DESIGN PHASE CONSTRUCTABILITY CONCEPTS IN HIGHWAY PROJECTS

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To my beloved mother and father, my families, my lecturers, my friends and my special friend…..Thanks for the everlasting love and supports…..

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ABSTRACT

Nowadays, highway construction projects suffer from lack of constructability, which causes many problems; traffic, substantial number of changes, poor planning, disputes, cost overruns, poor safety practices and time delays. Some researchers have realized the seriousness of this shortfall and have suggested solutions to resolve it. Previous studies indicate that, overall constructability is not being implemented to its full potential in highway sector. So, this study tries to explore constructability implementation in the local construction industry particularly the highway sector. The aim of the study is to establish guideline that can be used by engineers in order to improve constructability of highway project design. The findings of the study shows there were eighteen design phase constructability concepts that are 'very important' and 'important' in highway sector. For the level of application, it was found that most of the concepts are in 'medium application'. It can be concluded that the engineers have the constructability knowledge but lack of understanding of the concepts. Based on the survey exercise, a guideline has been developed consisting of two parts which are 'very important' and 'important'. It is expected that by having this guideline, engineers will be able to apply this concepts effectively in highway project design in Malaysia.

ABSTRAK

Kesan daripada kurangnya aplikasi kebolehbinaan dalam pembinaan jalanraya pada masa kini telah menyebabkan berlakunya banyak masalah dalam pembinaan seperti lalulintas, perubahan rekabentuk, perancangan yang lemah, pertikaian, kos projek yang melebihi nilai projek sebenar, sistem keselamatan yang lemah, serta kelewatan masa penyiapan projek itu sendiri. Para penyelidik telah mengenalpasti betapa seriusnya masalah ini dan telah mencadangkan beberapa penyelesaian dalam menyelesaikannya. Kajian terdahulu menunjukkan bahawa keseluruhan kebolehbinaan ini tidak dilaksanakan secara sepenuhnya di dalam projek jalanraya. Maka, kajian ini cuba meninjau perlaksanaan kebolehbinaan ini di dalam projek pembinaan jalanraya setempat. Matlamat kajian ini adalah untuk menghasilkan satu garis panduan agar boleh digunakan oleh para jurutera dalam usaha untuk mempertingkatkan lagi penggunaan kebolehbinaan dalam fasa rekabentuk di dalam projek jalanraya. Hasil daripada kajian ini menunjukkan bahawa lapan belas konsep kebolehbinaan yang dikaji adalah 'sangat penting' dan 'penting' dalam projek jalanraya. Dari segi tahap penggunaan konsep ini pula, didapati bahawa semua lapan belas konsep yang dikaji di bawah kedudukan 'penggunaan pertengahan'. Dapat disimpulkan bahawa jurutera di Malaysia mempunyai pengetahuan mengenai kebolehbinaan ini, tetapi kurangnya pemahaman dari segi konsep-konsepnya. Berdasarkan pemerhatian kajian yang dijalankan, garis panduan telah dibentuk di mana ia mengandungi dua bahagian iaitu 'sangat penting' dan 'penting'. Adalah dijangkakan bahawa dengan adanya garis panduan ini, jurutera boleh mengaplikasikan konsep-konsep ini secara berkesan di dalam rekabentuk projek-projek jalanraya di Malaysia.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Introduction

Government and private agencies that carried out highway construction project are facing the reality that the public will no longer tolerate construction projects that are insensitive to road users and adjacent communities. According to Russell *et al*. (1993), highway construction projects are characterized by traffic problems, changes of design, poor planning, disputes, cost overruns, poor safety practices and time delays. Constructability is seen as one of the best solutions to these problems where it has demonstrated the potential to minimize the number and magnitude of changes, disputes, cost overruns, and delays during construction.

Constructability has been defined in a number of ways. Constructability is described as the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives (*Constructability,* 1986). Constructability is also defined as a measure of the ease or expediency with which a facility can be constructed (Hugo *et al*., 1990). Lastly, constructability is often portrayed as integrating construction knowledge, resources,

technology and experience into the engineering and design of a project (Anderson *et al*., 1995).

Highway project constructability can be particularly demanding for a range of reasons. For example, some of the highway construction technologies are varying hastily, and, as with most construction, the personnel is transient and site conditions can vary to the highest degree. Nearly all projects are subjected to severe public scrutiny involving open competitive bidding, thereby separating the planning and execution phases and largely precluding a fast-tracked approach to construction. Designs standards, authored by a multitude of organizations abound and often limit, if not discourage selective innovation. The prerequisite for nonproprietary specifications often leads to vagueness. In general, the perception is that project durations are longer than necessary and that construction costs can possibly be lowered. As a result, specifications supportive of constructability become an important element for improving project performance (Hugo *et al*., 1990).

Beside the project performance, constructability also has been successfully used to reduce project durations. Eldin (1996) provides several examples of projects that have successfully used constructability to reduce project durations without increasing project cost. In a CII (1995) study five projects were analyzed, reporting 11 to 30% reductions in project duration directly attributed to constructability reviews (i.e., without cost increases). Although the majority of the projects were associated with industrial facilities, one of them was an interstate highway realignment that included the reconfiguration of eight bridges and the construction of two new bridges to facilitate the addition of a high occupancy vehicle lane in each direction (Eldin, 1996).

Constructability review is the phase of construction project management where an independent and detailed analysis of all the contract drawings and construction documents is conducted before their release for construction. An effective constructability review process has the potential to incorporate into design

documents the best practices, guidelines, checklist, and lessons learned from previous projects, thereby improving the ease of construction and reducing life cycle costs. This critical process evaluates the "ability to construct" your construction project (Milstead, 1997). Constructability reviews of highway projects during design have the potential to minimize the number and magnitude of changes and delays during construction and thereby reduce durations (Anderson and Fisher 1997). A constructability analysis of six highway projects suggests that benefits may be as large as 25 times greater as costs (Anderson and Fisher 1997). Improved processes and management for effectively using constructability reviews to reduce total project durations can potentially improve construction project management. The way how to provide the best constructability review is by improving the understanding of application and importance of constructability concepts in highway projects.

1.2 Problem Statement

Nowadays, highway construction suffers from lack of constructability, which causes traffic problems, changes of design, poor planning, disputes, cost overruns, poor safety practices and time delays. Researchers in developed countries have realized the seriousness of this shortfall and suggested solutions to resolve it. In Malaysia, research in constructability in highway projects has not been popular researched yet. One of the reasons is due to lack of understanding of constructability concepts among the engineers. Design Phase Constructability Improvement Concepts for Malaysian Highway Projects should be developed, that are aimed at encouraging the project team to apply them, where appropriate, to their projects. The basic message is that applying these constructability concepts will enhance project's constructability, consequently optimizing the schedule, cost and quality of the project for the benefit of all parties involved.

1.3 Aim and Objectives of The Study

The aim of this study is to establish Design Phase Constructability Guidelines For Highway Projects in Malaysian Construction Industry. In order to achieve it, the following objectives have been identified:

a) To identify the constructability concepts in highway projects.
b) To identify the level of importance and application of constructability concepts in highway projects.
c) To establish Design Phase Constructability Improvement Guidelines for highway projects.

1.4 Scope of Research

This research was carried out by questionnaires and interviews. The research focused on Malaysian Highway Projects with contract values of more than RM 5 million. The questionnaires were distributed to the senior construction management team like engineers, architect or project manager and etc, who involved in highway projects.

1.5 Research Methodology

The methodology of research were help to realize the essential stages of methodology performed or steps of process carried in order to achieve the objectives

of this research. Figure 1.1 shows the research methodology chart that has been used in this research.

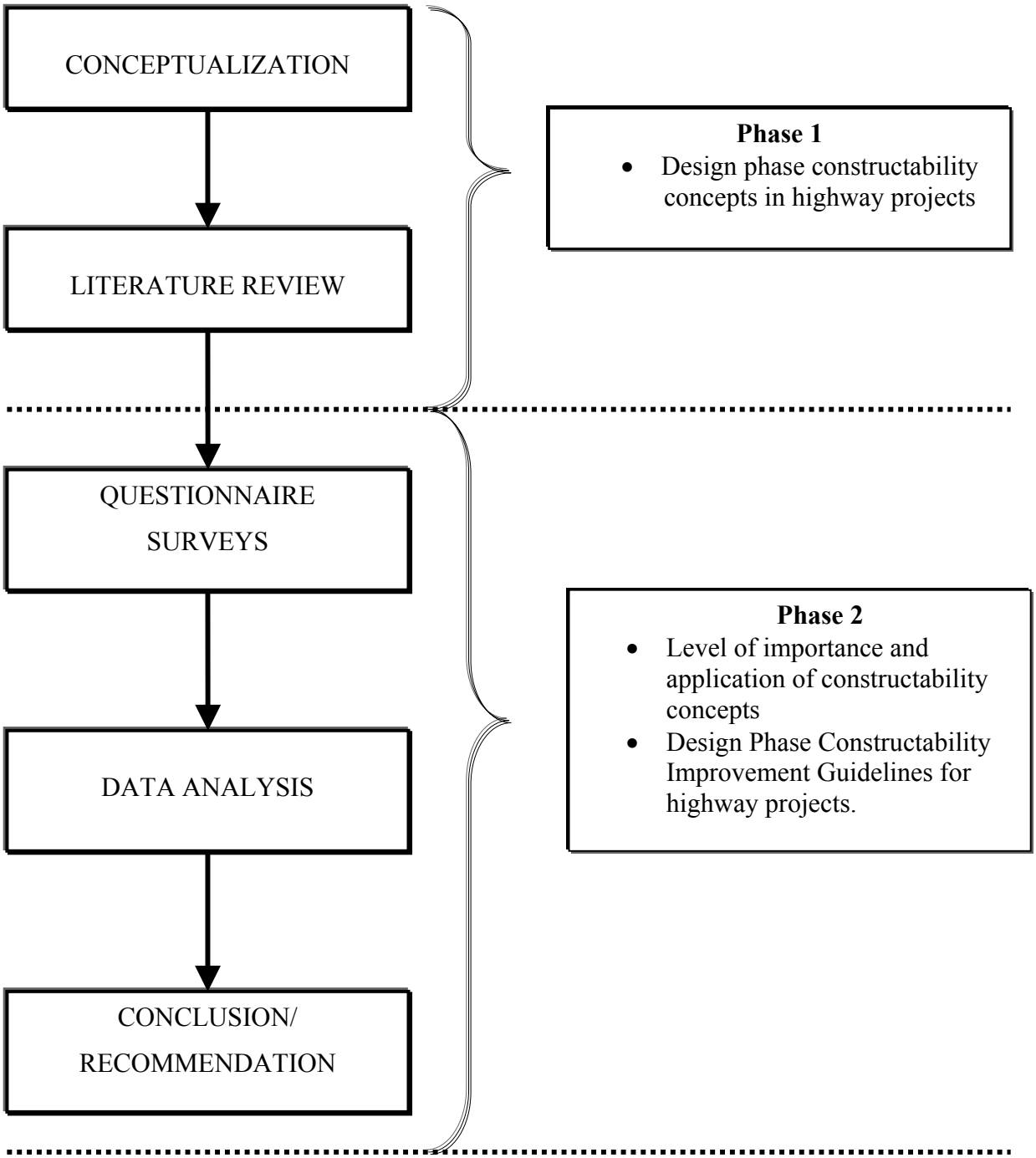

Figure 1.1 Research Methodology Chart

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