

## Mechanical Characterization and Durability of Eco-Efficient Ultra High Performance Concrete

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**Abstract :** Ultra high performance concrete (UHPC) is an innovative material which tends to exhibit superior properties such as incredible mechanical and durability performance and non-brittleness behavior. Over the last twenty years, phenomenal advances have taken place in the research and application of UHPC. Recently, the approach is to improve UHPC sustainability by reducing its embodied energy. First of all, this goal can be achieved by reducing Portland cement dosage. In this work, an experimental investigation was carried out to characterize the mechanical behavior and durability of UHPCs prepared by reducing the cement amount by 30% in order to verify the impact of lower cement content and higher water-to-cement ratio on both mechanical performance and durability, if any. Eight different UHPC mixtures were compared, with two different cement dosages (either 1000 or 700 kg) and four different brass-coated steel fibres dosages (0 - 50 - 100 - 150 kg), in terms of 28-day compressive and flexural strengths. Then, the mixtures prepared with the lower cement content were further investigated in terms of abrasion resistance, water absorption, freezing and thawing cycles, and resistance to sulphate attack. Results obtained showed the feasibility of reducing cement dosage without compromising mechanical performance and UHPC's extraordinary durability.

**Keywords :** abrasion resistance, durability, eco-efficiency, freeze-thawing cycles, steel fibres, sulphate exposure, sustainability, UHPC

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