HIGH TEMPERATURE EFFECTS ON THE MECHANICAL RESPONSE OF GFRP REINFORCED CONCRETE MEMBERS

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ABSTRACT

Starting from the early nineties the possibility to replace steel rebars with GFRP rebars as reinforcements of concrete beams and slabs has been increasingly investigated to increase their service life [1]. Nevertheless, many aspects related to the adoption of this composite materials still need to be investigated. One of these is the resistance to high temperatures that could occur because of localized fire.

The present work describes experimental tests performed on full scale concrete members reinforced with FRP rebars subjected to localized increase of temperature (Figure 1). The specimen are reinforced with GFRP rebars made of unidirectional E-glass fibres. Sand coated GFRP rebars with a diameter of 16 mm and a spiral wound, to increase bond to concrete, were adopted for the bottom reinforcement (see Figure 1). The mechanical properties of the rebars were verified experimentally [2]. The considered concrete members correspond to a crosswise strip of full scale bridge slabs previously designed and investigated under cyclic moving loads [3].

Figure 1. Geometry and reinforcement of the specimens, (“n∅k, L=ℓ” means n bars of k mm diameter and ℓ mm length) (dimensions are in mm).
Quasi-static three-points bending tests were performed on specimens previously heated to different maximum temperatures (230 °C and 510 °C). The heating was applied on an area (48cm x 50cm) at the bottom surface close to a support (Figure 2a).

The temperature was continuously recorded in three different positions: in the center of the heated zone (thermocouple named TC3) and in the mid-span on both longitudinal edge sides (thermocouple named TC1 and TC2) located 4 cm from the bottom and 2cm inside the concrete to monitor the temperature close to the GFRP rebars (see Figure 2).

The aim of the research was to verify the residual mechanical properties of this kind of structural elements reinforced with GFRP rebars after an increase of temperature similar to localized fires.

Several tests have been already concluded but new experiments are currently under preparation for other two groups of reinforced concrete elements, in particular:

− the second group of specimens with similar geometry, but made with an overlapping of the bottom reinforcement in the heated zone;
− the third group with an overlapping made with hooks to partially transfer the anchorage zone of the bottom reinforcement to the upper side of the slab.

![Figure 2](image)

Figure 2. Position of the heating zone and thermocouples. (a) bottom view; (b) side view

REFERENCES