NYC Buildings Department
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Robert D. LiMandri, Commissioner

BUILDINGS BULLETIN 2013-002
OTCR

Supersedes: None

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Purpose: This document establishes design and acceptance criteria of externally bonded fiber-reinforced polymer (FRP) systems for structural repair and upgrade of concrete and masonry elements.

Related Code/Zoning Section(s):

BC	1901	BC	703	BC	714.2
AC	28-113.2.2	BC	803		

Subject(s): Externally bonded fiber-reinforced polymer; Masonry, externally bonded fiber-reinforced polymer; Concrete, externally bonded fiber-reinforced polymer

Description: Externally bonded fiber-reinforced polymer (FRP) systems are applied to concrete and masonry substrates. The systems consist of carbon, glass and aramid combined with resins which in combination create the FRP composite system.

Evaluation Scope: 2008 NYC Construction Codes

Evaluation Criteria: Pursuant to AC 28-113, the Office of Technical Certification and Research (OTCR) recognizes externally bonded fiber-reinforced polymer (FRP) systems, tested and evaluated in accordance with ICC-ES AC125[1] "*Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening using Fiber-reinforced Composite Polymer (FRP) Composite Systems*". Acceptable fiber-reinforced composite systems shall be listed and labeled by an approved agency in accordance with AC 28-113.2.3 and shall comply with the conditions of this bulletin.

Note: The effect of the FRP composite system on fire-resistive shall be evaluated according to section BC 703.

Uses: Fiber-reinforced polymer system can be used to rehabilitate or restore the strength of a deteriorated structural member, retrofit or strengthen a sound structural member to resist increased loads due to changes in use of the structure, or address design change.

Conditions of Acceptance: Fiber-reinforced polymer systems shall comply with the 2008 NYC Construction Codes and the following applicable provisions:

*SEE RELATED BUILDING BULLETIN 2015-014

A. Design

1. Fiber-reinforced polymer systems shall be designed in accordance with the ACI 440.2R [2] "*Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures*". 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 reinforcing systems, the structural member without repair shall have sufficient capacity to resist a minimum level of load without collapse, as given by the following equation

$$\phi (R_n)ex \geq 1.2D + 0.5L + A_k + 0.2S$$

where:

- $\phi(R_n)ex$ is the factored resistance of the structural component without repair;
- *D, L*, and S are the specified dead, live, and snow loads, respectively, calculated for the rehabilitated structure; and
- A_k is the load or load effect resulting from an extraordinary event.

For cases where the design live load acting on the member to be strengthened has a high likelihood of being present for a sustained period of time, a live load factor of 1.0 should be used in place of 0.5 in the above equation.

B. Installation Requirements

1. Installation requirements shall be in accordance with the manufacturer's instructions, the evaluation report issued in accordance with ICC-ES AC 125 and the conditions of this bulletin.

C. Inspections

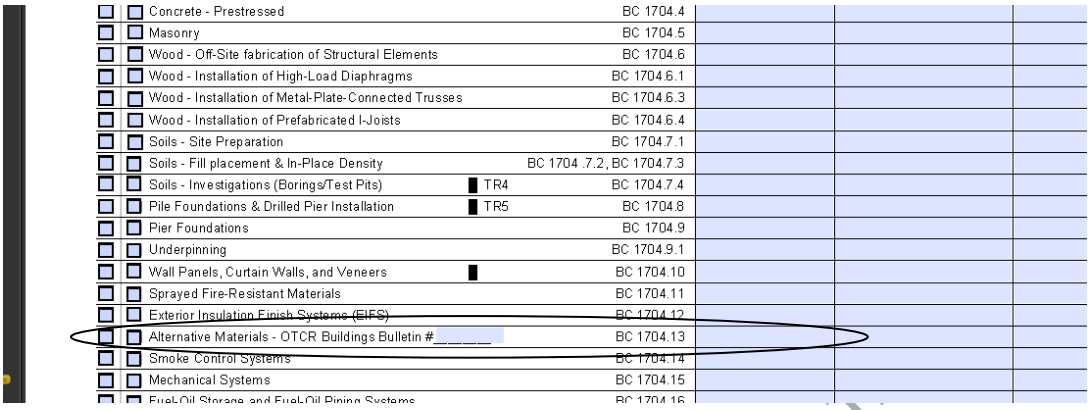
1. Pursuant to section BC 1704.13, the installation of fiber-reinforced polymer systems shall be subject to special inspection requirements of Chapter 17 of the NYC Building Code and Department Rules covering special inspection. Special inspectors of fiber-reinforced polymer systems shall:

   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.

   b. Have duties and responsibilities in accordance with, but not limited to, 1 RCNY section 101-06, and AC 178[3], "*Acceptance Criteria for Inspection and Verification of Concrete and Reinforced and Unreinforced Masonry Strengthening using Fiber-Reinforced Polymer (FRP) System*" , and

   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:

*SEE RELATED BUILDING BULLETIN 2015-014



Concrete - Prestressed		BC 1704.4	
Masonry		BC 1704.5	
Wood - Off-Site fabrication of Structural Elements		BC 1704.6	
Wood - Installation of High-Load Diaphragms		BC 1704.6.1	
Wood - Installation of Metal-Plate-Connected Trusses		BC 1704.6.3	
Wood - Installation of Prefabricated I-Joists		BC 1704.6.4	
Soils - Site Preparation		BC 1704.7.1	
Soils - Fill placement & In-Place Density		BC 1704 .7.2, BC 1704.7.3	
Soils - Investigations (Borings/Test Pits)	TR4	BC 1704.7.4	
Pile Foundations & Drilled Pier Installation	TR5	BC 1704.8	
Pier Foundations		BC 1704.9	
Underpinning		BC 1704.9.1	
Wall Panels, Curtain Walls, and Veneers		BC 1704.10	
Sprayed Fire-Resistant Materials		BC 1704.11	
Exterior Insulation Finish Systems (EIFS)		BC 1704.12	
Alternative Materials - OTCR Buildings Bulletin #_____		BC 1704.13	
Smoke Control Systems		BC 1704.14	
Mechanical Systems		BC 1704.15	
Fuel-Oil Storage and Fuel-Oil Piping Systems		BC 1704.16	

D. Labeling

1. Fiber-reinforced polymer composite systems shall be labeled as per BC 28-113.4 and ICC-ES AC 125. 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 AC 125, March 2010, *"Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening using Fiber-Reinforced, Composite Polymer (FRP) Composite System"*

2. ACI 440.2R-08, "*Guide for the Design and Construction of Externally Bonded FRP Systems for Strength Concrete Structures*"

3. AC178, June 2008 "*Acceptance Criteria for Inspection and Verification of Concrete and Reinforced and Unreinforced Masonry Strengthening using Fiber-Reinforced Polymer (FRP) Composite System*"

*SEE RELATED BUILDING BULLETIN 2015-014