THE EFFECT OF OVER DOSAGE OF CONCRETE RETARDER DARATARD 40 IN CONCRETE

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Especially dedicated
to my beloved family

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ABSTRACT

More than 70 % of insitu concrete is produced now by the ready mixed concrete industry in Malaysia. With the increases in economic growth and demand for highrise buildings as well as infrastructures make the industry to determine its own standards of the production by trial mixed design. The issues involves in the properties of fresh concrete during the casting stage. A high degree of workability is planned to speed up the construction. The suitable concrete retarder is being used in the fresh concrete to avoid the formation of cold joint due to time needed to place a large volume of concrete in a continuous operation. The chances to over dosage the concrete with retarder become so great and critical at the construction site. Sometimes it takes 2 to 3 days for the concrete to set and harden. It creates many doubt and disputes to engineers in the industries about the strength and durability of the concrete in long run. The study of behavior of the concrete with different dosage of retarder Daratard 40 has been conducted in the lab test prior to practical concrete practice. The investigation may help the industry to achieve the optimum dosage of concrete retarder without compromising the concrete strength. The relationships between slump test and optimum dosage of the Daratard 40 concrete retarder has been established from the study. Slump test a cheap, suitable and more reliable testing method use to detect the cause of over dosage in fresh concrete consent on consistency before placing and compaction works at the site.

ABSTRAK

Pada masa kini sebanyak 70 % konkrit tuang disitu menggunakan konkrit siap bancur (ready mixed concrete) dalam industri konkrit di Malaysia. Dengan perkembangan ekonomi yang pesat dan bertambahnya keperluan bangunan pencakar langit serta infrastruktur/kemudahan asas membolehkan industri pengeluar konkrit siap bancur menyediakan rekabentuk bancuhan konkrit mereka tersendiri secara cubaan (trial mix). Kesan dan masalah yang dihadapi oleh konkrit yang baru siap bancur (fresh concrete) dari segi sifat (properties) semasa konkrit dalam proses penuangan di tapak bina adalah perlu dikaji. Bagi mempercepatkan dan memudahkan sesuatu proses kerja pembinaan, konkrit pada tahap darjah kebolehankerjaan (slump) yang tinggi dan praktikal sangat diperlukan supaya kerja pembinaan itu senang di bina. Bahan kimia seperti bahan campur kelambatan (concrete retarder) digunakan dalam industri konkrit siap bancur bagi tujuan mengelakkan pembentukan sambungan sejuk (cold joint) semasa proses pemejalan konkrit dan penuangan konkrit dalam isipadu dan keluasan yang besar dengan cara operasi yang berterusan. Kebarangkalian bagi menambahkan dos bahan campur kelambatan yang berpatutan adalah amat tinggi dan kritikal semasa menerima konkrit di tapak bina. Ini adalah kerana kecuaian operator yang tidak sengaja dilakukan semasa membancur konkrit siap bancur di tapak lokasi yang lain dan berjauhan dari tapak bina yang sediada. Kadangkala 2 hingga 3 hari konkrit yang tuang dalam papan acuan tidak akan keras dan menjadi pejal. Ini menjadikan banyak tanda tanya dan bahan perbahasan dikalangan jurutera dalam industri pembinaan mengenai tahap kekuatan dan ketahanan ataupun tempoh perkhidmatan disepanjang hayat struktur konkrit tersebut. Satu kajian mengenai sifat konkrit akibat dos yang berbeza terutamanya berlebihan dos kepada bahan tambah kelambatan dalam konkrit telah dijalankan dalam makmal, ianya mirip dengan keadaan sebenar

yang berlaku di tapak bina. Hasil kajian ini akan membantu industri konkrit untuk menetapkan nilai optimum dos bahan tambah konkrit Daratard 40 dengan kekuatan izin konkrit yang maksimum. Hubungan diantara kebolehkerjaan (slump) dan nilai optimum dos bahan tambah konkrit dapat dijadikan sebagai pedoman. Satu alat pemantau/pengukuran seperti kebolehkerjaan (slump test equipments) yang murah serta sesuai dengan keadaan tapak bina dapat membantu mengesan dos bahan tambah konkrit yang berlebihan dalam konkrit sebelum dituangkan kedalam papan acuan serta pemadatan konkrit.

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Ø	=	Diameter of cylinder
C	=	Compressive strength
P	=	Applied load
W	=	Width of cube
L	=	Length of cube
d	=	Depth of penetration of water
h	=	Absorption of water
$\mathbf{M_w}$	=	Mass increases in the specimen due to immersion of water
$\mathbf{M_d}$	=	Mass of dry specimen

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this millennium a new challenge towards the construction industry not only in the process of producing consistent quality concrete but at the same time to be mindful as a responsible corporate citizen to preserve safety, health and environment. This has been manifested to be large extent in mega project such as Putra Jaya Development and more other project to be developed in our country. The ready mixed concrete industry in Malaysia experienced a dramatic consolidation of ready mix concrete players which saw multinationals company taking major position in the industry with potential for further growth. The industries enhance the knowledge in the IT to ensure competitiveness and technical skills matching world standards in concrete operations.

Concrete is a man made composite with major constituent of three materials namely cement, water and the aggregates and an additional material known as admixture, is sometimes added to modify certain of its properties. Cement is the chemically active constituent but its reactivity is only brought into effect on mixing with water. The aggregate plays not important roles in chemical reactions but its usefulness arises because of it is an economical filler material or hard composite material with good resistance to volume changes which take place within the concrete after mixing and it improves the durability of concrete. In hardened state, concrete is a rock like material with a high compressive strength. The fresh concrete in its plastic state may be mould into any form of shapes, it may be used to advantages architecturally or solely for decorative purposes. Normal concrete has low tensile strength and for structural applications it is normal practice to incorporate with steel bars to resist any tensile forces in the Reinforced Concrete. Concrete usually used in buildings for foundations, columns, beams and slabs, in shell structures, bridges, sewerage treatment plants, railway sleepers, roads, cooling towers, dams, chimneys, harbours or ports, offshore structures, coastal protection works and so on. In precast concrete product its widely used as concrete blocks, cladding panels, pipes and lamp posts (Jackson & Dhir, 1996).

Ready Mixed Concrete

More than 70% of in-situ concrete is produced now by the ready mixed concrete industry in Malaysia. This rapid development in output has caused the industry to determine its own standards of the production by trial mixed design. The use of large quantities of aggregates by the ready mixed concrete industry over along period ensures that the vast and expert knowledge of their properties is available for economic mix design. The coarse and fine aggregates availability varies according to geographical location and sources. Natural aggregates are obtained either as gravel or crushed rock from quarries and the mining sand. Sometimes due to shortage of supply the concrete mix do not comply exactly with the requirement of the relevant British Standard or Malaysia Standard but practical experience shows that with correct mix design, high quality concrete can still be produced. Aggregates should not be condemned solely on physical properties, but should be tested in trial mixes and their suitability assessed in terms of the properties of the concrete produced. It is most economical and cheapest to use locally available raw materials and the main choice of the ready mixed concrete producers. Ordinary Portland Cement (OPC) is easy available in Malaysia with high quality cement constituents and production also available some other types of cement such as sulphate resistance Portland cement also in the local market**. Admixtures** are normally used on request modifications and can not be made by varying the composition and proportion of the basic constituent materials or when the admixtures can produce the required effects

more economically (Stilwell, J.A The Concrete Society Journal 1984). Many type of admixtures found in the local market can used as accelerators, retarders, water-reducing and air entraining admixtures influence on hydration, liberation of heat, formation of pores and development of the cement gel. But in this study, the ready mixed concrete producers are using Daratard 40 as retarder admixture which is readily available from various sources of manufacturer's. The current practice usage of retarders by concrete industry at the site is about 300 ml to 550 ml per 100 kg of cement. The study showed about the effect of over dosage of concrete retarder Daratard 40 to the concrete mixed. In some cases at job site found that the concrete left unset for 2 to 3 days due to over dosage of the retarders admixture and become very common and serious in the concrete practice. It also creates many doubt and disputes about the strength and durability of concrete in the long run between concrete producers, project consultants and the contractor in the construction industry.

1.2 Problem Statement

The current production of concrete by ready mixed concrete batching plant in Malaysia is about 120 cubic metre per hour of concrete or 2880 cubic metre capacity per number of batching plant. The chances of over dosage the admixture especially concrete retarder into the fresh concrete mix is very high. This may be due to human errors or negligence while adding the concrete admixture in specific quantities through automatic dispenser tank.

1.3 Objectives of the Study

The main objectives of the study are:-

(i) to determine the optimum over dosage of concrete retarders without compromising the concrete strength.

(ii) to verify the slump test as a suitable technique to detect the over dosage in the fresh concrete before placing and compaction work at the job site.

The main significant of the project is to obtain the mean value of the compressive and tensile strength with optimum dosage of concrete retarder in the

fresh concrete at early age. This solution may help the contractors to remove their temporary works such props or scaffoldings which is supporting the permanent structures in the limited time frame with maximum mean value of the compressive strength of concrete.

1.4 Scope of the study

In this investigation, the concrete retarder Daratard 40 W.R.Grace is mixed with the proportion of 450 ml/100 kg of cement, 500 ml/100 kg, 600 kg/100 kg, 800 ml/100 kg, 1000 ml/100 kg and 1200 ml/100 kg of cement into the concrete mixed. The concrete retarder Daratard 40 is mixed with normal grade 30 concrete as per designed and supply in the local markets by the Concrete Producers. The Ordinary Portland Cement and the aggregates are 20 mm granite as coarse aggregate and mining sand as fine aggregate have been used in the batching. The specimens (cubes) shall be made and stored in the curing tank accordance with BS 1881 except that maximum temperature of 27º ± 2ºC is permitted. At the age of 24 hours, 3, 7 and 28 days, the specimens were tested for the compressive strength. The water penetration and absorption test also been conducted for checking the durability of the concrete mixes. The slump, compaction factor and proctor penetration tests was carried out for every batch of concrete mixes this to look at the behavior of fresh concrete due to over dosage. The specimens detail which to be tested as shown in Table 1.1.

Table 1.1: Sample of Specimens for Testing

Mix (Dosage of Concrete Retarder Daratard 40)	Slump (mm)	Curing Condition	Cube Test (Days)			
			1	3	7	28
Plain Concrete(Control)	100	Cured into curing tank at 27º ± 2ºC room temperature and kept 2 hours at atmospheric pressure before testing	3	3	3	7
450 ml/ 100 kg cement	75 ± 25		3	3	3	7
500 ml/ 100 kg cement			3	3	3	7
600 ml/ 100 kg cement			3	3	3	7
800 ml/ 100 kg cement			3	3	3	7
1000 ml/100 kg cement			3	3	3	7
1200 ml/ 100 kg cement			3	3	3	7

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