

## UNIVERSITI TEKNOLOGI MALAYSIA

**BORANG PENGESAHAN STATUS TESIS<sup>0</sup>**

JUDUL: **THE EFFECTIVENESS OF PAVEMENT  
REHABILITATION AT KUALA LUMPUR KARAK  
HIGHWAY**

SESI PENGAJIAN: **2006/2007**

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THE EFFECTIVENESS OF PAVEMENT REHABILITATION AT KUALA  
LUMPUR KARAK HIGHWAY

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A Project Report submitted in partial fulfillment of the  
requirements for award of the degree of  
Master of Science (Construction Management)

Faculty of Civil Engineering  
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MAY,2007

I declare that this Project Report entitled “*The Effectiveness of Pavement Rehabilitation at Kuala Lumpur Karak Highway*” is the result of my own research except as cited in the references. This report has not been accepted for any degree and is not concurrently submitted in candidature of any degree.

Signature : .....

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Date : .....

*Specially dedicated to my beloved father, mum, my sisters, brothers and all my friends.*

## ACKNOWLEDGEMENT

I would like to express my appreciation to many people who have contributed to successful completion of this project paper. Most especially, I thank my supervisor, for all his entire guidance, advices and suggestions in preparing this project. To all examiners, thank you for the suggestion, comment and ideas for overall my project.

My gratitude and sincere thank also goes to all my course mate and friends who participate by offering their helping making this project a reality.

And last but not least, thanks to all my beloved family especially my father, mother and my sisters who have contributed in giving me the moral support, encouragement and understanding in carrying out the project to such great degree. Thank you for being there whenever I need you all.

Thank you.....

## ABSTRACT

General function of a pavement is to provide a safe and comfortable riding surface to road users. However, pavement distress is major problems faced by contractor. Pavement rehabilitation is essential which can be improve and remain the functional of the roads networks and can be retard of deterioration. Since rehabilitation of pavement is a vital and continuous activity, maintenance shall be done effectively to avoid any reoccurrence and repeatedly works. Thus, in fulfill and meet pavement goals, the aim of this study is to determine sources of pavement distress and to determine the effectiveness of rehabilitation works in term of cost, quality and time at Kuala Lumpur Karak Highway. In view to the above, a thorough planning and scheduling had been organized on the methodology such as reading, adopting literature review, combination of analyzing of case study and adopting of actual data on site. The process of data collection involved obtaining data from contract document, bill of quantity, consultant reports and operations report. Then, the data are presented and analyzed conjunction with the aim and objectives of this study. In conclusion, some sources of distress identified to improve the effectiveness of pavement rehabilitation implemented at KL Karak Highway.

## ABSTRAK

Fungsi utama permukaan jalan adalah menyediakan keselamatan dan keselesaan kepada pengguna. Sungguhpun begitu, kerosakkan permukaan jalan merupakan permasalahan terbesar kepada kontraktor. Pembaikpulihan jalan, adalah amat penting dimana ianya dapat meningkatkan dan mengekalkan fungsi jalan serta ianya dapat mengekang kerosakkan jalan yang berterusan. Oleh kerana pembaikan jalan adalah penting dan merupakan satu aktiviti yang berterusan, penyelenggaraan jalan hendaklah hendaklah dijalankan secara berkesan agar ianya tidak berterusan rosak. Oleh itu, tujuan bagi kajian ini adalah untuk menentukan punca-punca kerosakkan jalan dan menentukan keberkesanan pembaikpulihan jalan daripada segi masa, kos dan kualiti. Kajian kes ini akan dijalankan di Lebuhraya Kuala Lumpur Karak. Sehubungan dengan itu, satu perancangan yang menyeluruh telah dilakukan terhadap kaedah-kaedah yang digunakan iaitu merangkumi daripada pembacaan, kajian literature, kombinasi kajian kes dan data daripada tapak. Proses bagi mendapatkan data-data telah diperolehi melalui kontrak dokumen, *bill of quantity*, laporan jururunding dan laporan operasi. Seterusnya, data-data yang diperolehi akan dipersembah dan dianalisis berdasarkan kajian kes yang dijalankan. Akhirnya, satu kesimpulan untuk kajian ini didapati seperti kajian dijalankan. Sebagai kesimpulan, punca-punca kerosakkan jalan yang dikenalpasti adalah meningkatkan keberkesanan kerja-kerja pembaikpulihan jalan.



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**LIST OF ABBREVIATIONS**

ADT	-	Average Daily Traffic
IKRAM	-	Institut Kerja Raya Malaysia
ISSA	-	International Slurry Seal Association
MHA	-	Malaysia Highway Authority
NCR	-	Non Conforming Records
SAMI	-	Stress Absorbing Membrane Interlayer

## **CHAPTER 1**

### **INTRODUCTION TO STUDY**

#### **1.1 Introduction**

Flexible pavements almost are being used at all networks of local roads, federal roads, expressway, highways and others road in our country. It is important that of these flexible pavements meet the required of pavement performances goals. Once the construction of the pavement works is completed, it is most essential to implement pavement preventive maintenance that emphasizes keeping roads in good condition through early application of maintenance treatments.

Pavement maintenance and rehabilitation major and minor incorporates all activities undertaken to provide and maintain serviceable roadways. Huge amount of money or capital had already being invested in the construction of roads and highways. In this country, several highways had been constructed namely North South Highways, East Coast Expressway, Penang Bridge, Shah Alam Expressway, Kulim-Butterworth Expressway, Seremban – Port Dickson Highway, Malaysia – Singapura Second Crossing Expressway, Sungai Besi Highway, Cheras – Kajang Highway, Damansara Puchong Highway, Ampang Kuala Lumpur Elevated Highway, Lebuhraya Penyuraian Trafik Kuala Lumpur Barat (SPRINT), Lebuhraya

Baru Pantai (NPE), Lebuhraya Lingkaran Penyuraian Trafik Kajang (SILK), Lebuhraya Koridor Guthrie (GCE) and Kuala Lumpur - Karak Highway. Huge amount of money would also be invested on the continuous maintenance of highways which is vital to ensure road worthiness, safety and end user satisfaction.

Kuala Lumpur Karak Highway was privatise in year October 1994, responsible on operations and maintenance of highways. Kuala Lumpur - Karak highway start from KM 19.20 and ends at KM 79.20 with total length will be 60km. On August 2004, highway concessionaire was executing theirs major project at KL Karak, pavement rehabilitation. This project is divided to six main packages and was awarded to three main contractors with sum of contract amounting around RM 60,000,000.

## **1.2 Problem Of Study**

Since 2004, several problems are frequently encountered during operations and maintenance of KL Karak Highways. Some of the problems such as ageing of operations and services building, slope stability, highways safety and flexible pavement distress.

However, flexible pavement distress is a major problem faced by concessionaire of KL Karak Highway during their operations and maintenances. The problems during operations were identified as follows:

1. Poorly identifying type of flexible pavement distresses
2. Poorly identifying sources of pavement distresses
3. Ineffectively corrective maintenance of pavement
4. Poorly identifying method of rehabilitations.

5. Poorly implementation method of rehabilitations during constructions

### **1.3 Aim And Objectives Of Study**

The aim of this study is to evaluate the Pavement Rehabilitation as a method to repair the existing pavement in order to meet pavement performances goals and to fulfill the standard requirement. The study will cover the pavement behaviour and performances, types of distresses in flexible pavement, sources of pavement problems, selection methods or options of rehabilitations and standard specifications requirement during constructions works. This study will evaluate the performance of flexible pavement from completed pavement rehabilitation and to ensure that the initial objectives are achieved. To achieve the above aim, the following objectives are identified:

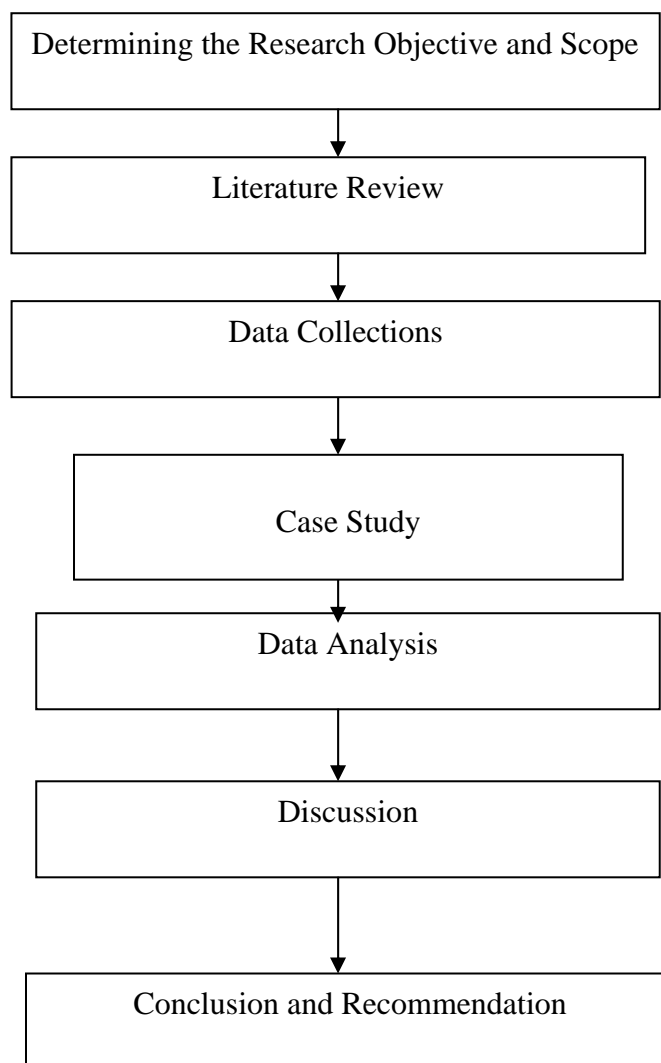
1. To determine sources of pavement distress at Kuala Lumpur Karak Highway
2. To evaluate the effectiveness of pavement rehabilitation in term of time, cost and quality at Kuala Lumpur Karak Highway

### **1.4 Scope of Study**

The scope of this study shall be on the highway flexible pavement on the problem at Kuala Lumpur - Karak Highways and limited to year 2004 until 2006.

## 1.5 Brief of Methodology

The methodology used in conducting this research is through literature search. The literature search for the study obtained through are journal papers, conference papers, technical reports, books and websites browsing to understand and meet the objectives of the study. Besides that, the data for study has been generated using methodology case study. The overall sequence of research process undertaken is shown in Figure 1.1.



**Figure 1.1** Research methodology sequence

## **CHAPTER 2**

### **FLEXIBLE PAVEMENT**

#### **2.1 Introduction**

This chapter is on the literature study of pavement behavior in performances pavement distress, method of maintenance, method of rehabilitation and finally on the effectiveness of corrective action.

#### **2.2 Pavement Behavior and Performances**

##### **2.2.1 Pavement components and materials**

A flexible pavement is a layered structure consisting of the sub base, road base and the surface overlying the natural ground or subgrade.

### 2.2.1.1 Surfacing

The surfacing is the upper layer of the pavement which fulfils the following requirements:

- a) To provide an even, non- skidding and good riding quality surface.
- b) To resist wear and shearing stress by traffic
- c) To prevent water from penetrating into underlying pavement layers
- d) To be capable of surviving a large number of repeated loading without distress
- e) To withstand adverse environmental conditions.

The form of bituminous surfacing commonly used can either be thick or thin. Thick bituminous surfacing normally consists of crushed mixed aggregates, bitumen and filler. Most types of plant mixed surfacing in Malaysia are asphalt concrete or bituminous macadam. Currently constructed thin surfacing are surface dressings and slurry seals.

Thick bituminous surfacing provides additional strength to the pavement and seal the pavement from water ingress. Thin surfacing does not give direct additional strength. It merely protects the pavement from water and provides a skid resistant riding surface.

### **2.2.1.2 Road base**

The road base is the main structural layer of the pavement which spread the load from heavy vehicles thus protecting the underlying weaker layers. Its functions are to reduce the compressive stress in the subgrade and the sub base to an acceptable level and to ensure that the magnitude of the flexural stresses in the surfacing will not lead to cracking. Unbound crushed mixed aggregates have been widely used as road base material throughout the country. Granite and limestone are readily available in most areas in Malaysia and have historically been the major sources of aggregate for road bases. (IKRAM, 1992).

### **2.2.1.3 Sub base**

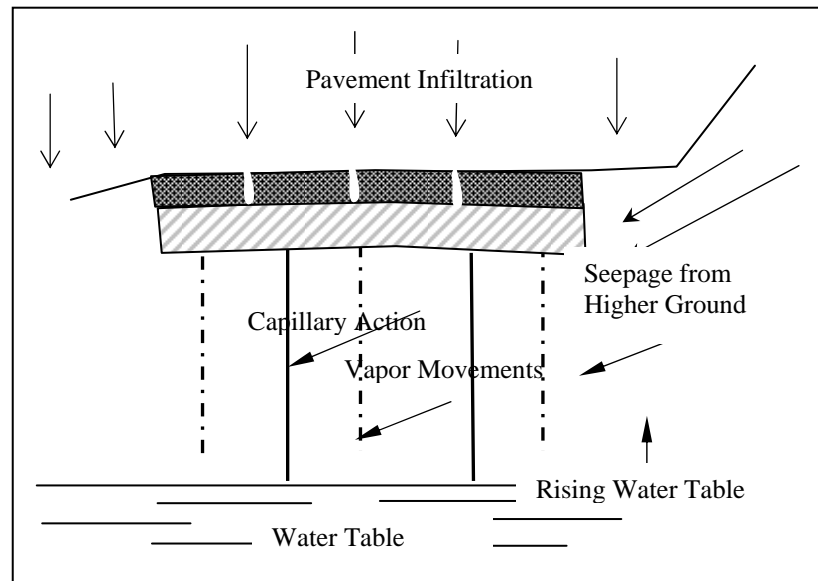
The sub base is secondary load spreading layer underlying the road base. It normally consists of lower grade granular material as compared to that of the road base. Sand and laterites are commonly used and are easily available. This layer also serves as a separating layer preventing contamination of the road-base by the sub grade and also acts as a preparatory layer for road base construction. (Poniah, 1995).

### **2.2.1.3 Sub grade**

The sub grade refers to the soil under the pavement within depth of approximately one meter the sub base. It is the upper layer of earthworks prepared for subsequent construction of the pavement layers described above. It can either be natural undisturbed soil or compacted soil obtained from elsewhere and placed as fill material. The strength of the subgrade layer is important as the thicknesses of the upper layers are dependent on it.



There are many sources of water that can enter the pavement subgrade. These include; surface infiltration through porous or cracked pavements, lateral seepage from saturated median ditches, capillary water rising from the underlying water table and high groundwater table. This is shown in Figure 2.1 (CDOT Drainage Design Manual). Subsurface drainage system can be provided to remove or control groundwater from these sources and minimize impacts on highways projects.



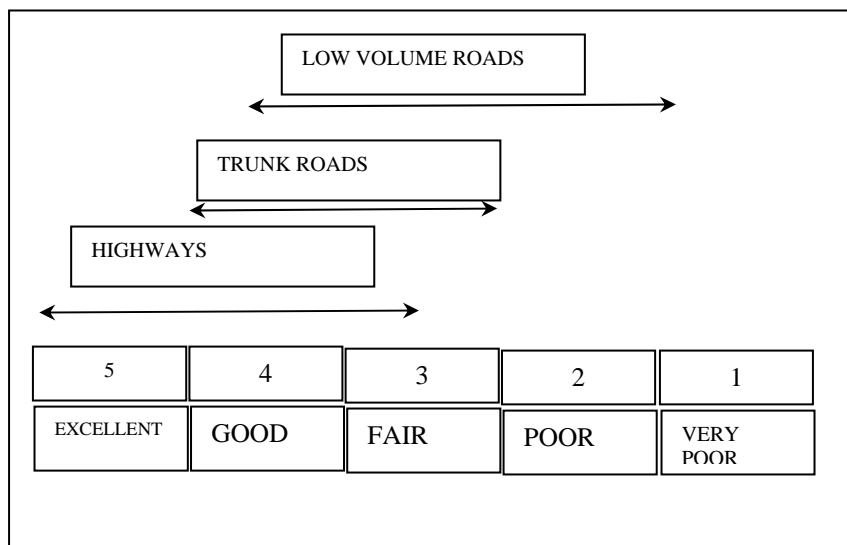
**Figure 2.1 Sources of Subsurface Water in Pavements (FHWA, 1992)**

### **2.3 Functions Of Flexible Pavement**

The general function of road pavement is to provide safe and comfortable riding surface for the road users. Its condition with respect to these characteristics is normally assessed by two groups of people, namely the user and the road engineers.

### 2.3.1 Road user requirements

A safe and comfortable riding surface is what the road users normally require. The aesthetic aspect of it is also a concern but will receive considerable attention only on heavily trafficked pavements. The life of the pavement perceived by the users will be primarily related to its riding quality. Road pavements that do not provide a safe and comfortable riding surface will trigger the road user awareness as to the increase in vehicle operating cost. The user requirement for a road pavement can be quantified in terms of serviceability index. The term serviceability was first introduced during the AASHO Road Test to represent pavement performance. The road pavement was given a rating in terms of riding comfort by various drivers with a value of as the highest index of serviceability and 0 as the lowest. A terminal serviceability of 2.5 was suggested as the condition when major rehabilitation works (See Figure 2.2).



**Figure 2.2** Typical Serviceability requirement For Different class of Road AASHO (AASHO Road Test)