MODELING OF SHEAR BOND IN COMPOSITE SLAB USING INTERFACE ELEMENT

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In loving appreciation of my dear family and friends

May God shower his blessing on you.

Love you forever...

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ABSTRACT

Composite slabs utilizing cold-formed steel decks are widely used in construction industries. The behavior of the slabs is governed by shear bond between concrete and the steel deck. Modeling the shear bond correctly is critical in a numerical study of composite slab. This paper pertains with finite element study to model the shear bond using an interface element available in LUSAS. The interface element normally used for modeling delamination of plane and crack propagation of a composite material was utilized to study the shear bond behavior in composite slab. Experimental data from published literatures was used to verify the finite element analysis results. The results show that with proper assignment of material parameters to the interface elements, the shear bond in the composite slab can be modeled correctly.

ABSTRAK

Penggunaan dek keluli dalam papak rencam amat luas digunakan dalam industri pembinaan. Kelakuan papak rencam bergantung kepada kekuatan interaksi di antara konkrit dan dek keluli. Permodelan interaksi antara konkrit dengan dek keluli adalah kritikal dalam kajian ‘numerical’ papak rencam. Kertas kerja ini membincangkan permodelan interaksi di antara konkrit dan dek keluli dengan menggunakan “interface element” dalam LUSAS dan analisis papak rencam dengan kaedah unsur terhingga. Dalam projek ini, “interface element” yang biasanya digunakan untuk pemodelan dua lapisan nipis dan kewujudan retak dalam bahan rencam telah digunakan untuk memodelkan interaksi konkrit dan dek keluli dalam papak rencam. Data ujikaji daripada laporan pengkaji yang lepas telah digunakan untuk mengesahkan hasil analisis dengan kaedah unsur terhingga. Hasil kajian ini menunjukkan bahawa dengan menggunakan nilai cirri yang sesuai untuk “interface element”, kekuatan interaksi papak rencam boleh dimodelkan dengan tepat.

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d	-	midspan displacement
d_s	-	steel deck depth
L	-	total slab span
L_s	-	shear span
M	-	ultimate moment
P	-	point load
t_c	-	concrete thickness
w	-	uniform load.

CHAPTER 1

INTRODUCTION

1.1 General

Composite slab is a slab system comprising of normal weight or lightweight structural concrete placed permanently over cold-formed steel deck in which the steel deck performs dual roles of acting as a form for the concrete during construction and as positive reinforcement for the slab during service ASCE (1992).

Cold-formed steel deck composite slabs become common in today construction industry due to several economic advantages. These include elimination of the use of formworks, ease in handling and placing the steel deck sheets, and the use of steel deck as the reinforcement for slab. The strength of the composite diaphragms is controlled by one of the three limit states, diagonal tension failure of the concrete, edge connector failure or shear transfer mechanism failure (Porter and Ekberg, 1977). Composite action of the slab is very much depending on the shear bond at the interface to eliminate end slip.

The interaction between the composite interfaces is very complex. The analysis and design procedures available today have to rely on test data to account the interaction parameters. Design and analysis based on test data is expansive. Numerical analysis such as by FE method can be used to replace the test data.

1.2 Objectives

The objectives of the study are:

a) To develop a finite element model for composite slab where interface elements are used to represent the shear bond between the concrete and the steel deck.

b) To perform non-linear FE analyses of composite slab to determine a suitable attribute of the interface element so that the element can be used to model the shear bond behavior correctly.

1.3 Scope of Works

The scopes of works for this research are:

- The FE model is in 3-Dimensional.
- To use interface elements for modeling the shear bond.
- This study is limited to simply-support slab with two-point loads only.
- Material non linearity is included in the analysis.

1.4 Organization of This Report

This project is organized in five chapters. Following Chapter 1, composite slab behavior, modeling of composite slabs by others researchers and introduction of interface element in LUSAS Modeller are described in Chapter 2. The FE modeling and analysis is presented in Chapter 3. The results of the analysis are discussed in Chapter 4. Lastly, the conclusions and recommendations are made in Chapter 5.

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