

## Reliability analysis of eco-concrete

### Summary

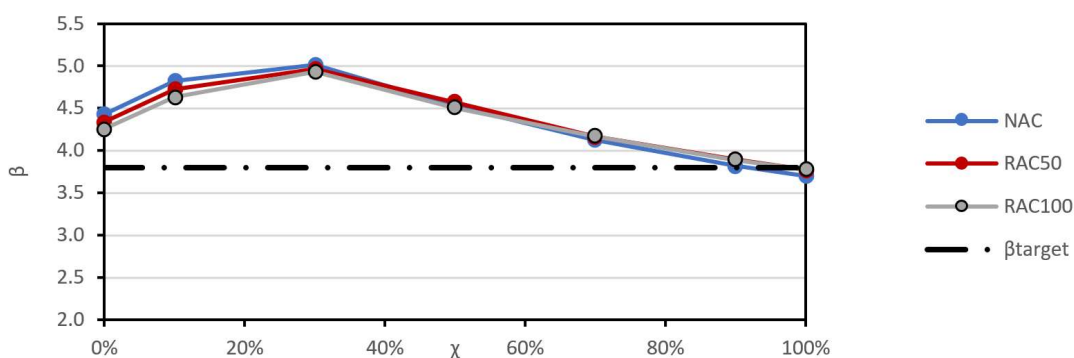
This thesis evaluates the effect of the incorporation of recycled aggregates on the reliability of reinforced concrete structures. Past research has shown that reinforced concrete prototypes made with recycled aggregates concrete are a viable solution to the construction sector that would minimize its environmental impacts. However, scepticism concerning recycled aggregates concrete has hindered its applicability, mostly because of the idea that since recycled aggregates are more heterogeneous than natural aggregates, recycled aggregates concrete will also be more variable than natural aggregates concrete - from this follows that the reliability and structural safety of recycled aggregate concrete may not be adequate.

The main goal of the thesis is to propose partial safety factors that ensure that when coarse natural aggregates are replaced with aggregates sourced from concrete waste, the structural safety and serviceability reliability of concrete structures comply with current standards, even for full coarse aggregate replacements. Ultimate limit-states, durability and serviceability limit-states will be investigated by means of reliability analyses, implying that probabilistic and statistical data concerning the mechanical and durability properties of recycled aggregates concrete are within the scope of the thesis.

The thesis has three research vectors: 1) the variability of the mechanical and durability properties of recycled aggregates concrete - investigated through laboratory experiments and benchmarking with reference data used in the calibration of current reinforced concrete codes; 2) model uncertainties due to constitutive modelling and model uncertainties caused by the analytic models that predict structural performance - evaluated by meta-analyses on credible studies; 3) reliability analyses and partial safety factor calibration - using the data obtained from 1) and 2) and covering a wide range of common design.

### Keywords

Coarse recycled concrete aggregate, structural concrete, resistance models, model uncertainty, reliability analysis.



Reliability index of the partial factors calibrated for recycled aggregate concrete shear design.



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