IMPROVEMENT OF ULTIMATE STRENGTH OF CONTINUOUS PROFILED STEEL SHEET DRY BOARD (PSSDB) FLOOR SLAB

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Abstract
An importance of the ultimate strength of Profiled Steel Sheet Dry Board (PSSDB) structures concerns in three major material components such that the ultimate strength is characterized by fractures of those material components, which are dry board, profiled steel sheet and screws. The shear transmission develops from the top face layer of dry board to the bottom face layer of profiled steel sheet by screws. It was further characterised the failure modes in previous research studies that the early yielding and buckling of the profiled steel sheet limit the ultimate strength of the PSSDB floor slab. Thus, this study was carried out with finite element analysis by introducing a strengthening method of reinforced concrete infill to postpone such failure modes. A simplified non-linear finite element (FE) model of the PSSDB floor slab was developed, validated in terms of load-deflection responses obtained from the experimental results, and the responses were reliable throughout the analysis with failure modes. The FE model was then extended to parametric studies such that different strength of reinforced concrete material introduced as infill to the profiled steel sheet, and the ultimate strength of the PSSDB floor structure was determined. Outcomes of the studies showed that significant differences concerning on the ultimate bending strength of the PSSDB floor slab are possible to gain due to the reinforced infill concrete. Finally, the failure prediction of FE models in each category in limiting the ultimate limit strength of the PSSDB floor slab based on the sum of the strength of its aspects criteria and global behaviour of PSSDB floor slab with various types of reinforced concrete infill are explained in detail in this paper.

Key words: PSSDB floor structures, Simplified non-linear FE analysis, Ultimate strength behaviour, failure modes, parametric studies

1.0 Introduction

Nowadays, in Malaysia, the Profiled Steel Sheet Dry Board (PSSDB) floor structures are widespread practice of building due to its cost and efficiency. A PSSDB structure is formed by profiled steel sheet and dry board, which the structural components are connected with screws with self-drilling and self-tapping. The concrete infill is placed usually inside the profiled steel sheet for strengthening in terms of avoiding early buckling. In addition, the composite action form as one structural component of PSSDB floor slab and the improvement of ultimate limit state behaviour of such structural components is still in subject to research in terms of innovative and efficient structural systems. Even the profiled steel sheet serves as steel reinforcement, the failure behaviours of buckling and yielding of such kind of thin sheets limit the ultimate limit state behaviour. Limited researches on the failure and ultimate limit state behaviours have been investigated. Bandaruzzaman et al. investigated the structural performance and applications of dry board as a load bearing element in the profiled steel sheet dry board floor panel system, and they reported the flexural capacity and mid-span deflection of the PSSDB floor slab with the different thicknesses of the profiled steel sheet stating that the profiled steel sheet is an effective structural component in determining the ultimate strength of the PSSDB floor slab. Seraji et al. (2013) conducted tests and numerical analysis on the membrane action in profiled steel sheeting dry board (PSSDB) floor slab system, and in terms of postponing the failure criteria of buckling and yielding of the profiled steel sheet, the model was extended in this study for analysing a viable method of strengthening by the reinforced concrete core.

2.0 Experimental reviews

The experimental test, which has been done by Seraji et al. (2013) in the testing lab of the National University of Malaysia to determine the membrane action in the PSSDB floor slab system in order to analyse the effects of the PSSDB floor slab subjected to vertical loading is reviewed in this research study and the experimental analysis is indicated in the Figure 1. They have tested three samples,

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