

Section 8.4

Volume I

QUALITY ASSURANCE PROGRAM FOR THE USE OF SELF-CONSOLIDATING CONCRETE (SCC) IN THE FABRICATION OF PRECAST/PRESTRESSED CONCRETE PRODUCTS

8.4.1 PURPOSE

This procedure provides guidelines to the Florida Department of Transportation (Department) personnel and their designees that are involved in the SCC related laboratory and field trial batches, review of the Quality Control (QC) Plans of the precast/prestressed fabrication facilities (Plants), and inspection and testing of production concrete.

8.4.2 AUTHORITY

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

8.4.3 REFERENCES

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 (FDOT) Standard Specifications for Road and Bridge Construction

Materials Manual Volume II, Section 8.4 Self-Consolidating Concrete for Precast/Prestressed Concrete Products, Florida Department of Transportation

Florida Department of Transportation Florida Sampling and Testing Methods (FSTM)

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

American Concrete Institute (ACI), Publication 237R-07, Self-Consolidating Concrete, Farmington Hills, Michigan, April 2007

American Association of State Highway and Transportation Officials (AASHTO), Part I Specification, and Part II Tests

8.4.4 SCOPE

This procedure establishes guidelines for the Department personnel who are involved in the SCC related inspection and testing activities, including, reviews of the proposed QC Plan, concrete mix designs, laboratory and field trial batch verifications, and inspection and testing of production concrete.

8.4.5 PROPOSED QUALITY CONTROL PLANS

The District Materials and Research Office (DMRO) reviews the Plant's proposed QC Plan or addendum(s) to the QC Plan related to SCC. The QC Plan should include information related to the SCC mix design approval process, batching, delivery, placement, and curing methods.

The QC Plan should include guidance to the Plant personnel who are involved in the operation and QC inspection and testing program.

8.4.6 PROPOSED SCC MIX DESIGNS

8.4.6.1 Specified 346 Class Concrete

SCC is allowed for the fabrication of precast prestressed concrete as a modification of the **FDOT Specification Section 346** class of concrete. This type of replacement requires that the Plant propose to the DMRO the use of a SCC mix and perform necessary trial batches. The Department reviews and approves the proposed concrete mix design upon its satisfactory test results.

The proposed **FDOT Specifications Section 346** classes of the SCC mixes require the State Materials Office's (SMO) approval. The DMRO reviews the proposed SCC mix designs and verifies that they meet the requirements of **Materials Manual Volume II, Section 8.4** and **FDOT Specifications Section 346**. Ensure that the proposed concrete mixes provide the required minimum target slump flow. Upon satisfactory results of the laboratory and field demonstration, the DMRO submits the proposed **FDOT Specifications Section 346** class mix along with supporting data and recommendation to the SMO for review and approval.

8.4.6.2 ASTM or AASHTO Class Concrete

For ASTM and AASHTO specification concrete, the DMRO will review and approve the proposed mix design upon satisfactory completion of the required laboratory and field trial batches.

8.4.7 LABORATORY TRIAL BATCH VERIFICATION

After the review of the proposed mix design, the DMRO representative will observe the trial batch to ensure that the mix ingredients, proportioning, and verification process meet the requirements of the **Specifications, Materials Manual** and QC Plan.

8.4.8 FIELD DEMONSTRATION OF SCC

The field demonstration of the proposed mix design is a requirement of the SCC approval process. The field demonstration requires either production of a

mockup, or static segregation evaluation of the hardened SCC, as described in this section.

The field demonstration includes the demonstration of delivery and placement of at least 9 cubic yards of concrete. During the field demonstration, the plant performs the slump flow loss test and evaluation of the mockup product in accordance with **FM 5-617** or **AASHTO R81**, as appropriate.

The DMRO must review the test results and ensure that they meet the requirements of the **Specifications**. Upon review and satisfactory results, the DMRO recommends the approval of the proposed **FDOT Specifications Section 346** class concrete mix design. The DMRO reviews and approves the Plant's proposed ASTM and AASHTO mix designs.

8.4.8.1 Mockup Product of the Field Demonstration Concrete

The field demonstration shall include the manufacture and evaluation of a mockup in accordance with **FM 5-617** if the Plant is utilizing SCC for the first time, and shall meet the following requirements:

- 1) The mockup shall be a partial or full-scale representation of the proposed Products.
- 2) The mockup shall contain reinforcing steel typical of those Products.
- 3) The mockup shall use the same mix design.
- 4) The Coarse Aggregate Index (C.A.I.) shall be determined by saw cutting the Product's entire cross-section.

If the Plant is introducing a new SCC mix design, but has previously successfully utilized SCC, then the reinforcing steel is optional.

When the coarse aggregate index (CAI) performed in accordance with **FM 5-617** exceeds 15 percent, it is an indication of segregation of concrete during placement. The Plant should review and determine the cause of segregation and provide information on how the segregation problem may be prevented during the placement of production concrete. The DMRO should review if the Plant's corrective action is acceptable, otherwise, the proposed mix design shall be rejected.

8.4.8.2 Static Segregation of the Field Demonstration Concrete:

The mockup is not required, and the assessment of static segregation shall be verified in accordance with **AASHTO R 81** when:

- 1) The target slump flow is increased for SCC mix designs already approved.
- 2) The DMRO/SMO determine that the mockup test is not required for a particular mix.
- 3) Permissible adjustments to previously approved mix design have been made as referenced below:

- a) Allowable variation of Coarse or Fine Aggregate: The variation for each aggregate can be ± 75 pounds per cubic yard of concrete.
- b) Admixtures: Should be within the admixture manufacturer's technical data sheet range. Dosage rates outside of this range may be used with written recommendation from the admixture producer's technical representative. Mixes with adjustments falling outside the technical data sheet range shall be suspended when written recommendation from the admixture producer's technical representative has not been obtained.
- c) Allowable variation of total Cementitious Materials: ± 6.5 percent per cubic yard but not less than the specified minimum for that class of concrete.

The adjusted mix must meet the theoretical yield requirements of the approved SCC mix design.

The District Materials Research Engineer (DMRE) will be advised of any adjustments to the concrete mix design. Batch adjustments shall not be used for batch tolerances of aggregate and cementitious materials. The adjustments shall be noted on the concrete delivery tickets.

8.4.9 PRODUCTION BATCH VERIFICATION

During the production, it is necessary that the inspectors closely observe the concrete mix delivery ticket, aggregate moisture, plastic properties test results, placement operation, and concrete curing. Any deviation from the requirements of the **Specifications** or QC Plan should be noted.

8.4.10 TRAINING

Department personnel involved in SCC mix design laboratory trials, field trials, and production batch verification shall be **ACI Concrete Field Testing Technician Grade I** and **ACI Self-Consolidating Concrete Testing Technician** certified.