

## **APPROVAL**

I admit that had read this dissertation and in my opinion this dissertation is satisfactory in the aspect of scope and quality for the bestowal of Bachelor of Mechanical Engineering (Design and Innovation)

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Date : 18 Mei 2009

DESIGN AND ANALYSIS OF SAFETY MOBILE PLATFORM

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This report is proposed to fulfilled some of the requirements to be honor with  
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## DECLARATION

“I verify that this report is my own work except for the citation and quotation that the source has been clarify for each one of them”

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Date : 18 MEI 2009

## **DEDICATION**

To my beloved family for their encouragement and support especially, and for their understanding in the way I am.

## ACKNOWLEDGEMENT

First and foremost, I would like to convey my sincere thank you to my supervisor En. Nor Azmmi Bin Masripan, who is willing to offer his support throughout my final year project; He has graciously contributed his time, patience, and guidance in helping me completing my project. His experience in this related topic has also given me a boost of confidence in conducting my experimental work. Not to forget, I would also like to thank him for re-checking my report writing thoroughly and frequently. Without him, I would never achieve what I have meant to complete. He has never given up on me when I doubt myself in completing this project. His constant encouragement and guidance had brought me to the final stage of my project.

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Finally, I would like to thanks to my future wife Nurhidayah and to all my friends to help and guide me and also discussed about my project. Without their moral support, I can't finish this project. Hopefully, this report will be used as guidance to future project and works.

## ABSTRAK

Dewasa ini, kerja-kerja yang dilakukan ditempat yang tinggi memerlukan tahap dan ciri-ciri keselamatan yang tinggi untuk mencegah dan mengelak sebarang kejadian dan kecelakaan yang tidak diingini berlaku seperti terjatuh, tergelincir dan sebagainya. Kejadian seperti ini akan memburukan imej dan juga kredibiliti sesebuah syarikat atau organisasi. Platfom keselamatan bergerak digunakan secara meluas di sektor-sektor industri perkilangan antaranya ialah seperti industri berasaskan minyak dan gas, industri simen dan batu kapur, industri pembinaan dan juga industri penjagaan dan baikpulih bangunan dan sebagainya. Penggunaan platfom keselamatan bergerak ini membantu meningkatkan tahap keselamatan kepada pengguna dan perkerja yang berkerja ditempat yang tinggi disamping memudahkan ianya mudah dikendalikan dan mudah dibawa ke mana saja untuk membuat kerja-kerja yang berkaitan. Platfom keselamatan bergerak ini juga hendaklah mematuhi standad yang ditetapkan oleh sesebuah syarikat mengikut faktor saiz ketinggian pekerja. Faktor keselamatan dan kemudahan yang terdapat pada platform keselamatan bergerak ini membuatkan kebanyakan industri memilih untuk menggunakannya disamping menjimatkan kos kerana ianya boleh bergerak dan tidak perlu untuk membina banyak platfom untuk satu-satu kerja yang memerlukannya pada satu-satu masa. Pada data yang didapati selepas analisis menunjukkan rekabentuk struktur platfom boleh digunakan.

## **ABSTRACT**

Latterly, works which does place high need a high level and high safety features to prevent and avoid any accident and disaster that are not needed to happen such as falls, slips and others. This incident would turn a bad image and perception and also the credibility of the company or organization. Mobile safety platform widely used in many sectors of manufacturing industry and also industry based on oil and gas, cement industry and aerospace, construction industry and many more. The use of safety mobile platform helps to increase the level of safety to the consumer and workers working at height beside facilitate it maneuverable and easy to bring to wherever to make works those related. The safety mobile platform also must abide standard that prescribed by one company following the height of the employees. The safety, security and facility factor that there were to mobile platform make it the most choose by industrial to deploy it beside save cost because it can move and do not need to construct many platform for each work that need it in a singles time. In the analysis, the structure of the design can be use due to the result from the Cosmos analysis.

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**LIST OF SYMBOLS**

Mpa	=	Mega Pascal, $\text{Nm}^{-2}$
N	=	Newton, $\text{kgms}^{-2}$
$\sigma$	=	Stress
kg	=	Kilogram
Pa	=	Pascal

## **CHAPTER I**

### **INTRODUCTION**

Safety mobile platform help and increase the safety support for the works at height. As usual the height is above two meter. The structure of the platform shall have safety characteristics like handrail, staircase, handle and many more. It's also shall have a point to worker hook their safety harness. Workers' who working at height should wear safety harness in order to prevent from falling. This mobile platform also used to lift the light equipment such as tools, tool box, maintenance tool and many more. Only the light equipment can be lift up. It is because the platform can't be use for platform to place heavy machine because of its stability, toughness, and many more. It's only for human as platform to do such certain work.

The structure of this safety mobile platform is drawn with use Solidworks software. This software is good and specializes in structure design and also it is very easy to use and learned. The analysis for this platform is used Cosmos software which is compatible in Solidworks software. Cosmos software is very suitable in order to analysis such a simple structure and easy to study and learned. The material and beam structure to construct this product such as I-Beam, Channel beam, mild steel plate, steel hollow rod and many more. As usual, the steel rod is used because of its toughness and ductility.



## **1.1 Objective.**

The objective for this project is as below:

1. Make a research and study the previous products and its structure and safety for the mobile safety platform.
2. Make the drawing and design with use Solidworks software and analysis with Cosmos software.
3. Redesign the product and optimize alongside with analysis.

## **1.2 Scope:**

- 1 Search all of the information regarding project. Include journals, materials, structures, related to drawing, and many more.
- 2 Identify all of the parameters and problem of the product. Create a drawing for previous product and select the material based on research and findings using Solidworks 2007 software.
- 3 Analyze the current product using Cosmos software.
- 4 Identify the problem of the current product.
- 5 Redesign the product and make some improvement.
- 6 Analyze the final product.

### 1.3 Project Background

A mobile platform and suspension system shall be certified by a licensed professional engineer competent in structural design as being in conformity with this project. A mobile platform used for lifting site personnel or jumpers shall be designed to meet the following criteria and specifications:

- a) The suspension system shall be designed to minimize tipping of the platform due to movement of the individuals occupying the platform.
- b) The mobile platform shall be capable of supporting, without failure, its own weight and at least five times its maximum intended load.
- c) The mobile platform shall be equipped with a guardrail system and shall be enclosed from the toe board to mid-rail.
- d) A grab rail shall be installed inside the entire perimeter of the mobile platform.
- e) The mobile platform shall have anchor points for safety harnesses or safety belts for all persons carried on the platform. The anchor points shall be designed and placed to best suit the movements of anyone on the platform.
- f) The mobile platform shall be free of rough or exposed edges.
- g) The mobile platform shall have a slip resistant floor surface.
- h) Welding of the mobile platform and its components shall be performed by a qualified welder familiar with the weld grades, types and materials specified in the platform design.
- i) The mobile platform shall be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load.

The persons on the mobile platform shall wear a safety harness or safety belt. The mobile platform shall be limited to a capacity of four persons. Individuals shall keep all parts of their bodies inside the mobile platform during raising and lowering to avoid pinch points. Individuals may not stand on the top rail, midrail or toe board of the mobile platform. A mobile platform may not be used in winds in excess of 25 miles per hour, electric storms or other adverse weather conditions which could affect the safety of individuals.

#### **1.4 Problems statement.**

##### **1.4.1 Safety issue (Injuries News from [www.bnet.com](http://www.bnet.com))**

Worker falls off platform: Failure to provide fall protection: Spinal injury: Quadriplegia: Verdict

Law Reporter, Nov 1998

Worker falls off platform: Failure to provide fall protection: Spinal injury: Quadriplegia: Verdict.

Woodbury, 24, was working for an excavation subcontractor on a construction project. As he was disassembling a work platform, he fell 11 feet to an underground walkway. He suffered a fracture at C6, rendering him a quadriplegic. He requires 24-hour attendant care and has incurred medical expenses totaling about \$350,000. A recent college graduate and temporary field technician earning about \$14,500 annually, he is currently taking vocational classes. Woodbury sued the general contractor, alleging failure to provide fall protection. Plaintiff claimed defendant had agreed to provide overall supervision and coordination of job-site safety, yet its employees had little knowledge of the state fall protection safety rules applicable to construction projects. The jury awarded \$11.5 million. Plaintiff's experts were Sally Niles, rehabilitation, Portland, Or.; Ronald Eakin, construction contracts, Springfield, Or.;

Wilhette Gibbons, occupational safety, Salem, Or.; John Dahlberg, life care planning, Denver, Colo.; and Lowell Bassett, economics, Seattle, Wash. Defendant's experts were Bruce Poinsette, occupational safety, Wilsonville, Or.; Hank Lageman, vocations, Beaverton, Or.; and John Goveia, economics, Portland, Or.

Plaintiff's Counsel: Ray Thomas, Doug Swanson, and Jim Coon, all of Portland, Or. [Documents in this case are available through the Court Documents section at p. 356, courtesy of Mr. Thomas.] Copyright Association of Trial Lawyers of America Nov.



Figure 1.0: Existing Safety Mobile Platform

(Source: Lafarge Malayan Cement)

Following (E. Russell Johnston, Jr. et al. 2004) the main problem for the structure is the material and beam use. Usually, I-beam is used as main structure and foundation for the platform. The sizes of the structure or material if define by the calculation. I-beams (also known as W-beams or double-T esp. in Polish and German) are beams with an I- or H-shaped cross-section ("W" stands for *wide flange*). The horizontal elements are flanges, while the vertical element is the web. The Euler-Bernoulli beam equation shows that this is a very efficient form for carrying both bending and shear in the plane of the web. The cross-section has a reduced capacity in the transverse direction, and is also inefficient in carrying torsion, for which hollow structural sections are often preferred.

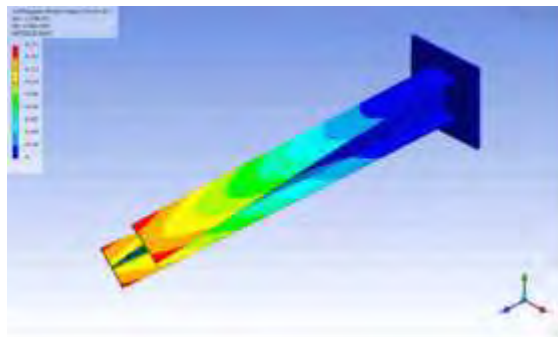


Figure 1.2: Vibrating I-Beam

(Source: [http://en.wikipedia.org/wiki/I\\_beam](http://en.wikipedia.org/wiki/I_beam))

The other problem of the current mobile platform is some of the design is not friendly user. These are only mobile but not have others characteristic like very functional, light weight, ecstatic and many more. When design, we should determine the purpose of the product and target market. This will help us to optimize the product.

## 1.4 Current Product

The current product like figure below show a safety mobile platform produced by ThyssenKrupp Services Company.



Figure 1.3 and 1.4 Mobile Platform ThyssenKrupp

(Source: [www.thyssenkrupp.com](http://www.thyssenkrupp.com))

The ThyssenKrupp Safway's mobile work platform are one of the safest option for painters, plasterers, maintenance workers and various other trades that require a firm working platform. The secure features for this product are:

1. A swing-in gate on each side of the platform offers safe access, and guardrail panel always provide the correct guardrail location, regardless of the platform level.
2. Two guardrail panels (complete with toe boards) connect to provide proper guardrail protection on all four sides.
3. There are no loose nuts and bolts and no special tools are required for construction.

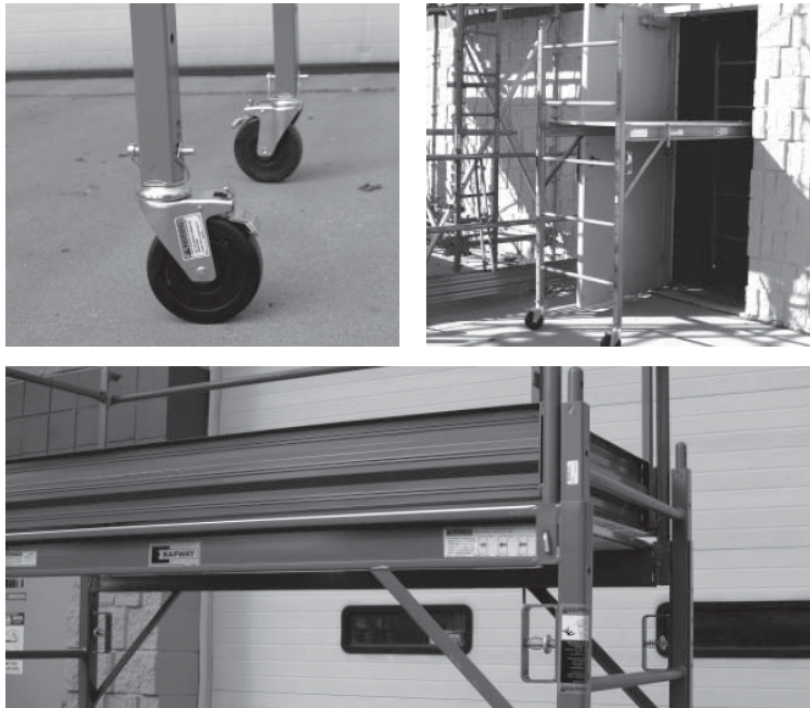


Figure 1.4: several features

(Source: [www.thyssenkrupp.com](http://www.thyssenkrupp.com))

This company history in scaffold design and services is based on product strength and durability, a standard evident in the construction of mobile work platforms. Durability features and benefits include:

1. Rigid square steel construction
2. Special side brace configuration that protects the plywood deck
3. Platform side braces that attach to frames with heavy duty, spring-loaded lock pins that are secured when rotated
4. 12.5 cm casters that are equipped a wheel and swivel lock

This safety mobile platform are available in three height (2m, 3m, and 4m), and their ease of use is boasted through the product's name. The mobility and accessibility of the platform is clear through and abundance of features and benefit:

1. Easily set up by one person
2. Glides through 75cm wide doorways
3. Independent adjustment of each ladder frame permits use on stairways
4. Platform adjust up or down 10cm increment
5. Side braces allow movement over lower obstacles and eliminates the need for lower cross braces
6. Workers can climb ladder frame at either end for easy access
7. A disassemble unit can be stored in the space required for a stepladder