

ACI 562 CODE REQUIREMENTS FOR THE REPAIR AND REHABILITATION OF EXISTING BUILDINGS



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EXISTING BUILDINGS

Repair/Rehabilitation of Existing Buildings

- Existing Buildings vs New Construction in NYC
 - 975,000+ Existing Buildings in NYC
 - Most buildings built under older codes and standards:
 - 1968 NYC Code
 - 1938 NYC Code
 - 1916 NYC Code
 - 1899 NYC Code ... etc.
 - Prior codes more prescriptive
 - Seismic Requirements adopted in 1995



EXISTING BUILDINGS

Repair/Rehabilitation of Existing Buildings

- Existing Buildings vs New Construction in NYC
 - 2012: Over 148,000 work permits issued
 - 2012: 1,462 New Building Permits
 - “Prior Code Buildings” term for structures built under 1968 or earlier code requirements



EXISTING BUILDINGS

Repair/Rehabilitation of Existing Buildings

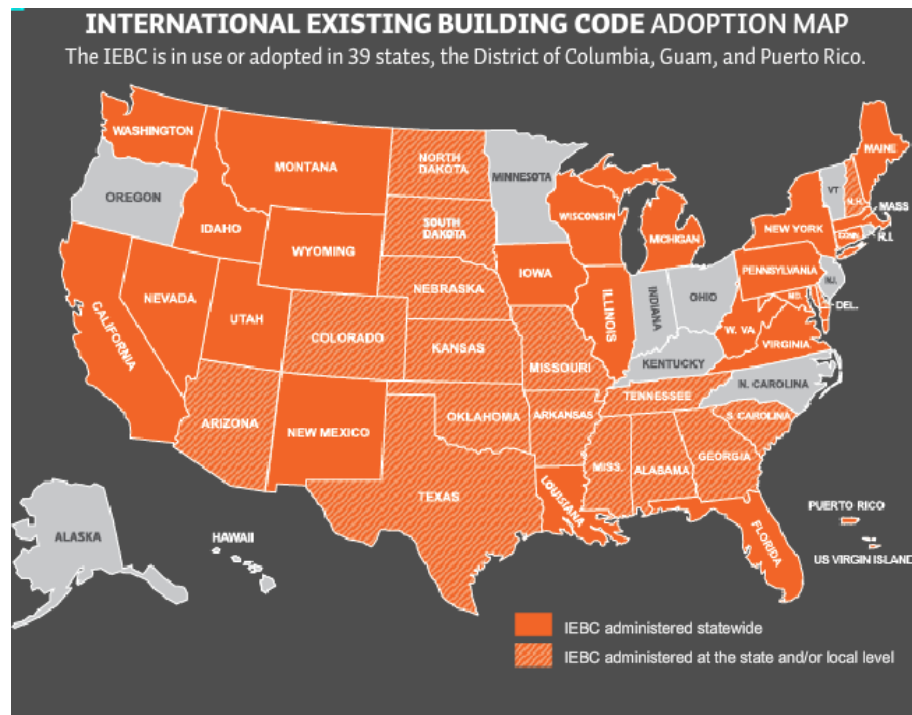
- New Construction Standards
 - Current building codes generally address new construction
 - International Building Code is moving away from Chapter 34 requirements for Existing Structures
 - Some requirements in IBC for existing buildings to comply as new construction
 - E.G. reroofing in IBC Chapter 15
 - Few technical standards for repair/rehabilitation of existing buildings and materials adopted in codes

INTERNATIONAL EXISTING BUILDING CODE

CODE

Repair/Rehabilitation of Existing Buildings

- ICC → IEBC is the Model Code for Existing Buildings



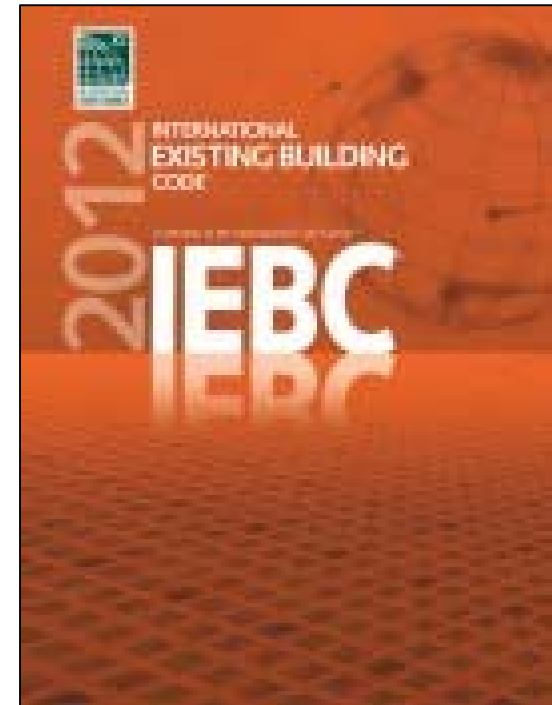
International Code Council (March 2014):

<http://www.iccsafe.org/gr/Pages/adoptions.aspx>

INTERNATIONAL EXISTING BUILDING CODE

2012 IEBC Work on Existing Buildings

- Provisions for the repair, alteration addition and change of occupancy of an existing building
- IEBC Chapter 3: Compliance Methods
 - Prescriptive compliance method (IEBC Chapter 4)
 - Work area compliance method (IEBC Chapters 5 -13)
 - Performance compliance method (IEBC Chapter 14)
- Seismic evaluation of structures:
 - ASCE 41-06 or ASCE 31-03



INTERNATIONAL EXISTING BUILDING CODE

2012 IEBC Work on Existing Buildings

- Materials
 - New Materials: Required to comply with new construction requirements (IBC)
 - Existing Materials – Materials approved for use at the time of their installation permitted to remain
- Structural Members
 - New Members: Comply with new construction requirements (IBC)
 - Existing Members: Permitted to remain unless subjected to:
 - Increases in loading
 - Damage
 - Large building alteration that triggers compliance as new for entire structure

INTERNATIONAL EXISTING BUILDING CODE

2012 IEBC Work on Existing Buildings

- **Repairs & Rehabilitation of Concrete Buildings**

- Design and implementation of repair/rehabilitation is required but no standards referenced for how to perform repair/rehabilitation
- Materials and methods may not be adequately described in new construction standards referenced in IBC, examples:
 - Fiber-Reinforced Polymers (FRP)
 - Concrete Repair Mortars
- Non-seismic evaluation of structure is required in IEBC but not described
- No requirements specific to repair/rehabilitation for construction or quality assurance even though they may be required

ACI 562-13 Code Requirements

ACI 562-13 Work on Existing Buildings

- **Where a jurisdiction has provisions for work on existing buildings (Existing Building Code)**
 - ACI 562 can be used as a referenced standard for evaluation of the structure and the design of repairs and rehabilitation of concrete structures to comply with the Existing Building Code requirements
 - Existing Building Code used to determine
 - Triggers for compliance with design and construction standards (IBC, ACI 318) for new construction are required (Current Building Code)
 - Allowances for compliance with design and construction standards in effect when building was built (Original Building Code)
 - ACI 562 Section 1.1.7 – Existing Building Code shall govern when there are conflicts

ACI 562-13 Code Requirements

ACI 562-13 Work on Existing Buildings

- Where a jurisdiction **DOES NOT** have provisions for work on existing buildings (Existing Building Code)
 - ACI 562 Section 1.3 used to assess structure for compliance based on Preliminary Evaluation in Section 4.3
 - Section 1.3.3 Determination of compliance with Original Building Code & ACI 318 standard in effect at that time
 - In compliance
 - Not in compliance but safe
 - Not in compliance and unsafe
 - Section 1.3.4 Compliance for Repairs/Rehabilitation
 - In compliance with Original Building Code, or Safe → Original Building Code/ACI 318 & ACI 562
 - Unsafe → ACI 318-11 & ACI 562
 - Section 1.3.5 complete replacement of members and new members must comply with requirements for new construction

ACI 562-13 Code Requirements

ACI 562-13 Work on Existing Buildings

- **ACI 562 Chapter 5 Loads**
 - Section 5.1.4 Loads during all phases of the construction and repair process shall be used to design shoring during repairs
 - Reference to ACE 37 for unoccupied buildings, and ASCE 7 for occupied buildings
 - 5.1.5 requires consideration be given to loads present that may not be specified in standards (e.g. crane loads)
 - 5.5.1 Load combinations for external reinforcing system repairs



ACI 562-13 Code Requirements

ACI 562 Chapter 6 Evaluation & Analysis

- **Section 6.1 Structural Evaluation**
 - Comprised of a structural assessment (6.2), structural analysis (6.5), or both
 - Structural evaluation required:
 - Strength called into question deterioration or additional loading
 - Insufficient information to determine that there is sufficient strength
 - Section 6.1.4 Where repairs are required on an element in a structure, it shall be determined if similar elements throughout the structure require evaluation



ACI 562-13 Code Requirements

ACI 562 Chapter 6 Evaluation & Analysis

- **Section 6.7 Structural Analysis for Repair Design**
 - **Section 6.7.1** The structural analysis used for repair design shall consider the structural repair process. The analysis shall consider the effects of the sequence of load application and material removal during all phases of the evaluation and repair process.
- **Section 6.8** Load testing per **ASC 437-13** is permitted to supplement analysis or demonstrate strength of original or repaired structure



ACI 562-13 Code Requirements

ACI 562 Chapter 7 Design of Structural Repairs




- **Section 7.5 Materials**
 - Existing compliant materials permitted to remain
 - Materials in ACI 318-11 permitted
 - Alternative materials require approval
- **Section 7.8 Permits use of repair using fiber-reinforced polymer (FRP) composites**
- **Section 7.9 Performance under fire and elevated temperatures**



ACI 562-13 Code Requirements

Alternative Materials Approvals

- **ACI 562 Section 1.4.2 Approval of special system of design or construction**
 - Allows approval of new methods of construction and alternative materials to what is recognized in codes
 - Requires approval by the building official or a board appointed by the building official
 - Similar requirements exist in ICC Codes and local building codes
- **NYC: Buildings Bulletins used to outline criteria for use of alternative materials and methods of construction**
- **ICC Evaluation Service provides criteria for use of FRP, Post-Installed Anchors, and others**

 NYC Buildings Department 280 Broadway, New York, NY 10007 Robert D. Librandi, Commissioner	
BUILDINGS BULLETIN 2013-002 OTCR	
Supersedes: None	
Issuer: Alan Price, P.E.  Director, Office of Technical Certification and Research	
Issuance Date: March 19, 2013	
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 "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:
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ACI 562-13 Code Requirements

Chapter 9 – Construction

- **ACI 562 Section 9.1.1**
 - Contract documents need to identify where temporary shoring and bracing is required
 - Shoring has to be designed by a Licensed Design Professional
- **9.1.2 Global structural stability and the stability of individual members shall be maintained prior to and during all stages of the repair process**
- **Licensed design professional who designed the repairs does not have to be the designer of the shoring**



ACI 562-13 Code Requirements

Chapter 9 – Construction



- **IEBC Chapter 15 Construction Safeguards**
 - Covers the protection of public and property
 - Local requirements may govern
- **NYC Building Code**
 - Chapter 33 Safeguards during construction and demolition
 - Chapter 17 includes special inspections for construction operations affecting structural stability



ACI 562-13 Code Requirements

Chapter 10 – Quality Assurance

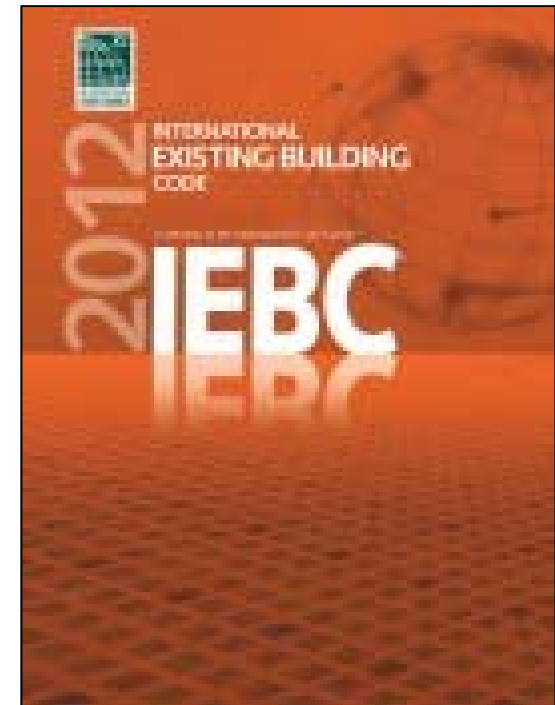
- **ACI 562 Section 10.1.1**
 - Concrete repair and rehabilitation construction shall be subject to inspection as required by the local jurisdiction
- **10.2.1 Testing of repair materials**
 - As specified by the Licensed Design Professional
- **10.3 Construction observations**
 - As specified on the construction documents
- **ICC Evaluation Service Reports (ESR) may require special inspections as part of their evaluation (FRP, Adhesive Anchors)**

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ACI 562-13 Code Requirements

2012 IEBC Section 109 Inspections

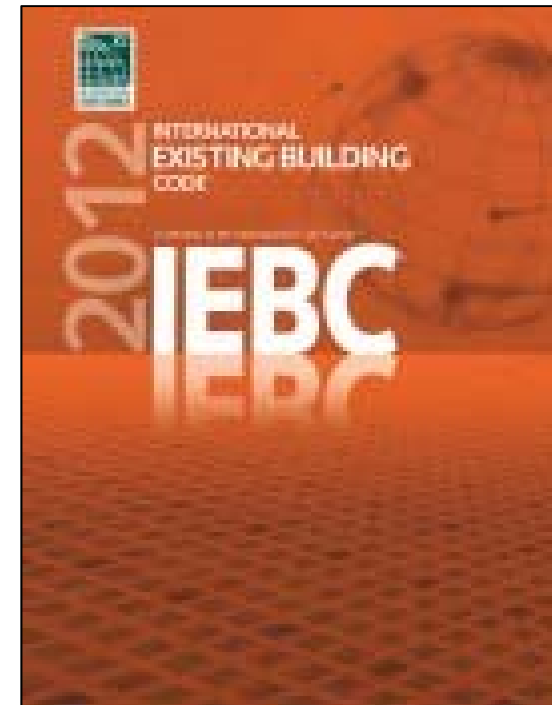
- **109.3.8 Special inspections shall be required in accordance with the International Building Code**
- **109.3.7 Code official authorized to require additional inspections to ascertain code compliance**
- **ACI 318-11 Requires Adhesive Anchor Installer certification (Horizontal & Vertically Inclined installations)**
 - ACI-CRSI Adhesive Anchor Installation Certification Program



ACI 562-13 Code Requirements

2012 IEBC Section 104.11 Alternative materials, design and methods of construction and equipment

- An alternative material, design, or method of construction shall be approved where the code official finds the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method, or work offered is equivalent to that prescribed in the this code in quality, strength, effectiveness, fire resistance, durability, and safety.
- ACI 562-13 Can be proposed for use as an approved method of design, subject to the approval of the code official



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