

STRUCTURAL PORTLAND CEMENT CONCRETE.
(REV 9-1-22)

SUBARTICLE 346-6.2 is expanded by the following:

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 and self-consolidating concrete, 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 value of 29 k Ω or below and one with higher than 29 k Ω 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, fly 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.

Ensure that the mix designs for volumetric measuring units include the current calibration for each of the concrete mix ingredients in accordance with manufacturer's recommendations. The calibration must include the functional controls and settings for the mix design. Repeat the calibration of the volumetric measuring unit under the following conditions:

1. Every six months, when the mixer has produced at least 20 cubic yards in six months.
2. When the concrete is not meeting the requirements of the specifications.
3. After any repairs of the batching or mixing unit.

SUBARTICLE 346-6.3 is expanded by the following:

346-6.3 Delivery Certification: Ensure that an electronic delivery ticket is furnished with each batch of concrete before unloading at the placement site. The delivery ticket may be proprietary software or in the form of an electronic spreadsheet, but shall be printed. Ensure that the materials and quantities incorporated into the batch of concrete are printed on the delivery ticket. Include the following information on the delivery ticket:

1. Arrival time at jobsite,
2. Time that concrete mix has been completely discharged,
3. Number of revolutions upon arrival at the jobsite,

4. Total gallons of water added at the jobsite,
5. Additional mixing revolutions when water is added,
6. Total number of revolutions.

Items (3) through (6) do not apply to non-agitating concrete transporting vehicles.

Ensure the batcher responsible for production of the batch of concrete signs the delivery ticket, certifying the batch of concrete was produced in accordance with the Contract Documents.

Sign the delivery ticket certifying that the design mix maximum specified water to cementitious materials ratio was not exceeded due to any jobsite adjustments to the batch of concrete, and that the batch of concrete was delivered and placed in accordance with the Contract Documents.

346-6.3.1 Volumetric Mixers: The Engineer, upon concurrence of the State Materials Office (SMO), may allow the use of volumetric mixing at the jobsite for Class I, Class I (Seal), Class I (Pavement) and Class II concrete.

Ensure that the concrete producer furnish a delivery ticket in accordance with Section 350 and Materials Manual Volume II Section 9.3. The signature of the Volumetric Mixer operator is required on delivery tickets, in lieu of the signature of the batch plant operator.

ARTICLE 346-8 is expanded by the following:

346-8 Plastic Concrete Sampling and Testing.

QC tests include air content, temperature, slump, and preparing compressive strength cylinders for testing at later dates. 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 testing arrives at the discharge site, a subsequent truck may also discharge once a representative sample has been collected from the QC 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 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 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. The acceptance sample and plastic properties tests may be taken from the initial portion of the load.

If any of the QC 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.

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.

346-8.1 Volumetric Mixer: The Volumetric Mixer shall have a metal rating plate plainly marked with the gross volume of mixed concrete and a valid identification card issued by the Department. Reject any concrete batched or mixed in a unit that does not have valid identification card.

SUBARTICLE 346-9.2 is expanded by the following:

346-9.2 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.

The LOT size for concrete from a Volumetric Mixer is defined as one day's production or 20 cubic yards, whichever comes first.

Table 346-9 Sampling Frequency	
Class Concrete ⁽¹⁾	LOT Size
I	One day's production or 20 cubic yards whichever comes first
I (Seal)	
I (Pavement)	
II	

Do Not Use Without
CO Specs Authorization