UNIVERSITI PUTRA MALAYSIA

EVALUATION OF ROAD PAVEMENT CRACKS IN MALAYSIA

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By

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A Thesis Submitted to the School of Graduate Studies, University Putra Malaysia
In Fulfillment of the Requirements for the Degree of Master of Science
in Civil Engineering

May 2008

Abstract of thesis presented to the senate of university Putra Malaysia in fulfillment of the requirement for the degree of Master of Science in civil engineering

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MAY 2008

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Road surface condition is one of the most important characteristics because it affects ride quality, operation cost, and vehicle dynamic load. Thus it is necessary to study all factors affect the roads conditions, and to evaluate the different types of pavement distresses occur in the Malaysian roads.

For this reason, this research was conducted to evaluate the main problem that occur in the Malaysian roads, and to find out the reasons of such a pavement behavior. In order to do four federal highways profile were studied, and data was collected using four different techniques, and analyzed to specify the dominate pavement distresses occur in the Malaysian roads.

ACKNOWLEDGEMENT

I would like to express my gratitude to all those who gave me the possibility to complete this thesis. First of all I would like to thank Allah the most merciful the most beneficent for His grace and mercy throughout this research.

Secondly I'm deeply indebted to my supervisor Assoc. Prof. Dr. RATNASAMY MUNIANDY, whose help, stimulating, suggestions, and encouragement helped me in all the time of research for and writing of this thesis, also I would like to extend my thanks to those who guided me in the course of my graduate work.

Especially, I would like to give my special grateful thanks to all my family and my fiancée for their love, support, encouragement, and for pushing me forward to make my dreams come true.

At last but not least, I like to thank my colleagues and friends in the Highway and transportation unit for their help, support, interest and valuable hints.

DEDICATION

This thesis is dedicated to my father Prof. Dr. FAWZI A. BUGHRARA, who taught me that the best kind of knowledge to have is that which is learned for its own sake. To my mother Dr. NAZIHA A. BENSALEM, who taught me that even the largest task can be accomplished if it is done one step at a time. To my brother Dr. NEBRAS F. BUGHRARA, who taught me that it is possible to reach my dreams if I work hard at it, and finally to my sister, my brother, and my fiancée whom cover me with their love.

APPROVAL

This project entitled **'EVALUATION OF RAOD PAVEMEBT CRACKS IN MALAYSIA'** which prepared by NERAL F. A. BUGHRARA as a part of the requirements of fulfilment master of highway & transport, is submitted to the faculty of engineering, university Putra Malaysia.

Approved by

……... …….

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Project Examiner

DECLARATION

I declare that the thesis is my original work except for quotations and which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institution.

(Signature)

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NERAL F. A. BUGHRARA

Date:

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CHAPTER 1

INTRODUCTION

1.1 Background:

In recent years highway engineering have seen huge development that demand high pavement performance and efficient prohibition techniques, hence , it is very important to study pavement behavior under different loading and weather conditions to produce pavement that meets the required pavement performance goals. In order to do that There are many different types of evaluation techniques that could be used to evaluate pavement distresses, some of these done by human inspector who gathers information by walking or driving along the road and making visual survey, and the others done by using some automated techniques.

Cracks are the most common pavement distresses usually occur in pavement structures, in addition it is very important factor for the pavement design, and therefore it is necessary to study all types of cracks that occur in the Malaysian roads.

1.2 Problem statement:

After a few years of the construction of some roads in Malaysia a serious distresses have appeared on these roads, and thus changed the conditions of the pavement to a failed state, although the road did not achieve its design life period yet, and was designed according to the design manuals, therefore it is very important to make comprehensive study of these problems to find out the main causes of such a behavior, but because of the

lack in database on this area only four roads could be studied which are BAHAU – ROMPIN road, BANGI – KAJANG road, ALOR SETAR – PADANG LALANG road, and SEPANG – Kg. JENDERAM road.

1.3 Research objectives:

- Study the different types of distresses occur in Malaysian roads.
- Find out which type is the dominant, and to figure out what is the main reason of such pavement distresses behavior.
- Since there is lack of such information in the Malaysian highway data base it will also give a reference for this problem.

1.4 Scope of Work:

The project organized as follow:

- Chapter 1; Introduction.
- Chapter 2; Literature review on pavement distresses and evaluation.
- Chapter 3; Methodology.
- Chapter 4; Collect and analyze data.
- Chapter 5; Conclusion.
- Chapter 6; Recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Location and climatic weather in Malaysia:

Malaysia located in the Southeastern part of Asia, peninsula bordering Thailand and northern one-third of the island of Borneo, bordering Indonesia, Brunei, and the South China Sea, south of Vietnam at latitude of 2 30 N and longitude of 112 30 E, and total area of 329,750 sq km. Malaysia has a tropical climate with warm weather all year round with temperature ranging from 21°C to 33°C, and annual rainfall from 2000 mm to 2500 mm (world fact book, March, 2008).

2.2 Historical background of roads in Malaysia:

The roads network in Malaysia has undergone several stages; the first stage was before 1950s when roads were built for trade purposes, and the second stage was the construction of the Rural roads to accelerate road development during the period 1960s-1970s, after that the stage of alleviation of transport problems by built Inter-urban

linkages during the period1980s-1990s, and the last stage is Connecting the developed areas with the less developed areas since 2000 onward, and nowadays the total length of the Malaysian road network is 73,403km (Dato' Ir. Hj. Mohamad Razali bin Othman 2006).

2.3 Road types in Malaysia:

Roads in Malaysia are classified into four types, in order to organize the road network Hierarchy. These types are mentioned below:

2.3.1 Federal roads:

Federal roads are all the roads linking the state capitals in Malaysia, and declared under the Federal Roads Ordinance (1959). Also includes highways and roads under the administration of the public work department Malaysia, and the regional development scheme roads, such as those within the federal land development authority (FELDA) schemes, federal land consolidation authority (FELCRA). Federal roads construction and maintenance is done by the Public Works Department Malaysia (Malaysian roads general information, 2003).

2. 3.2 State roads:

State roads are the entire road constructed by the state under the administration of the Malaysian highways authorities according to the JKR standard, which located within the state area and outside the jurisdiction of the local authority or district office. Maintenance of this road is the state responsibility and done through the state JKR (Malaysian roads general information, 2003).

2. 3.3 Local authority roads:

Local authority roads are the roads within the limit of the local authority, and are normally maintained by the responsible local authority, (JKR guide on geometric design).

2. 3.4 Kampong (District office) roads:

Kampong (district office) roads are all roads under the district office; they are usually earth roads with no right of way. The maintenance of these roads is the responsibility of the district office, (JKR guide on geometric design).

Table 2.1 shows the different types of roads and it is total lengths, and the percentage of the paved sections of these roads.

Table 2.1 Road types and length, (Malaysian roads general information 2003).

CLASS / CATEGORY	TOTAL LENGTH	PAVED LENGTH	%PAVED
TOLL EXPRESSWAY & HIGHWAY	1,238	1.238	100.00
OTHER FEDERAL ROADS	15,746	14,891	94.57
STATE ROADS	56,419	41,459	73,48

2.4 Flexible pavement distresses:

There are many types of distresses occur in the pavement, not only due to under design or insufficient construction method, but also due to over loading or because of the usage of week materials, which conduce a failure states some times. Thus it is very important to study these types of distresses, where distresses are very important factor for the pavement design, and for estimating the remaining life of roads. Distresses can be divided into five types, pavement cracks, Patching and pothole, surface deformation, surface defect, and miscellaneous distresses.

Pavement distresses affect the general function of pavement which presented by the next aspects:

1 – Road safety. 2 – Economy.

3 – Serviceability. 4 – Aesthetic.

2.4.1 Pavement Cracks:

Cracks are the most common type of distresses, thus it is very important to study them precisely to understand why they occur, and how to reduce theme to improve our roads network. Cracks can be divided into five types:

2.4.1.1 Fatigue cracks:

Fatigue cracks are an interconnected series of many-sided, sharp-angled pieces, usually less than 0.3 meters on the longest side. This type of cracks occurs in the wheel path due to the fatigue failure of asphalt surface or stabilized base under repeated traffic loading, and it considered as a structural distress measured in m^2. Fatigue cracking start as non-connected or few connected cracks, and increase gradually till it turns to interconnected cracks forming a complete pattern (YANG H. HUANG 1993).

Severity Levels (T. Paul Teng, P.E. 2003):

LOW: An area of cracks with no or only a few connecting cracks; cracks are not spalled or sealed; pumping is not evident, as shown in Figure (2.1-a).

MODERATE: An area of interconnected cracks forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; pumping is not evident, as shown in Figure (2.1-b).

HIGH: An area of moderately or severely spalled interconnected cracks forming a complete pattern; pieces may move when subjected to traffic; cracks may be sealed; pumping may be evident, as shown in Figure (2.1-c).

(A) **(B)** **(C)**

Figure 2.1: Fatigue cracks, (Texas transportation institute, 2006).