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FACTORS INFLUENCING TO THE SELECTION OF SEWAGE TREATMENT
PLANT

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A report submitted in partial fulfilment of the requirements for the award of the
degree of Master of Science (Construction Management)

Faculty of Civil Engineering
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MAY 2010

DECLARATION

I declare that this master's report entitled "Factors Influencing to the Selection of Sewage Treatment Plant" is the result of my own research except as cited in references. The master's report has not been accepted for any degree and is not concurrently submitted in candidate of any other degree.

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In the Name of Allah, the Compassionate, the Merciful, Praise be to Allah, Lord of the Universe

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ABSTRACT

The development of sustainable wastewater infrastructures is very critical at the initiating design stage in order to guarantee a long term achievement of services. Thus, sustainable strategic planning and engineering process including site planning is an important factor. Malaysia has undergone various experience and challenges in managing their sewerage management system. Most of the sewage system was developed by the developers to serve their own scheme development. This resulted in varies degree of design, sizes and performance quality. Moreover, some of the systems are inherently defective in design. The current sewerage system in Malaysia consist of a combination of centralize system and decentralize system. The choice between centralize or decentralize sewerage system will need to take consideration the existing situation and also the needs which differ based on the location. There is no universal applicable methodology can provide the definite solution is selection of centralized or decentralize sewage system. The aim of this study is to identify the factor influence for the selection of Sewage Treatment Plant (STP) construction between centralize and decentralize system. Thus, this paper review the current practice of sewerage system in Malaysia and the factors influencing the selection of sewage treatment plant construction with the centralize over decentralize system. The methodology of this study presumed with thorough literature to understand the scenario of the existing sewage treatment plant, gathering information and data collection from the questionnaire survey, and followed data analysis using frequency analysis and average index formula. The results from this study recommend the most influence factor and the implication to the selection of the sewage treatment plant construction. Based on the result, the important factors influencing this decision are topographical, size of catchment and location, land availability, buffer zone requirement, total capital and recurrent cost, requirement for future expansion and environmental impact as well.

ABSTRAK

Pembangunan mampan bagi infrastruktur air sisa merupakan sesuatu yang amat penting bagi memastikan keberkesanan sistem rawatan sepanjang hayat. Oleh yang demikian, perancangan sistem pemetungan yang strategik merupakan faktor yang perlu dititikberatkan. Kini, Malaysia telah melalui pelbagai pengalaman di dalam mengurus tadbir sistem pemetungan. Kebanyakan sistem pemetungan sediaada di Malaysia adalah dibangunkan oleh pihak pemaju. Atas faktor yang demikian, terdapat pelbagai tahap rekabentuk, saiz dan kualiti pencapaian. Malah, terdapat juga sistem pemetungan yang tidak mengikut spesifikasi piawaian yang diluluskan. Di Malaysia, terdapat dua jenis sistem pemetungan iaitu sistem berpusat dan sistem berselerak. Pemilihan bagi kedua-dua sistem tersebut hendaklah mengambilkira keperluan sediaada dan akan datang di mana ianya berbeza mengikut lokasi cadangan pembangunan. Tidak terdapat sebarang garis panduan mahupun kaedah yang boleh diguna pakai bagi tujuan pemilihan sistem tersebut. Oleh itu, fokus utama kajian ini adalah untuk mengenalpasti faktor-faktor yang mempengaruhi pemilihan binaan loji rawatan kumbahan iaitu di antara sistem berpusat dan sistem berselerak. Kaedah kajian yang digunakan adalah melalui literatur menyeluruh terhadap senario sistem pemetungan sediaada dan mengumpul data-data daripada kajian soal selidik yang dijalankan di ikuti dengan analisis data menggunakan analisis frekuensi dan formula Indeks Purata. Keputusan kajian mengesyorkan faktor-faktor yang mempengaruhi pemilihan loji rawatan kumbahan. Hasil daripada kajian menunjukkan antara faktor yang mempengaruhi pemilihan adalah bentuk topografi, saiz dan lokasi kawasan tadahan, kesediaan rezab, zon penampungan, kos kapital, keperluan menaiktaraf di masa hadapan dan kesan kepada alam sekitar.

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LIST OF ABBREVIATIONS

BF	Biofilter
BOD	Biological Oxygen Demand
CST	Communal Septic Tank
DOE	Department of Environment
FRP	Fibre Reinforced Plastics
IT	Imhoff Tank
IWK	Indah Water Konsortium Sdn Bhd
MPM	Mechanical Plant With Media
MPNM	Mechanical Plant Without Media
MLSS	Mixed Liquor Suspended Solid
MLVSS	Mixed Liquor Volatile Suspended Solid
NH ₃	Ammonia
OP	Oxidation Ponds
RSP	Raw Sewage Pretreatment Plant
TS	Trenching System
STP	Sewage Treatment Plant
DPE	Design Population Equivalent
CPE	Connected Population Equivalent

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CHAPTER 1

BACKGROUND OF STUDY

1.1 Introduction

Wastewater is water that has been affected in the quality which contains liquid waste discharge by domestic residence, commercial properties, industry and agriculture. It can comprise a huge range of potential contaminants and concentration. Sewage is subset of wastewater categorised in terms of its physical, chemical and biological composition. In Malaysia, wastewater is mainly generated from residential household, public toilet, kitchen, laundries and canteen which are located inside the commercial premises and institutional buildings, hospital and restaurants as well.

As populations increase by leaps and bounds, it places more pressure on the environment and threatening sources of fresh water supplies, it was recognised that the problem of 'human waste' needed proper management. Wastewater treatment plants are mushrooming in Malaysia as a response to the increasing demands for better and more effective sanitation services resulting from the country's remarkable economic growth after the 1997 Asian financial crisis (*Country:Malaysia Water & Wastewater Report May 2008*). There is a need to provide appropriate solution on selecting the construction of Sewerage Treatment Plant (STP) between centralize and decentralize system with a proper intergration and implementation process approach. This study will help in guiding the developing countries such Malaysia to

selecti appropriate construction of STP towards a comprehensive, moderns and sustainable environment.

1.2 Research Background

The STPs is functioning to collect and treat domestic wastewater produced due to human activities. Sewage from domestic and commercial, industrial and institutional premises have to be treated in order to ensure the water can be safely returned to the environment, and be discharged to rivers or coastal waters. As such, the provision of adequate sewerage infrastructure is of upmost importance to ensure the health and quality of life of the community (*Sewerage Development Plan Report 2004*).

Malaysia has been undergone various experience and challenges in managing their centralized and decentralized waster water management system. Indah Water Konsortium Sdn Bhd. (IWK) currently managing the public STP since 1996, which sewerage was previously managed by Local Authority (LA) level. Most of the sewerage infrastructure has been developed by the developer to served for their own schemes development which resulted in an ad-hoc and choatic collection of networks and treatment systems in most part of the country. Hence this resulted in not well designing and building of the STP and yet the STP's are performing poorly. The fact that there were no proper guideline in place controlling to sewerage issues such as inadequate buffer zone, defective in design, logistic of operation and maintanance the system as well. The situation becomes worsen whenever a huge percentage of the population continuously used the improper system such as individual septic tank and primitive system.

In Malaysia there are three main sewerage management practise being employed. These can be divided into public sewage treatment plant, private sewage treatment plant and individual septic tank. The individual septic tank is mainly known as on site treatment system with some of are so called pour flush system existing in the more rural area. Meanwhile the used of individual septic tank (IST) are suitable for single dwellings or individual buildings with a population equivalent (PE) up to 150 and installed where there is no central STPs and where effluent discharges will not adversely effect the environment. However, these systems only partially treat the sewage and concentrated groups of tanks can overload the capacity. This problems

of overloading creating unhealthy environment and odour problems (*IWK Sewerage Services report 2003*).

Centralized systems are costly to build and operate especially in areas where population densities low and dispersed household. Alternatively, the decentralized system is gaining more attention for implementation. The decentralized system is not only a long-term solution for small development but is more reliable and cost effective. However, both of these systems allowed vary degrees of system efficiency and functions. Therefore understanding the factor which influence in selecting which type of STP construction is crucial and should be accomplished by conducting a comprehensive study.

1.3 Research Problem

The development of STP in Malaysia operating in a mix system which are centralized and decentralize system. Presently IWK had managed more than five thousand numbers of public sewage treatment plant over the nationwide. All these system function at various degrees of efficiency. Currently there were no universal applicable strategy or methodology available in the selection of system between the centralize and decentralize system. Hence it is important on this study to identify what is the factor that needs to take into consideration for the decision making on the system selection in order to improve the sewerage management system.

1.4 Aim of the Research

This study is aim to identify the factors influence for the selection of Sewage Treatment Plant (STP) construction with centralize over decentralize system.

1.5 Objective of the Research

The aim of study highlighted above will achieve by following objectives:-

- i. To study the existing STP system used in Malaysia.
- ii. To identify the factor which influence in selection of STP.
- iii. To evaluate the implication of the factors towards STP.
- iv. To recommend the most influence factor and the implication to be considered in selection of STP.

1.6 Scope of Study

The scope of the study consist of the following aspect:-

- i. The study will carry out the current development of public sewage treatment plant managed by IWK.
- ii. The study focus on the factor influencing decisions making in selection of STP construction and and the implication integrated with the factors influence. Factors were focused into three main aspects which were social, technical and environmental aspect which divided into several sub-factors.
- iii. The study is focusing on the centralized and decentralized system applied in Malaysia sewerage industry.

1.7 Brief Methodology

In carrying out this study the methodology adopted four main stages from the literature review to understand and profound knowledge on the research topic, selection of study area, collection of data, data analysis, research finding, discussion, conclusion and recommendation related to the scope study. Hence it is require a systematic idea of methodology in order to have clear understanding of every process in contributing the research preparation. The four (4) main stages used to undertake the study is as follows:-

1. **First Stage** – Literature review from various sources which provide wide range of the information and knowledge as well as understanding pertaining of development STP. The literature review is including report, guideline, handbooks, dissertation, magazine, website and journal.
2. **Second Stage** – Data collection and data analysis. Data collection carried out in two method, first through the report reviews from the agencies involve in sewerage industry and second from the questionnaire survey with the expert panel in the sewerage industry . Analysis and evaluation of data collection within the study area helps to identify the influence factors of STP selection.
3. **Third Stage** – Result and proposal. Based on the data analysis and reading from the literature review, discussion on the research finding to measuring the result and identifying the factor that needs to take into consideration for the appropriate construction of STP.
4. **Fourth Stage** – Comprise of conclusion and recommendation which ended with the factor influence in selecting type of STP construction for appropriate sewerage development.