

# Mechanical performance and cost correlation of Ultra High Performance Fiber Reinforced Concrete (UHPFRC)

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## Abstract

Ultra-High Performance Fiber Reinforced Concrete (UHPFRC) is a material which is characterized by enhanced mechanical properties. The properties of the material are highly depended on the composition of the mix and the curing regimes. However, the final mix design should combine both high mechanical properties and cost effectiveness. In the present study an extensive experimental program takes place and the mechanical properties of UHPFRC, for different percentages of steel fibers as well as different curing regimes, are investigated. Finally, a cost analysis is performed and a discussion about the relation between the cost and the mechanical properties is made.

**Keywords:** Ultra High performance Fiber Reinforced Concrete, UHPFRC, Direct Tensile Tests, Cost Analysis, Heat Curing

## 1 Introduction

Ultra High Performance Fiber Reinforced Concrete (UHPFRC) is a material which is characterized by enhanced properties under tension and compression and high energy absorption in the post-cracking region. The behaviour of the material is highly depended on the amount of the fibers in the matrix and on the properties of the cementitious matrix. However, to date there are not any extensive experimental published studies on the evaluation of the effectiveness of heat curing and steel fibres percentage through direct tensile tests alongside with a cost analysis. In the present study the effect of different volumes of steel fibers on the tensile strength has been investigated through direct tensile tests, while the compressive behaviour has also been evaluated through standard compressive tests of cubes. Finally, a cost analysis of the material is presented.

One of the crucial parameters for the performance of UHPFRC is the curing regimes and the curing time. In order to accelerate strength development, heat curing is normally applied. In the current study, the effect of curing time on the compressive strength and the tensile stress-strain response of UHPFRC has been investigated.

Nicolaides et al.<sup>1</sup> in their study presented an experimental work which was focused on the development of Ultra High Performance Cementitious Composites using constituent material available in Cyprus. Hence, different parameters that can affect the strength and the workability of UHPFRC were investigated and the optimum mix was proposed. Kang et al.<sup>2</sup> and Yoo et al.<sup>3</sup> examined the effect of steel fibers amount on the flexural strength of UHPFRC and it was found that the flexural strength was increased with the fiber volume