For more information, contact ***Master Builders Solutions***; 23700 Chagrin Blvd., Beachwood, OH 44122; Phone: (800) 628-9990; Website: https://www.master-builders-solutions.com/en-us/support-for-professionals/technical-service/specifications

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SECTION 03 31 26

SELF-CONSOLIDATING CONCRETE (SCC)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for producing Self-Consolidating Concrete.

1.2 RELATED SECTIONS

A. Related Sections:

1. Section 01 10 00 - Summary
2. Section 01 33 00 - Submittal Procedures
3. Section 01 45 00 - Quality Control
4. Section 01 60 00 - Product Requirements
5. Section 03 01 30 - Maintenance of Cast-in-Place Concrete
6. Section 03 01 40 - Maintenance of Precast Concrete
7. Section 03 10 00 - Concrete Forming and Accessories
8. Section 03 20 00 - Concrete Reinforcing
9. Section 03 30 00 - Cast-in-Place Concrete
10. Section 03 33 00 - Architectural Concrete
11. Section 03 35 00 - Concrete Finishing
12. Section 03 39 00 - Concrete Curing
13. Section 03 41 00 - Precast Structural Concrete
14. Section 03 45 00 - Precast Architectural Concrete

1.3 REFERENCES

A. Standards referenced shall be the most current versions.

B. ASTM International (ASTM):

1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C33/C33M - Standard Specification for Concrete Aggregates
3. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C70 - Standard Test Method for Surface Moisture in Fine Aggregate
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete
6. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
7. ASTM C150/C150M - Standard Specification for Portland Cement
8. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete
9. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
10. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
11. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete
12. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete
13. ASTM C566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
15. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete
16. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars
17. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
18. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
19. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete
20. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
21. ASTM C1579 - Standard Test Method for Evaluating Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete (Using a Steel Form Insert)
22. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
23. ASTM C1609/C1609M - Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading)

24. ASTM C1610/C1610M - Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique
25. ASTM C1611/C1611M - Standard Test method for Slump Flow of Self-Consolidating Concrete
26. ASTM C1621/C1621M - Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring
27. ASTM C1712 - Standard Test Method for Rapid Assessment of Static Segregation Resistance of Self-Consolidating Concrete Using Penetration Test
28. ASTM C1758/C1758M - Standard Practice for Fabricating Test Specimens with Self-Consolidating Concrete
29. ASTM C1812/C1812M - Standard Practice for Design of Journal Bearing Supports to be Used in Fiber Reinforced Concrete Beam Tests
30. ASTM D7508/D7508M - Standard Specification for Polyolefin Chopped Strands for Use in Concrete
31. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

C. American Concrete Institute (ACI):

1. ACI SPEC-301 - Specifications for Concrete Construction
2. ACI SPEC-301M - Specifications for Concrete Construction (Metric)
3. ACI SPEC-305.1 - Specification for Hot Weather Concreting
4. ACI SPEC-306.1 - Standard Specification for Cold Weather Concreting
5. ACI SPEC-308.1 - Standard Specification for Curing Concrete

D. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components

E. DIN (Deutsches Institut Fur Normung, Germany):

1. DIN 1048 Part 5 “Testing Concrete - Testing of hardened concrete (specimens prepared in mould)”
2. DIN EN 12390-8 Testing hardened concrete – Part 8: Depth of penetration of water under pressure

F. Corps of Engineers:

1. CRD-C 48 Standard Test Method for Water Permeability of Concrete

G. International Organization for Standardization (ISO):

1. ISO 14025: 2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
2. ISO 14040: 2006 Environmental management - Life cycle assessment – Principles and framework

3. ISO 14044: 2006 Environmental management - Life cycle assessment – Requirements and guidelines
4. ISO 21930: Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

H. American National Standards Institute/ Steel Deck Institute (ANSI/SDI):

1. ANSI/SDI C - 2017 Standard for Composite Steel Floor Deck-Slabs

1.4 DEFINITIONS

A. Self-Consolidating Concrete (SCC): A highly flowable, non-segregating concrete that can spread into place, fill the formwork, and encapsulate the reinforcement without any mechanical consolidation.

B. Passing Ability: The ability of SCC to flow under its own weight (without vibration) and fill completely all spaces within intricate formwork, containing obstacles, such as reinforcement.

C. J-Ring Test: Test used to determine the passing ability of SCC, or the degree to which the passage of concrete through the bars of the J-Ring apparatus is restricted.

D. J-Ring Flow: The distance of lateral flow of concrete using the J-Ring in combination with a slump cone.

E. Slump Flow: Test method used to measure the unconfined flow and stability of SCC using a slump cone (upright or inverted).

F. Slump Flow Spread: The numerical value in inches (mm) of flow determined as the average diameter of the circular deposit of SCC at the conclusion of the slump flow test.

G. Stability: The ability of a concrete mixture to resist segregation of the paste from the aggregates.

H. Static Segregation (Segregation Factor): Segregation of the mortar from the coarse aggregate that occurs after placement while the concrete is still in a plastic state.

I. Static Segregation Resistance: Resistance of a concrete mixture to segregation of the mortar component from the coarse aggregate while the concrete is at rest and before initial setting.

J. Visual Stability Index (VSI) Rating: An assessment of the homogeneity of concrete based on the visual inspection of the concrete sample at the end of the slump flow test.

K. Green Sense Concrete: Green Sense Concrete is an environmentally preferable, cost-effective concrete that is proportioned to meet or exceed performance targets using an optimization procedure from Master Builders Solutions, and materials that include supplementary cementitious materials, non-cementitious inert fillers, or both, Master Builders Solutions' MasterGlenium Series high-range water-reducing admixtures and MasterSure Z 60 workability-retaining admixture.

1.5 SUBMITTALS

A. In accordance with 01 33 00.

1. Mixture proportions.
2. Certification: Manufacturer's certification stating that the products delivered meet or exceed Project Specifications.
3. Product Data.
4. Ready-mixed concrete delivery tickets.

B. Green Sense Concrete as proportioned by Master Builders Solutions, Phone: (800) 626-6260.

Submit an environmental assessment report for the concrete mixture. The environmental assessment shall be a third party validated Environmental Product Declaration (EPD) based on life cycle assessment in accordance with ISO standards 14025 and ISO 21930:2017 and comply with the appropriate Product Category Rules for concrete. An additional assessment following NSF P352 protocol for the validation and verification of Eco-Efficiency Analyses comparing the more sustainable concrete mixture to a reference mixture to confirm reductions in embodied carbon should be included. The methodology used to conduct the analysis and assessment shall be in accordance with ISO 14040 and ISO 14044.

1.6 QUALITY ASSURANCE

A. In accordance with ACI SPEC-301 (ACI SPEC-301M) for mixing, transportation and placing of concrete

B. In accordance with ACI SPEC-305.1 for hot weather concrete placement and protection.

C. In accordance with ACI SPEC-306.1 for cold weather concrete placement and protection.

D. In accordance with ACI SPEC-308.1 for curing.

E. In accordance with ACI SPEC-301 (ACI SPEC-301M) for concrete consolidation.

F. Testing and Inspection Agency Qualifications: Independent agency conforming to the requirements of ASTM E329. Testing shall be conducted by an ACI Self-Consolidating Concrete Testing Technician, or equivalent.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ready-mixed concrete truck driver shall provide batch ticket to the Architect/Engineer or his/her representative at the time of concrete delivery. Contents of the batch ticket shall be as specified in ASTM C94/C94M.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: Shall conform to ASTM C150/C150M, Type [I] [II] [I/II] [III] [V].

B. Supplementary Cementitious Materials (SCM):

1. The substitution of supplementary cementitious materials for cement shall be made on the basis of mass.

2. Fly Ash: Shall conform to ASTM C618.

3. Slag Cement: Shall conform to ASTM C989/C989M.

4. Silica Fume: Shall conform to ASTM C1240.

   a. Products and Manufacturers:
   MasterLife SF 100 by Master Builders Solutions.

5. Metakaolin: Shall conform to ASTM C618, Class N.

   a. Products and Manufacturers:
   MasterLife MK 828 by Master Builders Solutions.

C. Aggregates: Fine and coarse aggregates shall conform to ASTM C33/C33M.

D. Water: Potable. Non-potable water shall conform to ASTM C1602/C1602M.

E. Admixtures: Furnish from one manufacturer.

1. Characteristics: Compatible with each other and free of intentionally-added chlorides.

2. Air-Entraining Admixture:

   a. Shall conform to ASTM C260/C260M.
   b. Products and Manufacturers:
   MasterAir Series by Master Builders Solutions.

3. Water-Reducing Admixture:

   a. Shall conform to ASTM C494/C494M Type A.
   b. Products and Manufacturers:
   MasterPozzolith Series by Master Builders Solutions.

4. Mid-Range Water-Reducing Admixture:

   a. Shall conform to ASTM C494/C494M Type A.
   b. Products and Manufacturers:
   MasterPolyheed Series by Master Builders Solutions.

5. High-Range Water-Reducing Admixture:

   a. Shall conform to ASTM C494/C494M Type F [or ASTM C1017/C1017M Type I].
   b. Products and Manufacturers:
   MasterGlenium Series by Master Builders Solutions.

6. Accelerating Admixture:
   a. Shall conform to ASTM C494/C494M Type C or E.
   b. Products and Manufacturers:
      MasterSet AC 534 or MasterSet FP 20 by Master Builders Solutions.

7. Retarding Admixture:
   a. Shall conform to ASTM C494/C494M Type B or D.
   b. Products and Manufacturers:
      MasterSet R Series or MasterSet DELVO Series by Master Builders Solutions.

8. Hydration Controlling Admixture:
   a. Shall conform to ASTM C494/C494M Type B or D.
   b. Products and Manufacturers:
      MasterSet DELVO Series by Master Builders Solutions.

9. Workability-Retaining Admixture:
   a. Shall retain concrete workability without affecting time of setting or early-age strength development.
   b. Shall conform to ASTM C494/C494M Type S.
   c. Products and Manufacturers:
      MasterSure Z 60 by Master Builders Solutions.

10. Strength-Enhancing Admixture:
    a. Shall be a liquid crystalline CSH nanoparticle admixture that increases both early- and late-age strength development without affecting concrete setting time.
    b. Shall conform to ASTM C494/C494M Type S.
    c. Products and Manufacturers:
       Master X-Seed 55 by Master Builders Solutions.

11. Permeability-Reducing Admixture:
    a. Shall be a portland cement-based crystalline capillary waterproofing admixture that reacts in concrete to form non-soluble crystalline hydration products in the capillary pores of the concrete.
    b. Shall conform to ASTM C494/C494 M, Type S.
    c. Shall show a reduction in permeability of concrete compared to an identical concrete mixture without the admixture, when tested in accordance with CRD-C 48 at a pressure of 200 psi (1.4 MPa) [equivalent to 460 ft (140 m) of head].
    d. Shall reduce or have no penetration of water compared to an identical concrete mixture without the admixture, when tested in accordance with DIN 1048 [EN 12390] for a duration of 72 hours.
    e. Shall be certified to NSF/ANSI 61.
    f. Product:
       MasterLife 300 Series by Master Builders Solutions.

12. Viscosity-Modifying Admixture:
    a. Shall conform to ASTM C494/C494M Type S.
    b. Products and Manufacturers:
       MasterMatrix VMA Series by Master Builders Solutions.

13. Corrosion-Inhibiting Admixture:
    a. Shall be a nominal 30 percent solution of calcium nitrite or an amine/ester-based organic corrosion-inhibiting admixture.
    b. Products and Manufacturers:
       MasterLife CI 30 or MasterLife CI 222 by Master Builders Solutions.

14. Shrinkage-Reducing Admixture:
    a. Shall conform to ASTM C494/C 94M Type S.
    b. Products and Manufacturers:
       MasterLife SRA Series or MasterLife CRA 007 by Master Builders Solutions.

15. Alkali-Silica Reaction Inhibiting Admixture:
    a. Shall contain a nominal lithium nitrate content of 30 percent.
    b. Shall conform to ASTM C494/C494M Type S.
    c. Products and Manufacturers:
       MasterLife ASR 30 by Master Builders Solutions.

16. Coloring Admixture: Shall contain pigments conforming to ASTM C979/C979M.
    a. Products and Manufacturers:
       MasterColor by Master Builders Solutions.

16. Other admixtures shall be approved by the Architect/Engineer.

F. Fibers:

1. Synthetic Microfibers:
    a. Shall be manufactured from a proprietary blend of polypropylene resins in compliance with ASTM D7508/D7508M for micro-chopped strands for use in fiber-reinforced concrete meeting the requirements of ASTM C1116/C1116M, Type III.
    b. Shall provide a minimum cracking reduction ratio (CRR) of [40] [__] percent when tested in accordance with ASTM C1579.
    c. Products and Manufacturers:

       MasterFiber M or F Series by Master Builders Solutions.

2. Synthetic Macrofibers:
    a. Shall be manufactured from a proprietary blend of polypropylene resins in compliance with ASTM D7508/D7508 for macro-chopped strands or hybrids chopped strands, for use in fiber-reinforced concrete meeting the requirements of ASTM C1116/C1116M, Type III.
    b. Shall provide a minimum equivalent flexural residual strength, $f^{D}_{e,150}$ ($f_{e,3}$) of [__] psi when tested in accordance with ASTM C1609/C1609M, using the roller support system in ASTM C1812/C1812M.
    c. Products and Manufacturers:

       MasterFiber MAC Series by Master Builders Solutions.

G. Evaporation Reducer:

1. Shall be a monomolecular film-forming liquid for application to fresh concrete to prevent rapid drying of the surface.
   a. Products and Manufacturers:
      MasterKure ER 50 by Master Builders Solutions.
2. Evaporation reducer shall not be used as a finishing aid.

H. Curing Materials: Shall be in accordance with Section 03 39 00.

2.2 CONCRETE MIXTURES

A. Mixture Specifications:

1. Water-cementitious materials ratio shall not exceed 0.45 [_] by mass.

2. Supplementary Cementitious Materials: The mass of SCM shall not exceed the percentages listed in the following table for concrete exposed to freezing-and-thawing cycles with frequent exposure to water and exposure to deicing chemicals (ACI SPEC-301 (ACI SPEC-301M) Exposure Class F3).

Material	Maximum percent of total cementitious materials by mass
Fly ash or natural pozzolans	25
Slag cement	50
Silica Fume	10
Total of fly ash or natural pozzolans and silica fume	35*
Total of fly ash or natural pozzolans, slag cement and silica fume	50*

* Fly ash or natural pozzolans and silica fume shall not constitute more than 25 and 10 percent, respectively, of the total mass of cementitious materials

B. Slump Flow:

1. Slump flow shall be measured in accordance with ASTM C1611/C1611M.

2. The design slump flow of the SCC mixture shall be established after consideration of the project requirements.

3. The slump flow of SCC used on the project shall be the design slump flow plus or minus 2 inches (50 mm).

4. Typical ranges of slump flow are outlined in the following table:

Type of Construction	Range of Slump Flow Values	
	inches	mm
Slabs	20-30	500-750
Architectural members	24-30	600-750
Wall, lightly reinforced	20-30	500-750
Column or wall, densely reinforced	24-30	600-750
Drilled Shafts	20-24	500-600

C. Visual Stability Index (VSI): VSI Rating (in accordance with ASTM C1611/C1611M) shall not exceed 1.

D. J-Ring Flow (Optional): Difference between slump flow and J-Ring flow (as measured by ASTM C1621/C1621M) shall not be more than 2 inches (50 mm).

E. Stability: The stability of the concrete mixture shall be determined in the laboratory prior to approval of the SCC mixture using test method ASTM C1610/C1610M or ASTM C1712. Concrete mixtures shall have a maximum static segregation (segregation factor) of 15 percent, based on ASTM C1610/C1610M or a maximum penetration depth of 15 mm, based on ASTM C1712.

F. Compressive strength: [4000 psi (27.5 MPa)] [5000 psi (35 MPa)] [_ psi (__ MPa)] at 28 [_] days.

G. Air content shall be [less than 3%] [5-7%] [_ %].

H. Maximum nominal size of coarse aggregate:

1. Not larger than 1/5 the narrowest dimension between sides of forms.
2. Not larger than 1/3 the depth of slabs.
3. Not larger than 3/4 of the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, bundled tendons, or ducts.
4. [Maximum size of aggregate shall be [3/4-inch (19 mm)] [1-inch (25 mm)]]

I. Furnish to the Architect/Engineer a mixture proportion for the SCC to be used.

1. Proportion SCC mixture according to project specific criteria (Compressive Strength, Air Content, Slump Flow, VSI, J-Ring Value (optional) and Segregation Factor or Static Segregation Resistance (Penetration Depth)).
2. Green Sense Concrete shall be proportioned in accordance with the Master Builders Solutions procedure.
3. Use the same components in the trial batches as that to be used in the project including coarse and fine aggregates, inert non-cementitious fillers, water, source and type of cement, supplementary cementitious materials and admixtures including any site-added admixtures intended to be used.

PART 3 EXECUTION

3.1 FORMWORK

A. Concrete formwork shall be in accordance with Section 03 10 00, Concrete Forming and Accessories. Additional measures shall be taken to seal the formwork to prevent leakage of cement paste or mortar.

3.2 BATCHING

A. Materials shall be batched in accordance with ASTM C94/C94M [ASTM C1116/C1116M].

In addition to the use of a moisture probe, the moisture content of the aggregates shall be determined once a day prior to batching in accordance with ASTM C70 or ASTM C566. Aggregate samples shall be taken as close as possible to the area where moisture probe is located. Use of microwave oven or hot plate to dry the aggregates is permitted in addition to using an oven.

B. Volume of concrete batched shall be such that no spillage occurs during transport.

3.3 TRANSPORTING

A. Concrete shall be transported in accordance with ASTM C94/C94M [ASTM C1116/C1116M].

3.4 COLD WEATHER CONCRETING

A. Concrete shall be placed and protected in accordance with ACI SPEC-306.1.

3.5 HOT WEATHER CONCRETING

A. Concrete shall be placed and protected in accordance with ACI SPEC-305.1.

3.6 FIELD QUALITY CONTROL

A. General:

1. Water shall not be added to the concrete at the job site.
2. Field addition of admixtures, if needed for logistics reasons, shall be approved by the Architect/Engineer.
3. Provide concrete for testing of slump flow, air content, density (unit weight) and

temperature and, for making cylinders.

4. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for the first 24 hours or for additional time as may be required before transporting samples to the test lab.

B. Consult with the admixture manufacturer in developing quality control operations appropriate to the project.

C. Field testing and inspection shall be performed in accordance with ACI SPEC-301 (ACI SPEC-301M).

D. Concrete tests shall be conducted by an ACI Self-Consolidating Concrete Testing Technician, or equivalent.

E. Tests shall be conducted on the first batch of the day and for each 150 yd^3 (110 m^3) or fraction thereof, for each concrete mixture placed in any one day**.**

F. The testing and inspection agency shall provide the following services:

1. Inspect concrete placement.
2. Sample the concrete in accordance with ASTM C172/C172M.
3. Fabricate test specimens in accordance with ASTM C1758/C1758M.
4. Test concrete slump flow in accordance with ASTM C1611/C1611M. Cone can either be used either upright or inverted. Same procedure shall be followed throughout the project.
5. Record the Visual Stability Index (VSI).
6. Determine the static segregation resistance in accordance with ASTM C1712. (Optional)
7. Determine the density (unit weight) of concrete sample for each strength test in accordance with ASTM C138/C138M. Fill the mold with SCC following the procedure in ASTM C1758/C1758M.
8. Determine the air content of concrete sample for each strength test in accordance with ASTM C231/C231M or ASTM C173/C173M. Fill the mold with SCC following the procedure in ASTM C1758/C1758M.
9. Record the temperature of concrete for each strength test in accordance with ASTM C1064/C1064M.
10. Cast concrete specimens for compressive strength test as follows:

    Cast and cure at least three 6-inch by 12-inch (150 mm by 300 mm) cylinders or four 4-inch by 8-inch (100 mm by 200 mm) cylinders in accordance with ASTM C31/C31M. Fill the mold with SCC following the procedure in ASTM C1758/C1758M.

11. Record the fresh concrete data for each set. The data shall include the following:
    a. Mixture number
    b. Specified 28-day strength
    c. Date and time of batching
    d. Time of testing
    e. Location of placement
    f. Truck number

g. Ticket number

h. Slump flow, VSI, penetration depth (optional), air content, density (unit weight) and temperature of concrete

i. Ambient temperature

j. Names and quantities of admixtures added on site, and, name and title of the person who authorized the addition

k. Set number, if more than one set of cylinders is cast on a single day

l. Name of the testing agency

m. Name and signature of the inspector who conducted the test, and

n. Any additional observations or comments.

13. Mark the cylinders and write the date of casting on each cylinder.

14. Store and protect the cylinders at the job site immediately after casting in accordance with ASTM C31/C31M.

15. Transport the cylinders from job site to the laboratory in accordance with ASTM C31/C31M after the cylinders have attained acceptable strength.

16. Cure the cylinders in the laboratory in accordance with ASTM C31/C31M.

17. Test cylinders for compressive strength in accordance with ASTM C39/C39M.

    a. Test one cylinder at 7 days for information and at least two cylinders at 28 [_] days for acceptance when testing 6-inch by 12-inch (150 mm by 300 mm) cylinders unless otherwise specified.

    b. Test one cylinder at 7 days for information and at least three cylinders at 28 [_] days for acceptance when testing 4-inch by 8-inch (100 mm by 200 mm) cylinders unless otherwise specified.

18. Base strength value on the average of at least two 6-inch by 12-inch (150 mm by 300 mm) cylinders or three 4-inch by 8-inch (100 mm by 200 mm) cylinders tested at 28 [_] days.

19. Test report shall include all the information listed under Item 11 above and compressive strength data and, shall be signed by the laboratory manager.

20. Strength of concrete shall be deemed satisfactory if both of the following requirements are met (ACI SPEC-301 [ACI SPEC-301M]):

    a. Every average of any three consecutive strength tests equals or exceeds the specified compressive strength, and

    b. No strength test result falls below the specified compressive strength by more than 500 psi (3.5 MPa) if the specified strength is 5000 psi (35 MPa) or less; or by more than 10 percent of specified strength, if the specified strength is above 5000 psi (35 MPa).

    If any strength test of laboratory-cured cylinders falls below the specified compressive strength by more than the values specified above, remedial measures shall be taken as recommended by the Architect/Engineer.

3.7 CONSOLIDATION

A. Consolidation is typically not necessary for SCC. However, the contractor shall have internal vibrators as recommended in ACI SPEC-301 (ACI SPEC-301M) on site in case internal vibration is needed due to delays in placement or the concrete has a lower than expected slump flow and has to be placed to prevent the formation of a cold joint.

B. Prior approval by the Architect/Engineer shall be obtained if minimal vibration (external or internal) is required for proper consolidation due to congested reinforcement or space restrictions.

3.8 FINISHING

A. Concrete finishing shall be in accordance with Section 03 35 00.

3.9 CURING AND PROTECTION

A. Curing and protection of concrete shall be in accordance with ACI SPEC-308.1 [Section 03 39 00].

END OF SECTION