

**346 PORTLAND CEMENT CONCRETE.**  
**(REV 6-23-04) (FA 6-30-04) (1-05)**

SUBARTICLE 346-2.5.3 (Page 285) is deleted and the following substituted:

**346-2.5.3 High Range Water Reducing and Viscosity Modifying Admixtures:**

**346-2.5.3.1 General:** The Contractor may propose the use of a Type F or G admixture, meeting the requirements of Section 924, in all classes of concrete, except for concrete used in drilled shafts. The use of High Range Water Reducing (HRWR) admixtures in concrete mixes incorporating silica fume or metakaolin is mandatory.

**346-2.5.3.2 Flowing Concrete Admixtures:** The Contractor may propose the use of a Type I or Type II admixture, meeting the requirements of Section 924. Produce flowing concrete mix with target slump of 9 inches [230 mm]. The use of flowing concrete admixtures is limited to the construction of precast/prestressed concrete products. Add the flowing concrete admixtures at the ready mixed concrete production batch plant.

Submit the proposed flowing concrete mix design, containing Type I or II admixture, and test data as specified herein and in 346-6.2.

Subsequent to the laboratory trial batch, perform a field demonstration of the proposed mix design by production and placement of at least three batches, 3 yd<sup>3</sup> [2.3 m<sup>3</sup>] minimum size each, of concrete containing flowing concrete HRWR admixture. Take representative samples from each batch and perform slump, air content, density (unit weight), and temperature tests on these samples. Cast specimens from each sample for compressive strength tests. Record the ambient air temperature during the test. Ensure that the concrete properties are within the required specification limits.

Determine the workability of the demonstration concrete batches by performing the slump tests on the samples taken at 15 minute intervals from each batch. Continue sampling and testing until the slump measures 6 inches [150 mm] or less. From the plot of slump versus time, determine the time for each batch when the slump is at 7.5 inches [190 mm]. The shortest time period determined from three consecutive batches, at 7.5 inches [190 mm] slump, is considered the cutoff time of the proposed concrete mix. For production concrete, ensure that the time between the batching and depositing of each load of concrete is less than the cutoff time of the mix and also does not exceed the allowable time limit specified in 346-7.6.

Ensure that the demonstration concrete is mixed, delivered, placed, consolidated and cured in accordance with the proposed method and sequence. Produce the flowing concrete batches at slumps between 7.5 inches to 10.5 inches [190 mm to 265 mm].

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

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

After removal of the forms, perform the post-placement inspection of the in-place concrete. Observe for any signs of honeycombs, cracks, aggregate segregation or any other surface defects and ensure that the hardened concrete is free from these deficiencies. The

Engineer may require saw cutting of the mock-up products to verify the uniform distribution of the aggregates within the saw cut surfaces and around the reinforcing steel and prestressing strands. The Engineer will require saw cutting of the demonstration mock-up products for plants that are demonstrating the use of the flowing concrete for the first time. Obtain core samples from different locations of mock-up products to inspect the aggregate distribution in each sample and compare it with the aggregate distribution of other core samples. Perform rapid chloride permeability or surface resistivity tests on the core samples or test cylinders.

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

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

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

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

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

Do not produce or place concrete for payment under Contract pay items until design mixes have been approved.

SUBARTICLE 346-3.1(d) (Page 286) is deleted and the following substituted:

(d) When the use of silica fume or metakaolin is required as a pozzolan in Class V or Class V (Special) concrete, ensure that the concrete does not exceed a permeability of 1,000 coulombs at 28 days, when tested per AASHTO T 277. Submit 2, 4 x 8 inches [102 x 203 mm] cylindrical test specimens to the Engineer for permeability testing before mix design approval. Take the permeability test specimens from the concrete of the laboratory trial batch or from the field trial batch of at least 3 yd<sup>3</sup> [2.3 m<sup>3</sup>]. Verify the mix proportioning of the designed 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 permeability test specimens at least 7 days prior to the scheduled 28 day test. The average permeability of the two tests, one test per cylinder, is considered the rapid chloride permeability of the concrete mix.

In lieu of rapid chloride permeability test, submit three test cylinders to the Engineer for performing of surface resistivity test in accordance with FM 5-578. Ensure that the result of the average 28 day surface resistivity value of the concrete samples remains greater than or equal to 37 KOhm-cm.

