ABSTRACT

Characteristics of pre-cast concrete elements with GFRP reinforcement

The subject of this PhD thesis the analysis of limit bearing capacity under short-term loading and short-term deflections of bent concrete elements reinforced with composite bars (GFRP).

The main objective of the dissertation is to better recognize the behaviour of composite reinforcement during its operation. The study also tries to identify the mechanism of destruction of bent concrete elements reinforced with GFRP bars that vary in terms of the degree of reinforcement, cross-section geometry and class of concrete.

The study consists of a theoretical and technological part. The theoretical part introduces the most important issues considered in the study. The structure and types of composite reinforcement are discussed, The study describes the process of designing bending sections reinforced with FRP bars according in accordance with different standards: EN 1992-1-1: CEN/TC 250/SC 2/WG, ACI 440.1R-15, CNR-DT 203/2006, CSA S806-12, ISIS Canada 2007, JSCE 1997.

For the purposes of the study, the results of the following considerations were conducted and analysed:

- Strength tests of GFRP reinforcement
- Single-point bending of slabs with fixed geometry and fixed degree of reinforcement
- Two-point bending of slabs with different geometry and degree of reinforcement
- Two-point bending of beams with fixed geometry and different degree of reinforcement

The behaviour of reinforcing bars subjected to various stress tests was monitored. The method of operation of single-span slabs and beams freely supported under short-term load was analysed. The prepared slabs and beams varied in terms of the degree of reinforcement, cross-section and class of concrete.

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Simultaneously and independently for assumed work thesis, a number of additional studies were carried out concerning the resistance of FRP reinforcement to aggressive environment. The investigations of resistance to chemical aggression included:

- Testing of resistance of reinforced concrete samples and reinforcement to chloride corrosion
- Testing of resistance of reinforcement to sulphate corrosion
- Testing of reinforcing bars for hydrochloric acid resistance

In the opinion of the author, the experimental research and theoretical analyses carried out allowed to achieve the planned goals and prove the thesis.

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