

**NONLINEAR ANALYSIS OF SKEW REINFORCED AND  
PRESTRESSED CONCRETE COMPOSITE DECKS**

By

**HANY AHMED AHMED DAHISH**

A Thesis Submitted to the  
Faculty of Engineering, 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

2009

**NONLINEAR ANALYSIS OF SKEW REINFORCED AND  
PRESTRESSED CONCRETE COMPOSITE DECKS**

By

**HANY AHMED AHMED DAHISH**

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

**DOCTOR OF PHILOSOPHY**

In

**STRUCTURAL ENGINEERING**

**Under the Supervision of**

**Prof. Dr. Ahmed Mahmoud Ragab**

Prof. of Structural Engineering.  
Cairo University

**Dr. Ahmed Found El Ragi**

Lecturer in Structural Engineering  
Fayoum University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

GIZA, EGYPT

2009

**NONLINEAR ANALYSIS OF SKEW REINFORCED AND  
PRESTRESSED CONCRETE COMPOSITE DECKS**

By

**HANY AHMED AHMED DAHISH**

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

**DOCTOR OF PHILOSOPHY**

In

**STRUCTURAL ENGINEERING**

**Approved by the Examining Committee**

Prof. Dr. AHMED MAHMOUD RAGAB, Thesis Main Advisor

Prof. Dr. MOHAMED TALAAT MOSTAFA, Member

Prof. Dr. MONEER MOHAMED KAMAAL, Member

FACULTY OF ENGINEERING, CAIRO UNIVERSITY  
GIZA, EGYPT

2009

## ملخص رسالة الدكتوراه

عنوان الرسالة:

### **Nonlinear Analysis of Skew Reinforced and Prestressed Concrete Composite Decks**

الدراسة الملاحظة للبلاطات المركبة ذات الوحدات الخرسانية سابقة الصب والإجهاد ذات زاوية إنحراف

The benefits of using composite concrete slabs which consists of precast concrete unit and cast in situ layer in building construction and highway bridges have been recognized by many countries since the past fifty years. Researches on the effect of skew on slab construction have been limited. The behavior of the concrete slabs under repeated loading has been examined since the 19<sup>th</sup> century, but extended studies are more and more needed especially for this type of structures and taking skew effect into consideration. There is no information available that tells a designer exactly how to take into account the effects of skew when designing a composite slab. Thus, research on skew composite slab with the goal of developing design criteria that include the effects of skew is desirable. With this goal, experimental and theoretical studies were done in which the behavior of simply supported, skew composite slab is determined and to study the effect of skew angle, percentage of concrete shear keys and prestressing on the behavior of skew folded composite slab under cyclic loading. A skew folded corrugated panel was proposed and prestressed to allow its use as integral part of bridge composite deck. The proposed panels are of high strength concrete with small thickness and main deck reinforcement, where the cast in-situ is of lower concrete strength. The experimental program consists of six numbers of 3100 mm long (3 reinforced and 3 post-tensioned) corrugated slabs with overall height of 250 mm and thickness of 50 mm for both the inclined and top parts of the specimens, and thickness of 50 mm for the topping layer.