Faculty of Engineering

Structural Engineering Department

BEHAVIOR OF GYPSUM SHEATHED BEAM-COLUMN STEEL WALL STUDS

By

Amal Said Helmy Seliman Mohamed

B. Sc. Civil Engineering (2003)

Ain Shams University

A Thesis

Submitted in Partial Fulfillment for the Requirements of the Degree of Master of Science in Civil Engineering

Supervised by

Prof. Dr. Abdelrahim Khalil Dessouki

Professor of Steel Construction and Bridges

Structural Engineering Department

Ain Shams University

Dr. Ahmed Hassan Yousef Abu Donia

Associate Professor

Structural Engineering Department

Ain Shams University

Cairo 2010

EXAMINERS COMMITTEE

Prof. Dr. Hassan Ahmed Osman _____

Professor of Steel Construction and Bridges

Faculty of Engineering

Ain Shams University

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Professor of Steel Construction and Bridges

Faculty of Engineering

Helwan University

Prof. Dr. Abdelrahim Khalil Dessouki _____

Professor of Steel Construction and Bridges

Faculty of Engineering

Ain Shams University

Dr. Ahmed Hassan Yousef Abu Donia _____

Associate Professor

Structural Engineering Department

Ain Shams University

Ain Shams University
Faculty of Engineering
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Abstract of M.Sc. thesis submitted by:

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2) Dr. Ahmed Hassan Yousef Abu-Donia

Registration Date: Examination Date:

ABSTRACT

This research studies the structural behavior of cold-formed steel wall studs taking into consideration the effect of gypsum board on their capacity under the influence of combined axial load and bending moment. Cold-formed steel sections are widely used in building construction, roof, floor and wall panels due to their high strength, ease of fabrication and construction as well as their relatively lightweight. Cold-formed steel wall frame systems are commonly used as the load bearing and non-load bearing walls in residential, industrial and commercial building construction. Gypsum board is a common lining material used in combination with cold-formed steel studs (C or Z-sections). These gypsum boards are attached to both flanges of the stud with screws at regular intervals.

The main aim of this research is to study the structural behavior of steel wall studs under the influence of combined axial load and bending moment taking into consideration the effect of gypsum sheathing on their capacity. The effect of various parameters such as screw spacing, thickness of studs, ratio of acting moment to nominal yield moment and the geometry of steel sections are studied.

For this purpose, the finite element computer package (Cosmos M/V2.6) is used to model the gypsum sheathed studs. A finite element model is presented including steel studs with gypsum boards modeled as springs. A verification of the model has been performed by comparing its results versus the results of some experimental studies.

An extensive parametric study is conducted to assess the effect of the various parameters on the axial capacity of the studs. The behavior of these studs is illustrated and tabulated in different graphs and tables showing different relations based on the finite element results. The finite element model has been used through the parametric study. Some design equations are proposed to obtain the axial capacity of gypsum sheathed beam-column steel wall studs.

Key words: Gypsum board, Cold-formed, Wall studs, Finite element analysis, Beam-column, Axial capacity, Screws.

ACKNOWLEDGEMENTS

First and foremost, praise and thanks to Almighty ALLAH, the Most Gracious, the Most Merciful, and peace be upon His Prophet.

I would like to express my deepest gratitude and appreciation to my supervisor, Prof. Dr. Abdelrahim Khalil Dessouki for his invaluable guidance, support, and encouragement.

I also greatly appreciate the help, guidance and support provided by Associate Prof. Dr. Ahmed Hassan Yousef throughout all the stages of the research.

I would like to thank Eng. Heba Tarek Elnabarawy for her great help.

Finally, I would like to express my heartfelt appreciation to my parents and the whole family for lots of support.

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Structural Engineering.

The work included in this thesis has been carried out by the author in the Department of Structural Engineering, Ain Shams University, from December 2005 to February 2010.

No part in this thesis has been submitted for a degree or a qualification at any other University or Institution.

Date:

Signature:

Name: Amal Said Helmy

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