

Determination of rectangular stress block parameters for high performance concrete

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Abstract

Despite so much research on high performance concrete, the properties of this concrete are not known as well as those of ordinary concrete. There have been a lot of equations, rules and suggestions in the codes which are used in the design of reinforced concrete and prestressed concrete structures. They are obtained from experimental studies made on concrete that have compressive strength of less than about 40 MPa. It is not exactly known whether they could be used in the design of structures constructed by using high performance concrete. Therefore in this study, stress-strain and equivalent block parameters were obtained from experimental stress-strain diagrams for calculation of high performance reinforced concrete beams in flexure. The conclusions obtained from this study showed that determined rectangular stress block parameters can be used in the design of high performance reinforced concrete members in flexure.

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1. Introduction

The strength and durability of the concrete used in reinforced concrete structures have been increasingly related to technological developments. Today, the material known as high performance concrete has been continuing its development. Definition of the high performance concrete has been changing with time, geographical area and production technology. For instance, in the 1950s, concrete which had at least 35 MPa compressive strength was called high performance concrete.

In the 1960s concrete which had a compressive strength between 41 and 52 MPa was produced commercially in the US. In the early 1970s concrete which had 62 MPa compressive strength was produced [1–4]. Recently, concrete which has 80–100 MPa compressive strength has been used in reinforced concrete and prestressed concrete structures. High performance concrete

about 250 MPa compressive strength has been able to produced by using high strength aggregate.

A lot of investigations are verified to define the stress-strain relationship and equivalent stress block parameters in the design of high performance concrete members. Some of these investigations are published by Ibrahim and MacGregor [5], Swartz et al. [6], Kaar et al. [7], Schade et al. [8], Attard et al. [9], Azizinamini et al. [10], and Wee et al. [11].

Although high performance concrete is commonly used, its properties are not known as much as the properties of ordinary concrete in the design of reinforced concrete sections. Therefore, in this study the parameters used to design reinforced concrete section in flexure, have been stated using experimental data.

High performance concrete is produced using high strength aggregate and cement, water, mineral and chemical admixtures. Generally, superplasticizers or high-range water-reducer admixtures, etc., are used as chemical admixtures; silica fume, fly ash, ground slag, slag cement etc., are used as mineral admixtures.

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