FLEXURAL BEHAVIOUR OF PROFILED STEEL DECKING USING FINITE ELEMENT ANALYSIS

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Unsur terhingga (Finite element) digunakan secara meluas pada masa kini terutamanya ke arah bidang kejuruteraan awam. Dek keluli berprofil telah digunakan sebagai sebahagian daripada rekabentuk papak komposit di mana dek keluli digunakan sebagai kerja keras kekal dan tetulang tegangan untuk papak komposit. Kajian ini bertujuan untuk memberi tumpuan kepada tindak balas dek keluli berprofil dengan kewujudan c-channel dalam pembinaan tidak bersokongan. Sembilan spesimen ujian lenturan empat mata (Four-point bending test) akan dimodel di Abaqus untuk menyiasat tindak balas dek keluli berprofil dengan pelbagai jenis panjang. Tiga set spesimen terdiri daripada menguatkan dengan c-channel dan tidak memperkuat dengan c-channel. Hasil daripada kajian ini menunjukkan bahawa dek keluli berpengalaman menguatkan dengan c-channel lebih efisien daripada tidak memperkuat c-channel. Penemuan kajian ini akan digunakan untuk membuat cadangan kepada jurutera rekabentuk.

ABSTRACT

Finite element is widely used nowadays especially towards civil engineering field. Profiled steel decking has been used as part of composite slabs design where the steel deck is utilized as permanent form work and tensile reinforcement for composite slabs. This study aims to focus the response of bare profiled steel deck with a present of c-channel in unpropped construction. Nine specimen of four-point bending test will be model in Abaqus to investigate the response of profiled steel deck at various spans. Three set of specimen consists of strengthen with c-channel and unstrengthen with c-channel. Result from this study show that a profiled steel deck strengthen with c-channel more efficient than unstrengthen with c-channel. The findings from this study will be used to make recommendations for design engineers.

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FE	Finite Element
CFS	Cold-formed Steel

CHAPTER 1

INTRODUCTION

1.1 Introduction

The use of profile steel decks in a steel-concrete composite floor systems and roofing is common in construction, because the profile steel decks acts as formwork for relatively large spans and supports the weight of the concrete, as well as construction loads (Arrayago, Ferrer, Marimon, Real, & Mirambell, 2018). The height of the steel deck commonly used varies between 45 and 80mm, and sheet thickness between 0.8 and 1.0 mm.

Usually, profiled steel decking will be propped during construction stage to avoid excessive displacement and to reduce the possibility of ponding issues on the slabs. However, unpropped construction could possibly reduce construction time as the time spend to prepare the props could be eliminated. The behaviour of unpropped long span profiled steel decking is discussed widely and be practice in the construction industry.

1.2 Problem Statement

When wet concrete is poured onto an unpropped profiled steel deck which has no low bending stiffness, the profile steel deck might excessively bend and could fail during construction stage because of the load from the wet concrete and construction work.

Strengthening of the profiled steel deck could provide an alternative to increase the bending stiffness of unpropped profiled steel deck in steel-concrete composite slab construction. This study proposed a strengthening technique using steel C-channel sections where these sections are connected to the profiles steel deck ribs using bolts.

These C-channel will increase the second moment of inertia of the section, hence increase the bending stiffness of the profiled steel deck. This study will utilise finite element (FE) analysis to investigate the influence of the proposed strengthening technique to the behaviour of profiled steel deck under bending.

1.3 Research Objectives

The objective of this study are as follows:

i. To develop finite element models of profiled steel deck subjected four-point bending test in finite element software.

ii. To analyse the structure behavior of profiled steel decking.

iii. To investigate the strengthening effect of profiled steel decking.

1.4 Scope of Study

This study investigates the behaviour of unpropped steel decking under four-point bending test. The influence of the strengthening technique is investigate using Finite Element (FE) analysis using Abaqus software. The modelling technique used to develop the FE models is verified against disparate experimental program conducted on a full steel-concrete composite slab with profiled decking.

A total of nine specimen were proposed to investigate this study. Three specimen length of 1.7m, 2m and 3.2m with a 1m width without C-channel and six specimens with C-channel. For a profiled steel deck with C-channel, it is divided into two set size of C-channel which is 75mm and 100mm.

1.5 Significance of Study

These issues have been discussed widely in construction industry. For an instance, unpropped composite slab has been proved that it can speed construction work, performance and value to the engineer and contractor.

This study was therefore simulated in Abaqus to investigate the behavior of unpropped profiled steel decking to determine the amount of deflection and strengthening effect profiled steel decking effect. This study contributes to how unpropped steel deck deflection or bending is reduced and to what force it is. Moreover, this study might benefit the engineer, because of the reduction in construction time, to reduce the amount of money needed to pay the worker. This can also easily perform a load work the worker needs while construct a building.

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