



BUILDINGS BULLETIN 2017-015

OTCR

Supersedes: None

Related Bulletin(s): 2015-014

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Purpose: This Bulletin establishes criteria for acceptance of the fabric-reinforced cementitious matrix strengthening system (FRCM) used for structural repair and strengthening of concrete and masonry elements as an alternative material in the NYC Construction Codes.

Related Code Section(s): BC 1901 BC 703 BC 704.3 BC Chapter 14
AC 28-103.8 BC 803 BC 1704.14

Subject(s): Structural repair, fabric-reinforced cementitious matrix strengthening system; Concrete, fabric-reinforced cementitious matrix strengthening system; Masonry, fabric-reinforced cementitious matrix strengthening system

Background: NYC Construction Codes do not address repair and strengthening of concrete or masonry elements. This Bulletin establishes criteria for acceptance of the fabric-reinforced cementitious matrix strengthening system (FRCM) used for structural repair and strengthening of concrete and masonry elements.

Description: FRCM consists of two components:

- Open grid fabric (mesh) of strands made of fibers [i.e. aramid, alkali resistant (AR) glass, carbon, basalt or polyparaphenylene benzobisoxazole (PBO)] consisting of primary direction and secondary direction strands connected perpendicularly.
- Cementitious matrix is a grout system based on portland cement and a low dosage of dry polymers at less than five (5) percent by weight of cement (*contact OTCR for other cementitious matrix systems*). The organic polymer compounds are sometimes used to ensure proper workability, setting time, and mechanical properties.

Uses: FRCM is used as an externally applied structural reinforcement to repair and/or strengthen normal-weight reinforced concrete columns, beams and slabs; brick and concrete-masonry-unit (CMU) masonry walls (reinforced and unreinforced). FRCM may also be used as an interior finish.

NOTES

1. The effect of the FRCM on fire-resistive rated construction shall be evaluated according to section BC 703 of the NYC Construction Codes.

2. The classification of FRCM as an interior finish shall be determined according to Section 803 of the NYC Construction Codes. For exterior applications, FRCM shall comply with BC Chapter 14 and shall have a flame spread index of not more than 25 and a smoke developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723.

RESTRICTION

This Bulletin does not address Steel Reinforced Grout (SRG) Composite Systems.

Evaluation Scope: NYC Construction Codes

Evaluation Criteria: Pursuant to AC 28-103.8, the Office of Technical Certification and Research (OTCR) recognizes Fabric-Reinforced Cementitious Matrix (FRCM) tested and evaluated in accordance with ICC-ES AC 434¹ *Acceptance Criteria for Masonry and Concrete Strengthening using Fabric-Reinforced Cementitious Matrix (FRCM) and Steel Reinforced Grout (SRG) Composite System*.

Acceptable FRCM shall have an evaluation or Code compliance report issued in accordance with AC 434 and shall comply with the conditions of this bulletin. The agency providing the evaluation or Code compliance report shall be accredited to ISO 17065.

Acceptable FRCM shall be labeled by an approved agency in accordance with section AC 28-113.2.3 and the evaluation or Code compliance report, and shall comply with the conditions of this bulletin.

Conditions of Acceptance: FRCM shall comply with the NYC Construction Codes and the following applicable provisions:

A. Design

1. FRCM system shall be designed in accordance with the ACI 549.4R-13² *Guide for the Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) Systems for Repair and Strengthening Concrete and Masonry Structures* with properties used for design obtained from tests performed in accordance with AC 434. Fire-resistance-rating and interior finish requirements shall be in accordance with the NYC Construction Codes, manufacturer's recommendations and the conditions of the required listing.
2. For repairs and upgrade achieved with unprotected external FRCM, the increase in flexural or shear strength provided by the external reinforcing system shall not exceed 50% of the existing structural capacity of the member prior to strengthening. This increase should be checked before applying the strength reduction factor.
3. Careful consideration should be given to determine reasonable strengthening limits. These limits are imposed to guard against collapse of the structure should bond or other failure of the FRCM system occur due to damage, vandalism, or other causes. The required strength of a structure without repair should be as specified in in accordance with ACI 562³ *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* Section 5.5.

B. Installation Requirements

1. Installation requirements shall be in accordance with the NYC Construction Codes, manufacturer's installation instructions, the conditions of the required evaluation or Code compliance report issued in accordance with AC 434, and the conditions of this bulletin.

C. Inspections

1. Pursuant to section BC 1704.14, the installation of FRCM shall be subject to special inspection requirements of Chapter 17 of the Building Code and Department Rules covering special inspection. Special Inspectors of FRCM shall:
 - a. Maintain the same qualification requirements for the 'Concrete-Cast-in-place & Precast,' or 'Masonry' special inspection categories defined in 1 RCNY Section 101-06, Appendix A, as applicable.
 - b. Have duties and responsibilities in accordance with, but not limited to, 1 RCNY section 101-06, and the evaluation or Code compliance report issued in accordance with AC 434 Section 6.2, 'Installation and Special Inspection' and ACI 549.4R-13 Section 8.1, 'Inspection.'
 - c. Complete the statement of special inspection by referencing this Bulletin under the Special Inspection Item for 'Alternative Materials' in Section 3.0 of the TR1 form:

<input type="checkbox"/>	<input type="checkbox"/>	Mastic and Intumescent Fire-resistant Coatings	BC 1704.12		
<input type="checkbox"/>	<input type="checkbox"/>	Exterior Insulation and Finish Systems (EIFS)	BC 1704.13		
<input type="checkbox"/>	<input type="checkbox"/>	Alternative Materials - OTCR Buildings Bulletin #	BC 1704.14		
<input type="checkbox"/>	<input type="checkbox"/>	Smoke Control Systems	BC 1704.15		
<input type="checkbox"/>	<input type="checkbox"/>	Mechanical Systems	BC 170		

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D. Labeling

1. FRCM shall be labeled as per 28-113.4. All shipments and deliveries of materials shall be accompanied by a certificate or label certifying that the materials shipped or delivered are equivalent to those tested and approved.

Referenced Standards:

1. ICC-ES AC434¹ *Acceptance Criteria for Masonry and Concrete Strengthening using Fabric-Reinforced Cementitious Matrix (FRCM) and Steel Reinforced Grout(SRG) Composite System*
2. ACI 549.4R-13² *Guide for the Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) Systems for Repair and Strengthening Concrete and Masonry Structures*
3. ACI 562-16³ *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*