Florida Department of Transportation

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605 Suwannee Street
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JIM BOXOLD
SECRETARY

August 15, 2016

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section **346**
Proposed Specification: **3460202 Portland Cement Concrete.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification. An additional revision, highlighted in the attached documents, was made to 346-2.2 in response to a comment from Rafiq Darji.

The changes are proposed by Donnie Bagwell of the State Materials Office (SMO) to modify the language in response to Industry and Department input.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to dan.hurtado@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on File

Dan Hurtado, P.E.
State Specifications Engineer

DH/dt
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

PORTLAND CEMENT CONCRETE.

(REV ~~6-8-16~~~~7-27-16~~8-15-16)

SUBARTICLE 346-2.2 is deleted and the following substituted:

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

Blended cements:

~~a~~1. For Type IS, ~~-~~ Ensure that the quantity of slag ~~in Type IS~~ is less than or equal to 70% by weight.

~~b~~2. For Type IP, ~~-~~ Ensure that the quantity of the pozzolan ~~in Type IP~~ is less than or equal to 40% by weight.

~~c~~3. For Type IL, ~~-~~ Ensure that the quantity of the limestone ~~in Type IL~~ is less than or equal to 15% by weight.

Ternary Blend (Fly Ash, Slag and Portland Cement): When a ternary blend is used, the concrete must meet or exceed the following surface resistivity requirements when tested in accordance with AASHTO T358 for design mix approval:

1. Extremely aggressive environment - greater than 29 KOhm-cm
2. Moderately aggressive environment - 17 to 2~~8~~9 KOhm-cm
3. Slightly aggressive environment - less than 17 KOhm-cm

Submit resistivity test specimens at least seven calendar days prior to the scheduled 28 day test to the Engineer for testing by the State Materials Office.

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

SUBARTICLE 346-2.3 is deleted and the following substituted:

346-2.3 Pozzolans and Slag: Fly ash or slag materials are required in all classes of concrete, except for Class II 3400 and Class I 3000 used in slightly aggressive environments. Use fly ash or slag materials as a cement replacement, on an equal weight replacement basis with the following limitations:

1. Mass Concrete:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 50% by weight, except where the core temperature is expected to rise above 165°F. In that case, ensure that the percentage of fly ash is 35% to 50% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 50% to 70% by weight. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultrafine fly ash and/or metakaolin.

~~c. Fly Ash and Slag (Ternary Blend) - Ensure that there is 10% to 20% fly ash by weight, 50% to 60% slag by weight, and 30% portland cement by weight for mixes containing portland cement, fly ash and slag.~~

2. Drilled Shaft:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 33% to 37% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 58% to 62% by weight.

~~c. Fly Ash and Slag (Ternary Blend) - Ensure that there is 10% to 20% fly ash, 50% to 60% slag by weight, and 30% portland cement by weight for mixes containing portland cement, fly ash and slag.~~

3. Precast Concrete – Ensure that the precast concrete has a maximum of 25% fly ash or a maximum of 70% slag. In extremely aggressive environments, ensure that the precast concrete has a minimum of 18% fly ash or a minimum of 50% slag.

~~For fly ash and slag (ternary blend), ensure that there is 10% to 20% fly ash, 50% to 60% slag by weight, and 30% portland cement by weight for mixes containing portland cement, fly ash and slag..~~

4. For all other concrete uses not covered in (1), (2) and (3) above,

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 30% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 25% to 70% for slightly and moderately aggressive environments and 50% to 70% by weight when used in extremely aggressive environments. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultra fine fly ash and/or metakaolin.

~~c. Fly Ash and Slag (Ternary Blend) - Ensure that there is 10% to 20% fly ash, 50% to 60% slag by weight, and 30% portland cement by weight for mixes containing portland cement, fly ash and slag.~~

~~5. Ternary Blended (Fly Ash, Slag and Portland Cements):~~

~~a. Type IS - Ensure that the quantity of slag in Type IS is less than or equal to 70% by weight.~~

~~b. Type IP - Ensure that the quantity of the pozzolan in Type IP is less than or equal to 40% by weight. When a ternary blend is used, the concrete must meet or exceed the following surface resistivity requirements when tested in accordance with AASHTO T358:~~

a. cExtremely aggressive environment - greater than 29 KOhm-cm;
b. mModerately aggressive environment - 17 to 28 KOhm-cm;
c. sSlightly aggressive environment - less than 17 KOhm-cm,
when tested in accordance with FM 5-578AASHTO T 358.
Submit the resistivity test specimens at least 7seven calendar days prior to the scheduled 28-day test to the Engineer Laboratory Manager-Corrosion,for testing by the State Materials Office. The surface resistivity testing will be completed prior to design mix approval.

65. Highly Reactive Pozzolans: Highly reactive pozzolans are considered to be silica fume, metakaolin and ultrafine fly ash. When silica fume, metakaolin or ultrafine fly ash is usrequired, it must be used in combination with fly ash or slag and cured in accordance with the manufacturer's recommendations and approved by the Engineer.

a. Silica Fume - Ensure that the quantity of cement replaced with silica fume is 3% to 9% by weight of the total cementitious material.

b. Metakaolin - Ensure that the quantity of cement replaced with metakaolin is 8% to 12% by weight of the total cementitious material.

c. Ultrafine Fly Ash - Ensure that the quantity of cement replaced with ultrafine fly ash is 8% to 12% by weight of the total cementitious material.

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 for all classes of concrete is 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) (g)
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)
IV (Drilled Shaft)	4,000	8.5
V (Special) (d)(f)	6,000	3 (b)

V (d)(f)	6,500	3 (b)
VI (d)(f)	8,500	3 (b)

(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 C478 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~~AASHTO T358. 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, highly reactive pozzolans may be used outside the lower specified ranges to enhance strength and workability. Testing in accordance with ~~FM 5-578~~AASHTO T358 is not required.
(g) The Engineer may allow a higher target slump when a Ternary Blend is used. The maximum target slump will be 7 inches.

ARTICLE 346-5 is deleted and the following substituted:

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

TABLE 5

Description	Method
Slump of Hydraulic Cement Concrete	ASTM C143
Air Content of Freshly Mixed Concrete by the Pressure Method*	ASTM C231
Air Content of Freshly Mixed Concrete by the Volumetric Method*	ASTM C173
Making and Curing Test Specimens in the Field**	ASTM C31
Compressive Strength of Cylindrical Concrete Specimens***	ASTM C39
Obtaining and Testing Drilled Core and Sawed Beams of Concrete	ASTM C42
Initial Sampling of Concrete from Revolving Drum Truck Mixers or Agitators	FM 5-501
Low Levels of Chloride in Concrete and Raw Materials	FM 5-516
Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete	ASTM C138
Temperature of Freshly Mixed Portland Cement Concrete	ASTM C1064
Sampling Freshly Mixed Concrete****	ASTM C172
Static Segregation of Self Consolidating Concrete using Column Techniques	ASTM C1610
Slump Flow of Self Consolidating Concrete	ASTM C1611
Passing Ability of Self Consolidating Concrete by J-Ring	ASTM C1621
Fabricating Test Specimens with Self Consolidating Concrete	ASTM C1758
Concrete Resistivity as an Electrical Indicator of its Permeability	F~~M 5-578~~AASHTO T358

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. Cylinders will be delivered to the testing laboratory in their molds. The ~~L~~laboratory ~~responsible for testing~~ will ~~demold~~remove the specimens from the molds and begin final 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 346-9.5 is deleted and the following substituted:

346-9.5 Resolution Procedure: The Department may initiate an IA review of sampling and testing methods. The resolution procedure may consist of, but need not be limited to, a review of sampling and testing of fresh concrete, calculation of water to cementitious materials ratio, handling of cylinders, curing procedures and compressive strength testing. Compare the Verification sample results with the verification hold cylinders results. Compare the QC sample results with the QC hold cylinders results. Comparison results must not be greater than the comparison requirements in Table 7. Core samples of the hardened concrete may be required.

The Engineer will determine through the resolution procedure whether the QC strength test results or the verification strength test are deemed to be the most accurate, LOTS will then be considered to be verified. When the Engineer cannot determine which strength test results are the most accurate, the concrete represented by the four consecutive LOTs will be evaluated based on the QC data. The Engineer will inform the QC and the Verification lab within three calendar days of the acceptance compressive strength test to transport their "hold" cylinders to the resolution lab. The QC and Verification laboratories will transport their own hold cylinder to the resolution testing laboratory within 72 hours after the Engineer notifies the Contractor that a resolution is required. In addition, the Engineer will ensure that the QC and verification "hold" cylinders are tested within ~~seven~~14 calendar days of the acceptance strength tests.

The resolution investigation will determine the strength test results for each of the four or less LOTs. When the QC strength test results are deemed to be the most accurate, the QC strength test results will represent the four or less consecutive LOTs and the Department will pay for the resolution testing and investigation. When the verification strength test results are deemed to be the most accurate, the Department will assess a $1,000 pay reduction for the cost of the Resolution Investigation.

The results of the resolution procedure will be forwarded to the Contractor within five working days after completion of the investigation.

PORTLAND CEMENT CONCRETE.
(REV 8-15-16)

SUBARTICLE 346-2.2 is deleted and the following substituted:

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

Blended cements:

1. For Type IS, ensure that the quantity of slag is less than or equal to 70% by weight.
2. For Type IP, ensure that the quantity of the pozzolan is less than or equal to 40% by weight.
3. For Type IL, ensure that the quantity of the limestone is less than or equal to 15% by weight.

Ternary Blend (Fly Ash, Slag and Portland Cement): When a ternary blend is used, the concrete must meet or exceed the following surface resistivity requirements when tested in accordance with AASHTO T358 for design mix approval:

1. Extremely aggressive environment - greater than 29 KOhm-cm
2. Moderately aggressive environment - 17 to 29 KOhm-cm
3. Slightly aggressive environment - less than 17 KOhm-cm

Submit resistivity test specimens at least seven calendar days prior to the scheduled 28 day test to the Engineer for testing by the State Materials Office.

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 IL, Type II, Type III, Type IP, or Type IS	Type II (MH), Type IL, or Ternary Blend
Cast In Place	Type I	Type I, Type IL, Type II, Type IP, or Type IS	Type II (MH), Type IL, or Ternary Blend
BRIDGE SUBSTRUCTURE, DRAINAGE STRUCTURES AND OTHER STRUCTURES			
All Elements	Type I or Type III	Type I, Type IL, Type II, Type IP, or Type IS	Type II (MH), Type IL, or Ternary Blend

SUBARTICLE 346-2.3 is deleted and the following substituted:

346-2.3 Pozzolans and Slag: Fly ash or slag materials are required in all classes of concrete, except for Class II 3400 and Class I 3000 used in slightly aggressive environments. Use fly ash or slag materials as a cement replacement, on an equal weight replacement basis with the following limitations:

1. Mass Concrete:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 50% by weight, except where the core temperature is expected to rise above 165°F. In that case, ensure that the percentage of fly ash is 35% to 50% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 50% to 70% by weight. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultrafine fly ash and/or metakaolin.

2. Drilled Shaft:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 33% to 37% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 58% to 62% by weight.

3. Precast Concrete – Ensure that the precast concrete has a maximum of 25% fly ash or a maximum of 70% slag. In extremely aggressive environments, ensure that the precast concrete has a minimum of 18% fly ash or a minimum of 50% slag.

4. For all other concrete uses not covered in (1), (2) and (3) above,

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 30% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 25% to 70% for slightly and moderately aggressive environments and 50% to 70% by weight when used in extremely aggressive environments. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultra fine fly ash and/or metakaolin.

5. Highly Reactive Pozzolans: Highly reactive pozzolans are considered to be silica fume, metakaolin and ultrafine fly ash. When silica fume, metakaolin or ultrafine fly ash is required, it must be used in combination with fly ash or slag and cured in accordance with the manufacturer’s recommendations and approved by the Engineer.

a. Silica Fume - Ensure that the quantity of cement replaced with silica fume is 3% to 9% by weight of the total cementitious material.

b. Metakaolin - Ensure that the quantity of cement replaced with metakaolin is 8% to 12% by weight of the total cementitious material.

c. Ultrafine Fly Ash - Ensure that the quantity of cement replaced with ultrafine fly ash is 8% to 12% by weight of the total cementitious material.

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 for all classes of concrete is 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) (g)
STRUCTURAL CONCRETE		
I (a)	3,000	3 (b)
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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)
IV (Drilled Shaft)	4,000	8.5
V (Special) (d)(f)	6,000	3 (b)
V (d)(f)	6,500	3 (b)
VI (d)(f)	8,500	3 (b)

(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 C478 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 AASHTO T358. 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, highly reactive pozzolans may be used outside the lower specified ranges to enhance strength and workability. Testing in accordance with AASHTO T358 is not required.
(g) The Engineer may allow a higher target slump when a Ternary Blend is used. The maximum target slump will be 7 inches.

ARTICLE 346-5 is deleted and the following substituted:

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

TABLE 5	
Description	Method
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Compressive Strength of Cylindrical Concrete Specimens***	ASTM C39
Obtaining and Testing Drilled Core and Sawed Beams of Concrete	ASTM C42
Initial Sampling of Concrete from Revolving Drum Truck Mixers or Agitators	FM 5-501
Low Levels of Chloride in Concrete and Raw Materials	FM 5-516
Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete	ASTM C138
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Slump Flow of Self Consolidating Concrete	ASTM C1611
Passing Ability of Self Consolidating Concrete by J-Ring	ASTM C1621
Fabricating Test Specimens with Self Consolidating Concrete	ASTM C1758
Concrete Resistivity as an Electrical Indicator of its Permeability	FAASHTO T358

*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. Cylinders will be delivered to the testing laboratory in their molds. The laboratory will remove the specimens from the molds and begin final 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 346-9.5 is deleted and the following substituted:

346-9.5 Resolution Procedure: The Department may initiate an IA review of sampling and testing methods. The resolution procedure may consist of, but need not be limited to, a review of sampling and testing of fresh concrete, calculation of water to cementitious materials ratio, handling of cylinders, curing procedures and compressive strength testing. Compare the Verification sample results with the verification hold cylinders results. Compare the QC sample results with the QC hold cylinders results. Comparison results must not be greater than the comparison requirements in Table 7. Core samples of the hardened concrete may be required.

The Engineer will determine through the resolution procedure whether the QC strength test results or the verification strength test are deemed to be the most accurate, LOTS will then be considered to be verified. When the Engineer cannot determine which strength test results are the most accurate, the concrete represented by the four consecutive LOTs will be evaluated based on the QC data. The Engineer will inform the QC and the Verification lab within three calendar days of the acceptance compressive strength test to transport their "hold" cylinders to the resolution lab. The QC and Verification laboratories will transport their own hold cylinder to the resolution testing laboratory within 72 hours after the Engineer notifies the

Contractor that a resolution is required. In addition, the Engineer will ensure that the QC and verification “hold” cylinders are tested within 14 calendar days of the acceptance strength tests.

The resolution investigation will determine the strength test results for each of the four or less LOTs. When the QC strength test results are deemed to be the most accurate, the QC strength test results will represent the four or less consecutive LOTs and the Department will pay for the resolution testing and investigation. When the verification strength test results are deemed to be the most accurate, the Department will assess a $1,000 pay reduction for the cost of the Resolution Investigation.

The results of the resolution procedure will be forwarded to the Contractor within five working days after completion of the investigation.