# Origination Form

## Specifications

| | | | |
|---|---|---|---|
| **Name:** | James Greene | **Standard Specification Section:** | 346 |
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| **Date:** | 2025-06-04T20:38:07Z | **Associated Specs:** | none |

### Summary:

Incorporating Concrete Quality Assurance Acceptance Program rather than QC and VT testing as the default method for concrete materials acceptance.

### Justification:

To encourage independent process control and streamline concrete materials testing in the field, SMO proposes the Concrete Quality Assurance Acceptance Program for FY 26-27→.

### Do the changes affect other types of specifications?

Neither

### List Specifications Affected:

| Other Affected Documents/Offices | Contacted | Yes/No |
|---|---|---|
| **Other Standard Plans** | | No |
| **Florida Design Manual** | | No |
| **Structures Manual** | | No |
| **Basis of Estimates Manual** | | No |
| **Approved Product List** | | No |
| **Construction Office** | | No |
| **Maintenance Office** | | No |
| **Materials Manual** | | No |
| **Traffic Engineering Manual** | | No |

## Are changes in line with promoting and making progress on improving safety, enhancing mobility, inspiring innovation, and fostering talent; explain how?

The proposed changes will strengthen the independent quality control and optimize the Department's concrete materials testing.

## What financial impact does the change have; project costs, pay item structure, or consultant fees?

The changes will reduce the cost of materials testing for the Department.

## What impact does the change have on production or construction schedules?

Construction schedules will be improved by eliminating redundant testing between Quality Assurance and Verification tests.

## How does this change improve efficiency or quality?

With the new program, engineering consultant firms and independent testing laboratories could improve communication efficiency and testing accuracy during construction.

## Which FDOT offices does the change impact?

District Construction Offices, District Materials Office, State Materials Office.

## What is the impact to districts with this change?

Shifting the focus from redundant concrete materials testing to supervising the independent laboratory and materials quality assurance program.

## Does the change shift risk and to who?

No shift risk, but improve the efficiency.

## Provide summary and resolution of any outstanding comments from the districts or industry.

Comments and Responses are available on the Track the Status of Revisions hyperlink located on the Specifications landing page: https://www.fdot.gov/programmanagement/Specs.shtm

## What is the communication plan?

Through the established specification revision process (e.g., Internal and Industry Review)

## What is the schedule for implementation?

The Standard Specifications eBook and Workbook are effective July 1st every year.

**STRUCTURAL PORTLAND CEMENT CONCRETE**
**(REV 6-4-25)**

ARTICLE 346-1 is deleted and the following substituted:

**346-1 Description.**

Use a Department-approved concrete mix design composed of a mixture of portland cement, aggregate, water, admixtures, and supplementary cementitious materials. Deliver the portland cement concrete to the site of placement in a freshly mixed, unhardened state.

Obtain concrete from a plant that is currently on the Department's Structural Concrete Production Facility Listing. Producers seeking inclusion on the list shall meet the requirements of Section 105. If the concrete production facility's Quality Control (QC) Plan is suspended, the Contractor is solely responsible to obtain the services of another concrete production facility with an accepted QC Plan or await the reacceptance of the concrete production facility's QC Plan prior to the placement of any further concrete on the project. There will be no changes in the Contract Time because of the suspension, as described. Bear all delay costs and other costs associated with the concrete production facility's QC Plan acceptance or reacceptance.

ARTICLE 346-2 is deleted and the following substituted:

**346-2 Materials.**

**346-2.1 General:** Meet the following requirements:

| | |
|---|---|
| Coarse Aggregate | Section 901 |
| Fine Aggregate* | Section 902 |
| Portland Cement and Blended Cement | Section 921 |
| Water | Section 923 |
| Admixtures** | Section 924 |
| Supplementary Cementitious Materials | Section 929 |
| Materials for Concrete Repair** | Section 930 |
| Non-Shrink Grout** | Section 934 |

*Use only silica sand except as provided in 902.

**Use products listed on the Department's Approved Product List (APL).

Do not use materials containing hard lumps, crusts, or frozen matter, or that is contaminated with materials exceeding the specified limits in the above listed Sections.

**346-2.2 Types of Cement:** Unless a specific type of cement is designated in the Contract Documents, use Type I, Type IL, Type IP, Type IT, Type IS, Type II, or Type III cement in all classes of concrete. Use Type IL, Type IT, or Type II for all mass concrete elements.

Use only the types of cements designated for each environmental classification in structural concrete as shown in Table 346-1. A mix design for a more aggressive environment may be used in a less aggressive environmental condition.

| Table 346-1<br>Cement Use by Environmental Classification | | | |
|---|---|---|---|
| Component | Slightly Aggressive Environment | Moderately Aggressive Environment | Extremely Aggressive Environment (1) |
| Bridge Superstructures | | | |
| 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, Type IL, Type III (2), or Type IT ~~or Ternary Blend~~ |
| Cast in Place | Type I | Type I, Type IL, Type II, Type IP, or Type IS | Type II, Type IL, or Type IT ~~or Ternary Blend~~ |
| Bridge Substructures, 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, Type IL, or Type IT ~~or Ternary Blend~~ |

Notes:
(1) Cements used in a more aggressive environment may also be used in a less aggressive environment.
(2) Type III cement may be used in an Extremely Aggressive Environment for precast superstructure and prestressed elements when the ambient temperature at the time of concrete placement is 60°F and below.

**346-2.3 Supplementary Cementitious Materials:** Supplementary cementitious materials (SCMs) are required in all classes of concrete specified in Table 346-3. Nonreinforced concrete Class I (Seal) and Class I (Pavement), when used in any environment ~~are exempted~~, and Class II when used in slightly aggressive environments are exempted.

The quantity of portland cement that is replaced with SCMs must be on an equal weight replacement basis of the total cementitious materials in accordance with Table 346-2. When using Type IP, IS or IT blended cements, the total quantity of SCMs, including the blended cement added separately at the concrete plant shall meet the requirements of Table 346-2.

**346-2.3.1 Highly Reactive Pozzolans:** Materials that have a very high degree of pozzolanic reactivity due to their very fine particle sizes, including silica fume, metakaolin and ultrafine fly ash.

~~**346-2.3.2 Binary Concrete Mixes:** Concrete mixes containing portland cement and one SCM.~~

~~**346-2.3.3 Ternary Concrete Mixes:** Concrete mixes containing portland cement and any two SCMs.~~

Table 346-2
Cementitious Materials Concrete Mix Proportions (%)
(Environmental classification is extremely aggressive, unless otherwise noted)

| Application | Portland Cement | Coal Ash ~~Type~~Class F | Slag | Highly Reactive Pozzolans (4 and 5) | | |
|---|---|---|---|---|---|---|
| | | | | Silica Fume | Metakaolin | Ultra-Fine Fly Ash |
| General Use | 50-82 | 18-50 | | | | |
| | 51-79 | 18-40 | | 3-9 | | |
| | 63-77 | 15-25 | | | 8-12 | |
| | 63-77 | 15-25 | | | | 8-12 |
| | 30-45 | 10-20 | 45-60 | | | |
| | 30-50 | | 50-70 | | | |
| | 36-43 | | 50-55 | 7-9 | | |
| | 33-42 | | 50-55 | | 8-12 | |
| | 33-42 | | 50-55 | | | 8-12 |
| Precast / Prestressed | 70-85 (1) | 15-30 (1) | | | | |
| | 50-82 | 18-50 | | | | |
| | 51-79 | 18-40 | | 7-9 | | |
| | 63-77 | 15-25 | | | 8-12 | |
| | 63-77 | 15-25 | | | | 8-12 |
| | 30-40 | 10-20 | 50-60 | | | |
| | 30-50 | | 50-70 | | | |
| | 36-43 | | 50-55 | 7-9 | | |
| | 33-42 | | 50-55 | | 8-12 | |
| | 33-42 | | 50-55 | | | 8-12 |
| Drilled Shaft | 50-82 | 18-50 | | | | |
| | 38-42 | | 58-62 | | | |
| | 30-40 | 10-20 | 50-60 | | | |
| Mass Concrete | 50-82 (2) | 18-50 (2) | | | | |
| | 50-65 (3) | 35-50 (3) | | | | |
| | 66-78 | 15-25 | | 7-9 | | |
| | 63-77 | 15-25 | | | 8-12 | |
| | 63-77 | 15-25 | | | | 8-12 |
| | 30-40 | 10-20 | 50-60 | | | |
| | 30-50 | | 50-70 | | | |
| | 36-43 | | 50-55 | 7-9 | | |
| | 33-42 | | 50-55 | | 8-12 | |
| | 33-42 | | 50-55 | | | 8-12 |

(1) Slightly Aggressive and Moderately Aggressive environments.
(2) For Concrete with Core Temperature T≤165°F.
(3) For Concrete with Core Temperature T≥165°F.
(4) A minimum concrete Surface Resistivity (SR) value of 29 kΩ-cm is required.
(5) Highly reactive pozzolans may be used below the specified ranges to enhance strength and workability when it is not required by the Contract Documents. A minimum concrete Surface Resistivity (SR) value is not required.

**346-2.4 Aggregates:** Produce all concrete using Size No. 57, 67 or 78 coarse aggregates. Use Size No. 8, and Size No. 89 alone, only when approved by the Engineer.

Use Size No. 4 or larger blended with smaller size coarse aggregate as two components.

**346-2.4.1 Optimized Aggregate Gradation:** Improve the aggregate packing density at the Contractor's option, by adding an intermediate-size coarse aggregate in accordance with FM 5-621 to produce combined aggregate gradation of fine, intermediate, and coarse aggregate sizes for the concrete mixes.

**346-2.4.2 Lightweight fine aggregate (LWFA) for internal curing:** At the Contractor's option, use LWFA to reduce the early-age concrete cracking by replacing some of normal fine aggregate with saturated LWFA.

**346-2.5 Admixtures:** Ensure admixtures are used in accordance with the manufacturer's recommendations and meeting the requirements of Section 9.2, Volume II of the Materials Manual.

ARTICLE 346-3 is deleted and the following substituted:

**346-3 Classification of Concrete.**

**346-3.1 General:** The classifications of concrete are designated as Class I (Seal), Class I (Pavement), Class II, Class II (Bridge Deck), Class III, Class IV, Class IV (Drilled Shaft), Class V, Class VI, and Class VII. The 28-day specified minimum compressive strength, maximum water to cementitious materials ratio and target slump of each class are detailed in Table 346-3. The required air content for all classes of concrete is less than or equal to 6.0%.

For purposes of this Specification the concrete is further classified as follows:

1. Conventional Concrete: The target slump is described in Table 346-3 with a tolerance of ± 1.5 inches.
2. Increased Slump Concrete: The maximum target slump is 7 inches with a tolerance of ± 1.5 inches when a Type F, G, I or II admixture is used.
3. Slip-form Concrete: The target slump is 1.5 inches with a tolerance of ± 1.5 inches. For Class I (Pavement), meet the requirements of Section 350.
4. Flowing Concrete: Request Engineer's authorization to use flowing concrete for cast-in-place applications. The target slump is 9 inches with a tolerance of ± 1.5 inches.
5. Self-Consolidating Concrete (SCC): Request Engineer's authorization to use SCC for cast-in-place applications. The minimum target slump flow is 22.5 inches with a tolerance of ± 2.5 inches.

**346-3.2 Concrete Class Substitutions:** The Engineer may allow the substitution of a higher class concrete in lieu of the specified class concrete 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 specified class concrete.

When the average compressive strength is less than the specified minimum compressive strength of the higher class mix design, notify the Engineer. Acceptance is based on the requirements in Table 346-3 for the specified class concrete.

~~**346-3.3 Acceptance Requirements:** The specified minimum 28-day strengths, maximum water to cementitious materials ratio (w/cm), and target slumps for each class of~~

~~concrete are given in Table 346-3. For lightweight concrete, acceptance requirements also include the hardened density specified in the Contract Documents.~~

~~The calculation of the water to cementitious materials ratio (w/cm) is based on the total mass of cementitious materials including portland cement and any SCMs used in the mix.~~

Table 346-3
Compressive Strength, w/cm, and Slump of Concrete Classes

| Class of Concrete | 28-day Specified Minimum Compressive Strength (f'c) (psi) | Maximum Water to Cementitious Materials Ratio (pounds per pounds) | Target Slump Value (inches) |
|---|---|---|---|
| I (Seal) | 3,000 | 0.53 | 8 |
| I (Pavement) (1) (5) | 3,000 | 0.50 | 1.5 or 3 |
| II (3) | 3,400 | 0.53 | 3 (2) |
| II (Bridge Deck) | 4,500 | 0.44 | 3 (2) |
| III | 5,000 | 0.44 | 3 (2) |
| IV | 5,500 | 0.41(4) | 3 (2) |
| IV (Drilled Shaft) | 4,000 | 0.41 | 8.5 |
| V | 6,500 | 0.37(4) | 3 (2) |
| VI | 8,500 | 0.37(4) | 3 (2) |
| VII | 10,000 | 0.37(4) | 3 (2) |

Notes:
(1) Meet the requirements of Section 350.
(2) For increased slump concrete, flowing concrete, SCC and slip form concrete meet the requirements of 346-3.1.
(3) 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 (2). The Contractor is permitted to use concrete meeting the requirements of ASTM C478 (4,000 psi) in lieu of the specified Class II concrete for precast endwalls, inlets, manholes and junction boxes.
(4) When silica fume or metakaolin is required, the maximum water to cementitious material ratio will be 0.35. When ultrafine fly ash is used, the maximum water to cementitious material ratio will be 0.30.
(5) If 28-day strength is 2,500 or greater, concrete may be accepted if 28-day compressive strength is reached by 56 days.

~~**346-3.4 Acceptance of concrete at 56 days:** Use concrete mix designs meeting the specified compressive strength at 56 days at the Contractor's option. Submit the request to the Engineer for approval. After the Engineer's approval, notify the concrete producer to initiate the mix design approval process at least 90 days prior to the anticipated concrete placement.~~ **346-3.3~~5~~ Durability for Concrete Construction:**

**346-3.3~~5~~.1 Minimum Cementitious Materials Content:** Ensure that the produced concrete meets the minimum amount of cementitious materials content in Table 346-4.

Table 346-4
Minimum Amount of Total Cementitious Materials Content
(pounds per cubic yard of concrete)

| Concrete Class | Environmental Classification | | |
|---|---|---|---|
| | Extremely Aggressive | Moderately Aggressive | Slightly Aggressive |
| I (Seal) (1), I (Pavement) (1), and II, | 470 | | |
| II (Bridge Deck), III (2), IV, IV (Drilled Shaft), V, VI and VII | 600 | 550 | 510 |

| Table 346-4<br>Minimum Amount of Total Cementitious Materials Content<br>(pounds per cubic yard of concrete) | | | |
|---|---|---|---|
| Concrete Class | Environmental Classification | | |
| | Extremely Aggressive | Moderately Aggressive | Slightly Aggressive |
| Notes:<br>(1) Request the use of concrete mixes with a lower amount of total cementitious materials content at the Contractor's option. The mix design must meet the requirements of Section 9.2 Volume II of the Materials Manual.<br>(2) When precast three-sided culverts, box culverts, endwalls, inlets, manholes or junction boxes require a Class III concrete, minimum cementitious materials content may be reduced to 470 pounds per cubic yard. | | | |

**346-3.35.2 Chloride Content Limits:** Use the following maximum allowable chloride content limits for the concrete application and/or exposure environment shown:

| Table 346-5<br>Chloride Content Limits for Concrete Construction | | |
|---|---|---|
| Application/Exposure Environment | | Maximum Allowable Chloride Content, (pounds per cubic yard of concrete) |
| Non-Reinforced Concrete | | No Test Needed |
| Reinforced Concrete | Slightly Aggressive Environment | 0.70 |
| | Moderately or Extremely Aggressive Environment | 0.40 |
| Prestressed Concrete | | 0.40 |

Suspend concrete placement immediately for every mix design if chloride test results exceed the limits of Table 346-5 until corrective measures are made. Submit an Engineering Analysis Scope in accordance with 6-4 by a Specialty Engineer knowledgeable in the areas of corrosion and corrosion control, to determine if the material meets the intended service life of the structure on all concrete produced from the mix design failing chloride test results to the previous passing test results.

**346-3.35.3 Surface Resistivity Test:** Ensure that the concrete meets or exceeds a S~~r~~R value of 29 kΩ-cm at 28 days ~~or 56 days if specified~~, when a highly reactive pozzolan is specified in the Contract Documents.

SUBARTICLE 346-4.4 is deleted.

~~**346-4.4 Lightweight Concrete:** Submit the fresh and hardened concrete density for mix design approval. The hardened density is the equilibrium density in ASTM C567. Ensure that the hardened density of the mix design is within ± 2 lb/ft$^3$ of the hardened density specified in the Contract Documents.~~

~~During production, the freshly mixed concrete density must be within ± 3 lb/ft$^3$ of the approved mix design fresh density.~~

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 346-7
Concrete Sampling and Testing Methods

| Description | Method |
|---|---|
| Slump of Hydraulic Cement Concrete | ASTM C143 |
| Air Content of Freshly Mixed Concrete by the Pressure Method (1) | ASTM C231 |
| Air Content of Freshly Mixed Concrete by the Volumetric Method (1) | ASTM C173 |
| Making and Curing Test Specimens in the Field (2) | ASTM C31 |
| Compressive Strength of Cylindrical Concrete Specimens(3) | ASTM C39 |
| Obtaining and Testing Drilled Core and Sawed Beams of Concrete | ASTM C42 |
| ~~Density of Structural Lightweight Concrete~~ | ~~ASTM C567~~ |
| 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 (4) | ASTM C172 |
| Static Segregation of Self-Consolidating Concrete using Column Techniques | ASTM C1610 |
| Slump Flow of Self-Consolidating Concrete | ASTM C1611 |
| Relative Viscosity of Self-Consolidating Concrete | ASTM C1611 |
| Visual Stability Index of Self-Consolidating Concrete | ASTM C1611 |
| Passing Ability of Self-Consolidating Concrete by J-Ring | ASTM C1621 |
| Rapid Assessment of Static Segregation Resistance of Self-Consolidating Concrete Using Penetration Test | ASTM C1712 |
| Aggregate Distribution of Hardened Self-Consolidating Concrete | FM 5-617 |
| Hardened Visual Stability Index of Self-Consolidating Concrete | AASHTO R 81 |
| Fabricating Test Specimens with Self-Consolidating Concrete | ASTM C1758 |
| Concrete Resistivity as an Electrical Indicator of its Permeability | AASHTO T 358 |

(1) 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.
(2) Provide curing facilities that have the capacity to store all QC, Verification, and Resolution 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.
~~(3) Lightweight concrete also includes hardened specimen density. The ASTM C567 may be used in lieu of ASTM C39 to verify the density.~~
(34) 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 346-6.2 is deleted and the following substituted:

**346-6.2 Concrete Mix Design:** Provide concrete that has been produced in accordance with a Department approved mix design, in a uniform mass free from balls and lumps.

For slump target values in excess of 6 inches, including flowing concrete and SCC, utilize a grate over the conveyance equipment to capture any lumps or balls that may be present in the mix. The grate must cover the entire opening of the conveyance equipment and have an opening that is a maximum of 2-1/2 inches in any one direction. Remove the lumps and balls from the grate and discard them. Discharge the concrete in a manner satisfactory to the Engineer. Perform demonstration batches to ensure complete and thorough placements in complex elements, when requested by the Engineer.

Do not place concretes of different compositions such that the plastic concretes may combine, except where the Plans require concrete with a ~~surface resistivity~~SR value of 29 kΩ-cm or below and one with higher than 29 kΩ-cm values in a continuous placement. Produce these concretes using separate mix designs. For example, designate the mix with calcium nitrite as the original mix and the mix without calcium nitrite as the redesigned mix. Ensure that both mixes contain the same cement, coal ash or slag, coarse and fine aggregates and admixtures. Submit both mixes for approval as separate mix designs, both meeting all requirements of this Section. Ensure that the redesigned mix exhibits plastic and hardened qualities which are additionally approved by the Engineer as suitable for placement with the original mix. The Engineer will approve the redesigned mix for commingling with the original mix and for a specific project application only. Alternately, place a construction joint at the location of the change in concretes as approved by the Engineer.

SUBARTICLE 346-7.4 is deleted and the following substituted:

**346-7.4 Concreting in Cold Weather:** Do not mix or place concrete when the air temperature is below 40ºF. Protect the fresh concrete from freezing in accordance with Section 400. ~~The requirements of concreting in cold weather are not applicable to precast concrete mixing and placement operations occurring in a temperature controlled environment.~~

SUBARTICLE 346-7.6 is deleted and the following substituted:

**346-7.6 Sample Location:** ~~Obtain a~~Acceptance samples will be obtained from the point of final placement.

Where concrete buckets are used to discharge concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge of the bucket. When the concrete is discharged directly from the mixer into the bucket and the bucket is discharged within 20 minutes, samples may be obtained from the discharge of the mixer.

Where conveyor belts, troughs, pumps, or chutes are used to transport concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge end of the entire conveyor belt, trough, pump, or chute system.

Where concrete is placed in a drilled shaft or other element using a tremie pipe and a concrete pump, samples will be obtained from the discharge of the pump line at the location of the tremie hopper.

For all other placement methods, prior to each placement, obtain Department approval for sampling at the discharge of the mixer in lieu of sampling at the point of final placement. Submit the sampling correlation procedure to the Engineer for approval prior to the

placement of the concrete. Once the comparative sampling correlation is approved by the Engineer, apply this correlation to the plastic properties tolerances for samples obtained from the discharge of mixer.

Where a concrete pump is used to deposit concrete directly into a drilled shaft which is a wet excavation without the use of a tremie, or other applications as approved by the Engineer, ensure the discharge end of the pump line remains immersed in the concrete at all times after starting concrete placement.

ARTICLE 346-8 is deleted and the following substituted:

**346-8 Plastic Concrete Sampling and Testing.**

Acceptance~~QC~~ tests include air content, temperature, slump, water to cementitious materials ratio, and preparing cylinders for testing at later dates with the following exceptions: ~~with the following exceptions:~~

For Class I (Pavement), ~~the~~ air content testing is not required.

~~For Lightweight concrete, tests also include the plastic density (unit weight).~~

For SCC, ~~QC~~Acceptance tests also include slump flow in lieu of slump, visual stability index, and rapid assessment of static segregation.

~~In addition, calculate the water to cementitious materials ratio in accordance with FM 5-501 for compliance to the approved mix design.~~

Ensure that each truck has a rating plate and a valid mixer identification card issued by the Department. Ensure that the revolution counter on the mixer is working properly, and calibration of the water dispenser has been performed within the last twelve months. Reject any concrete batches that are delivered in trucks that do not have mixer identification cards. Remove the mixer identification card when a truck mixer is discovered to be in noncompliance and the mixer deficiencies cannot be repaired immediately. When the mixer identification card is removed for noncompliance, make note of the deficiency or deficiencies found, and forward the card to the District Materials and Research Engineer who has Producer QC Plan acceptance authority.

~~Perform plastic concrete tests on the initial delivery from each plant of each concrete design mix each day. Ensure QC technicians meeting the requirements of Section 105 are present and performing tests throughout the placement operation. Ensure a technician is present and performing tests throughout the placement operation at each placement site. If a project has multiple concrete placements at the same time, identify the technicians in the QC Plan to ensure minimum sampling and testing frequencies are met. Ensure that the equipment used for delivery, placement and finishing meets the requirements of this Specification.~~

When a truck designated for ~~QC~~ acceptance testing arrives at the discharge site, a subsequent truck may also discharge once a representative sample has been collected from the ~~QC~~ acceptance truck and while awaiting the results of ~~QC~~ testing. Reject non-complying loads at the jobsite. Ensure that corrections are made on subsequent loads. Immediately cease concrete discharge of all trucks if the ~~QC~~ acceptance truck has failing test. ~~Perform plastic properties tests of concrete on all trucks prior to the first corrected truck and the corrected truck.~~ When more than one truck is discharging into a pump simultaneously, only the truck designated for ~~QC~~ acceptance testing may discharge into the pump to obtain a representative sample of concrete~~from the QC truck only~~.

~~Furnish sufficient concrete of each design mix as required by the Engineer for verification (VT) testing. When the Engineer's VT test results do not compare with the QC plastic properties test results, within the limits defined by the Independent Assurance (IA) checklist comparison criteria, located in Materials Manual Chapter 5, disposition of the concrete will be at the option of the Contractor.~~ On concrete placements consisting of only one load of concrete, ~~perform initial sampling and testing in accordance with this Section. T~~the acceptance sample and plastic properties tests may be taken from the initial portion of the load.

If any of the ~~QC~~acceptance plastic properties tests fail, reject the remainder of that load, and any other loads that have begun discharging, terminate the LOT and notify the Engineer. Make cylinders representing that LOT from the same sample of concrete.

~~Following termination of a LOT, obtain samples from a new load, and perform plastic properties tests until the water to cementitious materials ratio, air content, temperature and slump comply with the Specification requirements. Initiate a new LOT once the testing indicates compliance with Specification requirements.~~

**346-8.1 Contractor Quality Control Requirements:** When Contractor Quality Control (CQC) Acceptance is chosen, perform plastic concrete tests on the initial delivery from each plant of each concrete design mix each day. Ensure QC technicians meeting the requirements of Section 105 are present and performing tests throughout the placement operation. Ensure a technician is present and performing tests throughout the placement operation at each placement site. If a project has multiple concrete placements at the same time, identify the technicians in the QC Plan to ensure minimum sampling and testing frequencies are met. Ensure that the equipment used for delivery, placement and finishing meets the requirements of this Specification. Reject non-complying loads at the jobsite. Ensure that corrections are made on subsequent loads. Perform plastic properties tests of concrete on all trucks prior to the first corrected truck and the corrected truck.

Furnish sufficient concrete of each design mix as required by the Engineer for Verification (VT) testing. When the Engineer's VT test results do not compare with the QC plastic properties test results, within the limits defined by the Independent Assurance (IA) checklist criteria, located in Materials Manual Chapter 5, disposition of the concrete will be at the option of the Contractor.

On concrete placements consisting of only one load of concrete, perform initial sampling and testing in accordance with this Section. The acceptance sample and plastic properties tests may be taken from the initial portion of the load.

Following termination of a LOT, obtain samples from a new load, and perform plastic properties tests until the water to cementitious materials ratio, air content, temperature and slump comply with the Specification requirements. Initiate a new LOT once the testing indicates compliance with Specification requirements.

Suspend production when any five loads in two days of production of the same design mix are outside the specified tolerances. Increase the frequency of QC testing to one per load to bring the concrete within allowable tolerances. After production resumes, obtain the Engineer's approval before returning to the normal frequency of QC testing.

If concrete placement stops for more than 90 minutes, perform initial plastic properties testing on the next batch and continue the LOT. Cylinders cast for that LOT will represent the entire LOT.

When the Department performs Independent Verification (IV), the Contractor may perform the same tests on the concrete at the same time. ~~The Department will compare results based on the Independent Assurance (IA) Checklist tolerances.~~

ARTICLE 346-9 is deleted and the following substituted:

**346-9 Acceptance Sampling and Testing.**

**346-9.1 Quality Assurance Acceptance**

**346-9.1.1 General:** The default acceptance method is Quality Assurance (QA) Acceptance where testing is performed by the Engineer to ensure materials utilized during production meet the specified requirements.

Notify the Engineer at least 48 hours prior to placing any concrete. Furnish sufficient concrete of each mix design as required by the Engineer for QA testing. Provide a secure area for testing and initial curing of test specimens. The Engineer will perform plastic properties tests and cast a set of three QA cylinders for all structural concrete incorporated into the project. QA samples will be randomly selected by the Engineer. All cylinders will be clearly identified as outlined in the Sample/LOT Numbering System instructions located on the State Materials Office website. The Engineer will initially cure and then deliver the QA samples to the final curing facility in accordance with ASTM C31. The Engineer will test QA samples for compressive strength at the age of 28 days in a laboratory meeting the qualification requirements in Section 105.

**346-9.1.2 Sampling Frequency:** At a minimum, the Engineer will sample and test concrete of each mix design for water to cementitious materials ratio, air content, temperature, slump, and compressive strength once per LOT as defined by Table 346-9. The Department will perform Independent Verification (IV) testing to verify compliance with specification requirements, at a minimum of once per 6 months.

Table 346-9
Sampling Frequency

| Class Concrete [1] | LOT Size |
|---|---|
| I (Seal) | Each seal placement |
| I (Pavement) | According to Section 350 |
| II, II (Bridge Deck), III, IV, V, VI, VII | 50 cubic yards, or one day's production, whichever is less |
| IV (Drilled Shaft) | 50 cubic yards, or one day's production, whichever is less [2] |

(1) For any class of concrete used for roadway concrete barrier, the lot size is defined as 100 cubic yards, or one day's production, whichever is less.
(2) Start a new LOT when there is a gap of more than two hours between the end of one drilled shaft placement and the beginning of the next drilled shaft placement.

**346-9.1.2.1 Reduced Frequency for Acceptance Tests:** Except for Class I (Pavement), the LOT size may represent 100 cubic yards when produced 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 precast/prestressed production facility will only include the same mix design at the same concrete production facility. The reduced testing frequency of Class I (Pavement) is described in Section 350.

The Engineer will used the following criteria:

1. The average of the acceptance compressive strengths is equal to or greater than the specified minimum compressive strength (f'c) plus 2.33 standard deviations minus:

a. 500 psi, if f'c is 5,000 psi or less.

b. 0.10 f'c, if f'c is greater than 5,000 psi.

2. Every average of three consecutive strength test equals or exceeds the f'c plus 1.34 standard deviations.

Calculations will be based 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 calendar year 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.

The Engineer will return to the frequency represented by the LOT as defined in Table 346-9 if 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 does not conform to the above conditions.

**346-9.1.3 Strength Test Definition:** The strength test of a LOT is defined as the average compressive strength tests of three companion cylinders cast from the same sample of concrete and tested at the same age.

**346-9.1.4 Acceptance of Concrete:** The Engineer will accept the concrete of a given LOT when the compressive strength test results meet the minimum specified compressive strength in Table 346-3.

**346-9.2 Contractor Quality Control Acceptance:** Select CQC Acceptance if desired during the Pre-construction conference.

**346-9.2.1 General:** Perform plastic properties tests in accordance with 346-8 and cast a set of three QC cylinders, for all structural concrete incorporated into the project. Take these acceptance samples randomly as determined by a random number generator acceptable to the Department. The Department will independently perform VT plastic properties tests and cast a set of VT cylinders. The VT cylinders will be the same size cylinder selected by the Contractor, from a separate sample from the same load of concrete as the Contractor's QC sample.

For each set of QC cylinders verified by the Department, cast two additional cylinders from the same sample, and identify them as the quality control resolution (QR) test cylinders. The Department will also cast two additional verification resolution (VR) test cylinders from each VT sample. All cylinders will be clearly identified as outlined in the Sample/LOT Numbering System instructions located on the State Materials Office website. Deliver the QC samples, including the QR cylinders to the final curing facility in accordance

with ASTM C31. Concurrently, the Department will deliver the VT samples, including the VR cylinders, to their final curing facility.

Test the QC laboratory cured samples for compressive strength at the age of 28 days, in a laboratory meeting and maintaining at all times the qualification requirements listed in Section 105.

The Department will compare the VT sample compressive strength test results with the corresponding QC sample test results.

**346-9.2.2 Sampling Frequency:** As a minimum, sample and test concrete of each mix design for water to cementitious materials ratio, air content, temperature, slump and compressive strength once per LOT as defined by Table 346-9. The Engineer will randomly verify one of every four consecutive LOTs of each mix design based on a random number generator. The Department may perform Independent Verification (IV) testing to verify compliance with specification requirements. All QC activities, calculations, and inspections will be randomly confirmed by the Department.

~~Table 346-9~~
~~Sampling Frequency~~

| ~~Class Concrete~~ [1] | ~~LOT Size~~ |
|---|---|
| ~~I (Seal)~~ | ~~Each seal placement~~ |
| ~~I (Pavement)~~ | ~~According to Section 350~~ |
| ~~II, II (Bridge Deck), III, IV, V, VI, VII~~ | ~~50 cubic yards, or one day's production, whichever is less~~ |
| ~~IV (Drilled Shaft)~~ | ~~50 cubic yards, or one day's production, whichever is less~~ [2] |

~~(1) For any class of concrete used for roadway concrete barrier, the lot size is defined as 100 cubic yards, or one day's production, whichever is less.~~
~~(2) Start a new LOT when there is a gap of more than two hours between the end of one drilled shaft placement and the beginning of the next drilled shaft placement.~~

**346-9.2.2.1 Reduced Frequency for Acceptance Tests:** Except for Class I (Pavement), the LOT size may represent 100 cubic yards when produced 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 precast/prestressed production facility will only include the same mix design at the same concrete production facility. The reduced testing frequency of Class I (Pavement) is described in the Section 350.

Submit strength test results indicating that the two following criteria are met:

1. The average of the acceptance compressive strengths is equal to or greater than the specified minimum compressive strength (f'c) plus 2.33 standard deviations minus:

a. 500 psi, if f'c is 5,000 psi or less.

b. 0.10 f'c, if f'c is greater than 5,000 psi.

2. Every average of three consecutive strength test equals or exceeds the f'c plus 1.34 standard deviations.

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 calendar year 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 LOTs.

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 does not conform to the above conditions, return to the frequency represented by the LOT as defined in Table 346-9. Notify the Engineer that the initial frequency is reinstated. In order to reinitiate reduced frequency, submit a new set of strength test results.

**346-9.2.3 Strength Test Definition:** The strength test of a LOT is defined as the average compressive strength tests of ~~at least two~~three companion cylinders cast from the same sample of concrete and tested at the same age.

**346-9.2.4 Acceptance of Concrete:** The Engineer will accept the concrete of a given LOT when the compressive strength test results are verified and meets the minimum specified compressive strength in Table 346-3. Ensure that the hardened concrete strength test results are obtained in accordance with 346-9.2.3.

The process of concrete compressive strength verification and acceptance consists of the following steps:

1. Verification of QC and VT data.
2. Resolution of QC and VT data if needed.
3. Structural Adequacy determination.

Do not discard a cylinder strength test result based on low strength (strength below the specified minimum strength as per the provisions of this Section).

When one of the three QC cylinders from a LOT is lost, missing, damaged or destroyed, determination of compressive strength will be made by averaging the remaining two cylinders. If more than one QC cylinder from a LOT is lost, missing, damaged or destroyed, the Contractor will core the structure at no additional expense to the Department to determine the compressive strength. Prior to coring, obtain Engineer's approval for coring the structure and its proposed coring location. Acceptance of LOT may be based on VT data at the discretion of the Engineer.

For each QC and each QR cylinder that is lost, missing, damaged or destroyed, payment for that LOT will be reduced by $750.00 per 1,000 psi of the specified design strength [Example: loss of two Class IV (Drill Shaft) QC cylinders that has no VT data will require the element to be cored and a pay reduction will be assessed (4,000 psi / 1,000 psi) x $750 x 2 = $6,000]. This reduction will be in addition to any pay adjustment for low strength.

**346-9.2.4.1 Small Quantities of Concrete:** When a project has a total plan quantity of less than 50 cubic yards, that concrete will be accepted based on the satisfactory compressive strength of the QC cylinders. Submit certification to the Engineer that the concrete was batched and placed in accordance with the Contract Documents. Submit a QC Plan for the

concrete placement operation in accordance with Section 105. The Engineer may perform IV testing ~~as identified in 346-9~~ and evaluate the concrete in accordance with 346-9.2.~~7~~3.

**346-9.2.5 Verification:** The results of properly conducted test by QC and VT laboratories on specimens prepared from the same sample of concrete are not to differ by more than 14%.

$$\text{Difference (\%)} = \text{ABS}\left(\frac{\text{QC}-\text{VT}}{\text{QC}}\right)100$$

Where:

Difference (%) is the absolute percentage difference between QC and VT average compressive strength.

The procedure consists of verifying if the QC and VT compressive strengths data meet the established comparison criteria:

1. When the difference between the average compressive strength of QC and the average compressive strength of VT is less than or equal to 14%, the QC test results are upheld and verified. The Engineer will accept at full pay only LOTs of concrete represented by plastic property results which meet the requirements of the approved mix design and strength test results which equal or exceed the respective specified minimum strength.
2. When the difference between the average compressive strength of QC and the average compressive strength of VT data exceeds 14%, the compressive strength results are not verified and the Engineer will initiate the resolution procedure.

Maintain the QR and VR cylinders for a minimum of 30 days following the testing date of the specified strength.

**346-9.2.6 Resolution:** The Engineer will perform the resolution process to identify the reliability of the compressive strength results when the difference between the average compressive strength of QC and the average compressive strength of VT data exceeds 14% as described in 346-9.2.5(2).

The Engineer will estimate the 28-day strengths ($VR_{28}$ and $QR_{28}$) for the VR and QR cylinders using the following equation:

$$\text{Estimated 28-Day Compressive Strength (psi)} = \left(\frac{\text{Average Strength at (t) days}}{\text{-17.8} + 46.3[\ln(t)] - 3.3[\ln(t)]^2}\right)100$$

Where:

(t) is the elapsed number of days from concrete placement to the resolution cylinders testing.

ln (t) is the natural logarithm of (t).

The Engineer will compare:

1. The VT sample results with the $VR_{28}$ cylinders results.
2. The QC sample results with the $QR_{28}$ cylinders results.

Comparison results must not be greater than 17.5%. Core samples of the hardened concrete may be required.

$$V_D\ (\%) = \text{ABS}\left(\frac{\text{VT} - \text{VR}_{28}}{\text{VT}}\right)100$$

$$Q_D\ (\%) = \text{ABS}\left(\frac{\text{QC} - \text{QR}_{28}}{\text{QC}}\right)100$$

Where:

$V_D$ (%) is the absolute percentage difference between VT and $VR_{28}$.

$Q_D$ (%) is the absolute percentage difference between QC and $QR_{28}$.

Perform the resolution with the concrete compressive strength data at 56 days in lieu of the 28 days when the acceptance of concrete is at 56 days.

The resolution procedure will use the above equations. The Engineer will determine through the resolution procedure whether the QC strength test results or the VT strength test are deemed to be the most accurate, LOTs will then be considered to be verified.

The Engineer will inform the QC and VT laboratories within three calendar days of the acceptance compressive strength test to transport their QR and VR cylinders to the resolution laboratory. The QC and VT laboratories will transport their own hold cylinders to the resolution testing laboratory within three calendar days after the Engineer notifies the Contractor that a resolution procedure is required. In addition, the Engineer will ensure that the QR and VR cylinders are tested within 14 calendar days of the acceptance strength tests.

The Engineer will determine the most accurate strength test result to represent the four or fewer consecutive LOTs as follows:

1. When both results meet the established comparison criteria, both are deemed accurate and the QC strength will represent the LOTs. The Department will pay for cost of the resolution testing.

2. When only the QC result is within the established comparison criteria, the QC strength is deemed as most accurate and will represent the LOTs. The Department will pay for the cost of the resolution testing.

3. When only the VT result is within the established comparison criteria, the VT strength is deemed as most accurate and will represent the LOTs. The Department will assess a $1,000 pay reduction for the cost of the Resolution Investigation.

4. When both results are outside the established comparison criteria, the Engineer, with input from the DMO, will determine if any Department IA evaluations are required and which test results are most accurate. The Department will pay for the cost of the resolution testing.

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

ARTICLE 346-10 is deleted and the following substituted:

**346-109.7 Structural Adequacy~~:~~.**

The Engineer will evaluate the structural adequacy for ~~verified~~ concrete that does not meet the minimum specified compressive strength of Table 346-3.

For structural adequacy, with standard molded and cured compressive strength cylinders, the compressive strength of concrete is satisfactory provided that the two following criteria are met:

1. The average compressive strength does not fall below the specified minimum compressive strength by more than:

a. 500 psi if the specified minimum compressive strength is equal to or less than 5,000 psi.

b. 10% of the specified minimum compressive strength if the specified minimum compressive strength is greater than 5,000 psi.

2. The average compressive strength with the previous two LOTs is equal to or exceeds the specified minimum compressive strength. This condition only applies if there are two or more previous LOTs to calculate the average.

The Engineer will consider the concrete for a given LOT as structurally adequate and coring will not be allowed when a concrete compressive strength test result falls below the specified minimum strength but has met the above conditions.

~~**346-9.7.1 Lightweight concrete:** The Engineer may require an Engineering Analysis Scope in accordance with 6-4 to establish structural and durability adequacy when the lightweight concrete plastic density (unit weight) is outside of the specified tolerances.~~

ARTICLE 346-11 is deleted and the following substituted:

**346-11~~0~~ Investigation of Low Compressive Strength Concrete.**

When a verified concrete compressive strength test result falls below the specified minimum strength, and does not meet the structural adequacy described in 346-10~~9.7~~, perform one of the following options:

1. Submit an Engineering Analysis Scope in accordance with 6-4 to establish structural and durability adequacy. When the scope is approved by the Engineer, submit an Engineering Analysis Report (EAR) in accordance with 6-4 that includes a full structural analysis. If the results of the structural analysis indicate adequate strength to serve its intended purpose with adequate durability, and is approved by the Engineer, the Contractor may leave the concrete in place subject to the requirements of 346-12~~1~~, otherwise, remove and replace the LOT of concrete in question at no additional expense to the Department.

2. At the Engineer's discretion, obtain drilled core samples as specified in this Section to determine the in-place strength of the LOT of concrete in question, at no additional expense to the Department. The Engineer will determine whether to allow coring of the in-place concrete or require an engineering analysis based on the compressive strength of the test cylinders.

**346-10~~0~~1.1 Coring for Determination of Structural Adequacy:** 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 used in lieu of the cylinder strength test results for determination of structural adequacy. 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 and test the cores in accordance with ASTM C42.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. Obtain the Engineer's written approval before taking any concrete core sample. Notify the Engineer 48 hours prior to taking core samples.

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 or 934 and meeting

the approval of the Engineer. Report the test results to the Engineer within two calendar days of testing the core samples.

The Engineer, with input from the DMO, will consider the concrete as structurally adequate, in the area represented by core tests at the actual test age, if the average compressive strength of cores does not fall below the specified minimum compressive strength (f'c) by more than:

1. 500 psi when the f'c is equal to or less than 5,000 psi.
2. 10% of the f'c when the f'c is greater than 5,000 psi.

The Engineer may also require the Contractor to perform additional testing as necessary to determine structural adequacy of the concrete.

ARTICLE 346-12 is deleted and the following substituted:

**346-121 Pay Adjustments for Low Compressive Strength Concrete.**

**346-121.1 General:** For any LOT of concrete failing to meet the f'c as defined in 346-3, 346-9, and satisfactorily meeting all other requirements of the Contract Documents, including structural adequacy, the Engineer will individually reduce the price of each low strength LOT in accordance with this Section.

**346-121.2 Basis for Pay Adjustments:** The Engineer will determine payment reductions based on the 28-day compressive strength, represented by either acceptance compressive strength or correlated cores strength test results based on the following criteria:

1. When the acceptance compressive strength test result falls below the specified minimum compressive strength, but no more than the limits established in 346-109.7 below the specified minimum strength, do not core hardened concrete for determining pay adjustments. Use the acceptance compressive strength test results.

2. When the acceptance compressive strength test result falls below the specified minimum compressive strength by more than the limits established in 346-109.7, the structure may be cored for determination of structural adequacy as directed by the Engineer. Use the result of the 28-day correlated core compressive strength or the acceptance compressive strength test, whichever is less.

A price adjustment will be applied to the certified invoice price the Contractor paid for the concrete or the precast product.

The Engineer will relate the strength at the actual test age to the 28-day strength for the design mix represented by the cores using appropriate strength time correlation equations.

In precast concrete operations, excluding prestressed concrete, ensure that the producer submits acceptable core sample test results to the Engineer. The producer may elect to use the products in accordance with this Section. Otherwise, replace the concrete in question at no additional cost to the Department. For prestressed concrete, core sample testing is not allowed for pay adjustment. The results of the cylinder strength tests will be used to determine material acceptance and pay adjustment.

**346-112.3 Calculating Pay Adjustments:** The Engineer will determine payment reductions for low strength concrete accepted by the Department. The 28-day strength is represented by either cylinders or correlated cores strength test results in accordance with 346-112.2.

Reduction in Pay is equal to the reduction in percentage of concrete compressive strength below the specified minimum strength:

$$\text{Reduction in Pay (\%)} = \left(\frac{\text{f'c}-\text{28 day Strength}}{\text{f'c}}\right)100$$

For the elements that payments are based on the per foot basis, the Engineer will adjust the price reduction from cubic yards basis to per foot basis, determine the total linear feet of the elements that are affected by low strength concrete samples and apply the adjusted price reduction accordingly.

Use the concrete compressive strength data at 56 days in lieu of the 28 days when the acceptance of concrete is at 56 days.

For 28-day Class I pavement concrete, if the 56-day strength meets or exceeds the 28-day strength requirement, no reduction in pay will be made. If the 56-day strength is less than the 28-day strength requirement, but is at least within 500 psi of the 28-day strength requirement, reduction in pay is equal to the reduction in percentage of concrete compressive strength below the specified minimum strength:

$$\text{Reduction in Pay (\%)} = \left(\frac{\text{f'c} - \text{56 day Strength}}{\text{f'c}}\right)100$$

SECTION 346 is expanded by the following:

**346-132 Pay Reduction for Plastic Properties.**

A rejected load in accordance with 346-6.4 is defined as the entire quantity of concrete contained within a single ready-mix truck or other single delivery vehicle regardless of what percentage of the load was placed. If concrete fails a plastic properties test and is thereby a rejected load but its placement continues after completion of a plastic properties test having a failing result, payment for the concrete will be reduced.

The pay reduction for cast-in-place concrete will be twice the certified invoice price per cubic yard of the quantity of concrete in the rejected load.

The pay reduction for placing a rejected load of concrete into a precast product will be applied to that percentage of the precast product that is composed of the concrete in the rejected load. The percentage will be converted to a reduction factor which is a numerical value greater than zero but not greater than one. The precast product payment reduction will be twice the Contractor's billed price from the producer for the precast product multiplied by the reduction factor.

If the Engineer authorizes placement of the concrete, even though plastic properties require rejection, there will be no pay reduction based on plastic properties failures; however, any other pay reductions will apply.