Inspection of Contractor's QC Process

Florida Department of Transportation's
Use of Contractor Quality Control

Inspection of Contractor's QC Process

Presented by
David Sadler, P.E.
Construction Engineer
Telephone: 850-414-5203
Email: david.sadler@dot.state.fl.us

FDOT CQC Process

- Overview/History
- Implementation
- FDOT Inspection
- Results/Findings/Challenges
- Future Directions

Overview/History

- Beginning in 1998, FDOT piloted the program, then known as QC2000, on various pilot projects. Program was FDOT's acceptance of materials testing based on Contractor QC results.

- FDOT fully implemented its Contractor Quality Control program in 2002.

Overview/History

- Approval to move to Contractor Quality Control was given by FHWA through its Technical Advisory under the conditions that FDOT had a system of performing verification testing on Contractor's Quality Control sampling and testing.

Implementation

Specification Changes:

- Quality Control Program
- Contractor Quality Control Plan for Project
- Contractor QC Manager
- Monthly certification of compliance with specifications.
- Trained Personnel

Implementation – QC Program

Consists of Contractor's QC Plan, Producer's and Manufacturer's QC Plans:

Contractor QC Plan – project specific approach to construction of the project (i.e., earthwork, asphalt laying, etc.)

Implementation – QC Program

Producer QC Plan – process for producing products for project (i.e., prestressed beams, asphalt mix, batched concrete)

Manufacturer QC Plan – controls used for fabrication (i.e., steel girders, mast arms)

Implementation – Contractor QC Plan

- FDOT worked jointly with industry to develop a Generic QC Plan as a boilerplate for industry to use for their QC Plans.
- Contractor QC Plans are submitted to the Construction Project Personnel for review and approval before work begins.

Implementation – Contractor QC Plan

- Areas covered under the CQC umbrella
  - Asphalt Mix
  - Portland Cement Concrete (Structural)
  - Earthwork
  - Cementitious Materials
  - Timber
  - Steel and Miscellaneous Metals
  - Galvanized Metal Products
  - Prestressed and/or Precast Concrete Items
  - Drainage Products

Implementation – QC Manager

- Contractor's QC Manager is an employee with authority to act as agent of the Contractor and has authority to stop operations on the project.
- QC Manager can be an employee of the Contractor or can be hired from a consultant.

Implementation – Monthly Certification

Each month, the Contractor and the QC Manager are required to certify to FDOT that all work on the project, including QC sampling and testing, was completed in substantial compliance with specifications.

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

CONSTRUCTION COMPLIANCE WITH SPECIFICATIONS AND PLANS

FIN PROJECT I.D.(s): _____

_____

_____

_____

DATE: _____

CONTRACT NO.: _____

Monthly: O

Final: O

_____ , Prime Contractor for the above referenced contract, hereby verifies based on personal knowledge or reasonable investigation and good faith belief, all Quality Control functions and Quality Control sampling and test results are in substantial compliance with the pertinent specification requirements and the approved Quality Control Plan for this project. This represents work done between _____ and _____ . Exceptions to these requirements are listed below.

1) Item No.: _____

Exception:

_____

A false statement or omission made in connection with this certification is sufficient cause for suspension, revocation, or denial of qualification to bid, and a determination of non-responsibility, and may subject the person and/or entity making the false statement to any and all civil and criminal penalties available pursuant to applicable Federal and State Law.

State of Florida

County of _____

Sworn to and subscribed before me this _____ day

of _____ , _____ , by _____
(Print name of person signing Certification)

_____
Notary Public

_____
Commission Expires

Personally Known _____ or Produced Identification _____

Type of Identification Produced _____

_____
Quality Control Manager

_____
By

_____
Title

State of Florida

County of _____

Sworn to and subscribed before me this _____ day

of _____ by _____

_____
Contractor

Implementation – Trained Personnel

- As part of approval of FHWA to use contractor's QC results, FDOT had to ensure personnel, both Contractor's and Department, were trained.
- FDOT developed the Construction Training and Qualification Program (CTQP) to address this requirement.

Implementation – Trained Personnel

- CTQP courses offered are:
  - Aggregates – field & lab sampling & testing
  - Asphalt – plant, paving & mix design
  - Concrete – field & plant sampling, testing & inspecting
  - Earthwork – inspection
  - Management – QC orientation & Manager

FDOT Inspection - Asphalt

Asphalt inspection: Starts at Plant -

Mix Designs done by CTQP qualified persons are submitted to FDOT Materials Office for approval.

Materials evaluates, issues approval.

FDOT Inspection - Asphalt

At the plant, Contractor runs QC samples and can run process control samples as well.

QC samples are used for acceptance purposes when verified.

FDOT Inspection - Asphalt

Mix at the Plant accepted based on results of testing for:

Gradation P_{-8} and P_{-200}

Asphalt Content

Volumetrics (air voids at design)

Density (at roadway)

FDOT Inspection - Asphalt

FDOT performs Verification Testing on the Contractor's QC samples to ensure specification compliance.

Sampling is done on split sample collected by Contractor.

FDOT Inspection - Asphalt

Acceptance is done on a LOT-by-LOT basis based on test results of random samples taken from sublots.

LOT sizes are either 2000 or 4000* tons.

FDOT Inspection - Asphalt

If QC and VT samples don’t compare, samples are sent to Resolution Testing.

Resolution testing (RT) will support either the Contractor’s QC or FDOT VT.

FDOT Inspection - Asphalt

Resolution testing is done by an independent laboratory.

If RT supports QC, then acceptance based on QC with FDOT paying RT costs.

FDOT Inspection - Asphalt

If RT supports VT, then acceptance is based on RT results and Contractor pays RT costs.

Repeated failed comparisons of QC/VT can result in pulling the Contractor QC Plan.

FDOT Inspection - Asphalt

Asphalt testing at the Roadway:

Mix at roadway accepted based on density.

Asphalt cores are used for QC sampling.

FDOT Inspection - Asphalt

Locations for QC cores are determined by FDOT based on random numbers.

Five cores from each sublot are taken for QC density testing.

Cores retained until LOT accepted by FDOT.

FDOT Inspection - Asphalt

At the completion of the LOT of asphalt, FDOT will test all of the cores from one sublot for density.

If all the cores compare, then the LOT is accepted for density based on Contractor QC results.

FDOT Inspection - Asphalt

If any of the cores fail to compare for density, then all of the cores for all of the sublots are tested.

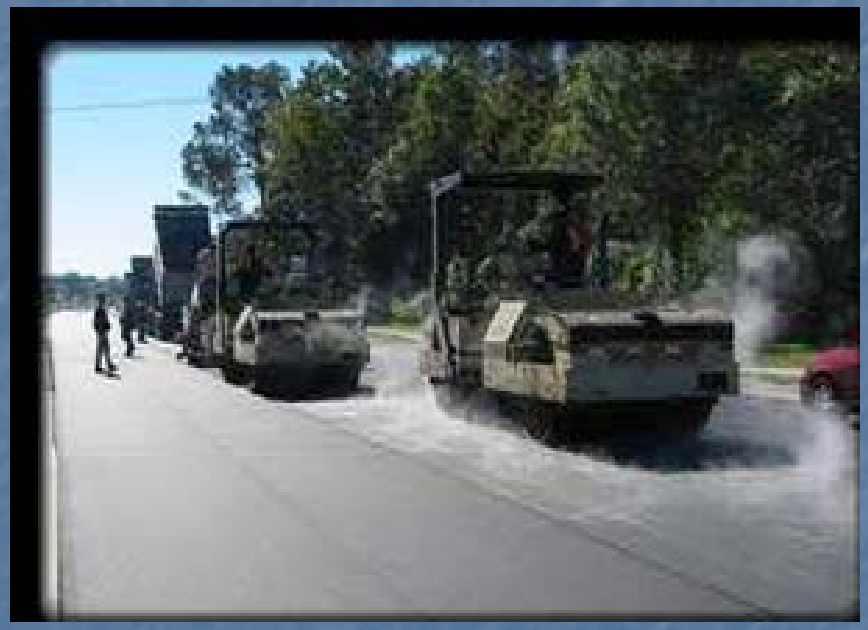
If two or more of the samples fail in comparison the core samples for the LOT will be sent to RT.

FDOT Inspection - Asphalt

Density core samples sent to Resolution Testing where the process is same as was shown for plant sampling comparisons.

Lost or missing VT/RT samples that were in the custody of the Contractor will result in minimum composite pay factor.

FDOT Inspection - Asphalt



Other Contractor asphalt operations inspected by FDOT are:

laydown operations

cross-slope

milling operations

FDOT Inspection - Concrete

Areas of Inspection for Contractor Quality Control of Concrete:

Starts in the plant with mix design approvals.

FDOT Inspection - Concrete

Concrete sampling at the field by the Contractor's QC technician (CTQP qualified) is done for:

w/c ratio

air entrainment

temperature

slump

compressive cylinders

FDOT Inspection - Concrete

Contractor samples each LOT of concrete batched. LOT size varies by concrete class:

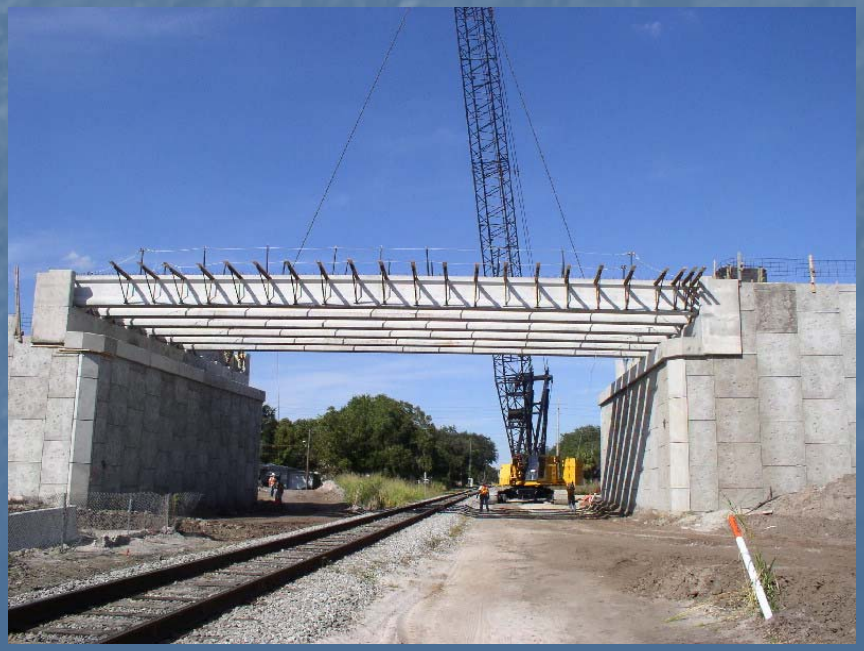
Class I – 150 cy or days placement, whichever is less

Other classes – 50 cy or days production, which-ever is less

FDOT Inspection - Concrete

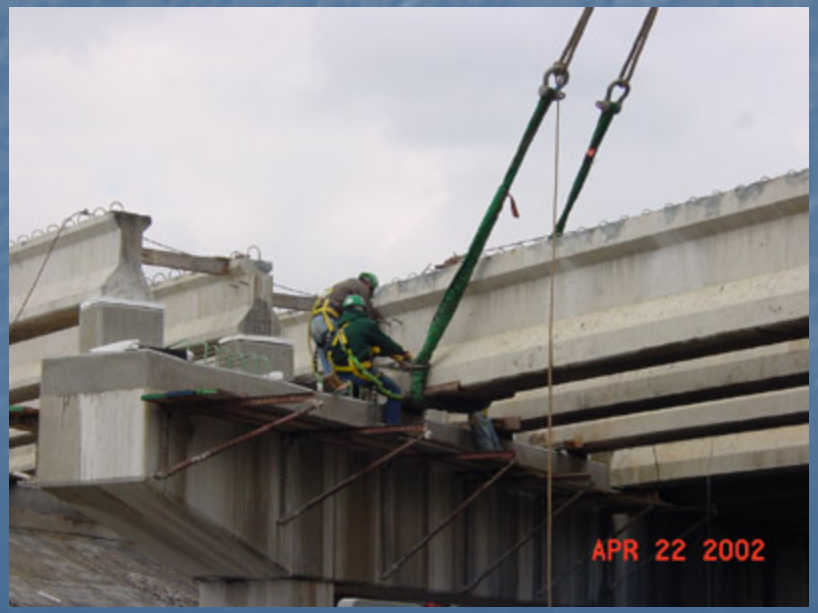
FDOT performs VT on plastic properties and casts cylinders for comparison. This is done randomly at a frequency of 1 VT per every 4 QC by Contractor.

Both the Contractor and FDOT cast additional cylinder for Resolution for LOT being verified.



FDOT Inspection - Concrete

If cylinders do not break within 750 psi, LOT is considered unverified and hold cylinders are taken to independent laboratory for testing.

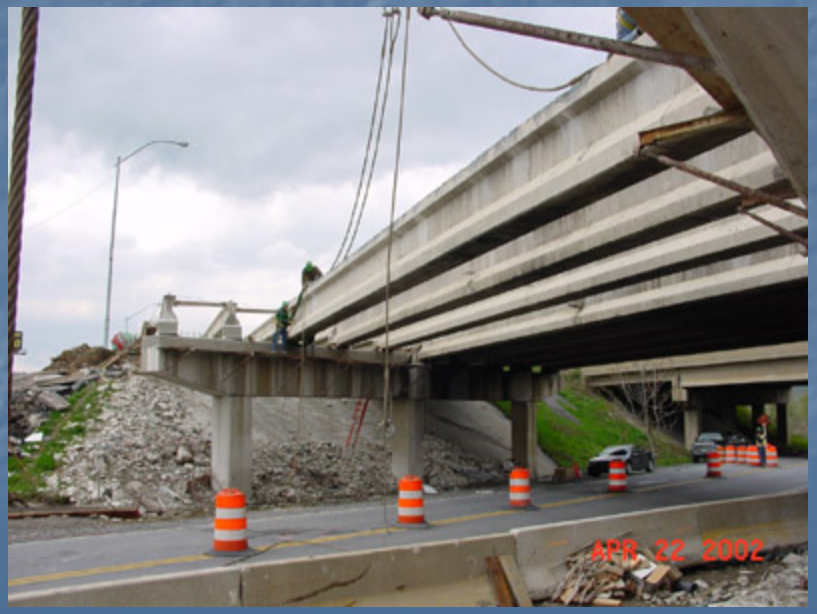


RT cylinders are to be tested w/i 7-days of 28-day QC/VT breaks.

FDOT Inspection - Concrete

If RT supports QC, acceptance is based on QC and FDOT pays for testing.

If RT supports VT, RT samples used for acceptance and Contractor pays RT costs.



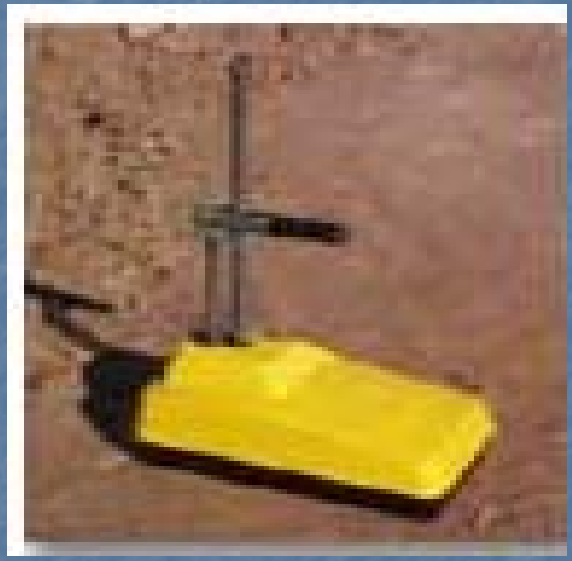
FDOT Inspection - Concrete

As with asphalt construction, repeated failed comparisons of QC/VT can result in pulling the Contractor QC Plan.

Other inspection areas: formwork, rebar placement, dimensions, concrete placement, curing, finishing, striping forms.

FDOT Inspection - Earthwork

Areas of Inspection for Contractor Quality Control of Earthwork:



Starts with comparison of gauges used for QC, verification and Independent assurance.

Must compare within 2 pcf or 3 pcf, depending.

FDOT Inspection - Earthwork

To begin production earthwork, the contractor must construct an initial production LOT in accordance with QC Plan.

After QC results pass, verification tests will be performed.

Three unsuccessful verifications will result in pulling QC Plan.

FDOT Inspection - Earthwork

Using qualified laboratory approved by FDOT, Contractor responsible for determining:

Material maximum density

Optimum moisture content

Soils Classification

FDOT Inspection - Earthwork

For verification testing, FDOT will determine lift of material, station and offset locations based on random number generator.

Each verification test evaluates all work represented by QC LOTs.

LOT verified if QC/VT within 4.5 pcf

FDOT Inspection - Earthwork

Contractor can reduce amount of QC sampling and testing based on QC performance.

If no resolution tests required or if resolution test upholds QC test, Contractor can reduce QC test to once per every two LOTs.

FDOT Inspection - Earthwork

For QC/VT that do not compare, FDOT will collect an additional sample of the material and will have its State Materials Laboratory or other AASHTO accredited laboratory perform resolution testing.

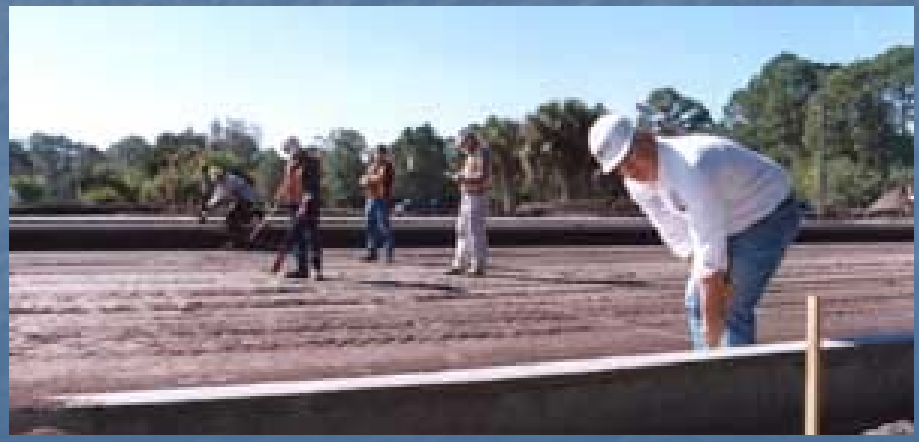
If RT supports QC, QC results will be used. If RT supports VT, VT results used.

FDOT Inspection - Earthwork

For density testing, if VT or RT testing does not compare with QC, Contractor required to retest density within 5 feet radius of location of original test.

If retest compares, LOT accepted.

If retest fails, rework the LOT.



FDOT Inspection - Earthwork

For pipe backfill operations, a LOT is defined as one lift of backfill material not to exceed 500 feet. Backfill operations around drainage structures is considered separate LOTs.

LOTs for drainage back-fill subject to the same QC, VT, and RT require-ments as embankment placement.

Results/Findings/Challenges

- QC Manager – experience, number of projects, authority
- Fears over certifications.
- Records falsification
- Not stopping production when material is out of tolerance.

Results/Findings/Challenges

- Repeated QC failures without action
- EAR's – Disposition of failed materials
- FDOT personnel letting go
- Lack of understanding of the process

Results/Findings/Challenges

- What's working – the PWL specification for volumetric properties at the plant and the roadway density
- What's working – The independent verification activities, both the sampling and testing and the actual monitoring of production and placement
- What's working – The system of warranty and CQC specifications

Results/Findings/Challenges

- Improvements needed in - The verification system, specifically the use of verification technicians and split sampling and testing is not as effective as expected in all Districts. Poor materials are being detected by the Department by means of the IV activities, but missed by the split sample element of the system.

Results/Findings/Challenges

- HMA industries total buy-in to true quality control versus minimum activities to satisfy spec compliance. Some have staffed up and changed their means and methods while others have not elected to make the necessary improvements.

Future Directions

- FDOT continues to educate and train its personnel, contractors, and consultants
- Continue with accountability for actions.
- Continue with prequalification of contractors.
- Continue with efforts to get contracting industry to recognize benefits to CQC and doing it right the first time.

Questions???