IABSE Symposium 2019 Guimarães
Towards a Resilient Built Environment - Risk and Asset Management
March 27-29, 2019, Guimarães, Portugal

Modelling the temperature effects at the interface between GFRP bar and concrete

Ana Veljkovic, Valter Carvelli

Politecnico di Milano, Milano, Italy

Sandor Solyom, György L. Balázs

Budapest University of Technology and Economics, Budapest, Hungary

Mohammadali Rezazadeh

University of Minho, Guimarães, Portugal

Contacting author: ana.veljkovic@polimi.it

Abstract

GFRP (Glass Fibre Reinforced Polymer) reinforcing bars find recently increasing application in RC (Reinforced Concrete) structures. In addition to the main advantages, such as non-corrosive nature and high strength-to-weight ratio, the main drawback is their endurance under high temperature. Mechanical properties of GFRP bars and their bond to concrete decrease significantly when exposed to elevated temperatures. Thus, thermal response represents one of the main safety concerns for GFRP RC structures. This study focuses on the numerical modelling of the thermo-mechanical behaviour of GFRP bar and concrete bond. The temperature dependent bond law was calibrated using the experimental pull-out tests, and subsequently it was implemented in the finite element simulations. The validation of the methodology is obtained by comparison of corresponding experimental and numerical results.

Keywords: GFRP bars; high temperature; bond performance; pull-out tests; FEM modelling.

1. Introduction

Application of Fibre Reinforced Polymer (FRP) bars as internal reinforcement for concrete structures is increasing in civil engineering due to their advantageous properties, e.g.: insensitivity to electrolytic corrosion, high strength, electromagnetic transparency. The most common type of FRP bars in construction industry is made using the long glass fibres. Glass FRP (GFRP) bars have mechanical and physical properties different from traditional steel reinforcement, hence their behaviour in severe environments, as well as the interaction with concrete, needs in-depth understanding. While some of the severe environments have less deteriorative effect on GFRP bars than on steel ones, the elevated temperature induces severe degradation in GFRP bars, due to softening of the polymer matrix at temperature levels around its glass transition (T_g) [1]. Thus, the use of GFRP bars as internal

https://doi.org/10.2749/guimaraes.2019.1065
Distributed by structurae