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Effect of Surface Preparation and Curing Method on Bond Strength between UHPC and Normal Strength Concrete

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Abstract

This study investigates the bond strength of UHPC-to-Normal Strength Concrete (NSC) interface. Bond efficiency between new and old layer is key factors for the performance of composite structures. In this study, old layer is made using UHPC to develop permanent formworks for concrete structures. To investigate the bond strength, cube shaped UHPC-NSC composite specimens are prepared and tested according to the direct-shear and splitting tensile test methods. The test variables are surface conditions and curing methods. The surface conditions include surface roughness and moisture content of UHPC, the curing methods include the curing period, temperature and relative humidity of the specimens. The test results show that the rough and grooved surfaces of UHPC increase the bond strength of the specimens in comparison to the smooth surface of UHPC. The bond strength is also influenced by the curing method of UHPC.

Keywords: Ultra High Performance Concrete (UHPC), Normal Strength Concrete (NSC), interface, bond strength, permanent formwork, composite structure.

1. Introduction

Over the past few decades, the advantages of the concrete admixtures such as silica-fume and super-plasticizer were contributed to the development of High Strength Concrete (HSC). Optimizations of the granular packing density [1] led to Ultra High Strength Concrete (UHSC). Finally, Ultra High Performance Concrete (UHPC), more ductile than UHSC was developed by incorporating small-sized steel fibers [2]. Although the mechanical and durability performance are excellent, UHPC should be used rationally and efficiently because this material is fundamentally expensive.

A reasonable way to use UHPC for the concrete structure is to develop UHPC-Normal Strength Concrete (NSC) composite structures. In particular, there are some advantages using precast UHPC as permanent formworks for concrete structures. First, it is possible to improve structural performance and durability by protecting the surfaces of concrete structures. Thanks to the enhancement of crack-resistance and water-tightness, sustainability of the structures can be improved. In addition to the performance enhancement, it is possible to

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