AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Structural Engineering Department

STRESS – STRAIN BEHAVIOR OF ULTRA HIGH STRENGTH CONCRETE UNDER COMPRESSIVE AND TENSILE STRAINS

A Thesis submitted in partial fulfilment of the requirements for the degree of

Master of Science in Civil Engineering

(Structural Engineering)

by

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Bachelor of Science in Civil Engineering

(Structural Engineering)

Faculty of Engineering, Ain Shams University, year 2012

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Date: 15 August 2016

Statement

This thesis is submitted as a partial fulfilment of Master of Science in Civil Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Abstract

Due to technological development, advance in tall buildings' construction and more frequent use of prestressed concrete in buildings and bridges, the demand for the use of High and Ultra High Strength Concrete (HSC and UHSC respectively) used in reinforced concrete structures has increased rapidly. For example, in building design using higher concrete strength lead to significant reduction in the dimensions of concrete members, which helped increasing spans and the construction of taller and lighter buildings. Also, in design of bridges, the use of UHSC is very useful in decreasing the number of girders required as well as reducing their depth with increased spans.

Design of reinforced concrete elements mainly depends on the characterestics of the equivlant compressive stress block subjected to combined flexural and compressive stresses. This research is based on determining the design parameters of the equivalent compressive stress block for ultra high strength concrete having strength higher than 60MPa, as such parameters are not well defined compared to those used for Normal Strength Concrete (NSC).

Seven C-bracket concrete specimens were tested under combined flexure and compression stresses to determine the realistic stress distribution at the

compression zone of ultra high strength concrete members. The main variable was the concrete compressive strength for each specimen. Equivalent rectangular stress block parameters as well as the ultimate compressive strain for those members were obtained from experimental investigations & compared to those defined in major international design codes.

The values of the equivalent rectangular stress block parameters changes with the increase in the concrete compressive strength. The stress-strain relationship for HSC and UHSC obtained from tested specimens indicated that the ascending branch is more linear when compared to NSC. Also, the failure of HSC and UHSC became more brittle than NSC in a more explosive manner.

Keywords: Ultra high strength concrete, Rectangular stress block, Compression, Flexure, Ultimate compressive strain.

Dedication

To my family

(My Father, My Mother, My Brother and My Sister)

I dedicate this thesis to them for their unlimited support and encouragement over the years. I could not be able to complete this work without their support.

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