REUSING OF TREATED WASTE WATER IN CONCRETE PRODUCTION

THAVAMALAR A/P MUNIANDY

A thesis submitted in fulfillment of the
requirements for the award of the degree of
Master of Engineering (Civil – Environmental Management)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

JULY 2009

This study is especially dedicated to my beloved Mother and Father,
Brothers and Sisters,
Beloved *Dear*,
for everlasting love, care, and supports…..

ACKNOWLEDGEMENT

With the accomplishment of this project, the author would like to extend the special and greatest gratitude to the project supervisor, Prof. Dr. Razman B.Salim of Faculty of Civil Engineering, Universiti Teknologi Malaysia for his enthusiastic effort and concern. With his invaluable advice, guidance and encouragement, the author was able to complete this project.

The author gratefully acknowledges the cooperation of Mr. Lee Meng Keng, Mr. Teva Kumar, Miss. Shanti and the technicians whom helped in conducting the laboratory testing during the trials of concrete batching.

Deepest thanks to the author's family especially for their encouragement and support in life. Without them the author would not be able to complete the project.

ABSTRACT

This Project was conducted to study the possibility of usage of treated waste water in concrete production, so that the shortage and cost using potable water can be greatly reduced and the waste water can be suitably disposed for safe guarding the environment at the concrete batching plant. Grade 30 and Grade 35 concrete mix design were prepared using Ordinary Portland Cement using potable water and treated waste water produce from paper recycling factory (which is treated in a facultative pond) were tested to determine the mechanical properties of concrete. Among the test conducted are slump test, slump retention, compressive strength and setting time for laboratory mix concrete and plant batching mix concrete. The concrete mix designs were mixed at the laboratory using a drum mixer and also batched at concrete batching plant further ascertain the various in laboratory and plant mix concrete. The research shows that treated waste water from the paper recycling factory which had been treated in the facultative pond qualifies and can be used in making concrete.

ABSTRAK

Projek ini dijalankan untuk mengkaji kesesuaian menggunakan air sisa yang telah dirawat dalam bancuhan konkrit di sebuah kilang bancuhan konkrit, dimana masalah kekurangan air and kos menggunakan air paip boleh dikurangkan serta pembuangan air sisa dapat membawa manfaat dalam isu menjaga alam sekitaran. Spesifikasi bancuhan konkrit gred 30 dan gred 35 dibancuh menggunakan simen 'Ordinary Portland' dengan air sumber paip and air sisa yang telah dirawat dari kilang kitar semula kertas (rawatan air sisa dalam kolam fakultatif) yang diuji sifat – sifat mekanikal konkrit. Diantara ujian yang dilakukan adalah ujian penurunan konkrit, ujian masa penurunan konkrit, ujian tekanan ricih konkrit and ujian penusukan konkrit untuk konkrit bancuhan dalam drum untuk kuantiti kecil konkrit manakala di kilang bancuhan bagi kuantiti yang lebih besar. Spesifikasi konkrit yang direka dibancuh di makmal konkrit dan juga di kilang bancuhan untuk menentukan perbezaan variasinya. Daripada kajian yang dijalankan ini, didapati air sisa dari kilang kitar semula kertas yang telah dirawat sesuai untuk bancuhan konkrit.

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TW	-	Treated Waste Water
PW	-	Potable Water

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In the era of new developments and an age in increasing human population coupled with the need to curb expenditure in various sectors of the government budget, attention has been brought to the re-use of resources whenever possible. Practice of reuse involves processing used materials into as an reuse able products in order to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from land filling) by reducing the need for "conventional" waste disposal. Reuse is one of key component of modern waste management and is an effective method to be in cooperated towards wastewater reuse in both the agricultural and industrial fields.

A popular criterion as to the suitability of water for mixing concrete is the expression that if water is fit to drink it is suitable for making concrete. Other criteria attempting to ensure the suitability of water for batching fresh concrete require that the water be clean and free from deleterious materials. However these specifications may not be the best basis for evaluation of the suitability of water as mixing water. Some waters which do not meet these criteria have been found to produce concretes of satisfactory quality.

Currently there are no special tests developed to determine the suitability of mixing water except comparative tests. Generally, comparative tests require that, if

the quality of water is not known, the strength of the concrete made with water in question should be compared with the strength of concrete made with water of known suitability. Both concretes should be made with cement proposed to be used in the construction works.

1.2 Research Background

Undoubtedly, concrete is an ideal material for construction industry which can provide desired strength and durability in the condition that everything is done properly from the early stage of concrete mix design, materials selection, mixing process, concrete placement to the stage of curing the concrete. In short, the performance of concrete is directly related to the design, workmanship and environment of the concrete. However, in actual construction, not all these stages can be done perfectly especially in the aspect of workmanship.

From the study of Ooi Soon Lee (2001), the result showed that the concrete strength produced using the reusing treated effluent in concrete technology increases the compressive strength concrete compare to potable water With proper water quality control, this treated effluent can also be considered as a potential water resource for specific applications. Two tests were carried out namely compressive strength test and setting time to determine the feasibility of using treated effluent for concrete mixing. The results were compared against the tests conducted on control specimens which used potable water. The results showed also that treated effluent increases the setting time when compared with potable water.

Another study by V Sivakumar (2008), using the waste water from the textile industry cubes, cylinders and beams were casted and tested for its mechanical properties (compressive strength, tensile strength, flexural strength etc) and the result was found to be satisfactory. Hence the experiment conducted in this study was continued on for durability studies where the corrosion attack was also studied. The

results of other durability studies were found to be satisfactory. In this experimental study the results of specimen's casted using treated and untreated textile water were compared with the specimens casted with potable water. Since there was some corrosion, admixtures were added to counter act the same and the results were found to be satisfactory.

Now, the questions are *"What is the significance of using the treated waste water in actual concrete production?", "What are the effects on strength concrete?"*, *"Is laboratory scale and actual production scale of batching concrete using treated waste water have a lot variance?"* and *"How will the outcome of the actual production of concrete using a treated waste water whether is favorable or not?"*. These are to be answered and become the main interests of this study.

This has brought the interest to conduct a research on reusing treated water waste produce from a paper recycling factory in a concrete production. The research is carried out at a concrete batching plant situated in Jalan Kuchai Lama. Their concrete are supplied throughout the Klang Valley construction projects. The concrete batching plant consists of two type of mixer in the batching plant consist of wet mix plant and dry mix plant. The production rate for the batching plant perday is about 1000m^3 of concrete in a day with high water usage consumption. The purpose of the study conducted is also to reduce the high water usage consumption.

Figure 1.1 shows a satellite view the location of concrete batching plant and the location facultative pond which the source of treated waste water. The plant operation runs twenty four hours with a monthly production supply of 35,000m^3 concrete. The plant operates with 50 numbers of concrete mix trucks with capacity of 6-9m^3 per truck batching concrete capacity. The concrete production is in massive quantity which suits for the research to take place.

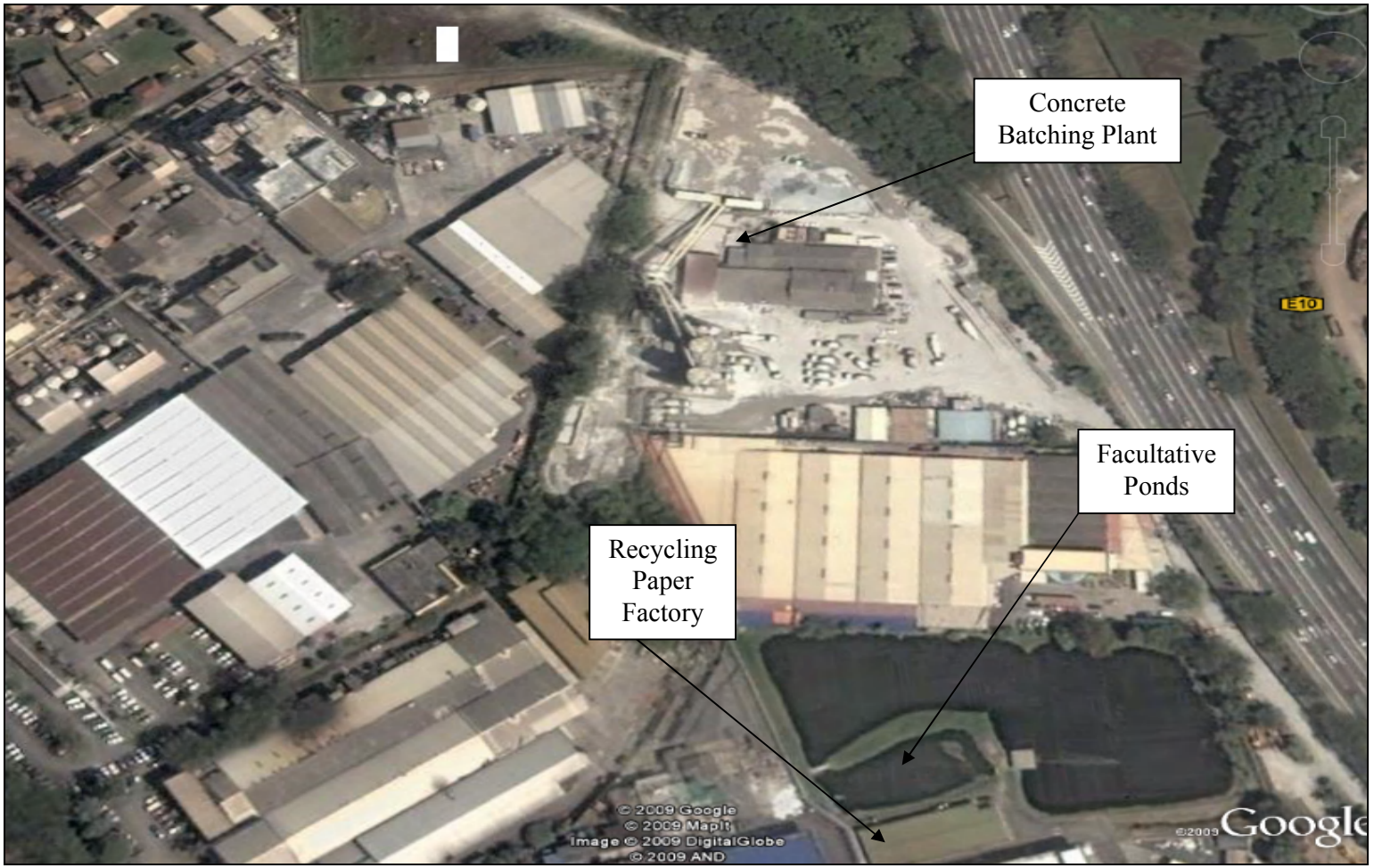

Figure 1.1: Satellite view of research study area

Figure 1.2 shows below the condition of the concrete batching plant on daily basis massive operation and supply of concrete to site.

Figure 1.2 : Concrete batching plant

The source treated waste water is produce from the activity of paper recycling factory (Figure 1.3) which is situated beside the concrete batching plant. The is also some water runoff from the cement truck washing bay which run to the facultative pond. This also contributes of some substances of carbon in the treated waste water.

Figure 1.3 : Paper recycling factory

Figure 1.4 : Facultative pond located beside the concrete batching plant

Figure 1.4 is the condition of the facultative pond, which is an alternative source of treated waste water (TW) and reduces the cost of using potable water (PW) for the batching plant concrete production. The treated waste water (TW) is proposed to be used in mixing concrete and also currently the batching plant is using the treated waste water as concrete slurry wash water.

1.3 Research Objectives

The objective of the research is to conduct a feasibility study of using treated waste water (TW) in concrete production.

i) The source of waste water is from paper recycling factory which is treated in a facultative pond

ii) The treated water is used in concrete mixing in a laboratory scale as experiment and actual concrete production scale at concrete batching plant.

iii) The comparison of chemical properties of the concrete produce is tested using portable water (PW) and treated water (TW).

1.4 Scope of Research

The scope of research shall be in line with the usage of treated waste water in the production of concrete in the effect on concrete compression strength, water demand, slump loss, slump retention, setting time and workability of the concrete. The research attempt to reduce the high cost potable water usage in concrete production, the use of treated waste water had been considered for this purpose. Finally, all the interpreted and analyzed of water sample and test conducted will be tabulated in a table form, showing comparison using portable water (PW) and treated waste water (TW). Data of concrete compressive strength tested at 1, 2, 3, 7 and 28 days, slump test, slump retention, setting time, water demand and workability of concrete is retrieve for the research analysis study.

In addition, it is hoped that the information from this study can be useful as a preliminary reference to reusing waste water in concrete production executing any concreting construction works in the future prospect of the Malaysian construction industry.