FIBER REINFORCED CONCRETE
(REV 6-4-24)

ARTICLE 346-1 is expanded by the following:

This specification includes material, labor, equipment, and service requirements necessary to complete the work for fiber reinforced concrete used in concrete bridge decks and link-slabs placed above prestressed concrete slab units. Based on the superstructure environmental classification, use the following type of fiber reinforcement for shrinkage control:

1. Polymeric fiber reinforced concrete (PFRC) in all superstructure environments.
2. Steel fiber reinforced concrete (SFRC) in moderately and slightly aggressive superstructure environments.
3. Fiber-reinforced polymer (FRP) macro-fiber- reinforced concrete in all superstructure environments.

SUBARTICLE 346-2.1 is expanded by the following:

Polymeric Fibers*** .....ASTM C 1116, Type III
Steel Fibers****..... ASTM C 1116, Type I
Fiber-reinforced Polymer Macro-Fibers*****ASTM C 1116, Type III

*** Use a synergistic blend of high performance macro-monofilaments with sinusoidal deformations and collated-fibrillated polypropylene fibers. Package the blend of fibers in degradable bags with a volume of one bag per cubic yard.
Produce an Average Residual Strength (ARS) of no less than 215 psi from a test set of 5 beams in accordance with ASTM C 1399 Test Method for Determining Average Residual Strength of Fiber Reinforced Concrete.

**** Use steel fibers made with low-carbon steel and with a minimum ultimate tensile strength of 120,000 psi. Meet the following requirements: length equal to 2 inches, plus or minus 5%, average equivalent diameter equal to 0.035 inch with an aspect ratio of 60, plus or minus15%. Ensure the material is a continuously deformed circular segment, clean and free of rust, oil and deleterious materials and corrugated full length for increased mechanical anchorage. Produce an ARS of no less than 215 psi from a test set of 5 beams in accordance with ASTM C 1399.

***** Use basalt or carbon FRP macro-fibers meeting the component material composition requirements of Section 932-4. Produce an ARS of no less than 215 psi from a test set of five beams in accordance with ASTM C 1399.

SUBARTICLE 346-2.4 is expanded by the following:

When fiber reinforced concrete is required, Size No. 89 coarse aggregate may be used.

SUBARTICLE 346-2.5.2 is expanded by the following:

In fiber reinforced concrete mixes, use Type D water-reducing and retarding admixture, and shrinkage reducing admixture (SRA) meeting the requirements of Section 924.

SUBARTICLE 346-6.1 is expanded by the following:

For fiber reinforced concrete, start the finishing and curing process prior to the drying of the concrete surface. Include the details of the mixing, batching, delivery, placement, finishing and curing methods of the fiber reinforced concrete in the quality control plan.

SUBARTICLE 346-6.2 is expanded by the following:

For fiber reinforced concrete, submit the following information with the mix design to the District Materials Office for approval:

1. Manufacturer's printed product data to indicate proposed polymeric, steel, or FRP macro-fiber-reinforced concrete materials including application rate per cubic yard of concrete.
2. Manufacturer's printed batching and mixing instructions.
3. Manufacturer's Certification of performance meeting the requirements of ASTM C 1116.

SUBARTICLE 346-7.1 is expanded by the following:

346-7.1.1 Fiber Reinforced Concrete Mixing: Follow the requirements of the manufacturer's recommendation for mixing sequence, number of revolutions at mixing speed, and mixing procedure. Do not exceed the limits defined in Chapter 9.2 of the Materials Manual. Batch fiber reinforced concrete in whole cubic yard quantities. Add fibers at the concrete plant. Limit the batch volume to three-quarters of the rated capacity of the transit mixer.

Ensure that no fiber clumps enter the mix. Demonstrate a satisfactory method of introducing the fibers into the mixture during the field demonstration batch.

346-7.1.2 Laboratory Trial Batch of Fiber Reinforced Concrete Mix: Perform a laboratory trial batch meeting the requirements of 346-6.2. Ensure the fiber reinforced concrete meets the plastic and hardened properties of this Section and the applicable provisions of ASTM C 1116.

During the development of the laboratory trial batch, and where macro fibers are required, prepare a set of at least 5 beams from each sample of fresh or hardened concrete meeting the requirements of ASTM C 1399. Deliver the samples of concrete beams to the State Materials Office for an ARS test at the time the mix design is being developed.

346-7.1.3 Field Demonstration of Fiber Reinforced Concrete Mix: Subsequent to the satisfactory laboratory trial batch, perform a field demonstration of the proposed mix design by production and placement of at least one demonstration batch (3 cubic yards minimum) for approval by the Engineer. During the development of the field trial batch, and where macro fibers are required, prepare a set of at least five beams from each sample of fresh or

hardened concrete meeting the requirements of ASTM C 1399. Deliver the samples of concrete beams to the State Materials Office for an ARS test within 7 days of casting the samples.

The Engineer's approval will be based on the acceptable results of the plastic and hardened concrete samples and an acceptable surface finish of the field demonstration concrete and the ability to introduce fibers without clumping.

346-7.1.4 Fiber Reinforced Concrete Placement and Curing: Ensure fiber reinforced concrete delivered to the project conforms to the applicable provisions of ASTM C 1116.

Place and cure the fiber reinforced concrete in accordance with Section 400.