Design codes and modeling for FRP recycled aggregates concrete

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ABSTRACT: This research investigates the performance of recycled aggregates concrete confined using either commercially Unidirectional Carbone Fiber Reinforced Epoxy Polymer or Unidirectional Flax Fibers Reinforced Bio-resourced Polymer. The concretes under study are C35/45 resistance class and are elaborated by incorporating recycled aggregates provided from demolition wastes.

The main objective is to discuss than to propose design codes for recycled aggregates concretes and to evaluate the effectiveness of confining them using bio-resourced composite by comparison to traditional ones.

To hit this target, the developed approaches are both experimental and analytical.

The first part is experimental and aimed to characterize the mechanical behavior of the materials: the resins, the unidirectional composites used in the confining process the unconfined concretes (effect of incorporating recycled aggregates on the overall mechanical characteristics) and the confined ones.

The second part is devoted to the establishment of design codes dedicated to the prediction of the mechanical properties of recycled aggregates concretes by the mean of the compressive mean strength.

The third part of this work is dedicated to analytical modeling of mechanical behavior of confined concrete with composite under compression in one hand.

This work outlines that EC2 should be revised and propose other relationships between the mechanical characteristics and the mean compressive strength. The incorporation of recycled aggregates from demolition wastes at ratios higher than 33% leads to a decrease of the mechanical properties of the concretes and requires taking it into account in the design codes. Confining recycled aggregate concrete by bio-resourced composite seems to be efficiency by comparison to carbon epoxy ones encouraging its application for concrete structures in civil engineering.

Analytical models from the literature are discussed. A modified one based on the established design codes is proposed and applied for the prediction of the compressive behavior of confined recycled aggregates concretes.