IN-LB	Inch-Pound Units
SI	International System of Units

ACI 549.4R-20

Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix and Steel-Reinforced Grout Systems for Repair and Strengthening of Concrete Structures

Reported by ACI Committee 549

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Fabric-reinforced cementitious matrix (FRCM) and steel-reinforced grout (SRG) systems for rehabilitation and strengthening concrete structures is an alternative to traditional techniques such as fiber-reinforced polymers (FRPs), steel plate bonding, section enlargement, and external post-tensioning. An FRCM/SRG is a composite material consisting of one or more layers of inorganic matrix reinforced with dry fibers in the form of open mesh or fabric. The inorganic matrixes are typically cement-based, lime-based, or geopolymer. When adhered to concrete structural members, they form an FRCM/SRG system that acts as supplemental, externally bonded reinforcement. This guide addresses the history and use of FRCM and SRG systems rehabilitation and strengthening, their unique material properties, and recommendations on their design, construction, and inspection. Guidelines are based on experimental research, analytical work, and field applications.

Keywords: cyclic loading; deflection; earthquake-resistant; fabric-reinforced cementitious matrix fatigue systems; fiber-reinforced polymer systems; lap splices; meshes; substrate repair; rehabilitation; surface preparation.

CONTENTS

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Fabric-reinforced cementitious matrix (FRCM) and steel-reinforced grout (SRG) composites have recently emerged as a viable technology for rehabilitation and strengthening concrete structures. The strengthening and rehabilitation of existing concrete structures has traditionally been accomplished using new and conventional materials and construction techniques, including externally bonded fiber-reinforced polymer (FRP) systems, steel plates, reinforced concrete (RC) overlays, and post-tensioning.

The primary reasons for considering FRCM/SRG as a suitable strengthening material system are from the inorganic matrix that shows properties of:

a) Inherent heat resistance
b) Compatibility with the substrate (that is, allows vapor permeability and application on a wet surface)
c) Long-term durability

FRCM and SRG are systems where all constituents are developed and tested as a unique combination and should not be created by randomly selecting and mixing products available in the marketplace.

AC434 establishes guidelines for the manufacturers for necessary tests and calculations required to receive a product research report from ICC-ES. Once received, the evaluated system can be accepted by code officials under Section 104.11.1 of the International Building Code (IBC 2018). Section 104.11.1 allows research reports to be used as a source of information to show building code compliance of alternative materials.

1.2—Scope

This guide covers fabric-reinforced cementitious matrix (FRCM) and steel-reinforced grout (SRG) composite systems used to strengthen or rehabilitate existing concrete structures, providing background information and field applications; composite material properties; axial, flexural, and shear capacities of the FRCM/SRG-strengthened structures; and structural design procedures.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

A_c = net cross-sectional area of compression member, in.^{2} (mm^2)
A_e = area of effectively confined concrete, in.^{2} (mm^2)