SI International System of Units

Strengthening Structural Concrete with Fiber-Reinforced Polymer (FRP) Systems—Code Requirements and Commentary

ACI CODE-440.13-24

Reported by ACI Committee 440S

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Strengthening Structural Concrete with Fiber-Reinforced Polymer (FRP) Systems—Code Requirements and Commentary

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ACI CODE-440.13-24

(SI Units)

Strengthening Structural Concrete with Fiber-Reinforced Polymer (FRP) Systems—Code Requirements and Commentary

An ACI Standard

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ACI CODE-440.13 was developed to provide design professionals a code for the design of strengthening strategies for concrete structures using fiber-reinforced polymer (FRP) systems.

Keywords: buildings; carbon fiber; fiber-reinforced polymer; glass fiber; rehabilitation; repair; strengthening; structural design.

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PREFACE

This Code provides minimum design requirements for strengthening of existing concrete structural systems and members using externally bonded and near-surface-mounted (NSM) fiber-reinforced polymer (FRP) systems. Among the subjects covered are design and detailing for strength, serviceability, and durability; load combinations, load factors, and strength reduction factors; FRP anchorage to concrete; development and splicing of FRP reinforcement; field inspection; and testing. This Code was developed by a consensus process. This Code is written for use by licensed design professionals and authorities having jurisdiction. This Code provides minimum requirements for materials, design and construction, and quality control and assurance requirements for FRP strengthening systems. This Code is written in a format that allows adoption by reference in a repair code or a general building code. Background details or suggestions for carrying out the requirements or intent of this Code provisions are in the Commentary.

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CODE

CHAPTER 1—GENERAL

1.1—Scope

1.1.1 ACI CODE-440.13, "Code Requirements for Strengthening Structural Concrete with Fiber-Reinforced Polymer (FRP) Systems—Code and Commentary," is hereafter referred to as "this Code." is presented in a side-by-side column format. These are two separate but coordinated documents, with Code text placed in the left column and the corresponding Commentary text aligned in the right column. Commentary section numbers are preceded by an "R" to further distinguish them from Code section numbers. The two documents are bound together solely for the user's convenience. Each document carries a separate enforceable and distinct copyright.

1.1.2 This Code shall apply to the strengthening of existing concrete structures using only those unidirectional externally bonded and near-surface-mounted (NSM) fiber-reinforced polymer (FRP) systems permitted in Chapter 4.

1.1.3 This Code provides minimum requirements for the materials, design, and construction of FRP strengthening systems for concrete structures consistent with the requirements of ACI CODE-562.

1.1.4 This Code shall not be applied to the strengthening of masonry structures.

1.1.5 This Code provides minimum requirements for the strength evaluation, testing, and inspection of FRP strengthening systems for concrete structures consistent with the requirements of ACI CODE-562.

1.2—General

1.2.1 The requirements of this Code use strength design provisions for demands and capacities.

1.2.2 FRP strengthening is permitted for the following:
(a) All members in structures assigned to Seismic Design Category (SDC) A in accordance with ASCE/SEI 7
(b) Structural members not designated as part of the seismic-force-resisting system in all SDCs.

1.3—Purpose

1.3.1 The purpose of this Code is to provide for public health and safety by establishing minimum requirements for

COMMENTARY

CHAPTER R1—GENERAL

R1.1—Scope

R1.1.2 Throughout this Code, the term "structure" means an existing building, nonbuilding structure, member, or system.

R1.1.3 This Code focuses on concrete buildings and nonbuilding structures. For buildings or structures similar to buildings, members that are addressed by this Code include concrete portions of composite members, and precast and prestressed concrete members.

The licensed design professional can perform assessment, design, and quality assurance activities that exceed the minimum requirements of this Code. Requirements beyond the minimum stated in this Code, such as those for long-term durability, redundancy, or integrity, can be considered by the licensed design professional.

R1.1.4 Guidance for strengthening of masonry structures is provided in ACI PRC-440.7.

R1.2—General

R1.2.2 Seismic strengthening of members of the seismic-force-resisting systems in structures assigned to SDC B through F is outside the scope of this Code. Other standards, such as ACI CODE-369.1 and ASCE/SEI 41, address repair and strengthening of seismic-force-resisting systems. ACI PRC-440.2 provides guidance for the use of FRP systems for strengthening seismic-force-resisting systems.

R1.3—Purpose

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