sample fails and one sample passes, send the third sample to confirm material acceptability. Reject the LOT of the reinforcing steel if the results of any two samples of the same LOT fail.

(B) Certified Materials

Accept welded wire reinforcement, aggregates, cementitious materials, chemical admixtures, Pipe gaskets, gasket lubricant, patching materials, and priming materials for elliptical Pipe based on certification. As described in Volume II of the Materials Manual, ensure that that the Plants use only the admixtures that are listed on the Department’s Approved Products list or approved by the District Materials Office as part of their quality control plans. The Approved Products List includes only the admixtures that are listed in Specifications Section 924, Subarticle 924-2. Similarly, the Plants may propose the Pipe repair methods and repair materials as part of the Plant’s quality control plan.

The Verification Inspector checks that the quality control Inspector maintains the required documentation.

At the DMRO’s discretion, the Verification Inspector may take samples of any certified materials.

6.2.6.2.3 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 Indexes, shop drawings, Specifications
tions, and performs a random review of the Plant's fabrication methods, procedures, workmanship, and quality control 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 cylinder 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 sample 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 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.

6.2.6.2.2.4 Post-Manufacturing Inspection and Testing of Pipe

The Verification Inspector verifies the following during the inspection of stored Pipe at the Plant:

(A) Verifies the quality control 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 LOT to determine if the Pipe are free from the deficiencies. Checks the dimensions of the Pipe to verify if they meet the specified dimensional tolerances.

(E) Performs visual inspection of all stored manufactured Pipe and measures the dimensions of at least 5% of the randomly selected Pipe in the LOT.

(F) Advises the quality control 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 the rejected Pipe.

(H) Visually inspects the repaired Pipe and methods.

(I) Compares Verification test results to the quality control acceptance test results.

(J) After each inspection, the Verification Inspector provides a list of deficiencies and discusses them with the Plant’s quality control manager.

### 6.2.6.2.2.5 Acceptance Status of Quality Control Test Results

The Verification Inspector performs quarterly inspection and testing. Use the quality control test results for acceptance of Pipe, when the quality control results compare favorably with the Verification test results. Consider the quality control and Verification tests as favorable when the results of both tests are, either both tests are passing or both failing. Consider the test results, not favorable, when one of the test result passes and the other one fails. If the comparison is not favorable, the Department and the Plant proceed to the resolution inspection and testing.
6.2.6.2.6 Close-out Meeting and Documentation

The following are the responsibilities of Verification Inspector upon completion of each inspection:

(A) Meets with the quality control manager at the completion of each inspection. During the meetings, the Verification Inspector discusses the product deficiencies found during the inspections.

(B) Documents the results of the inspections.

(C) Maintains the documentation of the inspection activities in a notebook or any other format that reflects key inspection, sampling and testing activities as well as key discussions with the Plant personnel.

(D) Maintains a record of the Verification testing and disposition of all material samples taken for testing.

(E) For each component, the Verification Inspector assures that quality control manager maintains documents indicating compliance with the quality control plan.

(F) Documents the deficiencies that have caused the suspension of the Plant’s quality control Plan and maintains documentation of the Plant's corrective actions.

6.2.6.2.3 Resolution Procedure

The District Materials Office initiates the resolution procedure. The resolution procedure may consist of Independent Assurance inspection, sampling, and testing of the products. Upon the 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 quality control data, accept the quality control 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
the 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 fails, 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 quality control 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 quality control Inspectors are using.

6.2.6.2.4 Independent Assurance Inspection and Testing

Independent Assurance sampling and testing are performed in accordance with Section 5.5 of the Materials Manual.

6.2.6.2.5 Independent Verification

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

6.2.7 STATE MATERIALS OFFICE RESPONSIBILITIES

The following are responsibilities of the State Materials Office:

(A) Provides precast concrete materials technical support for the Districts Materials and construction personnel.

(B) The State Materials Office representative may accompany District personnel during quarterly Plant inspections and Independent Verifications.

(C) The State Materials Office representative will serve as member of the Plants initial and annual qualification review team.

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

(E) The State Materials Office Precast Concrete Unit will coordinate with the Plant, District Materials Office personnel, and Construction Personnel to
discuss the repeating deficiencies of the manufactured Pipes.

(F) The representative of the State Materials Office observes the hydrostatic test to verify that Plant is performing the test in accordance with ASTM C 497.

(G) Reviews the proposed personnel training and qualification programs and issues the accreditation letters to the qualified provides

6.2.8 STATE DRAINAGE OFFICE RESPONSIBILITIES

The State Drainage Engineer reviews of 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, District Construction Office, DMRO, and the State Materials Office.

6.2.9 DISTRICT CONSTRUCTION OFFICE RESPONSIBILITIES

The project personnel accept only Pipe that are properly marked by the Plant’s approved quality control stamp. The 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.

The list of the Pipe Sections shall be on the Plant’s letterhead and include the following information as a minimum:

(A) Project Number
(B) Date shipped
(C) Serial Number of the Pipe Sections
(D) Notarized certification statement at the beginning of each delivery to the project site.
(E) Delivery ticket with each shipment to the project site, identifying the products in the shipment.
6.2.10 TRAINING

6.2.10.1 General

Ensure that the Plant’s quality control personnel and Department inspectors who are involved in the inspection and testing of precast concrete Pipe have the required qualifications as specified in *Materials Manual Section 6.2 Volume II*.

Ensure the Plant's quality control plan include a copy of the certificates of their qualified quality control personnel.

The State Materials Office maintains the list of the accredited precast concrete courses.

6.2.10.2 Department Inspectors of the Precast Concrete Pipe:

The 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

There are no forms associated with this procedure.
### QUALITY ASSURANCE REVIEW REPORT
**PRECAST CONCRETE PIPE PLANT**

<table>
<thead>
<tr>
<th>Type of Inspection or Review</th>
<th>Initial Qualification</th>
<th>Monthly</th>
<th>Quarterly</th>
<th>Annual Qualification</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>District No:</td>
<td>FDOT Plant Designation No:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant name:</td>
<td>Location:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDOT Quality Assurance (QA) Inspectors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Inspection Date:**

**Plant Quality Control Manager:**

**Plant Quality Control Inspectors:**

**General Notes:** The inspection checklist items are a general guide. The inspection is performed by FDOT QA inspectors accompanied with Quality Control (QC) Manager and plant QC inspectors. The compliance status of the inspected items are marked in the provided space with the letter “Y” for compliance and letters “N-1”, “N-2”, “N-3”, etc. for noncompliance. The details of each noncompliance is described in the remarks section of the report, unless noncompliance is self-explanatory. The non-applicable items will be marked with “NA.”

### APPLICABLE QC PERSONNEL QUALIFICATION CERTIFICATIONS

<table>
<thead>
<tr>
<th>Type of Qualification</th>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q. C. Inspector Level I</td>
<td></td>
</tr>
<tr>
<td>Q. C. Inspector Level II</td>
<td></td>
</tr>
<tr>
<td>Q. C. Manager</td>
<td></td>
</tr>
<tr>
<td>ACI Concrete Field Testing Technician – Grade I</td>
<td></td>
</tr>
<tr>
<td>ACI Concrete Laboratory Testing Technician – Level I</td>
<td></td>
</tr>
<tr>
<td>ACI Concrete Strength Testing Technician</td>
<td></td>
</tr>
<tr>
<td>Concrete Batch Plant Operator</td>
<td></td>
</tr>
</tbody>
</table>

Volume I: Quality Assurance Program of Precast Concrete Pipe 6-2-13
PRE-POUR INSPECTION

<table>
<thead>
<tr>
<th>Materials Certification</th>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Aggregate</td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td></td>
</tr>
<tr>
<td>Fly Ash</td>
<td></td>
</tr>
<tr>
<td>Slag</td>
<td></td>
</tr>
</tbody>
</table>

Remarks: ____________________________________________________________________________________________________________

Storage and Stockpiling of Concrete Materials

Different grades of aggregates are stockpiled separately

Stockpiles are clearly labeled

Aggregate stockpile labels match certifications

Silos are clearly labeled

Different cementitious materials are stored separately

Cementitious materials stored labels match certifications

Reinforcement steel is stored above the surface of the ground

Heat identification tags are attached to reinforcement steel

Gaskets are stored in in a cool dry location

Remarks: ____________________________________________________________________________________________________________
### Admixtures

<table>
<thead>
<tr>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admixtures meet the requirements of FDOT Specification Section 924 and Materials Manual Section 6.2</td>
</tr>
</tbody>
</table>

Remarks: 

### Reinforcing Steel

<table>
<thead>
<tr>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforcing steel meets the requirements of FDOT Specification Section 415</td>
</tr>
</tbody>
</table>

Manufactured in United States

Mill certifications are available

Remarks:

### Welded Wire Reinforcement

<table>
<thead>
<tr>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welded Wire Fabric meets the requirements of ASTM A 1064</td>
</tr>
</tbody>
</table>

Manufactured in United States

Mill certifications are available

Remarks:

### Carbon Steel Wire

<table>
<thead>
<tr>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Steel Wire meets the requirements of ASTM A 1064</td>
</tr>
</tbody>
</table>

Manufactured in United States

Mill certifications are available

Remarks:
Plastic Chairs and Bolsters

Plastic Chairs and Bolsters meet the requirements of FDOT Specification Section 415.5.13.3

Remarks

Water: FDOT Specification 923

Water Source: City: ___________________ Well: ___________________ Other: ___________________

Compliance Status

The water-to-cementitious materials ratios meet approved concrete mix designs requirements

Consolidation is performed per QCP

Volume I: Quality Assurance Program of Precast Concrete Pipe 6-2-16
Finishing is performed per QCP

Curing is performed per QCP

POST POUR INSPECTION

Repairs are completed in accordance with the QCP or specifications
Repair materials meet the requirements of QCP or on Approved Products List

Product Dimension Measurements

The dimensions of at least 20% of randomly selected units in each lot have been measured by QC personnel
The dimensions of the structures meet the requirements of the project plans

Remarks:

ABSORPTION TEST: ASTM C497

Absorption test results meet the requirements of FDOT Specification Section 449 or Materials Manual

Remarks:

TESTING AND CURING EQUIPMENT

Certified laboratory are performing the concrete compressive strength tests
Concrete cylinder curing facility calibration are current
Compressive strength testing machine calibration are current
Three-edge bearing test machine calibration are current

Volume I: Quality Assurance Program of Precast Concrete Pipe
THREE-EDGE BEARING TEST: ASTM C497

Compliance Status

D-Load machine conforms to the requirements of the specifications

Bottom bearing strips are properly located

Gauge has been calibrated annually

Loading rate have been applied per specifications

Three edge bearing machine data is on file

Pipe Size Tested: _______ Round: _______ Elliptical: _______ Class: _______ Wall: ______

Testing procedure meets requirement of ASTM C 497

The strength test results meets the requirement of ASTM C 76

QC RECORDS: Materials Manuals 6.2.7.9.8, Volume II

Compliance Status

Verify that the plant has maintained the following QC records:

Pipe joint performance test report from State Materials Office available

Notarized certification statement delivered at the beginning of each project

Daily log of production activities

Copy of signed or stamped shipping tickets

Lot identification sheet or tracking log

QC records available for:

Pre-pour inspection

During pour inspection

Post pour inspection

All required material certifications

Records are maintained for a minimum of three years

Standard specifications, indexes, Materials Manual Volume II

Volume I: Quality Assurance Program of Precast Concrete Pipe
CONDITION OF STAMPED UNITS WHILE IN STORAGE

Storage methods of the units

Remarks:

Compliance Status

Remarks:____________________________________________________________________________________________________

____________________________________________________________________________________________________

____________________________________________________________________________________________________
Precast Concrete Pipe Structures Plant Review Close-Out Meeting

Date ____________________  Review conducted by ________________________________

Plant ____________________________  Plant Number __________________________

Meeting Attendees:

Plant Personnel ____________________________

FDOT Personnel ____________________________

Type of Review (circle one):

Independent Verification  Monthly  Quarterly  Annual

Noncompliance (N) / Remarks (R)

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

Follow-up from previous noncompliance:  □  N/A

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

Sampled:  □ WWR  □ Rebar  □ Cylinders  □ Absorption Core  □ Other ________

________________________________________  ____________________________________________

FDOT Representative  Plant Representative