

Special Specification 4144

Rapid Setting Fiber Reinforced Keyway Concrete (RSFRC)



1. DESCRIPTION

Furnish and place rapid setting fiber reinforced concrete (RSFRC) intended for closure pour connections between precast elements.

2. MATERIALS

- 2.1. **RSFRC.** Provide a RSFRC meeting the requirements of Table 1. Submit proposed mix design for review and approval at least 2 months before closing first bridge.

Table 1
RSFRC Requirements

Property	Test Method	Requirement
4-hour Compressive Strength, Min (psi)	Tex-418-A	3,000
7-day Compressive Strength, Min (psi)	Tex-418-A	6,000
48 hour Pull-out Strength, min % of reinforcing bar yield strength ¹	ASTM E 488	75

1. Perform during trial batch testing only.

- 2.2. **Rapid Hardening Cement.** Furnish a non-blended belitic calcium sulfoaluminate cement meeting the requirements of ASTM C 1600 Type URH (ultra-rapid hardening).
- 2.3. **Water.** Furnish water meeting the requirements of Item 421, "Hydraulic Cement Concrete."
- 2.4. **Aggregates.** Furnish aggregates meeting requirements of Item 421, "Hydraulic Cement Concrete."
- 2.5. **Chemical Admixtures.** Furnish chemical admixtures meeting the requirements of DMS-4640
- 2.6. **Fibers.** Furnish steel fibers meeting ASTM C 1116, Type I fibers with a tensile strength greater than 250 ksi and a fiber length of 1/2-inch and a diameter of 0.008 inch. Determine the fibers dosage needed to meet the pull out strength requirement in Table 1.
- 2.7. **Trial Batch Testing for RSFRC.** Perform trial batches, at least 2 months before closing first bridge, using proposed RSFRC materials and equipment to demonstrate RSFRC can be mixed and placed properly. Conduct the necessary testing to ensure the proposed RSFRC meets the Table 1 requirements. Adjust steel fiber content to meet requirements.

During trial batching, cast six 12-in. diameter x 8-in. deep cylinders. Embed a 24 in. long #5 reinforcing steel bar in the center of the each cylinder to a depth of 5 inches. Ensure the axis of the bar is perpendicular to the finished surface. Test the pullout strength in accordance to ASTM E488.

3. EQUIPMENT

- 3.1. Provide equipment necessary to batch, mix, transport, and place RSFRC. All batching equipment must meet the requirement of Item 421.3 "Equipment." Provide an adequate amount of mixing, placing, and consolidation equipment to properly place RSFRC. Provide equipment necessary to test fresh and hardened RSFRC properties.

4. CONSTRUCTION

- 4.1. **Pre-Pour Meeting.** Before the initial placement of the RSFRC, arrange for an onsite pre-pour meeting with the material representatives, and the Engineer. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the RSFRC material.
- 4.2. **Storage:** Properly store all materials as required by the manufacturer to protect materials against loss of physical and mechanical properties.
- 4.3. **Mock-up.** Perform mock-up of connection detail with reinforcing steel included at least 2 months before construction. Place approved RSFRC mix and verify constructability. Saw-cut full depth the connection mock-up at centerline for examination.
- 4.4. **Mixing, Placing, and Finishing RSFRC.** Mix and place RSFRC in accordance to the cement and fiber manufacturer's recommendations. Use mixing equipment that is recommended by the cement manufacturer.
- Place and adequately consolidate before the RSFRC reaching initial set. When pouring long or intersecting joints, ensure that the leading edge of the pour does not dry out and crack. Pour all succeeding RSFRC placements into fluid RSFRC.
- 4.5. **Curing.** Water cure RSFRC in accordance to Item 422.8, "Final Curing," and as recommended by the cement manufacturer. Maintain curing until RSFRC has achieved a compressive strength of 4,000 psi.
- 4.6. **Quality Control.** Perform the testing listed in Table 2. The Engineer will make and test the compressive strength cylinders.

Table 2
RSFRC Testing Requirements

Property	Test Method	Frequency
Slump	Tex-415-A	Every Batch
Temperature	Tex-422-A	Every Batch
Cylinder for Compressive Strength	ASTM C 39	4 sets per production day ^{1,2}

1. Each set consists of two cylinders.
2. Make sets of cylinders intermittently throughout the pour.

The Engineer will sample concrete for four sets of cylinders from each production day to be tested at 4 hours, and 7 days after casting, and as necessary to determine opening to traffic.

5. MEASUREMENT

Measurement will be by the cubic yard of RSFRC measured in place.

6. PAYMENT

The work performed, materials furnished, trial batches, equipment, labor, tools, and incidentals will not be paid for directly, but will be considered subsidiary to pertinent items.