The Evolving Metropolis
2019 IABSE Congress New York City

IABSE 90 YEARS

Experimental Investigation of Adhesive Bonding for Post-installed Rebars into Concrete at High Temperatures

Thanyawat Pothisiri, Pitcha Jongvivatsakul and Vanichapoom Nantavong

Contact: thanyawat.p@chula.ac.th

Abstract

The use of post-installed rebars into existing reinforced concrete structures bonded with epoxy resins was constantly increasing due to the advantage of equivalent or even higher bearing capacities at service temperature, compared with conventional cast-in-place rebars. Previous studies have examined the effects of different parameters on the mechanical properties of bonded post-installed rebars at normal temperature. These studies showed that, for rebar diameter equal to 10 mm, the load bearing capacity increases linearly with the embedment length up to 75 mm. However, upon exposure to high temperatures, the glass transition of epoxy resins may occur and affect the mechanical behaviour of the adhesive bond. Studying the mechanical behaviour of an adhesive anchor at high temperatures is therefore necessary. An experimental investigation is conducted herein to examine the characteristics of the adhesive bonding stress between steel rebar and concrete interface at elevated temperatures using a series of pull-out tests with varying rebar diameters and embedment lengths.

Keywords: epoxy resins; post-installed rebar; reinforced concrete; high temperatures.

1 Introduction

Epoxy resins have been widely used as anchor adhesives in precast concrete construction where steel rebars are inserted into drilled holes in hardened concrete and the epoxy resin acts as the bonding agent between concrete and steel rebars. At normal temperature, epoxy resins bonded rebars generally have higher bond strength than cast-in-place mechanical anchors [1-3].

Under elevated temperature, a significant decrease of the bond strength of epoxy resins has been observed as their stiffness can be retained only up to a certain level of temperature, the so-called “glass transition temperature”, beyond which point the epoxy resins become soft and cohesive failure can be expected [4-5]. The deterioration of adhesive bonding can compromise the strength and stability of the entire structure as steel rebars can be easily pulled out from concrete. It is crucial that the bond characteristics of epoxy resins be clearly understood to prevent structural collapse upon exposure to high temperatures. In order to better predict the pull-out resistance of the epoxy adhesives, the distribution of the bonding stress within the adhesive layer in between the steel rebar and concrete is required.

To date, the experimental data on the bonding behaviour of epoxy resins at elevated temperature are scarce [4-5]. It is therefore the aim of this study to examine the characteristics of the bonding stresses developed in the epoxy resins between steel rebar and concrete at elevated temperature by using a series of pull-out tests performed on the concrete specimens embedded with steel rebars of various diameters and embedment lengths.

https://doi.org/10.2749/newyork.2019.1169
Distributed by Structurae