Retrofitting and Strengthening Interventions of RC Members Using Ultra High Performance Concrete (UHPC)

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Abstract

Two test series with various UHPC strengthening interventions were conducted in this study to investigate the behaviour of composite reinforced concrete (RC) slabs strengthened with UHPC. The first, RE series is a retrofit interventions, tested UHPC as patch material for repairing deteriorated concrete structures. As for the second, OV series is a UHPC overlay interventions, was used to strengthen soffit of RC slab members. The results showed that, in RE series, UHPC safeguard against diagonal cracking compare to conventional RC slab. The UHPC exhibited excellent energy absorption with extensive deflection hardening and ductility during the post cracking range. In OV series, all slabs showed formation of diagonal shear cracks and sign of debonding modes. The UHPC overlay delayed the development of shear cracking. The ultimate load carrying capacity and tendency of flexural failure increase with the overlay thickness.

Keywords: UHPC; retrofit; strengthening; slabs; high-rise buildings.

1 Introduction

Ultra-high performance concrete (UHPC) is a relatively new advancement in concrete technology. It exhibits superior advanced properties such as ultra-high strength with compressive strength over 150 MPa, high ductility and long term stability compared to normal strength concrete.

Due to its superior properties, recently UHPC is being explored to be a potentially new material for used in rehabilitation and strengthening of existing reinforced concrete (RC) members. Few research studies were conducted on using UHPC as top overlay to strengthen the existing RC members [1 – 4]. The preliminary results obtained from these studies showed very promising.

This paper aims to extend the investigation of using UHPC to strengthen conventional concrete slabs at the tension zone. Two test series with distinct UHPC strengthening interventions were conducted in this study. The experimental programme and test results obtained would be described in the subsequent sections.

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