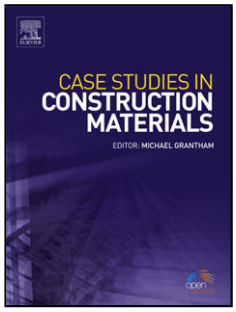


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# Ultra-High Performance Concrete: From Fundamental to Applications

**N. M. Azmee [1]** **N. Shafiq [2]**

*Universiti Teknologi PETRONAS, Department of Civil and Environmental Engineering, Perak, Malaysia*

*E-mail: [1] norzaireen@gmail.com: [2] nasirshafiq@utp.edu.my*

## Abstract

*Over the last twenty years, remarkable advances have taken place in the research and application of ultra-high performance concrete (UHPC), which exhibits excellent rheological behaviors that include workability, self-placing and self-densifying properties, improved in mechanical and durability performance with very high compressive strength, and non-brittleness behavior. It is the 'future' material with the potential to be a viable solution for improving the sustainability of buildings and other infrastructure components. This paper will give an overview of UHPC focusing on its fundamental introduction, design, applications and challenges. After several decades of development, a wide range of commercial UHPC formulations have been developed worldwide to cover an increasing number of applications and the rising demand of quality construction materials. UHPC has several advantages over conventional concrete but the use of it is limited due to the high cost and limited design codes. This paper also aims to help designers, engineers, architects, and infrastructure owners to expand the awareness of UHPC for better acceptance.*

***Keywords**: Ultra-high performance concrete, Fundamental, Application, Challenge*

## 1. Introduction

UHPC is an advanced cementitious material with high strength and excellent durability. It offers the potential to become a practical solution to improve the sustainability of buildings and other infrastructure components [1]. For the past two decades, UHPC is gaining increased interest in many countries with the usage ranging from building components, bridges, architectural features, repair and rehabilitation, vertical components such as windmills towers and utilities towers to oil and gas industry applications, off-shore structures, hydraulic structures and overlay materials [2]. Among all these applications, road and bridge constructions are the most popular for UHPC application [3]. The usage of UHPC for bridges and bridge components can been seen in various countries including Australia, Austria, Canada, China, Czech Republic, France, Germany, Italy, Japan, Malaysia, Netherlands, New Zealand, Slovenia, South Korea, Switzerland and the United States (US) [2]. Most projects in the mentioned countries have been motivated by government agencies as initial demonstration projects intended to encourage further implementation. However, for most of the countries, these demonstration projects did not create the anticipated acceptance with slow follow-up implementation [4]. It appears that the lack of design codes, limited knowledge on both the material and production technology, and high costs limit the implementation of this outstanding material beyond the initial