الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
يونيرسيتي إسلام انتارابغسا ملايسيا

A STUDY ON LABOUR PRODUCTIVITY OF REINFORCED CONCRETE STRUCTURAL FRAMEWORK CASE STUDY OF MASJID KOTA DAMANSARA & IIUM COMMERCIAL BUILDING

BY

HASLINA BT ABD HAMID

A dissertation submitted in partial fulfilment of the requirements for the degree of Master of Science in Building Services Engineering

Kulliyyah of Architecture and Environmental Design
International Islamic University
Malaysia

AUGUST 2009

ABSTRACT

The appreciation of the importance of productivity in construction process is now universally being recognized either in developed or developing country. The significance of productivity is very crucial as the task of the construction works are now turn out to be more difficult due to many reasons for instance the requirements of the client are more complex, tight specifications that need to be achieved, fluctuation of the materials price and other resources which is keep changing from time to time, and other factors. These circumstances are definitely will give bad impact towards the industry if there is no serious solution is being made. Labour productivity is perceived to be more reliable as it provides accuracy in determining duration taken in completing the tasks, time saving and establishing the performance. In relation to this issue, labour productivity is one of the major tools which is seen to be the most powerful method particularly in preparing an effective work program whereby all durations for each activities have been obtained through the calculation of labour output. In addition, throughout this efficient work program, development process at site can be performed well as what have been planned and it directly avoids any delay to the progress of construction work. Data were collected at two construction projects through observation and several techniques have been implemented which include time study method. From the data obtained, graphs are plotted for comparison purpose and also to show the trend of the operation. The comparison between Malaysia and the United Kingdom productivity rates were discussed as well and findings revealed that Malaysia is more productive in almost operations regarding to concrete structural framework. In addition some factors affecting construction labour productivity were identified. This research has proposed some equations that derived from the regression analysis in order to promote easy way to the calculation of the productivity rate later on and hence it can be exercised widely as to improve the accuracy of the scheduling works and directly to minimize the occurrence of delay.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion it confirms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering.

……..
Mohd Zaifuddin bin Idris
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering.

…….
Maisarah bt Ali
Examiner

This dissertation was submitted to the Department of Building Technology and Engineering and is accepted as partial fulfilment of the requirements for the degree of Master of Science in Building Services Engineering.

……..
Puteri Shireen Jahn Kassim
Head, Department of Building
Technology and Engineering

This dissertation was submitted to the Kulliyyah of Architecture and Environmental Design and is accepted as partial fulfilment of the requirements for the degree of Master of Science in Building Services Engineering.

……..
Mansor bin Ibrahim
Dean, Kulliyyah of Architecture and
Environmental Design

DECLARATION PAGE

I here declare that this dissertation is the results of own investigation, except where otherwise stated. I also declare that is has not been previously or concurrently submitted as a whole for my other degree at IIUM or other institutions.

Haslina bt Abd Hamid

Signature…… Date……..

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

DECLARATION OF COPYRIGHT AND AFFIRMATION OF FAIR USE OF UNPUBLISHED RESEARCH

A STUDY ON LABOUR PRODUCTIVITY OF REINFORCED CONCRETE STRUCTURAL FRAMEWORK CASE STUDY OF MASJID KOTA DAMANSARA & IIUM COMMERCIAL BUILDING

Affirmed by Haslina Binti Abd Hamid

……. ……..

Signature Date

ACKNOWLEDGEMENTS

Bismillahhirrahmanirrahim...

Highest grateful to my Lord, my Saviour for this precious opportunity and strength bestowed by Him in order to complete this research. Alhamdulillah. This dissertation would not have been possible without the assistance and encouragement of the numerous people that I have met and worked with over the last two years. Therefore a special thanks and gratitude to my supervisor Ir. Mohd Zaifuddin bin Idris for his enthusiastic inspiration and valuable advice throughout my research. His priceless experience and constructive criticism helps me in completing this tough task. I would also like to express my thanks to the lecturers especially to Dr. Maisarah bt Ali and Ir. Sharifuddin Ibrahim for their fruitful opinions and also to my friends and those who have assisted me directly or indirectly. Next I owe a debt of gratitude to the site teams and committees of Masjid Kota Damansara and IIUM Commercial Building for their technical guidance during data collection. Last but not least, a warmth appreciation goes to my parents Abd Hamid bin Mat and Hendon bt Nayan and to my sister Nor Hafizza for their faithful supports and love during the entire course of my graduate studies. May Allah sanctify all of us. Ameen.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BQ	Bill of Quantity
CBE	Centre for Built Environment
CIDB	Construction Industry Development Board
CIMP	Construction Industry Master Plan
CPM	Critical Path Method
GDP	Gross Domestic Product
GTT	Group Timing Technique
IBS	Industrialised Building System
IIUM	International Islamic University Malaysia
JAIS	Jabatan Agama Islam Selangor
JKR	Jabatan Kerja Raya
KAED	Kulliyyah of Architecture and Environmental Design
UAE	United of Arab Emirates

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE RESEARCH

1.1.1 Overview of the Malaysian Construction Industry

Construction has been recognized globally as one of the most demanding, challenging and a tough industry in developed and developing countries. Every construction projects has their own desired aim and objectives which need to be achieved in order to make it becomes a reality. A successful construction project is one that accomplishes the intended objectives in terms of cost, time and quality.

Construction is among the most important industries in the world as it generates wealth and improves the quality of life in the country. It is one of the productive sectors that continually contribute to the economy (Sundaraj, 2007). As highlighted by Construction Industry Development Board (CIDB), expansion of the construction industry in Malaysia is being developed through the transformation of Government's socio-economic policies into social and economic infrastructures and buildings. Further it offers job opportunities to approximately 800,000 people and enables the growth of other industries including manufacturing, financial services and professional services through its role as a fundamental building of the nation's socio-economic development.

Due to its involvement in long term investment and long term risk, it will be the first to be suspended during economic recession and will be the last to be reviewed during economic boom in which it leads to a long periods of downturn for the construction sector whenever an economic cycle is experienced (Sundaraj, 2007).

In Malaysia, the construction sector output drifted around RM 7 billion mark but gradually decreased since share of gross domestic product (GDP) in year 2000 is 3.3% shrank to 2.5% in year 2007 with average growth of 0.7% over the same period. Based on the historical statistics, contribution of construction sector to the Malaysian GDP is about 3%. Details are shown in Table 1.1.

Table 1.1
Construction Sector Growths in Year 2000 – 2007 (Source: Construction Industry Master Plan, CIDB)

Year	In RM millions – 1987 prices		GDP Growth (%)	Construction Sector Contribution to GDP (%)	Construction Sector Growth (%)
	GDP (Note A)	Construction Sector Output			
2000	209,959	6,964	8.9	3.3	0.6
2001	211,227	7,108	0.6	3.4	2.1
2002	220,422	7,251	4.4	3.3	2.0
2003	232,496	7,359	5.5	3.2	1.5
2004	249,314	7,248	7.2	2.9	-1.5
2005	262,175	7,133	5.2	2.9	-1.6
2006e	277,673	7,097	5.9	2.7	-0.5
2007f	294,373	7,310	6.0	2.5	3.0
e – estimate, f – forecast **Average**			**5.46**	**3.0**	**0.7**

The growth of construction industry recently is perceived as not very well. Further, the availability of budget to cater the demand is finite and limited as the industry is largely governed by Government budget where it is planned for every five years. In order to overcome the weaknesses in the construction industry, the Construction Industry Master Plan (CIMP) was developed by the industry for the industry (Sundaraj, 2007). CIMP promotes sustainability to the construction sector with its mission to be a dynamic, productive and resilient sector. It consists of seven

strategic thrusts and one of the thrusts was identified as to develop human resource capabilities and capacities in the construction industry (Sundaraj, 2007). Construction depends largely on human skills although there are many technologies intensive are available in the industry and it is classified as one of the most crucial aspects in order to improve the productivity of the construction industry (Sundaraj, 2007).

In United Kingdom (U.K), a comparison of labour output between construction industry and manufacturing industry (Figure 1.1) was carried out and the result was resulted the concern and awareness towards the construction productivity level (Olomolaiye et al, 1996). The significance of construction productivity has formed a major research area and appears to be a broad consensus as it has been declined in several countries in recent decades (Mawdesley & Qambar, n.d.).

Therefore the understanding of construction productivity is very important as it may affect the performance of the industry towards the economy, indeed through a well concern on the productivity issues, the occurrence of construction delay might be minimized.

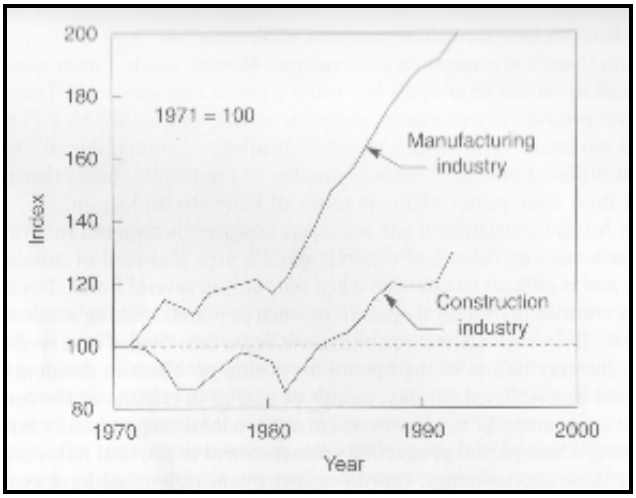

Figure 1.1: Comparisons of Labour Output Trends in the UK, 1972 – 1992

1.1.2 General Overview of Construction Method in Malaysia

Generally, there are four categories of construction methods that available in Malaysia in which it includes conventional construction method, cast in-situ method, composite method and fully pre-fabricated method (Nuzul Azam et al., 2005). Each of these building systems is characterised by its respective construction technology, functional and geometric configuration (Thanoon et al., 2003). In addition, Thanoon et al. (2003) identifies four distinguished groups which includes system with timber, steel, cast in-situ concrete and precast concrete as their main structural and space enclosing materials. These systems are then can be further classified according to geometric configuration of their main framing components such as linear or skeleton (beams and columns) system, planar or panel systems and three dimensional or box system as shown in Figure 1.2.

Malaysia is perceived as to undergo a transitional change from a conventional technology to a more efficient and mechanised system which is called the Industrialised Building System (IBS). This new method is believed to increase productivity and the quality of work through the application of better machinery, equipment, materials and extensive pre-project planning (Nuzul Azam et al., 2005). This method is being introduced as it promotes lesser usage of labour as compared to the conventional system which employs many workers to work at site.

However a research conducted by Nuzul Azam et al. (2005) highlights that the conventional system is more cost savings compared to the IBS. This is due to some reasons such as flexibility in choosing alternative building materials at lower price, higher cost for machinery and equipment, and limited manufacturers or specialised contractors in which the material have to be imported from outside.

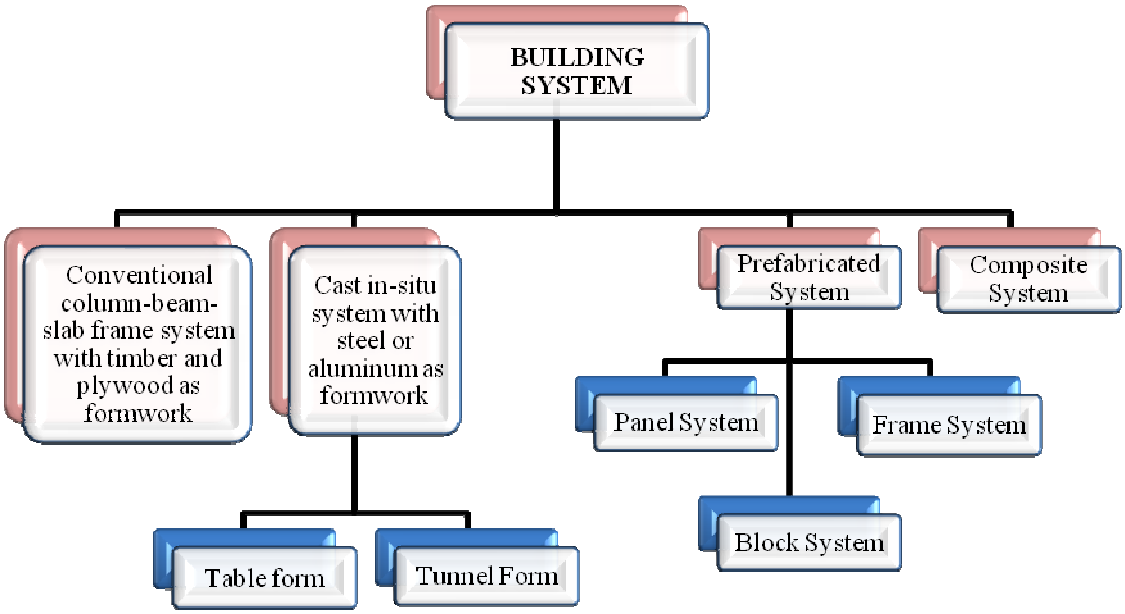

Figure 1.2 Type of Building System in Malaysia
Source: Thanoon et al. (2003)

1.1.3 Labour Productivity in the Construction Industry

In general, labour productivity is understood as the output measures on how much the thing have been produced and done within a certain period of time. From the clients' point of view, they normally perceived that higher productivity leads to lower cost, shorter construction program, enhance the value for money and higher return of investment (Horner & Duff, 2001).

Productivity remains as fascinating subject and issue in the construction sector in which it promotes cost savings and efficient usage of resources (Enshassi et al., 2007). Labour is one of important resources in the construction industry and it was reported that site workers (labour) account for up to 40% of the direct capital cost of large construction projects and the productivity of labour resources need to be maximised (Ng et al., 2004). Construction projects are mainly labour-based with basic hand tools and equipments therefore, the significant of the productivity plays an

important role as it affect the project schedule. Numerous studies have been carried out on labour productivity however, only few have addressed this issue in developing country (Enshassi et al., 2007).

1.2 STATEMENT OF RESEARCH PROBLEM

As mentioned earlier, the best achievement on cost, time and quality play an important role as it determines the successful of a construction project. However in Malaysia, research done by Abu Bakar (2001) highlighted that 194 projects were identified as delay in their progress. Based on the studies that have been conducted, half of the working time is being utilized for unproductive activities at site. These circumstances will definitely influence the progress of the construction works if there is no awareness and proper management being carried out. In addition, the objective to fulfill the best quality within the agreed budget and time cannot be realised.

At the moment there is no principle on labour productivity is being practiced in Malaysia for the preparation of work program. Most of the construction planners are using the labour productivity from other countries such as United Kingdom, United States and others. The construction projects in Malaysia are frequently over-run in time and cost as the labour productivity rate adopted from other countries is unsuitable with the work environment and conditions in Malaysia.

1.3 AIM OF RESEARCH

The aim of this research is to study the labour productivity of the construction projects specifically on reinforced concrete structural. The importance of construction productivity is largely being recognized either by developed or developing countries as it promotes time and cost saving. Therefore this research is purposely aimed to

improve an understanding on the significance of productivity in the construction industry in order to eliminate the occurrence of delay as well as to save time and cost.

1.4 OBJECTIVES OF THE RESEARCH

i. To study labour productivity on the construction of reinforced concrete structural framework.

ii. To identify the factors affecting the construction labour productivity at site.

iii. To compare the construction labour productivity on reinforced concrete structural framework between Malaysia and United Kingdom (U.K).

1.5 RESEARCH SCOPE

The research is conducted on two construction projects in Klang Valley area; Masjid Kota Damansara, Petaling Jaya and International Islamic University Malaysia (IIUM) Commercial Building (Bangunan Perniagaan), Gombak. These two case studies were adopted for this research as to provide comparison on the productivity between both sites later. Particulars for each of the project are described thoroughly in the following tables.

1.5.1 Masjid Kota Damansara, Kota Damansara, Petaling Jaya.

Table 1.2
Project Particulars for Masjid Kota Damansara, Petaling Jaya

PROJECT TITLE:	Cadangan Membina dan Menyiapkan sebuah Masjid Kota Damansara di atas Lot 45810 Seksyen 5, Kota Damansara, Selangor Darul Ehsan.
CONTRACT SUM:	RM 5,400,000.00
POSSESSION OF SITE:	22 December 2006
COMPLETION DATE:	21 June 2008
STATUS:	Completed

Masjid Kota Damansara was built in December 2006 at Kota Damansara, Petaling Jaya with the contract sum of RM 5,400,000.00. It was initiated by Jabatan Agama Islam Selangor (JAIS) as to fulfil the needs of Muslim residents in Kota Damansara to have a mosque since there were no other mosques nearby. The mosque was built through supervision of Jabatan Kerja Raya (JKR) Petaling. The mosque is a two-storey building consists of main prayer hall, ablution areas, imam and bilal offices, meeting room, library, store, minaret and two buildings for toilet which built separately outside the main building (mosque).

1.5.2 3-storey IIUM Commercial Building (Bangunan Perniagaan)

Table 1.3
Project Particular for IIUM Commercial Building

PROJECT TITLE:	Cadangan Membina dan Menyiapkan 1 Blok Bangunan Perniagaan 3 Tingkat di UIAM.
CONTRACT SUM:	RM 6,288,000.00
POSSESSION OF SITE:	28 August 2008
COMPLETION DATE:	29 June 2009
STATUS:	In progress

IIUM Commercial Building is a new complex in IIUM where it was intended to cater a comfortable area for banks, cafes, bookstores and it will be utilized for running the business activities. This three-storey building was built in August 2008 and is expected to complete in June 2009. The contract sum for this project is RM 6,288,000.00 and the construction process of this complex is under supervision of Centre for Built Environment (CBE) from Kulliyyah of Architecture and Environmental Design (KAED).

1.6 METHODOLOGY

This research implemented two case studies, in which an observation was conducted focusing on the activities such as cutting and bending reinforcement bar, fixing reinforcement bar, preparation of formwork, erection of formwork to beam and column and finally placing concrete to beam and column. The methods used in this research to collect the data were one-cycle time study and multiple-cycle time study. Besides that, data were also collected through documentation retrieval, review and

collection. Detail flow chart on the process of the research is presented in the Chapter 3.

1.7 SIGNIFICANT OF THE RESEARCH

The importance of the labour productivity has been extensively recognized mainly in the Western countries as it promotes time and cost savings where reliable measures of the productivity have been studied and accomplished in order to achieve the best value for money. Therefore the result of this research will help the planners and contractors in planning and producing more efficient work program in the future and directly result a smooth flow of progress at the construction site.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the thoughts and views from others including professionals, researchers, intellectuals and many more regarding to the topic of the research. This chapter generally discussed on the overview of construction method in Malaysia, overview of reinforced concrete structural framework, definition of the construction labour productivity, productivity measurement methods, factors affecting productivity and project planning and scheduling.

2.2 OVERVIEW OF CONSTRUCTION METHOD IN MALAYSIA

As mentioned in Chapter 1 previously, there are four types of common construction methods in Malaysia. The methods are conventional construction method, cast in-situ method, composite method and fully pre-fabricated method. Each of this method is discussed in general in this chapter.

2.2.1 Conventional Construction Method

In conventional method, construction works are being carried out through the process of timber or plywood formwork installation, steel reinforcement, and cast in-situ in which all the components of the building are pre-fabricated on site (Nuzul Azam et al., 2005). In addition it is quite expensive as this method involves labours, raw material, transportation and low speed of construction time.