

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 other entities that are involved in the SCC related laboratory and field trial batches, review of the quality control plans of the precast/prestressed fabrication facilities (Plants), and inspection and testing of production concrete.

Section 8.4, Volume II of the Materials Manual provides guidance to the Plants that are involved in the manufacturing of products using SCC.

8.4.2 Authority

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

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

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

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

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, Washington, D.C.

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 quality control 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 quality control plan or addendum(s) to the quality control plan related to SCC. The quality control plan should include information related to the SCC mix design approval process, batching, delivery, placement, and curing methods.

The quality control plan should include guidance to the plant personnel who are involved in the operation and quality control 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 replacement for the ASTM, AASHTO, or FDOT Specification, Section 346 class of concrete. This type of replacement requires that the Plant propose to the District Materials Office 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 *Florida Department of Transportation Specifications, Section 346* classes of the SCC mixes require the State Materials Office's approval. The DMRO reviews the proposed SCC mix designs and verifies that they meet the requirements of *Subarticle 8.4.6, Volume II of the Materials Manual* 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 State Materials Office 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 *FDOT Specifications, Materials Manual* and quality control 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 includes the demonstration of delivery and placement of at least 9 cubic yards of concrete.

8.4.8.1 The field demonstration shall include the manufacture and evaluation of a mockup product following *FM 5-617* when:

- (1) The plant produces SCC for the first time. The mockup product shall be a partial or full scale representation of the proposed precast concrete products. It shall contain reinforcing steel typical of those products, and shall use the proposed mix design. In this case, saw cutting of the cross-section is required for visual inspection.
- (2) A new SCC mix design is used in the plant. The mockup can be any shape that meets the dimensional requirements of *FM 5-617*, section 4.1.1. Reinforcing steel is optional in this case.

8.4.8.2 The mockup is not required, and the assessment of static segregation shall be verified following *FM 5-615* 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 designs have been made as referenced below:
 - a) Allowable variation of Coarse or Fine Aggregate: The variation for each aggregate can be ± 75 lbs/yd³ 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.

During the field demonstration, the plant performs the slump flow loss test and saw cutting or coring of the mockup product, as appropriate. There should not be excessive variation between the coarse aggregate content of concrete at different locations.

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.

If permissible adjustments were made to a previously approved design mix as stated in 8.4.8 (2) a), b), and c), only mixtures with HVSI of 0 or 1 will be accepted.

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.

Also, the DMRO reviews the test results and ensures that they meet the requirements of the FDOT 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 design mixes.

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 ***FDOT Specifications*** or quality control plan should be noted.

8.4.10 Training

The quality control and quality assurance personnel should review and become familiar with the SCC test procedures.

It is necessary that the Plants provide SCC related guidelines for their inspectors as part of the quality control plans.