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**CAUSES AND STEPS TO MINIMIZE VARIATIONS IN CONSTRUCTION
PROJECTS**

AHMAD ZAKI BIN ALI

**A project report submitted in partial fulfillment of the requirements for the
award of the degree of Master of Science in Construction Management**

**Faculty of Civil Engineering
University Technology Malaysia**

April 2008

I declare that this thesis entitled “*CAUSES AND STEPS TO MINIMIZE VARIATIONS IN CONSTRUCTION PROJECTS*” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree

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Specially dedicated to my beloved mother, late father, mother-in-law, beloved wife
(Dr. Haslina Hassan), my baby boy (Ahmad Hakim) and siblings

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ABSTRACT

Variation have been identified as one of the problems occurred in construction projects. Projects under implementation of the Department of Irrigation and Drainage have been chosen as the government plays a very significant role in providing infrastructure in Malaysia. The objectives of this study were to identify the causes of variation, their relative importance, the effects of variation and identify steps to minimize them. The questionnaire survey among the three group of respondents namely government, consultants and contractors who are directly involved in the implementation of Department of Irrigation and Drainage (DID) projects. Out of 130 questionnaires distributed, 112 were duly returned. Data were analyzed using SPSS Version 12. Based on the overall findings from the three group of respondents among other causes of variations were found to be site condition, design errors, inadequate soil investigation, etc. Among important steps identified to minimize variations are resolutions of land issues prior to awarding contract, adequate soil investigation, adequate budget on behalf of government, sufficient time to plan project brief and adequate time to prepare complete and detailed design.

ABSTRAK

Perubahan Kerja adalah antara masalah yang telah dikenalpasti berlaku di dalam projek pembinaan. Projek yang telah dilaksanakan oleh Jabatan Pengairan dan Saliran Malaysia di dalam Rancangan Malaysia ke Lapan diambil sebagai kajian kerana JPS merupakan Jabatan yang sinonim dalam menjalankan projek infrastruktur. Objektif kajian ini adalah untuk mengenalpasti punca berlakunya perubahan kerja dan kaedah yang boleh digunapakai bagi mengurangkan berlakunya perubahan kerja. Borang soalselidik telah diedarkan kepada juruperunding, kakitangan JPS dan kontraktor yang telah terlibat dengan projek di bawah Jabatan Pengairan dan Saliran Malaysia. Sebanyak 130 borang telah diedarkan dan 112 sahaja yang dikembalikan. Perisian SPSS versi 12 telah digunakan dalam analisis data yang diperolehi. Berdasarkan maklumbalas daripada Juruperunding, Kakitangan JPS dan kontraktor yang terlibat dengan projek JPS (Jabatan Pengairan dan Saliran) punca perubahan kerja adalah masalah tapak, masalah rekabentuk, kekurangan penyiasatan tanah, Pematuhan kepada kehendak PBT atau jabatan kerajaan, Kekurangan penyiasatan tapak dan sebagainya. Antara langkah penting dicadangkan untuk mengurangkan masalah perubahan kerja adalah menyelesaikan masalah yang berkaitan dengan status tanah, Penyiasatan Tanah yang cukup, Bajet yang cukup, Masa yang cukup untuk menyediakan perancangan projek dan masa yang cukup untuk menyediakan perincian rekabentuk dengan sempurna.

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CHAPTER 1

INTRODUCTION OF STUDY

1.1 Introduction

In Malaysia, in most cases every time heavy downpours occur, particularly in the city centre, flash flood problems will arise. In December 2006 about 60,000 people in Johor had been displaced by the worst flooding in the area in living memory. Due to bund failure in Butterworth, Penang last year, flooding had affected a few village areas. To repair the bund, Government is spending RM1.5 million (The Star, 10th September 2007)

Among other causes of flash flooding in Malaysia are due to rapid development without taking into consideration the local drainage system. The clearance of hillside land for new homes to accommodate the Klang Valley growing population is increasing the damage done by heavy rain in low lying areas of the city. Widening and deepening drains in the city will not solve the problem.

One of the major flooding problems is due to rivers being insufficient to cater for water overflow. In line with that Department of Irrigation and Drainage (DID)

has been entrusted to undertake extensive flood mitigation programs to overcome flooding problems throughout the country.

1.2 Background of the Study

The Department of Irrigation and Drainage (DID) dealing with among infrastructure works for flood mitigation and drainage projects. All these projects aim towards improving the standard of living of people in the country. Table 1.1 shows the allocation for flood mitigation projects from second Malaysia Plan to Ninth Malaysia Plan. Under The Seventh and Eighth Malaysian Plan the allocation for infrastructure components under the agriculture sector was irrigation and flood mitigation where RM1.93 billion and RM2.57 billion respectively (Economic Planning Unit, 2006). However, as in the Ninth Malaysian Plans the allocation has been increased to RM5.46 billion. i.e increased by 47.07 %.

This indicated that government is serious in tackling flood related problems. Therefore, DID plays a very important role in ensuring projects are completed on time, within budget, fulfill the quality and meet their objective.

Table 1.1: Allocation of Funds for The Flood Mitigation Projects

Period	RM	Remarks
1971-1975	14 Million	Second Malaysia Plan
1976-1980	56 Million	Third Malaysia Plan
1981-1985	182 Million	Forth Malaysia Plan
1986-1990	232 Million	Fifth Malaysia Plan
1991-1995	449 Million	Sixth Malaysia Plan
1996-2000	1.93 Billion	Seven Malaysia Plan
2001-2005	2.57 Billion	Eight Malaysia Plan
2006-2010	5.46 Billion	Ninth Malaysia Plan

1.3 Problem Statement

Infrastructure projects are affected more by ground condition as compared to building projects (Kaka and Price,1991). Flood mitigation projects can be categorized under infrastructure or civil engineering projects which can be affected by ground condition, weather, accessibility and other factors which eventually require variation to be made to original drawings. Latham (1994) suggested that variations were identified as one of the main problems controlling the construction industry in the United Kingdom.

Arian and Pheng (2005) concluded that the most frequent effects of variations were project cost and time overrun. This is due to additional works or changing in the design which is not incorporated prior to signing of contract. A significant number of earlier studies also identified variation as the top most important cause of delay. Assaf et. Al., Elinwa and Joshua,(2001); Kaming et al.,(1997); Meznee and Tawil, (1998); Abdul Rahman et al.,(2006)

In the implementation of any projects, the project manager or Superintending Officer (S.O) for government projects, will administer the contract so that it will meet the three common elements in any projects, i.e. meet the cost, time and quality. Any divergence from the objective will cause project delay and additional cost to the government. What is the causes of variations and how to minimize them?

1.4 Research Aims and Objectives

The aim of the study is to investigate the causes and steps to minimizing variation. To achieve the aims, the objectives of this study identified are as follows:

1. To identify the causes of variation orders according to their relative importance.
2. To identify and establish appropriate steps that could be adopted to minimize variation orders.

1.5 Scope of the Study and Limitation

The study focused on the implementation of DID projects in the Selangor State, Federal Territory and MSC Project Office. In carrying this study, only flood mitigation projects under Eighth Malaysian Plan (RMK8) will be considered.

In most government projects, problems arise mainly due to time given is too short in project planning. The projects particularly flood mitigation projects have to be carried out in a crisis effort, thus project planning is unable to be carried out in a better manner. Apart from that, lack of knowledge of designer and also the supervision team, insufficient finance, land matters problems, inadequate site inspection and site investigation, political influences are among the delay causes in project implementation for most government projects.

In carrying out the study the Condition of Contract used were JKR 203A(Rev 10/83) Conditions of Contract since it is the most commonly used previously and recently.

1.6 Brief Research Methodology

In carrying out this study, a questionnaire survey was carried out as one of the data gathering methods with three categories of respondents, namely government, consultants and contractors. Due to insufficient number of flood mitigation project in the study area i.e Selangor State, Federal Territory and MSC Project Office for class 'A' Contractors, the questionnaire was also extended to class 'B', class 'C' and class 'D' contractors. However, this will not jeopardize the quality of the answers since the majority of the respondents held bachelor status or were diploma holders. For better understanding in the scope of study, classification of contractor and the limit of project values on the Treasury Circular No. 14/2002 are shown in Table 1.2 below:

Table 1.2 :Classification of Contractors

Class of Contractor	Project Value
A	Above RM10,000,000.00
B	RM5,000,001.00 to RM10,000,000.00
C	RM2,000,001.00 to RM5,000,000.00
D	RM500,001.00 to RM2,000,000.00
E	RM200,001.00 to RM500,000.00
F	Up to RM200,000.00

Upon receiving the answers of the survey, checking and sorting of data were done followed by data analysis by using basic statistical data analysis method. Finally the result of the data analysis will be table out in the report and acquired conclusion and recommendation were made. Figure 1.1 shows the flowchart of the research methodology.

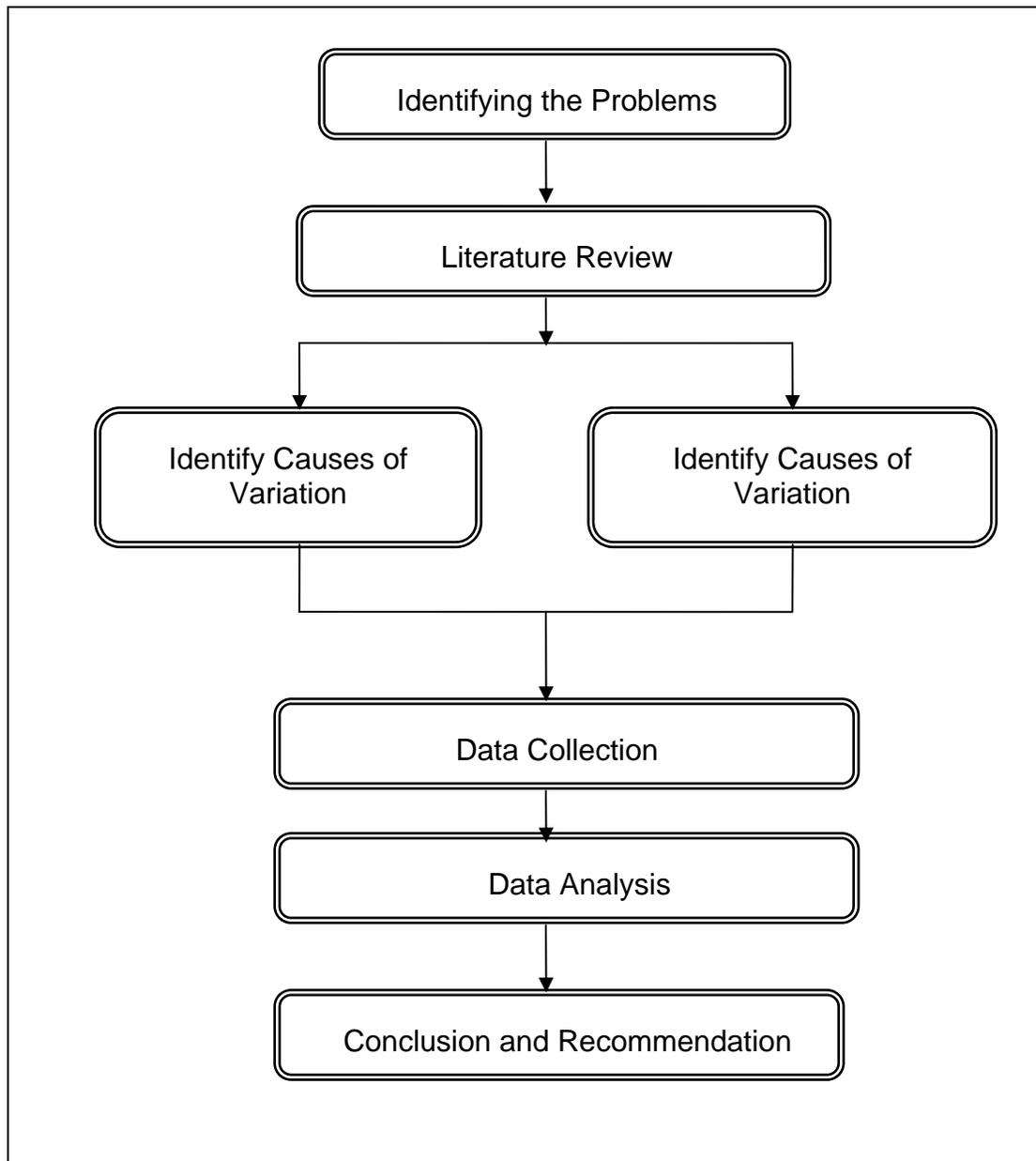


Figure 1.1 Flowchart of brief research methodology

1.7 Structure of Dissertation

The dissertation is divided into six chapters. The first chapter discusses on the objectives, scope and limitation of the study and brief research methodology adopted to fulfill the objectives of the study.

Chapter 2 discusses on literature review.

While in Chapter 3, it discussed in detail the research methodology adopted for the study. The approach to the questionnaire design is explained and the flowchart of the research methodology was shown.

The data collected from the survey questionnaire are analyzed in details in Chapter 4. In Chapter 5, the research findings are thoroughly discussed.

Chapter 6 concludes the study and makes recommendations to the construction industry for future research specifically to the construction project regarding variation order.

CHAPTER 2

PROCESS OF VARIATION

2.1 Introduction

Variation in construction projects create a considerable number of issues among others are delay in completion and as a consequence cost overrun, bad reputation either the designer or may be to some extent the contractors, public suffer for government projects and loss of profit for private projects. Apart from that variations sometimes create legal problems.

It is very common to have variation in construction, be it building or civil projects. Almost everyday agree that variation is like an evil in construction but nevertheless it is a reality and impossible to avoid due to various reasons which will explained in paragraph 2.4.

2.2 Definitions of Variation Order

Hibbred (1996) said that there is no specific definition what is a variation. Generally the words variation can be defined as any changes in the quality or quantity of the works as mentioned or spelled out in the Contract Documents. In other words, variation can mean any changes from the original scope of works. It can make significant changes in the cost and duration of a project.

Various definitions with regard to variation order are as follows:

- T.I 202.1 defined variation as any deviation from the contract with regard to the drawings, specifications and or Bills of Quantities either alteration, addition or omission ; and
- Clause 24(b) JKR203A(Rev.10/83) Condition of Contract defined variation as the alteration or modification of the design, quality of works as shown upon the Contract Drawings, Bills of Quantities and/or Specification, and includes the addition, omission or substitution of any works, the alteration of the kind or standard or any of the materials or goods to be used in the works and the removal from the Site of any of the works other that work, materials or goods are not in accordance with this contract.

2.3 Delays in Construction Projects

Generally, in construction projects, delays has become an international problem faced by many countries worldwide as reported in a significant number of references and Malaysia is no exception. This reported in the studied conducted by Chan and Kumarasawamy (1997, Abdul Majid & McCaffer (1998), Al-Momani (2000), Elinwa and Joshua (2001),Frimpong et al.(2003) and Abdul Rahman et al.(2006).

Chan and Kumaraswamy (1996) identified and investigate the importance of principle causes contributing to delays in building projects in Hong Kong based on three group of respondents, namely clients, consultants and contractors. The finding regarding ten topmost significant causes of delay in building project were:

- Poor site management and supervision;
- Unforeseen ground conditions;
- Low speed of decision making involving all project teams;
- Delays in design information;
- Lack of communication between consultant and contractor;
- Necessary variation of works;
- Inadequate contractor experience;
- Client-initiated variations; and

- Improper control over site resource allocation.

The study recognized that variations are one of the contributing factors to project delay and this issue will be addressed in this study.

2.4 Causes of Variation

Variations arise due to many reasons. Some may be genuine which are projects related e.g to suit unforeseen site conditions and some may be other reason which is designer related for e.g. design error by the designer. Other reasons are contractor related e.g. delay by the contractor supplier to supply material or poor site management by the contractor. Some may be due to client requirement in the course of construction. Other may be requirement by external factors such as compliance with local authorities' requirement. All these factors and many others generally are dislike by all parties because it will delay the project completion and in most cases increase in cost. In some cases, it is difficult to establish the reason and quantum of the variations and it will lead to dispute.