EFFECT OF SHEAR CONNECTORS AND INTERFACE ROUGHNESS ON THE BEHAVIOR OF TWO WAY COMPOSITE PRE-SLABS

By

MAHMOUD HISHAM HASSAN EL-MELIGY

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

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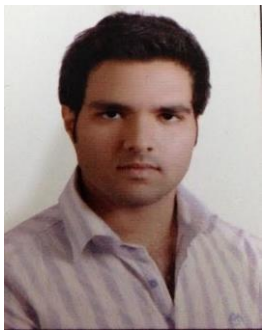

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Title of Thesis:

Effect of shear connectors and interface roughness on the behavior of two way composite pre-slabs

Key Words:

Concrete; Pre-slabs; Interface Roughness; Shear Connectors; Shear Transfer

Summary:

Pre-slabs are one of the most commonly used concrete elements especially in construction of buildings, skyscraper and bridges, the pre-cast concrete layer is used as form or shuttering for the cast in place concrete layer. In addition, this cast-in-place layer is widely used for strengthening an existing slab and repair applications, one of the main problems when using pre-slabs is the shear transfer between the two layers.

In this research, the behavior of two-way composite pre-slabs was studied and an experimental program was carried out to test nine simply supported two way slabs, one of them was a monolithic slab that was used as a reference and the other remaining eight slabs were composite pre-slabs composed of two concrete layers. The composite pre-slabs were divided into three main groups to investigate the effect of shear connectors length and ratio, and interface roughness on the behavior of two-way composite pre-slabs. Also a theoretical analysis was carried out to confirm the experimental program using ANSYS Simulation software.

It was concluded from these experiments that increasing of shear connectors length or ratio led to increase horizontal shear capacity. Also, using epoxy binding materials and interface roughness at the contact surface between the two concrete layers had a great effect on increasing the horizontal shear capacity of composite pre-slabs.

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Dedication

This thesis is dedicated to my parents who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve. Also to my brother who I am truly grateful for having him in my life and to my wife who have always been a constant source of support and encouragement during the challenges of my life and to my beloved son Marwan.

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Abstract

Composite reinforced concrete elements are one of the most used elements in construction for many buildings and structures. Pre-slabs are a type of composite concrete elements that are commonly used in constructing bridges, skyscrapers and buildings.

The pre-slabs are formed of a pre-cast concrete layer that works as a form to shutter the other cast-in-place concrete layer, this type of pre-slabs are very common in applications like strengthen and repairing exciting pre-slabs. Main factors when designing these types of pre-slabs is the shear transfer along the interface, which has a great effect achieving the composite action between concrete layers and making the two layers, work together as one unit which leads to an increase in shear strength and load capacity.

The behavior of two-way composite pre-slabs were investigated in this study, also an experimental test program was done on nine specimens which were simply supported pre-slabs, a monolithic slab was used as reference which was casted as one layer and the other remaining eight slabs were composite pre-slabs composed of two layers with various shear connections between the two layers had been used to test the effectiveness of them.

To accurately investigate the effect of shear dowels length, ratio and also study the effect of changing the interface roughness condition, These eight tested specimens were divided into three different groups which will be discussed later in this study. Also a theoretical analysis was done using (ANSYS) software to confirm the experimental test program and make comparison between experimental and theoretical results.

It was concluded from this research that increasing of shear connectors ratio and length led to a significant improvement in the horizontal shear transfer capacity for the tested pre-slabs and led to an increase in shear strength and load capacity for the tested specimens. Also the interface roughness condition has a great effect on the horizontal shear transfer capacity.