ALTERNATIVE SEWERAGE SYSTEM IN MALAYSIA : A NEW CONSTRUCTION TECHNOLOGY

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A project report submitted in partial fulfilment of the requirements for the award of the degree of Master of Engineering (Civil-Construction and Management)

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Universiti Teknologi Malaysia

MARCH 2004

SISTEM PEMBETUNGAN ALTERNATIF DI MALAYSIA : SATU TEKNOLOGI PEMBINAAN BARU

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Laporan projek ini dikemukakan sebagai memenuhi sebahagian daripada syarat penganugerahan Ijazah Sarjana Kejuruteraan
(Awam - Pembinaan and Pengurusan)

Fakulti Kejuruteraan Awam
Universiti Teknologi Malaysia

MARCH 2004

To my family with love.

ACKNOWLEDGEMENTS

This master project report was never an individual effort, but with combination contribution of others who involved directly or indirectly. Among all who involved in this project, the author wishes to express the greatest appreciation to PM. Haji Wan Zulkifli and Mr. Bachan Singh as the supervisors of this master project. With all the guidance and advices given from both of the supervisor, this master project was able to complete on time. Their dedication and continuous assistances have led the author to strive for better achievement in this master project.

The author wishes to express his gratitude to his family and friends for their supports and cares. Last but not least, the author wishes to thank all those who have contribute in one way or another in making this master project a possible one.

ABSTRACT

Gravity sewer system has been the conventional way of laying sewer pipes and therefore has been the most popular sewer pipe-laying method in the construction industry. However, not all ground conditions favour the gravity sewer system. As such, the main focus of this study is to study one alternative sewerage collection system, which is the vacuum sewerage system, that had been implemented in Malaysia for the past few years. The purpose of this study is to study the characteristics of the Vacuum Sewerage System in terms of the environmental and safety aspects, and aims at identifying the problems faced during the implementation of Vacuum Sewerage System and the main factors contributing to the selection of the Vacuum Sewerage System. A total of 50 questionnaires were distributed to respondents in the state of Kuala Lumpur, Selangor, Johor, Pahang, Perak and Kedah. The feedbacks were analyzed using frequency analysis, average index analysis and relative index analysis. The vacuum sewerage system is a more flexible sewerage system as compared to the conventional gravity system as the construction of vacuum sewerage system in various soil conditions has a lower level of difficulties.

ABSTRAK

Sistem pembentungan graviti sememangnya merupakan kaedah konvesional dalam pembinaan sistem pembentungan dan merupakan kaedah yang terpopular dalam kerja pembinaan sistem pembentungan dalam industri pembinaan. Akan tetapi, sistem pembentungan graviti tidaklah sesuai dalam semua keadaan tanah. Justeru itu, tumpuan utama kajian ini adalah untuk mengkaji satu sistem pembentungan air sisa yang telah diimplementasikan di Malaysia, iaitu Sistem Pembentungan Vakum. Tujuan kajian ini adalah untuk mengkaji ciri-ciri Sistem Pembentungan Vakum dari segi faktor alam sekitar dan faktor keselamatan, mengenalpastikan masalah-masalah yang dihadapi semasa pelaksanaan Sistem Pembentungan Vakum dan juga factor-faktor yang mempengaruhi pemilihan Sistem Pembentungan Vakum. Sebanyak 50 set borang kajian soal selidik telah diedarkan kepada responden di negeri-negeri seperti Kuala Lumpur, Selangor, Johor, Pahang, Perak dan Kedah. Maklum balas para responden telah dianalisiskan dengan menggunakan analisis frekuensi, analisis index purata dan analisis index relatif. Sistem Pembentungan Vakum merupakan sistem pembentungan yang lebih fleksibel jika dibandingkan dengan sistem pembentungan graviti memandangkan kerja pembinaan Sistem Pembentungan Vakum di pelbagai keadaan tanah mempunyai tahap kesukaran yang rendah.

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SYMBOL	PARAMETER	UNITS
H_f	Friction head	ft
H_s	Static head	ft
H_v	Vacuum head	ft
t	System pump-down time	min
TDH	Total dynamic head	ft
Q_a	Station average flow	gpm
Q_{max}	Station peak flow	gpm
Q_{min}	Station minimum flow	gpm
Q_{dp}	Discharge pump capacity	gpm
Q_{vp}	Vacuum pump capacity	cfm
V_{ct}	Collection tank volume	gal
V_o	Collection tank operating volume	gal
V_{rt}	Reservoir tank volume	gal
V_p	Piping system volume	gal
V_t	Total system volume	gal

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CHAPTER I

INTRODUCTION

1.1 Background of the Study

From the sixties to the early eighties in the last century, sanitation problems in Malaysia were largely rural in nature reflected by the periodic outbreak of waterborne communicable diseases in these areas. In the early seventies, as a strategy to overcome this problem, the government launched a community based rural water supply and environmental sanitation coverage programme using low cost appropriate technologies to improve water supply and sanitation coverage in the rural area. This programme has succeeded in raising the coverage of rural population with proper sanitation facility from a mere 2.6% in 1970 to 90% in 1995 and 99% at the end of 2003 and in the process contained the frequent outbreak of waterborne communicable diseases in these areas (Ir. Tan Hoo, 2003).

The provision of an adequate standard of environmental sanitation in city, urban and urban fringe areas in Malaysia has been given a high priority in previous five (5) years plans. Emphasis has been places on the provision of an efficient and effective sewage management system to all communities in Malaysia. As the government has emphasized on improving sanitation in Malaysia in the coming

years, the public health will benefit from the huge capital expenditures already invested in the provision of an integrated sewerage management system in Malaysia

Sanitation problems in Malaysia have been exacerbated by the rapid urbanization and industrialization taking place. In 1988, domestic sewage contributed some 69% of the total BOD load discharged to inland waterways. It was also estimated in 1988 that only 4.9 % of the urban population living in local authority areas were served by a central waterborne sewerage system whilst 34% of the population in these areas utilized septic tanks and communal systems. The majority of the septic tank systems do not have on-site disposal facilities and the septic tank effluent is normally discharged directly to monsoon drains. Poor septic tank design, construction and maintenance and the lack of on-site disposal facilities results in drains and watercourses being highly polluted with partially treated or raw human wastes.

In our march towards becoming a developed nation, it has been largely accepted that a modern water borne sewerage system has to be one of the basic amenities serving the society. However, like other infrastructure needed by a modern society, a water-borne sewerage system requires a hefty investment for its construction as well as operation and maintenance. Unfortunately, unlike transportation, power and water supply, which have a direct bearing on economic development, sewerage development has not been given he same level of attention in the successive Nation Development Plans. As a result sewerage system development lags far behind other infrastructure. The rapid pace of urbanization of the last three decades compounded this situation and poses a difficult challenge on strategic planning for sewerage system development (Ir. Tan Hoo, 2003).

In line with the aspirations stipulated in the 2020 Vision, a modern sewerage system for a developed Malaysia should be able to meet environmental and public health standards, able to meet the service and aesthetical expectations of consumers, financially and technically sustainable and able to achieve a high degree of efficiency

and cost effectiveness. A well-planned, professionally developed and effectively managed water-borne sewerage system can meet the above objectives. It was with these in mind that a major effort was made to prepared sewerage master plans for more than twenty urban centers in the country between the late seventies to the mid eighties of the last century. However, Malaysia soon learned the lesson that the conventional approach towards developing regional sewerage system comes with a price beyond the reach of a developing country needing to focus its resources on economic development. This problem was compounded by the situation of not having to develop sewerage system for existing built up areas but also to cope with the numerous new settlements sprung up at the urban fringes as a result of the tremendous pace of urbanization unleashed by the economic development policy.

Currently there are three major stakeholders involved in the development of a private sewerage system. These are Sewerage Service Department which is responsible to enforce the legal requirements and in the process protect the interest of the consumers; Indah Water Konsortium which basically look after its own interest as explained earlier; the developer represented by his consultant and the contractor who executes the work. As far as the developer is concerned, sewerage system with the lowest capital cost meeting the minimum requirements stipulated in MS 1228 and Sewerage Service Department's guidelines and specifications would be his choice as the operation and maintenance cost is not the responsibilities of the developer. This situation is often compounded by the extremely keen competition among the contractors resulting in developers imposing specific design requirements onto the consultant to cut cost. Unfortunately, as many consultants are not specialized in sewerage system design and furthermore may be due to business consideration, more often than not, they offer only a token resistance to such a pressure from developers, under such a circumstance achievement of optimum design based on a holistic consideration become very difficult to say the least. (SSD, 2003)

On the other hand there is a lack of systematic evaluation and accumulation of information on the performance of the performance of various sewerage system and equipment rendering rational decision making on design optimization impossible

or unconvincing, Obviously, there are much works to be done on this matter to find a suitable solution.

Malaysia is a developing country with a clear vision and in hurry towards becoming a modern and dynamic developed nation. As economic development holds the key towards achieving such an objective, until recently, sewerage development has lost out in the competition for available budget from other infrastructures which have a more direct bearing on economic development. Under such a situation, conventional approach for sewerage development has to be abundant in our search for viable means to meet the escalating needs of the nation. In the process the community for the developing urban sewerage have served us well.

It has become a challenge for us to forge ahead beyond accessibility and develop a sustainable national sewerage system with the capability to meet the most stringent environment standards, a quality and consistency meeting the expectations of the most demanding consumers, an efficiency and cost effectiveness worthy of a developed nation. Achieving this objective requires continuous improvement in all aspects of sewerage development and involves all out effort from all sectors as well as the support from all segments of the society on the initiatives taken in this direction.

1.2 Statements of Problem

Gravity sewer system has been the conventional way of laying sewer pipes and therefore has been the most popular sewer pipe-laying method in the construction industry. Gravity sewer system, as suggested by the word 'gravity', transport sewage from one higher point to a lower point by gravitational flow.

Gravity sewer system seems to be ideal sewage collection system as it is easy to be constructed and it seems to be workable on all ground conditions. On top of everything, gravity sewer system seems to be the only sewer pipe laying-method being implemented in our country.

However, not all ground conditions favour the gravity sewer system. There are circumstances where gravity sewer system poses a headache to contractor, such as the excavation works may go as deep as 11.0m on a piece of relatively flat land due the gradient required for the gravitational flow. This would definitely increase the overall construction cost. Pipe-laying contractors also encounter difficulties in soft ground, when the additional shoring structures such as sheet piling need to be constructed to prevent the collapse of earth. Similarly, the contractors may face problems in laying the sewer pipe on the ground with high water table.

1.3 Objectives of the Study

The aim of this study is to study an alternative technology in the collection of municipal wastewater and the implementation for such vacuum technology in Malaysia.

In order to achieve the aim of the study, the following objectives have been identified:

a) To identify the level of difficulties in constructing gravity sewerage system and vacuum sewerage system under different soil conditions.

b) To study the characteristics of vacuum sewerage system in terms of environmental and safety aspects.

c) To identify the problems faced during the implementation of vacuum sewerage system.

d) To identify factors contributing to the selection of vacuum sewerage system

e) To identify the system submission procedures to the authority and its requirements.

1.3 Scope of the Study

In order to achieve the objectives for this study, the scope of the study will be focusing on the completed vacuum sewerage projects in Malaysia.