

## Contributions in the Field of Composite Materials Uses for Strengthening of Industrial Buildings

Codrin Valentin Saftiuc<sup>1</sup>

*S.C.ValCon ,Bacau, Romania*

- ▶ Date of submission: (31.10.2005)
- ▶ PhD. Supervisor: NICOLAE TARANU, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania
- ▶ President: THEODOR MATEESCU, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania
- ▶ Scientific Board:
  - ONEȚ TRAIAN, Faculty of Civil Engineering, Technical University of Cluj-Napoca, Romania
  - VIRGIL BREABAN, Faculty of Civil Engineering, "OVIDIUS" University of Constanta, Romania
  - MIHAI BUDESCU, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania

### Summary

The use of composites materials in strengthening of industrial buildings is part of a primary research area, of timely interest for meeting the safety requirements in service of engineering structures and elements. The objective of this work is to establish efficient structural rehabilitation solutions based on the use of modern state-of-the-art composite materials in case of engineering structures.

A brief review is performed first, focusing on the evolution of composite materials uses in structural rehabilitation purposes. The author makes a general presentation upon the composite materials, the classification criteria for easing their use in engineering applications, the role of each constituent in defining the final mechanical properties of the fiber reinforced composite systems and description of the technological aspects related to forming of composite materials and products with polymeric matrix that are fit for structural rehabilitation of traditional materials made members. There are also analyzed specific problems related to the



*Codrin Valentin Saftiuc*

use of polymeric composites in civil engineering and other fields where they are recommended for application, in comparison to the service requirements.

Another step in the present work is dealing with the selection of analytical material models used in micromechanics aiming a proper evaluation of material properties in case of long fibers reinforced composites. A critical evaluation of the relations existing in the literature has been performed in order to allow a proper evaluation of the elastic constants, namely of the longitudinal elasticity modulus, the transversal elasticity modulus, the shear elasticity modulus, Poisson's coefficients, properties that are necessary for establishing of composite and hybrid systems. There have been pointed out and analyzed the possible failure modes likely to occur in case of reinforced concrete beams strengthened with FRP composite materials, with composite bands attached on the tensile zones. There have been selected the analytical models suitable for evaluation of stresses in the marginal areas, considering the strengthening solution parameters.

A complex experimental program has been carried out in order to evaluate the behaviour of RC beams that were strengthened using FRP materials based solutions. It was described the technological application procedure specific to the FRP composite material sheets as well as their "wetting" with thermoset resins, a solution that is mainly used in case of shear bearing capacity enhancement. Working stages of the strengthened beams were established and failure modes have been identified. A Finite Element Analysis has been performed both in case of the unstrengthened and the strengthened beams. The obtained results confirmed the quality of the experimental program and the possibility of using the computational instruments in the study of FRP composite strengthened beams.

*Keywords:* fiber reinforced polymeric composites, enhancement of bending bearing capacity; enhancement of shear bearing capacity; carbon fiber reinforced polymeric bands; finite element analysis.

