Cairo University

FLEXURAL BEHAVIOR OF TWO-SPAN REINFORCED CONCRETE BEAMS SUBJECTED TO SELECTED FACE CORROSION AFTER INITIALLY LOADED _ EXPERIMENTAL AND FINITE ELEMENT

By

Hassan Ahmed Hassan Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Structural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Title of Thesis:

Flexural Behavior of Two-span Reinforced Concrete Beams Subjected to Selected Face Corrosion After Initially Loaded _ Experimental and Finite Element

Key Words:
ABAQUS; Chlorides; Concrete; Corrosion; Finite Element Analysis; Reinforcement.

Summary:

Corrosion of reinforcement bars in two-span concrete beams was investigated using both experimental and finite element analysis. The experimental program comprised a total of twenty-two full scale reinforced concrete beams. The beams were divided into three equal groups of seven beams each, in addition to a non-corroded control beam. The three groups were initially loaded, before subjecting to corrosion, with a concentrated load at the middle of each span ranging from zero loading for group No. 1, to 40% and 60% of the ultimate load for groups No.2 and No. 3 respectively. The impressed current technique was used for accelerating the corrosion with a current intensity not exceeding 200 µA/cm2. The tension side at the middle of the beam was selected for corrosion to avoid uniform corrosion of the rebars along the beam. A finite element model was developed using the finite element code ABAQUS 6.14. A new model was proposed to model the behavior of concrete in compression and tension through the plastic portion of the stress-strain curve. The finite element model showed a good agreement with the results of the experimental beams.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledge all sources used and have cited them in the references section.

Name: Hassan Ahmed Hassan Ahmed Date: 18/12/2018

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Hassan Ahmed Hassan Ahmed
December 2018

Dedication

I dedicate the success in this work to my beloved parents for always supporting me and driving force in my life and enhancing my career. Throughout my life, they have actively supported me in my studies and work. They pushed me towards the right track for success. Many thanks to my father who died while I am working on this research. Without his help and advices, nothing of my experimental work would have been established or finished.

Hassan Ahmed Hassan Ahmed
December 2018

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