Ductility of Beams Strengthened with Externally Bonded Composites

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Summary

This paper presents results of a theoretical study to evaluate the ductility of reinforced concrete beams strengthened in flexure with externally bonded carbon fibre reinforced polymers (CFRPs).

Research into the design of flexural strengthening of concrete structures with carbon fibre composites (CFC) is well known, but understanding of the beams' ductility behaviour has yet to reach the same level.

The main objective of this investigation is to discover a new and consistent approach towards the ductility of reinforced concrete beams flexurally strengthened by carbon fibre composites.

The need to clarify the behaviour of CRFP strengthened beams is defined as a new energetic index based on the strain energy of the deformed beam. The ductility is evaluated by using the energy indexes obtained from the curves for load *vs.* deflection, and bending moment *vs*. curvature.

Keywords: Ductility; Energy index; Structural concrete.

1. Introduction

Today the building industry, universities and researchers are being challenged to make new developments by means of improved technologies and methodologies that make maximum use of the available resources and minimize the cost of projects.

Carbon fibre reinforced strengthening of concrete has been widely used during the last 15 years in several countries, and can be considered a well established construction procedure. During the last few years some important contributions by researchers have introduced new design models into this reinforcing system [1], [2] and [3].

This is an extremely flexible technique of strengthening structures, enabling adaptation of the material to different needs in accordance with the given architectural, structural and economic requirements. The technique of strengthening reinforced concrete elements with external bonded composite material is both economic and effective.

The composite materials technology offers a wide range of different products, which vary in type, diameter and fibre orientation, and in their epoxy properties. The arrangement of the strengthening is another fundamental parameter that influences beam resistance.

Wide studies on the ductility behaviour of concrete beams reinforced with flexural strengthening have been recently developed, however they remain inconclusive.

The main objective of this study is to examine the parameters that influence the flexural ductility of reinforced concrete beams strengthened with externally bonded CFRP.

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