



Reactive Powder Concrete with Steel, Glass and Polypropylene Fibers as a Repair Material

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Abstract

Repairing of reinforced concrete structures is currently a major challenge in the construction industry and is being put back into operation with a slight loss in load carrying capacity. Damage occurs due to many factors that reduce the strength of concrete structures and their durability. The aim of this paper is study the compatibility between three types of reactive powder concrete with (steel fibre, glass fibre and polypropylene fibre) as a repair materials and normal strength concrete as a substrate concrete. Compatibility was investigated in three steps. First: individual properties for substrate concrete were studied, these are (slump test, compressive strength, splitting strength, and flexural strength) also, for repair material these are (compressive strength and flexural strength) were determined by using standard ASTM test methods. Second: bond strength of composite cylinder for substrate concrete with different repair materials were evaluated by using slant shear test. Third: compatibility was investigated by using composite prisms of substrate concrete with different repair materials under two-point loading (flexural strength test). From the experimental results concluded, bond strength between reactive powder concrete with glass fibre as a repair material and normal strength concrete as a substrate layer is higher (17.38 Mpa) compared with RPC with steel fibre (13.13 Mpa) and polypropylene fibre (14.31 MPa). Also, it is more compatible due to flexural strength for composite prisms (having higher flexural strength (8.13 MPa). Compared with steel fibre (7.44 MPa) and polypropylene fibre (6.47 MPa). These results due to RPC with glass fibre have good workability with suitable flowability and glass fibre have higher tensile strength compare with other fibre.

Keywords: RPC; Bond Strength; Compatibility; Steel Fibers; Glass Fibers; Polypropylene Fibers; Slant Shear Test; Composite Prisms.

1. Introduction

Deterioration can define the process of degeneration or degradation of quality to an inferior state of a material. There are many causes of deterioration, which are physical, chemical, mechanical and reinforcement corrosion [1]. Any concrete structure when damaged must be repair to return its function. It is important to determine causes and the degree of the problem, so that repair adopted must be effective [2]. Repairing concrete can define replacing process, process or correcting deteriorated, damaged or faulty material, components or element of structure. The composite system consists of three components: substrate concrete (previous concrete), repair material (overlay) and bond region. Bond region means the interface and nearness of bond surface. The bond region must be able of resisting the stresses imposed on the composite system [3]. According to ACI 546-04, repair materials can classified into two basic categories, these are cementitious materials and polymer materials [4]. A new development of cement-based products is “reactive powder concrete (RPC)” because of RPC has extremely high strength, excellent toughness, excellent bond strength and higher durability, thus RPC as a repair mate has accomplished a lot of attention [5, 6].

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