

THE INFLUENCE OF POLYMER FORMWORK SYSTEM TO THE  
PERFORMANCE OF CIVIL CONSTRUCTION PROJECT:  
CASES STUDY IN ORIENTAL MAX GROUP AND FAITHVIEW GROUP

WONG SHYANG JIAN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## **SUPERVISOR APPROVAL**

I/ We as supervisor of University Technical Malaysia Malacca has approved this thesis prepared by Wong Shyang Jian (B061110116) and submitted in partial fulfillment of the requirements for the Bachelor Degree of Technology Management (Innovation Technology).

**Supervisor Name** : \_\_\_\_\_

**Date** : \_\_\_\_\_

**Chop & Signature** : \_\_\_\_\_

**Panel Name** : \_\_\_\_\_

**Date** : \_\_\_\_\_

**Chop & Signature** : \_\_\_\_\_

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WONG SHYANG JIAN

A REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE  
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## DECLARATION

“I admit that this report is the result of my own but summarizes and quotes that for everything I have explained the source.”

Signature :.....

Name :.....

Date :.....

## **ACKNOWLEDGEMENT**

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## **DEDICATION**

This thesis is dedicated to my father, Wong Kah Chan and my mother Chong Sok Choo, who taught me the value of education and who made sacrifices for us, so that I have the opportunity that finished my research.

## **ABSTRACT**

Industrial building system is a hot topic in current construction industry. The implementation of polymer formwork system is the new system that adopted by many contractor in Malaysia. The impacts of using this polymer formwork system to the performance are not known-well by public. In Malaysia, besides of the polymer formwork system, many type of formwork system in market such as steel formwork, fabric formwork, aluminum formwork and bamboo formwork system. The comparison of polymer and the conventional formwork system which is plywood formwork system carried out in the research. In a case study, is to investigate how the organization accepted the polymer formwork system from the known well of impacts and the total performance. The research utilized PEST analysis by (Taherkhani R. et al, 2012) to study the impacts and factors that influence the performance of construction by using polymer formwork system. A series of researcher administrated questionnaires or interview were conducted to collect respondents' answer, while data collected were analyzed qualitatively. As a conclusion, Polymer formwork system performed well in Malaysia construction project market, with successful completed more than millions value projects. Inevitably, the organizations need to consider many factors of implement the polymer formwork system and study well the impacts that brings along.

## **ABSTRAK**

*Sistem bangunan perindustrian adalah suatu topik hangat dalam industri pembinaan semasa. Pelaksanaan sistem acuan polimer adalah sistem baru yang diterima pakai oleh ramai kontraktor di Malaysia. Kesan menggunakan sistem acuan polimer ini kepada prestasi tidak dikenali dengan baik oleh orang ramai. Di Malaysia, di samping sistem acuan polimer, jenis banyak sistem acuan dalam pasaran seperti acuan keluli, kain acuan, acuan aluminium dan sistem acuan buluh. Perbandingan polimer dan sistem acuan konvensional iaitu sistem acuan papan lapis yang dijalankan dalam kajian ini. Dalam satu kajian kes, adalah untuk menyiasat bagaimana organisasi menerima sistem acuan polimer dari telaga diketahui kesan dan jumlah persembahan. Penyelidikan yang digunakan oleh analisis PEST (Taherkhani R. et al, 2012) untuk mengkaji kesan dan faktor-faktor yang mempengaruhi prestasi pembinaan dengan menggunakan sistem acuan polimer. Satu siri penyelidikan soal selidik ditadbir atau temubual telah dijalankan untuk mengumpul jawapan responden, manakala data yang dikumpul telah dianalisis secara kualitatif. Kesimpulannya, Polimer sistem acuan prestasi yang baik dalam pasaran projek pembinaan Malaysia, dengan menyiapkan lebih daripada nilai projek berjuta-juta berjaya. Tidak dapat tidak, organisasi perlu mengambil kira banyak faktor melaksanakan sistem acuan polimer dan belajar dengan baik kesan yang membawa bersama-sama.*



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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of study

Malaysia is a country that heading towards industrialization in development. The improvement of the construction industry is one of the significant changes. Construction Industry in Malaysia is now towards to more systematically forms, started to promoting the latest and modernized technology to improve the construction quality. One of the major constituents in the construction systems called Industrialized Building System (IBS). (Syazwan, 2013)

Construction Industry Development Board Malaysia (CIDB) promoting the IBS allover Malaysia as an alternative to the conventional building system. According to the CIDB, building formwork system is one of the IBS that highly recommended to construction used. CIDB qualified the industrialized formwork system materials are steel, aluminum, and polymer. Plywood formwork is not categorized in IBS.

Formworks systems are used to hold and stable the construction reinforced concrete works in place until it completely hardens to form the desired shape. The constructions formworks can be made up from different materials. One of the most common used formwork in worldwide is plywood formwork. Plywood is pieces of wood made of three or more layers of surface joined with chemical glue, and almost always an odd number of plies are used to provide balancing of construction work. (Nemati, 2007)

IBS is not new in Malaysia construction industry but it is not fully implemented by the contractors. The current construction formworks trends in Malaysia are still using the conventional formwork system which is plywood formwork. Most of the housing contractor dare not to adopt the others materials of formworks such as Steel Formworks and Plastic Formworks because of the costing. (Muhammad Hassan, 2009)

IBS formwork system brings a lot of benefits to the construction industry. Reduction of site labor and materials, reduce the wastage, cleaner environment, controlled quality, higher productivity, neater and safer construction site, faster project completion and the last also the most important advantage which is lower the total construction cost.

## **1.2 Problem Statement**

According to the industry interview with Project Manager of Oriental Max Group, the construction site faced many of the problem by using the conventional formwork building system.

First of all, the installation of the plywood formwork is difficult. The unskilful foreigner workman might spoil the plywood formworks. Besides, the scale and the installation method need a lot of manpower. Once the incorrect scale or uneven installation may causes the leakage of cement.

Safety problem occur as the conventional formwork system need a lot of nails to install. Nails will cut or injured the manpower while they installing the formwork system. Workman safety issue unprotect able in using conventional formwork system.

The construction site environment will be polluted by the broken or spoiled formworks. The working environment control is very important to an organisation to classify the company value. In an addition, Plywood is unable to recycle because of the chemical glue in between the plies.

The formwork system occupied highly cost of the total construction cost. The conventional building formworks materials is cheaper than the IBS formwork materials in term of per square feet (psf) but the IBS product life period is longer than conventional system.

Polymer Formwork system is an alternative to replace the plywood formwork system. Polymer formwork system has stronger practicability than the plywood in term of the product installation. Accessories installation knowledge of polymer formwork system is much easier compared to nails work in plywood formwork system.



Besides that, the timing of preparation of polymer formwork system is faster than the plywood, it is because by providing formwork measurement to formwork engineer, polymer formwork will be prepared well when concrete work is ready. Next is the durability of polymer is longer than the plywood. According to the project manager of Oriental Max Group of Company, plywood formwork can be reuse up to 4 times only. But polymer formwork can be reuse up to 150 times. This mean the total cost of the formwork system will be reduce due to the reuse of polymer formwork system.

The disadvantage of the polymer formwork system is needed a large construction project to reached the ideal of cost reduction it is because of the cost is higher than the plywood about 4 times. The larger of the construction project, the more time reuse of polymer formwork. The more time reuse of the polymer formwork, the more cost reduction will made.

Due to very tight competition in the construction business, construction companies have to find out new system of technology to optimize their project objective in term of faster schedule time, quality of deliverable and cost reduction. The choice of the right Formwork System will contribute much to this objective in the construction business. One of good option is to use Polymer Formwork System in executing civil project.

### **1.3 Research Questions**

This research is focus on the materials of formwork system. Here come the following research questions.

1. How can the schedule time of the civil project be reduced by using Polymer Formwork System?
2. How can quality of the civil project execution be improved by using Polymer Formwork System?
3. How can the cost of the civil project execution be reduced by using Polymer Formwork System?

## 1.4 Research Objective

The research objectives are designed to improve the efficiency and effectiveness in an organization which using the right Formwork System. Below are the objectives:

1. To identify the reducing time resulted from the use of right Formwork System in civil project execution.
2. To identify the quality improvement resulted from the use of right Formwork System in civil project execution.
3. To identify the cost reduction resulted from the use of right Formwork System in Civil project execution.

## 1.5 Scope and Limitation

This research is focus to the selection of the formwork materials. The conventional formwork is made up by plywood and the IBS formwork is made up by recyclable materials. In this research, we will only focus on two materials from IBS which is steel formwork system and plastic formwork system.

Steel formwork system and plastic formwork system is not new in Malaysia, but not fully implement. This research will bring an outcome to the most effective and most cost saving formwork system.

This research is included the price, usage, quality, specification, durability and the uniqueness. The information will be collected from the interview and questionnaires.

Limitation of this research is in doing the comparison of materials. The formwork materials are made up of steel, plastic and aluminium. There is no laboratory experiment to do for this comparison. Besides that, this research will be case study in one or two organization only. Then, the result could not generalise to represent the entire industry.

The research is within 2014 and 2015. Therefore, the technology of the formwork system in before and after the research period is uncounted in this research. In this research, researcher assume that respondents given the honest answer; assume a good cooperation of respondents; assumption of research is practical useful for company.

## **1.6 Significance of Study**

The selection of the formwork materials between conventional systems of IBS are the aimed to an organization. The final result is to select the most cost saving system and higher performance. This study is benefits to the research and organization in both.

### **1.6.1 Organisation**

In this research, the outcome and result will help the construction industry companies to have a clear vision to how to select the better performance formwork system. The construction quality is the key to leads to the said performance. Besides that, organization is also will get the information on which formwork system is most cost saving. The price per unit and the formwork durability will help the organization to select the formwork materials.

### **1.6.2 Researcher**

In this research, the researcher will gain a lot of knowledge of the construction formwork system. Research can be making himself a minor expertise on this research to give some opinion upon formwork materials. Besides that, research can build a relationship in the construction industry while doing interview and questionnaires. In future, researcher can be easily to work in this industry.

## **1.7 Summary**

The problem of selection of formwork system in the construction industry in Malaysia is one of the current issues. The research of the formwork system influence the performance of civil construction project is following the research objectives as a guideline. The aim and goal is to find out the reason of choosing polymer formwork system.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

New formwork system is not only helps to save our forests, but also save labour, material, time and capital for construction. It also helps improve the quality of the construction performance and most important, improve company profit by reducing cost.

In construction industry, building construction project normally consists of four major stages. Survey and setting is the first stage. In this stage, the entire boundary and all the building pegs are being identified in order to determine the building foundation is same with the building plan. Secondly, is building structural works. Building structural works involve in piling work which is depends on soil condition follow by excavations for foundation works. In Malaysia, most of the buildings are construct by reinforced concrete (RC) structural work. RC structural work is the backbone of the building which is very important factor that will influence the building quality. In this stage, the formwork system also plays an important role in order to commence the building structural works which will be discussed further in this study.

The architectural stage, it involves bricklaying, coating, plastering, roof coverings; door frames installation, window frame installation, fittings installation as well as painting work. Besides that, quality of architectural works needs to be controlled properly before the finishing products to be handed to the client.

The final stage is the building external works that involve sewerage system and water reticulation work and road and drainage work.

## 2.2 Current Trend

According to Hadi (2011), Malaysia has approximately 1.9 million foreign workers spread across sectors such as manufacturing (39%), construction (19%), plantation (14%), housemaids (12%), and services (10%), with the rest in agriculture. The contributing countries by rank are: Indonesia (50.9%), Bangladesh (17.4%), Nepal (9.7%), Myanmar (7.8%), India (6.3%), and the rest from Vietnam. These figures are excluding the illegal foreign workers.

Malaysia Construction industry employs 1,214,000 or about 10% of our country total employment 12,116,600. However, around 70% - 80% of construction labours are occupied by foreigners. Due to the influx of foreign workers, the employers are reluctant to employ locals since the wages paid to foreign workers are much less as compared to the locals. (DSM, 2011)

The limitation of using conventional construction method are divided into three main categories. Quality of the building is usually most concern by developers and end users. Most of the foreign workers of construction in Malaysia are from semi-skilled worker and low-skilled worker. This will bring an impact towards the quality of works directly; safety of the construction site is also concern by the employer and employee. Workers having high percentage of being harm by the wastes of the conventional construction method; highly construction cost of conventional method is also a limitation. Main of construction cost are come from labours cost and materials cost. Conventional formwork system occupied a high percentage of the total construction cost.

## 2.3 Type of Formwork System

Formworks systems are used to hold and stable the construction reinforced concrete works in place until it completely hardens to form the desired shape. The constructions formworks can be made up from different materials. One of the most common used formwork in worldwide is plywood formwork. Plywood is pieces of wood made of three or more layers of surface joined with chemical glue, and almost always an odd number of plies are used to provide balancing of construction work.

Plywood formwork system are the system that used by majority of contractors in Malaysia. The figure 1.0 below shows the plywood formwork system. It shows the ground beam formwork system that ready to casting of cement. The Reinforced Cement (RC) Shear wall formwork system also shows in figure 1.1 as below.



Figure 1.0: Ground beam formwork system (plywood)



Figure 1.1: Reinforced Cement Shear Wall formwork system (plywood)

Besides than the plywood formwork system, Steel formwork system is also being famous in this industrialised building system. Steel formwork system is made up from the thin pieces of steel. Steel formwork system is also needed back ridge to support the structural

shape. Steel formworks are installed with the supportive back ridge while ready to casting cement. Steel formwork of RC shear wall and RC columns are shows in figure 1.2 and figure 1.3 respectively.



Figure 1.2: RC Shear wall formwork system (Steel)



Figure 1.3: RC columns formwork system (Steel)

Polymer formwork system is the minority known in Malaysia. This formwork system is not fully using polymer to implement. Polymer formwork is made up of plastic and the back ridge can either choose of plywood or steel ridge. Polymer formwork is able to expose to direct sunlight. Figure below shows the plastic formwork system of shear wall (Figure 1.4) and columns (Figure 1.5).



Figure 1.4: RC Shear wall formwork system (Polymer)



Figure 1.5: RC Columns Formwork System (Polymer)