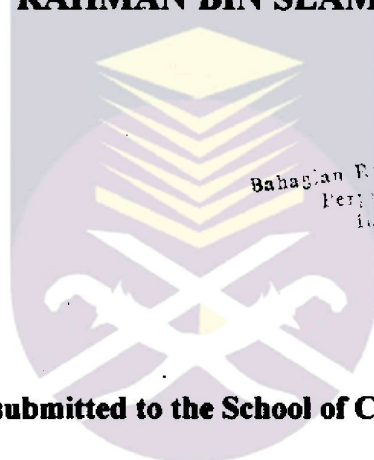


**ANALYSIS OF THIN-WALLED  
FRAME STRUCTURE**

by

**RAHMAN BIN SLAMAT**



**A Report submitted to the School of Civil Engineering  
MARA Institute of Technology, Shah Alam  
In partial fulfilment of the requirements for a Degree in  
Bachelor of Engineering (Hons) (Civil)**

**November 1996**

## **ACKNOWLEDGEMENTS**

---

In the name of ALLAH the Almighty, the Most Beneficent and the Most Merciful, firstly I would like to express my sincere gratitude to my project advisor Dr. Hanizah Binti Abdul Hamid for her encouragement, guidance and constructive suggestion in completing this project.

My thanks to Dr. Azmi Bin Ibrahim (Project Coordinator) for his assistance in using the ANSYS programme. I also would like to thank to the staffs of CADEM and to all my colleagues for their help and idea contributed directly or indirectly to this project.

Lastly I wish to convey my thanks to my beloved parents, brothers and sisters for their moral support and encouragement during my period of study in ITM.

**Rahman bin Slamet**

**November 96**

# TABLE OF CONTENTS

TITLE	PAGE
ACKNOWLEDGEMENTS	i
TABLE OF CONTENTS	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
NOTATION	viii
SYNOPSIS	x
CHAPTER 1 : INTRODUCTION	
1.1 General	1
1.2 Scope of study	2
1.3 Objective of study	2
CHAPTER 2 : LITERATURE REVIEW	
2.1 Introduction	3
2.2 Advantages of Cold-Formed Steel	4
2.3 Influence of stiffeners	6
CHAPTER 3 : THEORY OF THIN-WALLED OPEN SECTIONS	
3.1 General	9
3.2 St. Venant's Torsion	10
3.3 Warping Torsion	11

## **SYNOPSIS**

---

The analysis of engineering structures provides a natural introduction to Finite Element Methods. In this project the analysis of thin-walled open channel section structures with different angle of discontinuity is considered.

The structure to be analysed composed of two parts loaded member and unloaded member. The length of loaded member is approximately 1922 mm and 920 mm length of unloaded member. The software that being used in this project is ANSYS (ANALYSIS SYSTEM).

To make a comparison on the theoretical result obtained by ANSYS the DEVELOPED PACKAGE (BY MOHD. RAZALI IBRAHIM, NOV 1995) was used. The package was developed by using FORTRAN LANGUAGE. Analysis by ANSYS using shell element whereas for DEVELOPED PACKAGE the line element analysis is chosen.

# CHAPTER 1

## INTRODUCTION

### 1.1 General

Almost all steel buildings now use cold-formed steel products in some manner. Approximately 70% of the components by weight of a typical pre-engineered metal building are cold-formed members. They are used in the floor systems of high-rise buildings, as permanent formwork for concrete bridge decks, components of trusses and storage racks, diaphragms to resist seismic forces, and many, many other uses.

Cold formed steel is made from steel sheet, strip, plates, or flat bars shaped at ambient temperatures in special roll forming machines, or in press or bending brake machines. The steel sheets normally have a thickness ranging from 0.0149 to 0.25 inch (0.4 to 6.4 mm); steel plates and bars can be up to 0.75 inch (19 mm) thick. Cold formed sections are used in many industries and often specially shaped to suit the particular application. In building uses, the most common sections are the C, I, and Z shapes.

Cold formed steel could be treated like timber in its versatility and use, instead of being a variant of fabricated structural steelwork. The principal advantages that steel has over timber are increased strength or longer spans for a given depth of section, and longer life (if properly protected).<sup>1</sup>