NCDOT
Self-Consolidating Concrete (SCC) for Precast and Prestressed Concrete (Special)

11-28-05 (Revised 12-5-05)

Furnish and place Self-Consolidating Concrete (SCC) as noted on the plans or with the permission of the Engineer. Perform this work in accordance with this Special Provision and the applicable parts of the Standard Specifications.

Self-consolidating concrete is concrete designed to flow under its own weight, maintain homogeneity and completely fill the formwork, even in the presence of dense reinforcement. Do not form-vibrate SCC without permission of the Engineer. Internal vibration of self-consolidating concrete is prohibited.

Design the mix as follows:

A. Cement -- Use a minimum of 639 lbs. per cubic yard and a maximum of 850 lbs. per cubic yard.

B. Pozzolan – With permission of the Engineer, a pozzolan such as fly ash, ground granulated blast furnace slag, silica fume or limestone powder may substituted for a portion of the cement.

C. Coarse and fine aggregate – Use a fine aggregate content of 40 % to 60 % of the combined coarse and fine aggregate weight.

D. Water – For precast concrete, use a quantity of water that produces a water-cementitious material ratio no greater than 0.48. For prestressed concrete, see Table 1000-1 in the (2006) Standard Specifications.

E. Admixtures – Although not required, a viscosity modifier is recommended as a way to enhance the homogeneity and flow of the mix.

Submit the proposed mix design to the Engineer on M & T Form 312U. Attach supporting data from trial batches conducted by an approved testing laboratory. The Engineer will evaluate the data for compliance with the following test methods and specifications:

A. Shrinkage (required for prestressed concrete only) – Shrinkage, tested in accordance with ASTM C 157 as modified herein shall not exceed 0.04 % at 28 days. Use the mix proportions to be used in production. Use steel molds 3 inches x 3 inches x 11.25 inches in size. Do not rod, vibrate or otherwise consolidate the concrete. Finish the exposed surface of each specimen with a steel trowel. Report the length change of each specimen to the nearest 0.001 % of the effective gage length at 3, 7, 14 and 28 days and 8 weeks.

B. Slump flow – Slump flow, tested in accordance with ASTM C 1611, "Standard Test Method for Slump Flow of Self-Consolidating Concrete," shall be within the range of 24 inches to 30 inches spread. Use Filling Procedure B.

C. J-Ring test – Follow the "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants (TR-6-03)" published by PCI. The difference in spread between tests with and without the ring shall not exceed 2 inches.

D. L-Box test – Follow the guidelines referenced in Item C for design of the L-box and conducting the test. The ratio of H2 to H1 shall be within the range of 0.8 to 1.0.

E. Compressive strength – Report the compressive strength of concrete cylinders made in accordance with AASHTO T-23 as modified herein or T-126 as modified herein. Test cylinders in accordance with T-22 at 3, 7, 14 and 28 days. The strength shall meet the requirements shown on the plans or in the Standard Specifications. Fill the cylinder molds in one layer with no rodding or vibration of the sample. Do not cast specimens until the J-Ring test has been completed.

F. Modulus of elasticity (required for prestressed concrete only) – Report the modulus of elasticity of concrete specimens made and tested in accordance with ASTM C 469 at 3 and 28 days.

G. Air content – Test the air content of the plastic concrete in accordance with AASHTO T-152 or T-196.

Before beginning production, the producer shall demonstrate competence in using SCC by casting a mock item of like or similar design in the presence of the Engineer. With the permission of the Engineer, he may substitute in lieu of a mock item a production item being cast for another state or agency.

A representative of the admixture supplier shall be present during casting of the demonstration item and all production items. After production begins, the Engineer may waive this requirement.

Self-consolidating concrete shall remain plastic and within the specified range of slump flow during placement. Concrete delivery shall be timed such that consecutive lifts will combine completely without creating segregation, visible pour lines or cold joints. Do not allow more than 20 minutes between placement of consecutive lifts.

Concrete shall be placed from one point and be allowed to flow outward, or pumped from the bottom upward so as not to encapsulate air. Avoid opposing flow of concrete.

The distance of horizontal flow shall not exceed 30 feet and the vertical free fall distance shall not exceed 10 feet.

Perform the following field tests on the plastic concrete using the standards and modifications listed above and the sampling rates listed herein:

A. Slump flow – The slump flow shall range between 24 and 30 inches spread. For both precast and prestressed concrete, test the first batch and whenever cylinders are made. In addition, for precast, test each 30 cubic yards after the first batch; and for prestressed concrete, test each 10 cubic yards after the first batch. Whenever testing occurs, retest if the initial test fails. Reject the batch if the original and the retest fail.

B. J-Ring – The difference between tests with and without the ring shall not exceed 2 inches. For both precast and prestressed concrete, test the first batch and whenever cylinders are made. In addition, for precast concrete, test each 30 cubic yards after the first batch. Whenever testing occurs, retest if the initial test fails. Reject the batch if the original and the retest fail.

C. Air Content – For both precast and prestressed concrete, test the first batch and whenever cylinders are made. In addition, for prestressed concrete, test each 10 cubic yards after the first batch. Follow AASHTO T-152 or T-196. When testing occurs, retest if the initial test fails. Reject the load if the original and the retest fail.

D. Compressive strength – Report the compressive strength of concrete cylinders made in accordance with AASHTO T-23 as modified herein or T-126 as modified herein. Test cylinders in accordance with T-22. The strength shall meet the requirements shown on the plans or in the Standard Specifications. Fill the cylinder molds in one layer with no rodding or vibration of the sample. Do not cast specimens until the J-Ring test has been completed. For precast box culverts, make one set of cylinders for every 10 cubic yards cast. For all other precast items, make one set of cylinders per day.

E. Concrete temperature – Follow the Standard Specifications.