ISSUES AND CHALLENGES IN CONSTRUCTION OF ROLLER COMPACTED CONCRETE DAM IN MALAYSIA

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DEDICATION:

My beloved parents and family,

&

Norleen Fariza

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ABSTRACT

Rapid and economical construction are among numerous advantages of the construction of roller compacted concrete (RCC) dam compared to conventional dam. However, the complex process of RCC dam construction is facing difficulties due to lack of understanding and involvement from the local construction player since this type of construction in Malaysia is still new. Therefore, the objectives of this study is to examine the process of RCC dam construction and the issues and challenges during construction stage of RCC dam project in Malaysia. The study on the literature of RCC dam construction was performed to get the real view on the construction process of such project. The expert panel interview was conducted to get the view on RCC dam construction. Panel interview result was analysed and relate it to the literature to gather the process of RCC dam construction, and to further capture the issue and challenges of RCC dam construction. The results show that the main construction processes consists of determination of mix design, RCC production and RCC placement. Major issues and challenges in RCC dam construction was to place a high volume of RCC and to ensure the quality of RCC placement. Those issue and challenges during construction stage was overcome by controlling the temperature during RCC placement.

ABSTRAK

Tempoh pembinaan yang singkat dan pantas dan kos pembinaan yang rendah adalah antara kelebihan pembinaan empangan konkrit termampat (empangan RCC) berbanding empangan konvensional. Walau bagaimanapun, proses pembinaan empangan RCC yang kompleks, menyebabkan kesukaran dalam pembinaan projek seumpama ini di Malaysia. Ini kerana kurangnya pemahaman dan penglibatan dari pemain industri pembinaan tempatan dalam projek empangan RCC disebabkan jenis pembinaan ini masih baru di Malaysia. Objektif kajian ini adalah untuk mengkaji proses pembinaan empangan RCC dan mengenal pasti isu-isu dan cabaran semasa peringkat pembinaan projek empangan RCC di Malaysia. Kajian literatur mengenai pembinaan empangan RCC di buat untuk mendapatkan gambaran sebenar mengenai proses pembinaan projek itu. Temubual dengan pakar dalam pembinaan empangan RCC telah dijalankan untuk mendapatkan data utama dalam kajian ini. Keputusan temu bual pakar dianalisis dan dikaitkan dengan literatur untuk mendapatkan keputusan proses pembinaan empangan RCC, dan untuk mengenalpasti isu-isu dan cabaran dalam pembinaan empangan RCC. Keputusan menunjukkan, proses utama pembinaan empangan RCC adalah terdiri daripada penentuan campuran konkrit (RCC), pengeluaran campuran RCC dan penempatan campuran RCC. Isu dan cabaran utama dalam pembinaan empangan RCC ialah jumlah campuran RCC yang tinggi diperlukan untuk membentuk empangan dan untuk memastikan kualiti semasa kerja-kerja penempatan RCC dijalankan. Pengawalan suhu semasa proses penempatan RCC adalah salah satu cara mengatasi isu dan cabaran tersebut.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACI	-	America Concrete Institute
ASTM	-	American Standard Testing Material
GERCC	-	Grout Enriched Roller Compacted Concrete
RCC	-	Roller Compacted Concrete
USACE	-	United State Army Corps of Engineer

CHAPTER 1

INTRODUCTION

1.1 Study Background

Roller Compacted Concrete (RCC) has been rapidly developed over the past 40 years and commonly used for gravity dam application. Willow Creek Dam at Willow Creek was the first Roller Compacted Concrete Dam in history which was constructed by the Army Corps of Engineers between November 1981 and February 1983. There are numerous advantages of roller compacted concrete dam compared to conventional dam has lead to the acceptance of this type of dam technology is and are being used extensively in China, Japan, Spain, Brazil and elsewhere in Asia and Southeast Asia.

In Malaysia, the first dam project which adopted RCC technology is Kinta Dam was completed in March 2006. RCC dam is new to Malaysia construction industry and the understanding on the construction of this type of dam is still at the beginning stage. The local construction player such as a local consultant and contractor has limited knowledge about RCC dam construction which leads to the RCC dam construction in Malaysia facing many difficulties.

The process of construction of RCC dam is complex should be taken as a positive challenge to the construction industries in Malaysia. Rapid and cheaper construction are among the numerous advantage of constructing this type of dam. The construction industry stakeholder such as the government need to benefit from the numerous advantages which can give a significant impact to economy, environment and social.

1.2 Problem Statement

RCC dam has numerous advantages over a conventional dam such as rapid construction period and cheaper construction. The history of RCC technology began in 1970 and from there on many of RCC dam projects were constructed in China, Japan, Spain, Brazil and elsewhere including Southeast Asia.

For the large gravity dams, the projects can easily attract the big and well known heavy and civil engineering contractors who were successful in applying their overall construction knowledge in working with RCC dam. Today many of the gravity dam projects require some degree of prequalification for contractors (Bass, 2004). Allen (1992) has state that in his article title *RCC dam construction. A contractor's view,* construction team must be more than technically skilled and experience to manage RCC dam project.

The first RCC dam project in Malaysia was Kinta dam situated in Ipoh and it was constructed by Japanese contractor (Hazama Corporation) which was completed in 2007. In 2008, Batu Hampar dam project then becomes the second RCC dam project in Malaysia. “Dekon Sendirian Berhad” (Dekon), the local contractor who had no previous experience of RCC dams was selected to construct the dam. The government intention to develop local knowledge or expertise of RCC instead of

recourse to international contractor was the main reason why Dekon was selected to undertake that project (Wagner, 2011).

Based on the above fact, RCC dam was considered new to the Malaysian construction industry. Hence, the understanding and involvement from the local construction players were still at the beginning stage. The construction personnel such as engineer, supervisor, technician and even the general workers have very limited knowledge, skills and experiences on the RCC dam project that lead to the construction of RCC dam in Malaysia facing many issues and challenges both in the technical and management aspects during construction. According to Bass (2004), during the early years of RCC projects, even contractors had little to no experience working with RCC.

By referring to real situation on construction of RCC in Malaysia, therefore there is need to develop knowledge on construction of RCC dams among the local construction industries player in order to benefit from the numerous advantage of RCC dam construction. Refereed journals that discuss about the design aspect of RCC dam are there, but not many report about the issues and challenges faced by the construction team during construction period. Hence, there is a need to capture the knowledge of RCC dam construction in term of process, issue and challenges during construction stage.

This study will serve as an avenue for further understanding on construction of RCC dam among the local construction industry players.

1.3 Aim and Objectives

The aim of this master project is to explore the construction process of the Roller Compacted Concrete dam project in Malaysia. To achieve this aim, the objectives of the study are as follows:

1. To examine the process of the construction of RCC dam
2. To identify the issue and challenges in construction of RCC dam
3. To investigate how certain issues and challenges were overcome during construction stage

1.4 Scope and Limitation of Study

Scope of this study will focus on the perspective on construction of RCC dam project during construction stage. The study only covers the physical construction works in RCC dam construction project. The construction of RCC dam in Malaysia is chosen as suitable case study due to the fact that only recently Malaysia has adopted the RCC dam technology in the construction of the dam project.

Batu Hampar dam project will be used as a main case study to fulfil the aim and objectives of this study. The respondents are chosen from the construction personnel who were involved in the Batu Hampar and Kinta dam project which consist of the professional and semi professional individuals.

The literatures search indicated a few study about the specific design aspect of RCC dam construction project in term of the behaviour, characteristics and

performance of the RCC dam. However, the study on RCC dam construction in Malaysia is not commonly covered by the refereed journals.

1.5 Significant of Study

The understanding and involvement from the local construction player on construction of RCC dam is still at the beginning stage. To benefit from the numerous advantage of RCC dam construction, there is need to develop knowledge on construction of RCC dams among the local construction industries player. The study will serve as an avenue for further understanding on construction of RCC dam among the construction industries player. Throughout this study, the knowledge of RCC dam construction in term of process, issue and challenges during construction stage will be exposing to the public and the construction industries player can benefit from it.

1.6 Arrangement of the Report

This master project report consists of five (5) chapters which are the introduction, literature review, methodology, result and discussion, and conclusion. Introduction chapter describes the background and the need to study the RCC dam construction in Malaysia.

The literature review chapter describes the definition, characteristic and process of RCC dam construction which was gathered from various sources such as books, conference journal, engineering manual, journal paper and from the author

personal document. Most of refereed journals on this study matters come from the various author who are experienced in RCC dam construction in others country including Malaysia.

Research methodology chapter explains the methods used to conduct this study which is taken from the author's experience in RCC dam construction, expert panel interview and supported with the refereed literature.

The interview data (primary data) and the literature review (secondary data) was analysed and the results are discussed in Result and Discussion chapter. Then, the conclusions are made based on each of the objectives of this study as described in conclusion chapter.

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