

**A COMPARISON BETWEEN TRADITIONAL PAVEMENT
REHABILITATION METHOD AS COMPARED TO RECYCLING
METHOD**

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To my beloved family

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ABSTRACT

Approximately, more than 20% of the road networks in Malaysia are unpaved roads of natural soil or earth or gravels. The primary objective of both pavement maintenance and pavement design is to ensure that the pavement provides adequate service to the road users. In lines with the government's aspiration for Malaysia to be a developed nation by year 2020, it is necessary to upgrade the roads to a better quality. The emergence of recycling technique in pavement maintenance is not widely accepted. The current practice of mill and pave technique which is the traditional technique in pavement maintenance is widely used in Malaysia. Hence, many steps are taken to introduce alternative techniques in pavement rehabilitation. This alternative method had been proven by various maintenance contractors that is cheaper and takes shorter duration as compared to the traditional technique. The focus of this study includes: identifying types of pavement maintenance available in Malaysia; to identify differences between traditional methods to recycling method; and to identify the most economic method that can be used. The study employs the historical data and descriptive method and it was conducted in two stages that were literature reviews and interviews. Better understanding of theory and concept of the issues were developed through literature reviews. Unstructured and structured interviews had been carried out to obtain data as well as observation at the project sites. All data was analyzed using Frequency Analysis and Average Index. From this study, it can be concluded that the objectives of the study was successfully achieved. It was found that selection criteria for type of maintenance depends on the distress occurred and experiences in similar project in the particular technique. It is also found that recycling method provide more savings and advantages compared to conventional method.

ABSTRAK

Dianggarkan lebih daripada 20% jaringan jalan raya di Malaysia adalah merupakan jalan yang tidak berturap. Jalan-jalan ini merupakan jalan yang dibina dari tanah asli ataupun batu kerikil. Tujuan utama penyelenggaraan jalan dan rekabentuk jalanraya adalah untuk memastikan jalan tersebut boleh memberikan perkhidmatan yang mencukupikepada pengguna jalan raya. Sejajajr dengan aspirasi kerajaan untuk menjadikan Malaysia sebagai negara maju menjelang tahun 2020, kerja-kerja menaiktaraf jalan kepada suatu kualiti yang lebih baik adalah amat diperlukan. Kemunculan dan kebangkitan teknik kitar semula dalam penyelenggaraan jalan belum lagi diterima secara meluasnya di Malaysia. Kaedah Konvensional merupakan kaedah yang digunakan secara meluas kini dalam kerja-kerja penyelenggaraan dan membaikpulih jalan raya. Pelbagai langkah telah diambil untuk memperkenalkan teknik alternatif ini dalam insutri pembaikpulihan jalan. Kaedah alternatif ini telah dibukikan dapat mengurangkan kos dan tempoh pembinaan sesuatu projek. Kajian ini menggunakan gabungan Teknik Kajian Data-data Lepas dan Teknik Penghuraian Data. Ianya dijalankan dalam dua peringkat iaitu kajian literature dan melalui temuramah. Temuramah Berstruktur dan secara tidak formal di samping pemerhatian sendiri di tapak projek juga dijalankan untuk mengumpul data kajian. Analisa data dijalankan menggunakan kaedah Analisa Ke kerap an dan Indeks Purata. Fokus kajian ini ialah untuk mengenalpasti jenis-jenis penyelenggaraan jalan yang digunakan di Malaysia; mengenalpasti perbezaan-perbezaan yang wujud di antara kaeda konvensional dan kaedah kitar semula dan mengenalpasti kaedah yang paling ekomoni dalam penyelenggaraan dan pembaikpulihan jalan raya di Malaysia. Kajian ini telah berjaya mencapai objektifnya dan daripada kajian ini, didapati criteria pemilihan jenis penyelenggaraan banyak bergantung kepada jenis-jenis kerosakan jalan dan pengalaman kerja kontraktor. Kajian ini juga berjaya mengenalpasti bahawa kaedah kitar semula lebih ekonomi berbanding kaedah konvensional.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Approximately, more than 20% of the road networks in Malaysia are unpaved roads of natural soil/earth or gravels. This figure does not cover small or rural roads, which is estimated to be in the range of 80,000 to 100,000 km. These unpaved roads are generally in poor condition especially during wet season, where the roads are undulating and almost impassable. During dry season the roads can be very dusty posing health hazard to the surrounding community (IKRAM, 2004)

The primary objective of both pavement maintenance and pavement design is to ensure that the pavement gives adequate service to the road users (Peterson, 1987). The performance of the pavement is measured in relation to the quality of service provided and the achievement of acceptable levels of service. Measures of service and performance are difficult to define, however, because roads deteriorate through variety of different mechanisms.

The maintenance of roads in the country is generally the responsibility of the Public Works Department (PWD). It is the government department responsibilities for the construction, improvement and maintenance of the roads. However, in the local authority areas, the maintenance of roads is the responsibility of the local authority itself.

1.2 BACKGROUND OF STUDY

The primary objective of both pavement maintenance and pavement design is to ensure that the pavement gives adequate service to the road users (Peterson, 1987). The performance of the pavement is measured in relation to the quality of service provided and the achievement of acceptable levels of service. Measures of service and performance are difficult to define, however, because roads deteriorate through variety of different mechanisms.

The deterioration of paved roads is defined by the trend of its surface condition over time. The defects in a pavement surface, usually quantified through a pavement condition survey, are classified under three major modes of distress, namely:

1. Cracking (or fracture)
2. Disintegration; and
3. Permanent deformation

Maintenance activities for paved road are classified according to their frequency and their impact on the standards of the road. The categories are routine maintenance, resurfacing, rehabilitation, betterment (or improvement), reconstruction and new

construction. Routine maintenance is a day-to-day maintenance and periodic maintenance is a programmed maintenance. In Malaysia, we have special problem which affects the maintenance roads. Basically, the problem is due to lorry using the roads being overloaded well-beyond the specified limit set for the road. The excessive pounding of the carriageway by such vehicles certainly shorten the life-cycle of the roads

During the early phase of the pavement's life, prior to the occurrence of surface distress, the only changes in condition are slightly increases in root depth and roughness, there are no road costs except the small annual routine maintenance cost, and there are slightly changes in the average vehicle operating cost due to the small increase in roughness. Following the initiation of surfacing distress, the roughness and the associated vehicle operating costs increase more rapidly. Patching maintenance reduces the roughness and cost slightly, but not back to the levels that would have applied in the absence of surfacing distress because the patching itself is a defect, deviating in profile from the perfect planar surface

Rehabilitation works such as a thick overlay have the immediate effects of reducing the roughness to approximately the level of new pavements and the surfacing distress to nil, and the future effect of reducing the rate of deterioration through strengthening the pavement

The choice of maintenance technique can be based primarily on the condition and performance history of the existing pavement. The major factors should include the present condition of pavement, based on ride quality and type, the type, extent and severity of distress, the structural condition of the pavement, the environmental conditions of the region, primarily temperature and rainfall, drainage conditions of

pavement, including surface and sub-surface drainage, construction considerations and the design life required for treatment.

There are large numbers of rehabilitation alternatives available for asphalt pavements. The choice of rehabilitation alternative depends on observed pavement distress, laboratory and field evaluation of existing material, and design information. Except asphalt surface recycling, all other recycling methods such as hot mix or hot-in-place or cold-in-place recycling, have the potential to improve the structural capacity of pavements. In addition to this, recycling has some unique advantages which are not available with other types of rehabilitation techniques.

Recycling of existing asphalt pavements for pavement rehabilitation or reconstruction has the following advantages:

1. Reduced costs of construction,
2. Conservation of asphalt and aggregate,
3. Preservation of existing pavement geo-metrics,
4. Preservation of the environment; and
5. Conservation of energy.

Recycling or reuse of pavement material is very simple but powerful concept. Recycling of existing pavement materials to produce new materials result in considerable savings of material, money and energy. Different recycling methods are now available to address specific pavement distress and structural needs. The Asphalt Recycling and Reclaiming Association defines four different types of recycling methods, namely Hot recycling, hot in place recycling, cold in place recycling and full depth reclamation.

1.3 PROBLEM STATEMENT

In lines with the government's aspiration for Malaysia to be a developed nation by the year 2020, it is necessary to upgrade the roads to a better quality. There are various techniques or methods used by the relevant agencies to construct rural roads. However, the emergence of recycling technique in pavement maintenance is not widely accepted. Mill and pave, the traditional technique in pavement rehabilitation and maintenance, is the current practice which is widely used in Malaysia nowadays. However, many steps were taken to introduce alternative techniques in pavement rehabilitation. This alternative method had been proven by various maintenance contractors that it's much cheaper and takes short duration than that of the traditional technique.

1.4 AIMS AND OBJECTIVES OF RESEARCH

The aim of this study is to prove that recycling method is cheaper and more economics in various aspects compared to traditional technique. The objectives of this study are:

1. To identify various type of pavement maintenance in Malaysia
2. To identify differences between traditional pavement rehabilitation technique compared to recycling technique; and
3. To identify the economic technique of pavement rehabilitation

1.5 SCOPE OF STUDY

The study only covers paved road in rural area. In this study, three sites have been chosen which are Kuantan-Temerloh Road, Kuantan-Dungun Road and Jalan Lepar Hilir, Kuantan, Pahang. This study covers only the techniques of pavement maintenance which is suitable to use in Malaysia and the methods covered are Mill and Pave, Recycling techniques which are Hot In Place Recycling and Cold In Place Recycling. The guidelines for this study were using Standard Road Specification by JKR for Hot-In-Place recycling and mill and pave method. Meanwhile, for Cold In Place recycling, the author used Standard Method by Malaysian Road Convention in collaboration with JKR.

1.6 JUSTIFICATION OF THE STUDY

The author chooses this study because the outcome of this study perhaps can bring knowledge to other people regarding the arrivals of new techniques in pavement maintenance which is better than the traditional method. Besides, by this study also the author can hopefully improve the knowledge on pavement maintenance and provide that the knowledge obtained can be spread out to others in meaningful ways.

1.7 RESEACRH METHODOLOGY

Research methodology is the careful and systematic process in generating information that the researcher can follow to find answer to the problems of interest. To conduct a systematic research, the author's methodology is based on the research process

The following figure shows a research process that being used as a guideline to the author

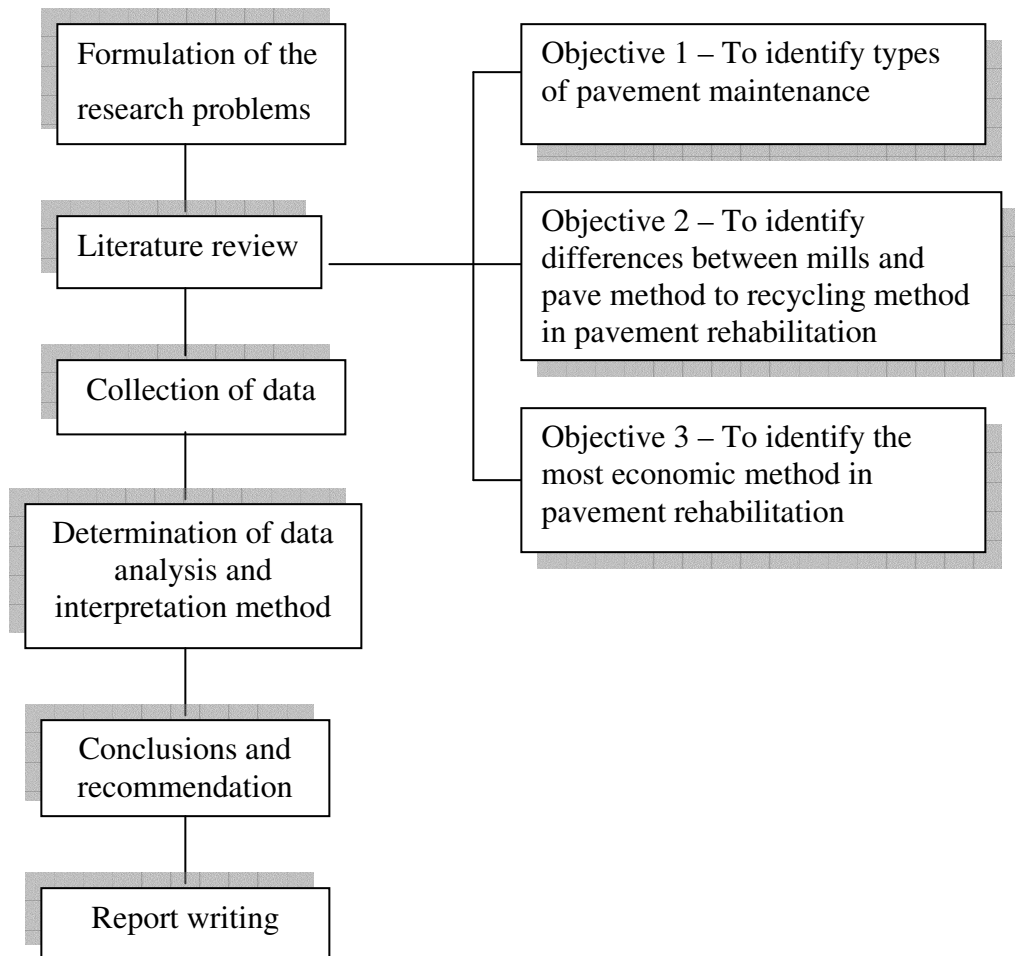


Figure 1.1 – Research process

The details of each step in the process will be discussed in the respective Research Methodology chapter.

1.8 SUMMARY

The ultimate aim of this study is specifically to establish the economic technique in pavement maintenance especially in rehabilitation works. By using the methodology of research as shown previously, perhaps the objectives laid for this study will be achieved. To achieve this study, the author will discuss in details the pavement maintenance available in Malaysia and then the process of pavement rehabilitation works using recycling technique in specific. All the data obtained will be discussed in data analysis and further discussion will be done in the very next chapter.