



UNIVERSITI PUTRA MALAYSIA

EVALUATION OF ROAD PAVEMENT CRACKS IN MALAYSIA

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By

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In Fulfillment of the Requirements for the Degree of Master of Science
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Supervised by Assoc. Prof. Dr. RATNASAMY MUNIANDY

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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.



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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. BENSALAM, 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.

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Date



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:



TABLE OF CONTENT

	Page
ABSTRACT	ii
ACKNOWLEDGMENT	iii
DEDICATION	iv
APPROVAL	v
DECLARATION	vi
LIST OF TABLES	xii
LIST OF FIGURES	xiii
CHAPTER ONE	
INTRODUCTION	1
1.1 Background.	1
1.2 Problem statement.	2
1.3 Research objectives.	2
1.4 Scope of work.	3
CHAPTER TWO	
LITERATURE REVIEW.	4
2.1 Location and climatic weather in Malaysia.	4
2.2 Historical background of roads in Malaysia.	4
2.3 Types of roads in Malaysia.	5
2.3.1 Federal roads.	5
2.3.2 State roads.	6



	Page
2.3.3 Local authority roads.	6
2.3.4 Kampong (District office) roads.	6
2.4 Flexible pavement distresses.	7
2.4.1 Pavement cracks.	8
2.4.1.1 Fatigue cracking.	8
2.4.1.2 Longitudinal and transverse.	10
2.4.1.3 Block cracks.	11
2.4.1.4 Joint reflection cracks.	12
2.4.1.5 Edge punch out cracks.	14
2.4.2 Pavement patching and Potholes.	15
2.4.2.1 Patch Deterioration.	15
2.4.2.2 Potholes.	16
2.4.3 Surface Deformation.	18
2.4.3.1 Rutting.	18
2.4.3.2 Shoving.	19
2.4.4 Surface defects.	20
2.4.4.1 Bleeding.	20
2.4.4.2 Polished Aggregate.	21
2.4.4.3 Raveling.	22
2.4.5 Miscellaneous Distresses.	24
2.4.5.1 Pumping and water Bleeding.	24
2.4.5.2 Lane-to-Shoulder Drop-off.	25



	Page
2.5 Pavement distresses Evaluation.	26
2.5.1 Roughness.	27
2.5.2 Surface distresses.	28
2.5.3 Skid resistance.	29
2.5.4 Deflection.	30
2.6 Pavement Evaluation in Malaysia.	31
2.6.1 Data collection levels.	32
2.6.1.1 Research level data collection.	32
2.6.1.2 Network level data collection.	32
2.6.1.3 Project level data collection.	33
2.6.2 Cracks index in Malaysia.	35
2.6.3 Pavement cracks evaluation techniques in Malaysia.	35
2.6.3.1 Survey.	35
2.6.3.2 Automated evaluation techniques.	37
2.7 Pavement rehabilitation.	40
2.7.1 Cracks treatment.	41
2.7.1.1 Benefits of cracks treatment.	42
2.7.1.2 Types of cracks.	43
2.7.1.3 Cracks treatment techniques.	43
2.7.1.4 Cracks treatment materials.	46
2.7.1.5 Cracks treatment installation methods.	49
2.7.1.6 FHWA recommendations for crack treatment.	51

	Page
2.7.2 Evaluating Crack Treatment Performance.	52
 CHAPTER THREE	
METHODOLOGY.	54
3.1 Introduction.	54
3.2 Literature review.	54
3.2.1 Background of roads in Malaysia.	55
3.2.2 Flexible pavement distresses.	55
3.2.3 Pavement distresses Evaluation.	56
3.2.4 Pavement Evaluation in Malaysia.	58
3.2.5 Pavement cracks evaluation techniques in Malaysia.	59
3.2.6 Pavement rehabilitation.	59
3.2.7 Evaluation of Crack Treatment Performance.	60
3.3 Inventory in Malaysia.	61
3.3.1 Types.	61
3.3.2 Traffic.	62
3.3.3 Layers.	64
3.4 Data collection on cracks.	65
3.4.1 Density.	65
3.4.2 Intensity.	65
3.4.3 Severity.	65
3.5 Analysis.	66
3.6 Writing the report.	67



	Page
3.7 Conclusion and recommendations.	68
3.8 Methodology flow chart.	69
CHAPTER FOUR	
RESULTS AND DISCUSSION.	70
4.1 Introduction.	70
4.2 Data collection.	70
4.3 Data analysis.	75
CHAPTER FIVE	
CONCLUSION AND RECOMMENDATIONS.	100
REFERENCES	103



LIST OF TABLES

		Page
2.1	Road types and length.	7
2.2	Roughness evaluation techniques.	28
2.3	Cracks index in Malaysia.	35
2.4	Guidelines for determining the type of maintenance to be performed.	44
2.5	Recommended criteria to determine whether to seal or fill.	45
2.6	Effectiveness levels.	48
3.1	Roughness evaluation techniques.	57
3.2	Cracks index in Malaysia.	58
4.1	BAHARU – ROMPIN road condition.	75
4.2	BAHARU – ROMPIN road pavement structure layers.	78
4.3	BANGI – KAJANG road condition.	79
4.4	BANGI – KAJANG road pavement structure layers.	81
4.5	ALOR SETAR – PADANG LALANG road condition.	82
4.6	ALOR SETAR – PADANG LALANG pavement structure layers.	84
4.7	Kg. JENDERAM – SEPANG road condition.	85
4.8	Kg. JENDERAM – SEPANG pavement structure layers.	87
4.9	Cracks and rutting percentage.	94
4.10	Roads structure condition.	95



LIST OF FIGURE

		Page
2.1	Fatigue cracks.	9
2.2	Longitudinal and transverse cracks.	10
2.3	Block cracks.	11
2.4	Joint reflection cracks.	13
2.5	Edge punch out cracks.	14
2.6	Patch deterioration.	15
2.7	Pothole.	17
2.8	Rutting.	18
2.9	Shoving.	19
2.10	Bleeding.	20
2.11	Polished Aggregate.	22
2.12	Raveling.	23
2.13	Pumping and water Bleeding.	24
2.14	Lane-to-Shoulder Drop-off.	25
2.15	Pavement evaluation process.	34
2.16	Surface condition survey form.	36
2.17	Road scanner.	38
2.18	Road scanner image viewed by digital image viewer.	39
2.19	Water intrusion.	42
2.20 - A	Material placement configurations.	49
2.20 - B	Material placement configurations.	50



		Page
2.21	Difference between adhesion and cohesion loss.	53
3.1	Percentage of Unpaved roads in Malaysia.	61
3.2	Registered vehicle statistics.	63
3.3	16 Hour traffic composition by vehicle type for state roads.	63
3.4	16 Hour traffic composition by vehicle type for federal roads.	64
3.5	Pavement layers.	64
3.6	Methodology flow chart.	69
4.1	Falling weight deflectometer.	72
4.2	Dynamic cone Penetrometer.	73
4.3	BAHAU Bound carriageway condition.	76
4.4	ROMPIN Bound carriageway condition.	77
4.5	KAJANG Bound carriageway condition.	80
4.6	BANGI Bound carriageway condition.	80
4.7	PADANG LALANG Bound carriageway condition.	83
4.8	ALOR SETAR Bound carriageway condition.	83
4.9	Kg. JENDERAM carriageway condition.	86
4.10	SEPANG Bound carriageway condition.	86
4.11	Distresses in BAHAU bound carriageway.	88
4.12	Distresses in ROMPIN bound carriageway.	89
4.13	Distresses in KAJANG bound carriageway.	90
4.14	Distresses in BANGI bound carriageway.	90
4.15	Distresses in PADANG LALANG bound carriageway.	91

		Page
4.16	Distresses in ALOR SETAR bound carriageway.	92
4.17	Distresses in Kg. JENDERAM bound carriageway.	92
4.18	Distresses in SEPANG bound carriageway.	93
4.19	Average percentage of cracks and rutting.	98
4.20	Road structure condition.	99
5.1	Average percentage of cracks and rutting.	100
5.2	Road structure condition.	101



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 period 1980s-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 its 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 weak 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 them 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).

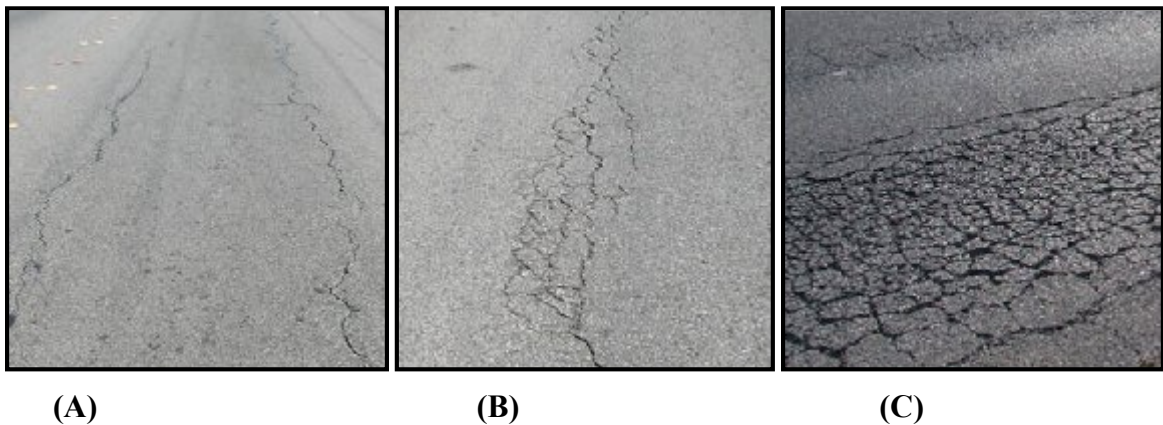


Figure 2.1: Fatigue cracks, (Texas transportation institute, 2006).