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Exploring the Potential Use of GFRP Bars in Earthquake-Resistant Concrete Structures

Hayato AUMAN
PhD Candidate
University of Canterbury
Christchurch, New Zealand
hayato.auman@pg.canterbury.ac.nz

Alessandro PALERMO
Professor
University of Canterbury
Christchurch, New Zealand
alessandro.palermo@canterbury.ac.nz

Victoria WORNER
Structural Engineer
WSP-Opus
Christchurch, New Zealand
victoria.worner@wsp-opus.co.nz

Allan SCOTT
Associate Professor
University of Canterbury
Christchurch, New Zealand
allan.scott@canterbury.ac.nz

Contact: hayato.auman@pg.canterbury.ac.nz

1 Abstract

The corrosion of steel reinforcement is a persistent issue plaguing concrete structures today. The availability of non-corrodible fiber-reinforced polymer (FRP) reinforcement presents an opportunity to mitigate or even eliminate the issue of corrosion, however there is minimal uptake of these bars specifically in seismic applications due to their brittleness. Glass FRP (GFRP) bars, being one of the more common and economical of the FRP products, is being explored at the University of Canterbury for its potential use in earthquake-resistant design. In particular, the cyclic bond of GFRP bars with concrete is being tested using a modified RILEM beam bond test to determine whether they are able to maintain adequate bond with concrete under seismic loading. This paper will discuss the potential use of GFRP bars in seismic applications, drawing form work around the world, and introduce the salient features and behavior of cyclic bonding of GFRP bars as preliminary observations from the bond tests conducted.

Keywords: GFRP, seismic, cyclic, bond, earthquake

2 Introduction

The deterioration of steel reinforcement due to corrosion is a persistent issue plaguing concrete structures to this day. Corrosion leads to loss of cover concrete, steel reinforcement mass and reduced bond, which all adversely impact a structure's overall strength and deformation capacity. While attempts to inhibit or delay rebar corrosion such as epoxy coating or galvanizing are available, they are seldom done.

Fiber-reinforced polymer (FRP) bars are gaining more attention in in the structural discipline due to their non-corrodibility, which opens up a variety of potential applications particularly in environments where steel reinforcement would otherwise be expected to require ongoing and expensive maintenance to mitigate the effects of corrosion.

In seismically active regions, however, consideration must first be given to understanding the performance of concrete structures reinforced with FRP specifically under earthquake loading.

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