CONCRETE PRACTICE AND DEFECTS DURING CONSTRUCTION – CASE STUDY

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ABSTRACT

This study is implemented for collecting information whether the activities that carried out at site are complied to the standard specification. This study concentrate on activities such as preparation, delivery, pouring, compaction and curing of concrete. Besides, preparation and installation of formwork and reinforcement also being stressed in this study. Condition of materials which are used in preparation of site mix concrete that will affect the workability and durability are also being discussed. The compressive strength of concrete can be influenced by quality of workmanship. Most of the methods in construction are not complied to the Standard Specifications for Building Works 2005. Furthermore, workers with lacking of skills, limitation of construction period, low quality of materials, design problem, limitation of workers and shortage of equipment will affect concrete quality and specification could not be complied. These factors affect the quality of concrete structure and number of tests is required to determine the actual strength of the concrete structure. Therefore, the right construction methods need to be implemented at site. As a result, the concrete structure will perform at optimum within long period.

ABSTRAK

Kajian yang dijalankan ini bertujuan mendapatkan maklumat tentang aktiviti-aktiviti yang berkaitan samada sebelum atau selepas kerja pembinaan dijalankan mematuhi spesifikasi yang ditetapkan. Kajian ini menjurus kepada kerja di tapak bina dari segi penyediaan, penghantaran, penuangan dan pemadatan konkrit serta pengawetan konkrit. Selain itu, focus juga diberikan kepada proses penyediaan dan pemasangan acuan konkrit dan besi tetulang. Dalam kajian ini, keadaan bahan-bahan yang digunakan dalam penyediaan konkrit segar di tapak juga dibincangkan kerana ianya akan mempengaruhi sifat konkrit seperti kebolehkerjaan dan ketahanlasakan. Selain itu, kekuatan mampatan konkrit juga dipengaruhi oleh cara kerja yang diamalkan oleh buruh binaan ditapak. Cara kerja yang biasa diamalkan di tapak kebanyakkannya tidak mematuhi spesifikasi yang ditetapkan dalam *Standard Specifications for Building Works 2005*. Faktor-faktor yang menghalang kerja-kerja di tapak dari mematuhi spesifikasi yang telah ditetapkan ialah pekerja kurang berkemahiran dan pengetahuan, tempoh pembinaan yang pendek, sumber bahan yang digunakan kurang berkualiti, masalah reka bentuk, jumlah pekerja yang tidak mencukupi dan jumlah kelengkapan untuk kerja-kerja pembinaan yang terhad. Faktor-faktor ini menjejaskan kualiti struktur konkrit yang dibina sekali gus memerlukan ujian-ujian dilakukan untuk mengetahui kekuatan sebenar konkrit di tapak bina. Oleh yang demikian, amalan pembinaan yang betul perlu diterapkan di tapak bina supaya kualiti struktur konkrit yang dihasilkan akan berfungsi secara optimum dalam jangka masa panjang.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Concrete used in construction industry must be in good quality to ensure its long term performance. Nowadays, construction industry such as building, bridges and other infrastructures are mainly used concrete as the main structure. The requirement to use good quality concrete is to prevent deterioration to the reinforced concrete structures. Deterioration of concrete may be due to either degradation caused by chemical attack, corrosion of steel reinforcement or damage due to impact loads and fire. Factors that will affect the quality of concrete are improper construction method, mistake in design, low quality of the material and bad workmanship.

Quality concrete means the concrete is consists of good components and characteristics of materials that provide good performance in long period of service life. Specifically, the constituent materials in concrete such as cement, aggregates and admixture incorporated have good quality that could satisfy the requirements during its service life. Quality concrete is influence by design mix, method of mixing, characteristic and proportions of material and workmanship during compaction. In order to provide quality concrete with good durability, it is not just depends on design mix, detailing and use of appropriate materials but also on satisfactory standards of execution or workmanship. Therefore, concrete without quality most probably reduced in durability and strength.

Particular examples where execution has a large influence include achievement of specified cover to reinforcement, cover thickness play an important role in particular to guard against penetration of chloride and prevent carbonation which the reaction may induced corrosion to reinforcement. The thickness of cover varies from 25mm to 50mm depending on the types of concrete structure. Curing process also one of the important aspects that must be taken into consideration particularly to ensure adequate hydration in the near surface. In addition, finishing work of horizontal and other unformed surfaces is also important; the finishes layer can prevent concrete surface from dust and provide the required degree of abrasion resistance.

Furthermore, durability of concrete means that capability of the concrete to maintain and perform the functions for which it is designed and used over a specified time. If the concrete has this capability it is called durable. Durability is part of the performance of the quality concrete. The durability of concrete is principally related to the ability of water either without or with aggressive ions, oxygen, and carbon dioxide to penetrate into the concrete pore structure. Durability aspect is vital for concrete to perform to its required level.

1.2 Background Problem

Quality of concrete in construction at site sometimes very less convincingly. Quality of the materials used in preparing the concrete at site is also questionable. Perhaps the constituents material such as cement, aggregates and water can be contaminated. Workers at site who work with the concrete probably do not fully understand the techniques, such as method of mixing, compaction and curing.

Lacking of skills workers in pre concreting work such as in formwork preparation and reinforcement installation can lead to alignment problem and air voids problem. Therefore the quality of concrete construction may be influence by

human error either before, during or after construction work, low quality of material can also give back effect to concrete structures.

1.3 Objectives

In making the study more realistic with clear direction, there are few objectives that have been listed and shall be used for the guideline in achieving the goals. Those objectives as follows:

(i) To study the normal practice methods during construction of reinforced concrete structure.

(ii) To compare the normal practice works in concrete construction with the Standard Specification for Building Works 2005.

(iii) To investigate the common type of defects due to faulty work during construction.

1.4 Scopes

The scope of this study shall cover the activities during construction session and after construction has been completed. The scopes in this study are:

i) The activities involve in site preparation such erection of formwork, installation of reinforcement, checking alignment, stiffness and spacing between reinforcement, condition of reinforcement.

ii) The concrete supply either from ready mix plant or in-situ. The distance between the ready mix plant and the construction site will be considered in designing the concrete mix.

iii) The workmanship before and after concreting give affect to the quality of concrete. The method being used in pouring, compacting and curing are important during concrete construction.

iv) Defects of concrete are happen due to wrong practices in concrete construction. Defects can be seen immediately after removal of formwork. These may occurred due to the faulty workmanship and low quality of the material being used in preparing concrete.

REFERENCES

1. Standard Specifications For Building Works (2005). Jabatan Kerja Raya Malaysia

2. John Newman and Ban Seng Choo. (2003). *Advanced Concrete Technology.* Burlington. Elsevier Butterworth Heinemann.

3. Susan Macdonald. (2003). *The Investigation and Repair of Historic Concrete.* New South Wales. NSW Heritage Office.

4. Taerwe L. and Lambotte H. (1991). *Quality Control of Concrete Structures.* Belgium. E & FN SPON.

5. Ravindra K. Dhir, M. Roderick Jones and Li Zheng. (2002). *Repair Rejuvenation and Enhancement of Concrete.* Dundee, Scotland. Thomas Telford.

6. Ravindra K. Dhir, Thomas D. Dyer and Judith E. Halliday. (2002). *Sustainable Concrete Construction.* Dundee, Scotland. Thomas Telford.

7. British Standard 8110 (1985). *Structural Use of Concrete, Part 1: Code of Practice for Design and Construction*

8. Malaysia Standard 523 (1993). *Specification for Concrete Including Ready Mixed Concrete, Part 1: Guide to Specifying Concrete.*

9. Malaysia Standard 28 (1985). *Specification for Tests for Water for Making Concrete, (First Version).*