BEHAVIOR OF POST-TENSIONED SLABS WITH OPENINGS

By

Ahmed Fakhr Mohamed Mohamed Ghozy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
STRUCTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of:
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Title of Thesis:

Behavior of post-tensioned slabs with openings

Key Words:
post-tensioned; slabs; openings; RAM CONCEPT V6.0; ANSYS V19.0;

Summary:

This research is to study the behavior of post-tensioned slabs after applying openings at different locations of slab, in mid-span, at end of span and corner of slab. At these locations; different opening dimensions will be applied with different aspect ratios. All of the previously mentioned parameters will be applied on different slab types; simple slab, continuous slab with equal spans and continuous slab with unequal spans. ANSYS V19.0 FE model was verified against an experimental post-tensioned slab, then against FE RAM CONCEPT V6.0 model. The verified RAM CONCEPT V6.0 model was used afterwards in the parametric study and the results were based on these models are elaborated in this research. Based on the results, these parameters have significant effect on adding PT strands into a post-tensioned slab in order for stresses to stay within the allowable limit of the ACI-318 code.

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 acknowledged all sources used and have cited them in the references section.

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Dedication

Dedicated for everyone that supported me thoroughly.

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I want to express my deep gratitude for my advisor **Prof. Dr. Hany Abdalla** for advising me into doing a research about important topic concerning prestressing. Adding to that, his guidance, continuous support and follow ups to finish within given time.

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Needless to say, my parents and brothers are my strongest emotional support through the process of acquiring my degree and in all difficult phases of life.

Table of Contents

List of Tables

List of Figures

Abstract

A finite element analysis was performed to study the effect of openings on the behavior of post-tensioned slabs. The parameters considered include opening dimensions, aspect ratios and location. Three models were analyzed; simply-supported slab, continuous slab with equal spans, and continuous slab with unequal spans. The increase in stress due to the different opening application was compared to the allowable limits given by the ACI-318 code. In case theses stresses exceed such limits, prestressting strands were applied at the vicinity of the openings to keep the slab stresses within the allowable limits. Based on the results of this study, it is concluded that the governing factors of adding strands are opening location, opening size and type of slab. Furthermore, number of strands added after openings are applied depends also on the number of strands cut due to the opening.