ORIGINATION FORM
Proposed Revisions to the Specifications

(Please provide all information - incomplete forms will be returned)

Date: October 28, 2015

Specification Section: 346

Originator: Timothy J. Ruelke

Articles/Subarticles: 346-2,346-3,346-5,346-7,346-9,346-10, Table 2 and footnotes, Table 5

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Will the proposed revision involve Design Standard Index changes? Yes ○ No ◉

Roadway Design staŦŦ contaŎǘŜŘ óyl·Y·Ŝú:

Structures Design staff contacted (name):

Will the proposed revision involve PPM changes? Yes ○ No ◉

Roadway Design staff contacted (name):

Will the proposed revision involve CPAM changes? Yes ○ No ◉

Construction staff contacted (name):

Will the proposed revision involve Pay Item changes? Yes ○ No ◉

Estimates staff contacted (name):

Will the proposed revision involve SDG changes? Yes ○ No ◉

Structures staff contacted (name):

Will the proposed revision involve APL changes? Yes ○ No ◉

Product Evaluation staff contacted (name):

Will this revision necessitate any of the following:

Design Bulletin ☐ **Construction Bulletin** ☐ **Estimates Bulletin** ☐

Are all references to external publications current? Yes ◉ No ○

If not, what references need to be updated (please include changes in the redline)?

Why does the existing language need to be changed?

Added revisions will add clarity and consistence to the 346 language.

Summary of the changes:

Update and clarify subsection of the specification based on input from Industry, Construction Office, and the District Offices. For additional information contact Mike Bergin at 352.955.6666

Are these changes applicable to all Department jobs? Yes ◉ No ○

If not, what are the restrictions?

Contact the State Specifications Office for assistance in completing this form.

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SECRETARY

M E M O R A N D U M

DATE: November 20, 2015

TO: Specification Review Distribution List

FROM: Daniel Scheer, P.E., State Specifications Engineer

SUBJECT: Proposed Specification: **3460202 Portland Cement Concrete.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

The changes are proposed by Donald Bagwell of the State Materials Office to clarify existing language and update testing and slump requirements.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at http://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx . Comments received after **December 18, 2015,** may not be considered. Your input is encouraged.

DS/ot
Attachment

PORTLAND CEMENT CONCRETE.
(REV 11-~~5~~*12*-15)

SUBARTICLE 346-2.2 is deleted and replaced by the following:

346-2.2 Types of Cement: Unless a specific type of cement is designated elsewhere, use Type I, Type IP, Type IS, Type II, Type II (MH) or Type III cement in all classes of concrete. Use Type II (MH) for all mass concrete elements.

Do not use high alkali cement in extremely aggressive environments or in mass concrete.

Use only the types of cements designated for each environmental condition in structural concrete. A mix design for a more aggressive environment may be substituted for a lower aggressive environmental condition. ~~Do not use high alkali cement in extremely aggressive environments or in mass concrete.~~

TABLE 1			
BRIDGE SUPERSTRUCTURES			
Component	Slightly Aggressive Environment	Moderately Aggressive Environment	Extremely Aggressive Environment
Precast Superstructure and Prestressed Elements	Type I or Type III	Type I, Type II, Type III, Type IP, or Type IS	Type II (MH)
Cast In Place	Type I	Type I, Type II, Type IP, or Type IS	Type II (MH)
BRIDGE SUBSTRUCTURE, DRAINAGE STRUCTURES AND OTHER STRUCTURES			
All Elements	Type I or Type III	Type I, Type II, Type IP, or Type IS	Type II (MH)

SUBARTICLE 346-2.4 is deleted and the following substituted:

346-2.4 Coarse Aggregate Gradation: Produce all concrete using Size No. 57, 67 or 78 coarse aggregate. With the Engineer's approval *and input from the District Materials Office with Producer QC Plan acceptance authority*, Size No. 8 or Size No. 89 may be used either alone or blended with Size No. 57, 67 or 78 coarse aggregate. The Engineer will consider requests for approval of other gradations individually. Submit sufficient statistical data to establish production quality and uniformity of the subject aggregates, and establish the quality and uniformity of the resultant concrete. Furnish aggregate gradations sized larger than nominal maximum size of 1.5 inch as two components.

For Class I and Class II, excluding Class II (Bridge Deck), the coarse and fine aggregate gradation requirements set forth in Sections 901 and 902 are not applicable and the aggregates may be blended; however, the aggregate sources must be approved by the Department. Do not blend the aggregate if the size is smaller than Size No. 78.

SUBARTICLE 346-3.1 is deleted and the following substituted:

346-3.1 General: The separate classifications of concrete covered by this Section are designated as Class I, Class II, Class III, Class IV, Class V and Class VI. Strength and slump are specified in Table 2. The air content range for all classes of concrete is ~~1.0 to 6.0%, except for Class IV (Drilled Shaft) which is 0.0~~*less than or equal* to 6.0%.

Substitution of a higher class concrete in lieu of a lower class concrete may be allowed when the substituted concrete mixes are included as part of the QC Plan, or for precast concrete, the Precast Concrete Producer QC Plan. The substituted higher class concrete must meet or exceed the requirements of the lower class concrete and both classes must contain the same types of mix ingredients. When the compressive strength acceptance data is less than the minimum compressive strength of the higher design mix, notify the Engineer. Acceptance is based on the requirements in Table 2 for the lower class concrete.

TABLE 2		
Class of Concrete	Specified Minimum Strength (28-day) (psi)	Target Slump Value (inches) (c)
STRUCTURAL CONCRETE		
I (a)	3,000	3 (b)
I (Pavement)	3,000	2
II (a)	3,400	3 (b)
II (Bridge Deck)	4,500	3 (b)
III (e)	5,000	3 (b)
III (Seal)	3,000	8
IV (d)(f)	5,500	3 (b)*(g)*
IV (Drilled Shaft)	4,000	8.5
V (Special) (d)(f)	6,000	3 (b)*(g)*
V (d)(f)	6,500	3 (b)*(g)*
VI (d)(f)	8,500	3 (b)*(g)*

(a) For precast three-sided culverts, box culverts, endwalls, inlets, manholes and junction boxes, the target slump value and air content will not apply. The maximum allowable slump is 6 inches, except as noted in (b). The Contractor is permitted to use concrete meeting the requirements of ASTM C 478 4,000 psi in lieu of Class I or Class II concrete for precast endwalls, inlets, manholes and junction boxes.
(b) The Engineer may allow a higher target slump when a Type F, G, I or II admixture is used, except when flowing concrete is used. The maximum target slump shall be 7 inches.
(c) For a reduction in the target slump for slip-form operations, submit a revision to the mix design to the Engineer.
(d) When the use of silica fume, ultrafine fly ash, or metakaolin is required as a pozzolan in Class IV, Class V, Class V (Special) or Class VI concrete, ensure that the concrete meets or exceeds a resistivity of 29 KOhm-cm at 28 days, when tested in accordance with FM 5-578. Submit three 4 x 8 inch cylindrical test specimens to the Engineer for resistivity testing before mix design approval. Take the resistivity test specimens from the concrete of the laboratory trial batch or from the field trial batch of at least 3 cubic yards. Verify the mix proportioning of the design mix and take representative samples of trial batch concrete for the required plastic and hardened property tests. Cure the field trial batch specimens similar to the standard laboratory curing methods. Submit the resistivity test specimens at least 7 calendar days prior to the scheduled 28 day test. The average resistivity of the three cylinders, eight readings per cylinder, is an indicator of the permeability of the concrete mix.
(e) When precast three-sided culverts, box culverts, endwalls, inlets, manholes or junction boxes require a Class III concrete, the minimum cementitious materials is 470 pounds per cubic yard. Do not apply the air content range and the maximum target slump shall be 6 inches, except as allowed in (b).
(f) *When the concrete does not require a minimum resistivity of 29 KOhm-cm at 28 days,* ~~H~~*h*ighly reactive pozzolans may be used outside the lower specified ranges to enhance strength and workability. Testing in accordance with FM 5-578 is not required.
(g) The Engineer may allow a higher target slump when a Ternary Blend is used. The maximum target slump ~~*shall*~~*will be 7 inches.*

SUBARTICLE 346-3.2 is deleted and the following substituted:

346-3.2 Drilled Shaft Concrete: Notify the Engineer at least 48 hours before placing drilled shaft concrete. Obtain slump loss tests results demonstrating that the drilled shaft concrete maintains a slump of at least 5 inches throughout the concrete elapsed time before drilled shaft concrete operations begin. *Ambient temperature conditions for placement of drilled shaft concrete for summer condition is 85°F or higher, and below 85°F for normal condition.*

Perform the slump loss test at the anticipated ambient temperature for drilled shaft placements greater than 30 cubic yards and an elapsed time of greater than five hours.

Obtain slump loss test results from an approved laboratory or from a field demonstration. Slump loss test results for drilled shafts requiring 30 cubic yards of concrete or less and a maximum elapsed time of five hours or less may be done in a laboratory. Obtain all other slump loss test results in the field. Technicians performing the slump test must be ACI Field Grade I qualified.

~~Ambient temperature conditions for placement of drilled shaft concrete for summer condition is 85° or higher, and below 85° for normal condition. Perform the slump loss test in one of the above ambient temperature conditions.~~

The concrete elapsed time is defined in Section 455. Obtain the Engineer's approval for use of slump loss test results including elapsed time before concrete placement begins.

Test each load of concrete for slump to ensure the slump is within the limits of 346. Initially cure acceptance cylinders for 48 hours before transporting to the laboratory.

If the elapsed time during placement exceeds the slump loss test data, provide an engineering analysis preformed by a Professional Engineer, registered in the State of Florida, and knowledgeable in the area of foundations, to determine if the shaft is structurally sound and there are no voids in the drilled shaft concrete. At the direction of the Engineer, excavate the drilled shaft for inspection. Obtain approval from the Engineer before placing any additional shafts.

SUBARTICLE 346-3.4 is deleted and the following substituted:

346-3.4 Flowing Concrete for Precast/Prestressed Concrete: Produce flowing concrete mix with target slump of 9 inches.

Subsequent to the laboratory trial batch, perform a field demonstration of the proposed mix design by production and placement of at least three batches, 3 cubic yard minimum size each, of concrete containing flowing concrete HRWR admixture. Take representative samples from each batch and perform slump, air content, density (unit weight), and temperature tests on these samples. Cast specimens from each sample for compressive strength tests. Record the ambient air temperature during the test. Ensure that the concrete properties are within the required specification limits. The plants that are producing concrete with batch sizes of less than 3 cubic yards are required to produce and place at least a total amount of 9 cubic yards and perform the aforementioned tests on at least three randomly selected batches.

Determine the workability of the demonstration concrete batches by performing the slump tests on the samples taken at 15 minute intervals from each batch. Continue sampling and testing until the slump measures 6 inches or less. From the plot of slump versus time, determine the time for each batch when the slump is at 7.5 inches. The shortest time period determined from three consecutive batches, at 7.5 inches slump, is considered the cutoff time of the proposed concrete mix. For production concrete, ensure that the time between the batching and depositing of each load of concrete is less than the cutoff time of the mix and also does not exceed the allowable time limit specified in this Section.

Ensure that the demonstration concrete is mixed, delivered, placed, consolidated and cured in accordance with the proposed method and sequence. Produce the flowing concrete batches at slumps between 7.5 inches to 10.5 inches.

Perform inspection of the demonstration concrete during batching, delivery, placement and post placement. During placement, ensure that the concrete batches meet all plastic property requirements of the specifications and maintain their cohesive nature without excessive bleeding, segregation, or abnormal retardation.

Dispose of concrete produced for demonstration purposes at no expense to the Department. Subject to the Engineer's approval, the Contractor may incorporate this concrete into non-reinforced concrete items and may be included for payment, provided it meets Contract requirements for slump, entrained air, and strength.

After removal of the forms, perform the post-placement inspection of the in-place concrete. Observe for any signs of honeycombs, cracks, aggregate segregation or any other surface defects and ensure that the hardened concrete is free from these deficiencies. The Engineer may require saw cutting of the mock-up products to verify the uniform distribution of the aggregates within the saw cut surfaces and around the reinforcing steel and prestressing strands. The Engineer will require saw cutting of the demonstration mock-up products for plants that are demonstrating the use of the flowing concrete for the first time. Obtain core samples from different locations of mock-up products to inspect the aggregate distribution in each sample and compare it with the aggregate distribution of other core samples. ~~Perform surface resistivity tests on the core samples or test cylinders at 28 days.~~

Submit the results of the laboratory trial batch tests and field demonstration of verified test data and inspection reports to the Engineer, along with certification stating that the results of the laboratory trial batch tests and field demonstration tests indicate that the proposed concrete mix design meets the requirements of the specifications. For the proposed mix design, state the anticipated maximum time limit between the batching and when the concrete of each batch is deposited during the production.

Upon the review and verification of the laboratory trial batch, field demonstration test data, inspection reports and contractor's certification statement, the Department will approve the proposed mix design.

The Department may approve proposed flowing concrete mixes, centrally mixed at the placement site, without the production of demonstration batches, provided that the proposed mix meets the following two criteria:

1. A previously approved flowing concrete mix of the same class has demonstrated satisfactory performance under the proposed job placing conditions with a minimum of fifteen consecutive Department acceptance tests, which met all plastic and hardened concrete test requirements.

2. The cementitious materials and chemical admixtures, including the flowing concrete HRWR admixture, used in the proposed mix are the same materials from the same source used in the previously approved mix, (1) above.

Do not produce or place concrete until the design mixes have been approved.

ARTICLE 346-5 is deleted and the following substituted:

346-5 Sampling and Testing Methods.

Perform concrete sampling and testing in accordance with the following methods:

TABLE 5	
Description	Method
Slump of Hydraulic Cement Concrete	~~ASTM~~ *ASTM* ~~C~~ *C*-143
Air Content of Freshly Mixed Concrete by the Pressure Method*	~~ASTM~~ *ASTM* ~~C~~ *C*-231
Air Content of Freshly Mixed Concrete by the Volumetric Method*	~~ASTM~~ *ASTM* ~~C~~ *C*-173
Making and Curing Test Specimens in the Field**	~~ASTM~~ *ASTM* ~~C~~ *C*-31
Compressive Strength of Cylindrical Concrete Specimens***	~~ASTM~~ *ASTM* ~~C~~ *C*-39
Obtaining and Testing Drilled Core and Sawed Beams of Concrete	~~ASTM~~ *ASTM* ~~C~~ *C*-42
Initial Sampling of Concrete from Revolving Drum Truck Mixers or Agitators	~~FM~~ *FM* 5-501
Low Levels of Chloride in Concrete and Raw Materials	~~FM~~ *FM* 5-516
Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete	~~ASTM~~ *ASTM* ~~C~~ *C*-138
Temperature of Freshly Mixed Portland Cement Concrete	~~ASTM~~ *ASTM* ~~C~~ *C*-1064
Sampling Freshly Mixed Concrete****	~~ASTM~~ *ASTM* ~~C~~ *C*-172
Static Segregation of Self Consolidating Concrete using Column Techniques	~~ASTM~~ *ASTM* ~~C~~ *C*-1610
Slump Flow of Self Consolidating Concrete	~~ASTM~~ *ASTM* ~~C~~ *C*-1611
Passing Ability of Self Consolidating Concrete by J-Ring	~~ASTM~~ *ASTM* ~~C~~ *C*-1621
Fabricating Test Specimens with Self-Consolidating Concrete	*ASTM C-1758*
Concrete Resistivity as an Electrical Indicator of its Permeability	~~FM~~ *FM* 5-578

TABLE 5	
Description	Method
*The Department will use the same type of meter for Verification testing as used for QC testing. When using pressure type meters, use an aggregate correction factor determined by the concrete producer for each mix design to be tested. Record and certify test results for correction factors for each type of aggregate at the concrete production facility. ** Provide curing facilities that have the capacity to store all QC, Verification, "hold" and Independent Verification cylinders simultaneously for the initial curing. ***The Verification technician will use the same size cylinders as the Quality Control technician. **** Take the test sample from the middle portion of the batch in lieu of collecting and compositing samples from two or more portions, as described in ASTM C172.	

SUBARTICLE 346-7.5 is deleted and the following substituted:

346-7.5 Concreting in Hot Weather: Hot weather concreting is defined as the production, placing and curing of concrete when the concrete temperature at placing exceeds 85ºF but is ~~less than~~ 100ºF *or less*.

Unless the specified hot weather concreting measures are in effect, reject concrete exceeding 85ºF at the time of placement. Regardless of special measures taken, reject concrete exceeding 100ºF. Predict the concrete temperatures at placement time and implement hot weather measures to avoid production shutdown.

SUBARTICLE 346-7.6 is deleted and the following substituted:

346-7.6 Adding Water to Concrete at the Placement Site: ~~If the slump, as delivered, is outside the tolerance range, reject the load. If the slump is within the tolerance range, that load may be adjusted by adding water~~*Water may be added at the placement site* provided the addition of water does not exceed the water to cementitious materials ratio as defined by the mix design. After adding water, perform a slump test to confirm the concrete is within the slump tolerance range*; if the slump is outside the tolerance range, reject the load*. If an adjustment is made at the concrete production facility, perform a slump test on the next load to ensure the concrete is within the slump tolerance range. Do not place concrete represented by slump test results outside of the tolerance range. Include water missing from the water storage tanks upon arrival at the project site in the jobsite water added.

SUBARTICLE 346-9.2.1 is deleted and the following substituted:

346-9.2.1 Reduced Frequency for Acceptance Tests: The LOT size may represent 100 cubic yards when produced ~~at~~ *with* the same mix design at the same concrete production facility for the same prime contractor and subcontractor on a given Contract. *As an exception, the requirements for the ~~P~~precast/~~P~~prestressed production facility ~~shall~~will only include the same mix design at the same concrete production facility.* Submit test results indicating the average compressive strength is greater than two standard deviations above the specified minimum strength for that class of concrete. Base calculations on a minimum of ten consecutive strength test results for a Class IV or higher; or a minimum of five consecutive strength results for a Class III or lower.

The average of the consecutive compressive strength test results, based on the class of concrete, can be established using historical data from a previous Department project. The tests from the previous Department project must be within the last 60 calendar days or may also be established by a succession of samples on the current project. Only one sample can be taken from each LOT. Test data must be from a laboratory meeting the requirements of Section 105. Obtain Department approval before beginning reduced frequency LOT's.

If at any time a strength test is not verified or the average strength of the previous ten or five consecutive samples based on the class of concrete from the same mix design and the same production facility is less than the specified minimum plus two standard deviations, return to the maximum production quantity represented by the LOT as defined in Table 8. Notify the Engineer that the maximum production rate is reinstated. In order to reinitiate reduced frequency, submit a new set of strength test results.

ARTICLE 346-10 is deleted and the following substituted:

346-10 Investigation of Low Strength Concrete ~~for~~ *and* Structural Adequacy.

346-10.1 General: When a concrete acceptance strength test result falls ~~more than~~ 500 psi *or less* below the specified minimum strength, *coring ~~shall~~will not be allowed and the concrete ~~shall~~will be considered structurally adequate*~~and the Department determines that an investigation is necessary, make an investigation into the structural adequacy of the LOT of concrete represented by that acceptance strength test result at no additional expense to the Department. The Engineer may also require the Contractor to perform additional strength testing as necessary to determine structural adequacy of the concrete~~.

When a concrete acceptance strength test result falls more than 500 psi below the specified minimum strength, furnish either a structural analysis performed by the Specialty Engineer to establish strength adequacy or obtain drilled core samples as specified in 346-10.3 to determine the in-place strength of the LOT of concrete in question,~~. The structural analysis nor the drilled cores shall be~~ at ~~any~~no additional expense to the Department.

~~Furnish either a structural analysis performed by the Specialty Engineer to establish strength adequacy or drilled core samples as specified in 346-10.3 to determine the in-place strength of the LOT of concrete in question at no additional expense to the Department. Obtain the Engineer's approval before taking any core samples.~~ When the concrete is deemed to have low strength, obtain and test the cores and report the data to the Engineer within 14 calendar days of the 28 day compressive strength tests. Core strength test results obtained from the structure will be accepted by both the Contractor and the Department as the in-place strength of the LOT of concrete in question. The core strength test results will be final and used in lieu of the cylinder strength test results for determination of structural adequacy and any pay adjustment. The Department will calculate the strength value to be the average of the compressive strengths of the three individual cores. This will be accepted as the actual measured value. *Obtain the Engineer's approval before taking any core samples.*

346-10.2 *Investigation and* Determination of Structural Adequacy: *When the Department determines that an investigation is necessary, make an investigation into the structural adequacy of the LOT of concrete represented by that acceptance strength test result, at no additional expense to the Department. The Engineer may also require the Contractor to perform additional testing as necessary to determine structural adequacy of the concrete.*

If core strength test results are ~~less than~~ 500 psi *or less* below the specified minimum strength, consider the concrete represented by the cores structurally adequate. If the core strength test results are more than 500 psi below the specified minimum strength, the Department will consider the concrete represented by the cores structurally questionable. Submit a structural analysis performed by the Specialty Engineer. If the results of the structural analysis indicate adequate strength to serve its intended purpose with adequate durability, and is approved by the Department, the Contractor may leave the concrete in place subject to the requirements of 346-11, otherwise, remove and replace the LOT of concrete in question at no additional expense to the Department.

346-10.3 Coring for Determination of Structural Adequacy: Notify the Engineer 48 hours prior to taking core samples. The Engineer will select the size and location of the drilled cores so that the structure is not impaired and does not sustain permanent damage after repairing the core holes. Sample three undamaged cores taken from the same approximate location where the questionable concrete is represented by the low strength concrete test cylinders. Repair core holes after samples are taken *with a product in compliance with Section- 930 and meeting the approval of the Engineer*.

346-10.4 Core Conditioning and Testing: Test the cores in accordance with ASTM C 42. Test the cores after obtaining the samples within seven calendar days.