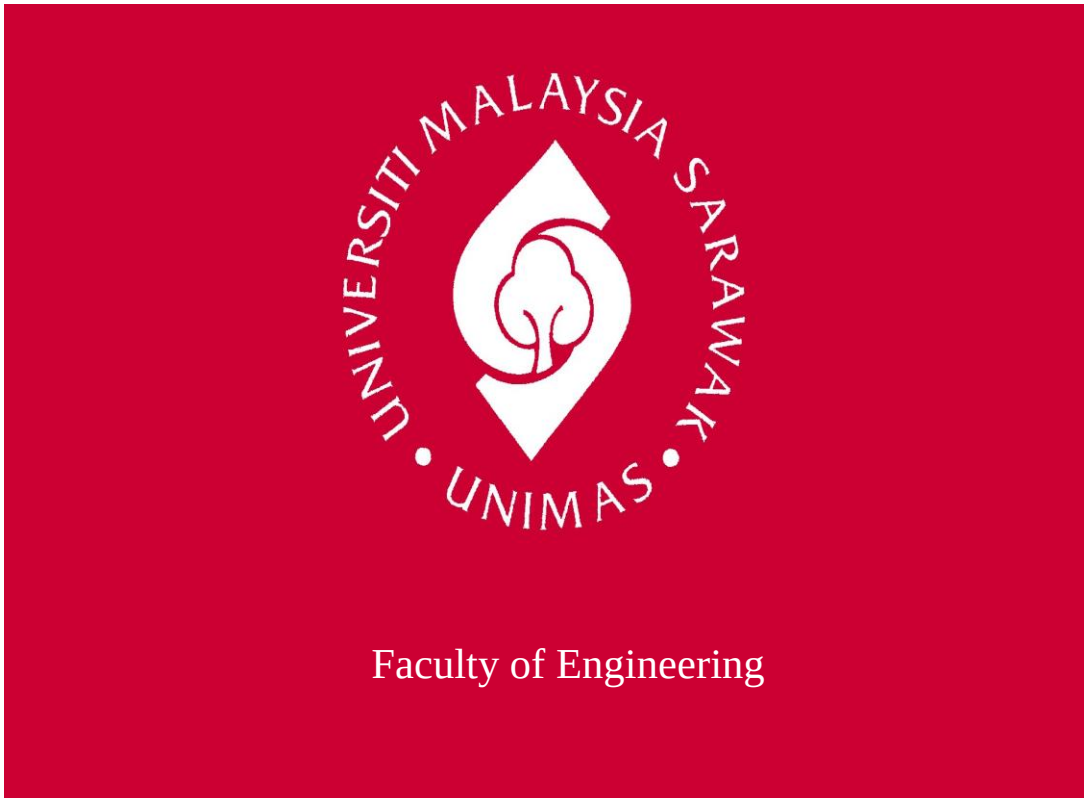


# DESIGN AND ANALYSIS BEAMS FOR A FOUR STOREY STEEL STRUCTURE USING CSC SOFTWARE

**Dayang Lydiawati Binti Awang Jemat**

**Bachelor of Engineering with Honors**
**(Civil Engineering)**
**2006**

# UNIVERSITI MALAYSIA SARAWAK

R13a

**BORANG PENGESAHAN STATUS TESIS**

Judul: **DESIGN AND ANALYSIS BEAMS FOR A FOUR STOREY STEEL STRUCTURE USING CSC SOFTWARE**

**SESI PENGAJIAN: 2005/2006**

Saya **DAYANG LYDIAWATI BINTI AWANG JEMAT**
**(HURUF BESAR)**

mengaku membenarkan tesis * ini disimpan di Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sarawak.
2. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Membuat pendigitan untuk membangunkan Pangkalan Data Kandungan Tempatan.
4. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
5. ** Sila tandakan ( √ ) di kotak yang berkenaan

☐ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972).

☐ TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan).

☐ TIDAK TERHAD

Disahkan oleh

(TANDATANGAN PENULIS) (TANDATANGAN PENYELIA)

Alamat tetap: 13,LOT 1034, LORONG 1E,
JLN JAMBU UTARA, TMN SUSUR
JAMBU,96100 SARIKEI, SARAWAK

Pn.Azida bt Rashidi
Nama Penyelia

Tarikh: 11 MEI 2006 Tarikh: 11 MEI 2006

**CATATAN** * Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah, Sarjana dan Sarjana Muda.
** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT atau TERHAD.

This final year project report:

| | | |
|---|---|---|
| Title | : | DESIGN AND ANALYSIS BEAMS FOR A FOUR STOREY STEEL STRUCTURES USING CSC SOFTWARE |
| Prepared by | : | DAYANG LYDIAWATI BINTI AWANG JEMAT |
| Matric No. | : | 8100 |

Is hereby read and approved by:

---------- ----------

Pn.Azida bt Rashidi Date

Project Supervisor

Specially dedicated to my beloved family

# ACKNOWLEDGEMENTS

First of all, I would like to thank Allah S.W.T for giving me enough courage and patient to face all the obstacles during completing this project and also the opportunity to successfully finish this project.

I would like to express my deepest grateful to my supervisor, Pn. Azida bt Rashidi for her guidance, ideas, support and advices throughout the development of this project.

My special thanks also go to my beloved family, for their continuous support and encouragement. Besides that, I also would like to express my sincere thank to my friends for their suggestions, advice, accompany and invaluable help for me in making this project a success.

Lastly, I would like to take this opportunity to express my deepest gratitude to all the people who had helped me out through completion of this project.

Thank you very much.

# ABSTRAK

Keluli adalah salah satu daripada bahan binaan yang penting selain daripada konkrit, pertukangan batu dan kayu. Pada masa kini, struktur keluli telah berkembang pesat sejajar dengan perkembangan industri pembinaan dan menjadi semakin penting. Oleh sebab itu, penggunaan perisian kejuruteraan sivil untuk merekabentuk dan menganalisis struktur binaan telah menjadi semakin meluas. Matlamat projek ini adalah untuk merekabentuk dan menganalisis struktur keluli dengan menggunakan perisian Computer Services Consultant (CSC) iaitu S-FRAME dan S-STEEL. Untuk projek ini, S-FRAME digunakan untuk menganalisis rangka struktur, manakala S-STEEL digunakan untuk menyemak semula rekabentuk berdasarkan kod rekabentuk yang ditetapkan dan merekabentuk semula struktur tersebut sekiranya saiz keluli yang dicadangkan tidak memenuhi syarat yang dinyatakan dalam kod rekabentuk British Standard (BS5950:2000). Secara keseluruhannya, projek ini telah dapat memenuhi kesemua objektif.

# ABSTRACT

Steel is one of the most important construction materials besides concrete, masonry and wood. Nowadays, steel structure has developed along with the growth of the construction industries and become more important. Therefore, the use of civil engineering software in designing and analyzing the structure has become more popular. The aim of this project is to design and analyze the steel structures using the Computer Services Consultant (CSC) Software that is S-FRAME and S-STEEL. For this project, the S-FRAME is used to analyze the frame of the structure while the S-STEEL is used to check the design based on the design code. The redesign of the structure is done if the proposed section does not fulfill the requirements stated in the British Standard design code (BS5950:2000). The verifying of the result obtained from the software is done with hand calculation. Overall, the project has achieved all the objectives.

# TABLES OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# DESIGN AND ANALYSIS BEAMS FOR A FOUR STOREY STEEL STRUCTURE USING CSC SOFTWARE

DAYANG LYDIAWATI BINTI AWANG JEMAT

This project is submitted in partial fulfillment of
The requirements for degree of Bachelor of Engineering with Honors
(Civil Engineering)
2006

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Currently the growth of construction industries has affected the development of steel structures. The steel structures ideally meet the construction industry's need which is to build stronger and safer buildings. In order to accomplish this in steel structure, many structural steel is used to construct the structure. Structural steel is an important construction material instead of concrete, masonry and wood. The steel used in structural engineering is a compound containing approximately 98% iron and small percentage of carbon, silicon, manganese, phosphorus, sulphur, niobium and vanadium as specified in British Standard (BS4360) [1].

Steel structures include low and high rise buildings, bridges and towers. The design of steel structure is in frame, where the dead loads, imposed loads and wind loads are transmit in a direct way to the foundation. For multi storey buildings, steel frame construction is one of the best ways to build the structures. The great strength of this building material makes it a suitable material where height of building is important. In addition, the structure must

be capable to resists the sway forces. The use of bracing, rigid joints or shear wall in the structures part can prevent the sway forces from affecting the building structure.

The design of the structure must fulfill the requirements stated in the British Standard (BS5950) steel design code, to produce safe and economic structure. The nature of forces, length and cross section of the members and the magnitude of yield strength are factors that must be taken into account when designing steel structures. After the analysis is completed, the design of the structures must be done. The analysis of the structure is necessary before the structure can be constructed. Therefore, nowadays civil engineering software such as STAADPRO, CADPRO, ATLANTIC V2, MICROSTRAN and Computer Services Consultants (CSC) are some example that is widely used for designing and analyzing the structures.

## 1.2 Advantages of Using Steel as Construction Materials

Below are some of the advantages of using steel in construction industry:

- **Strength to weight ratio**: In construction, a steel structure offers feasible options with respect to the strength to weight ratio of any framing material. This ratio is high compare to other common building materials such as masonry, wood and concrete. For these common materials, their used is dictating by these ratios which offer economies for using it.

- **Quality**: In terms of quality, steel will not crack, shrink or swell since steel has a high stiffness and high strength. Therefore, for structures where the load applied and span are large, usually steel is used as construction materials to implement the design of the structures.

- **Non-combustible**: Steel will not burn which eliminate the third leading house fires.

- **Safety**: In terms of safety, the steel offers better protection during earthquakes, tornadoes and hurricanes due to its strength.

- **Termite proof**: Structural damage by the insects can be eliminating since steel is not influences by termites.

- **Environmental**: The steel material is 100% recyclable.

- **Value**: Since the price of the steel is more stable compare to other materials such as wood, therefore the used of steel is more cost-effective.

## 1.3 Significance of Study

Structural steel frame has become more popular in the construction industries in Malaysia. The use of steel gives more advantages compared to other construction materials. Similar with the hand calculation design, the design and analysis of steel structures using computer software is important. The advantage of using the software is to get reliable and fast results which can save more time.

One of the most widely used civil engineering software used to design and analyze structure is CSC. The CSC software includes S-FRAME, S-STEEL, CSC 3D+ CAD SYSTEM for Structural Engineer, ORION and FASTRAK. However, the focus of this study is the S-FRAME and S-STEEL.

## 1.4 Limit of Study

For this study, only 2D Frame Model type is used. Besides that, the design and analysis of the structure is by floor and not the whole structure.

## 1.5 Objectives of the study

Essentially, the objectives of this study are:

i. To design four-storey steel structure using CSC.

ii. To analyze the loading and the selected section used for the structure using CSC.

iii. To verify the analysis and design result obtained from CSC

iv. To compare the design result obtained from CSC with hand calculation result

v. To check the suitability of using the CSC to design and analyze the steel structure.

## 1.6 Conclusion

Various methods for analysis and design have been developed over the years. Along with the growth of steel construction industries, there are a lot of civil engineering software being created to make the design and analysis of structure become easier. Generally, the usage of software in designing and analyzing the steel structures can save more time compared to hand calculation method.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

In the 21st century, taller building are built and designed by using the latest technology. In order to create an effective design for multi-storey steel structure, the structure must be analyzed properly to ensure safety.

Most of the multi-storey steel structures are constructed using the steel frame for modern high-rise construction. This frame is composed of rigidly connected beams and columns. One of the characteristic features for this frame structure is the reduction of load-carrying members to minimize sizes and cost.

Once the structure is constructed, it is expected that the structure look stylish, attractive and most important is structurally correct. Therefore, currently there are many civil and structural engineering projects using computer software to analyze and design the structure for the purpose of maintaining the strength and stability. STAADPRO, CADPRO, MICROSTRAN, CSC SOFTWARE including S-FRAME and S-STEEL are

some example of the civil engineering software that usually being used by the structural engineers to design and analyze the structure.

## 2.2 Background

### 2.2.1 S-FRAME

Basically, most of the civil engineering analysis software provides analysis on linear static, frequency and earthquake effect to the building structure. S-FRAME is an example of civil engineering software that allows the linear static analysis to be applied for analyzing the structure.

S-FRAME is steelwork design software and it comes in several editions. There are 3 editions of S-FRAME that is S-FRAME Standard, S-FRAME Professional and S-FRAME Enterprise. Each of these editions is build on the features, functionality and analysis capabilities of the previous one yet still maintaining the same basic interface.

For S-FRAME Standard Edition, only the linear elastic static analysis option is applicable. This type of analysis is the most commonly used analysis option in structural engineering. If no non-linear elements or constraints have been defined for example tension only members and compression only members, then linear elastic static analysis is the most suitable option to analyze the structures.