

ROAD DAMAGE AND MAINTENANCE ALONG FEDERAL ROAD IN KUALA
KRAI, KELANTAN

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DEDICATION

This work is dedicated to the sincerest,

Loving and caring parents,

My beloved Father and Mother,

Mokhtar bin Yusoff,

Hamlah binti Yusoff,

My beloved Father and Mother in law,

Ibrahim bin Mamat,

Zawiah binti Ab. Rahman,

And my supportive wife,

Maziah Hanim binti Ibrahim.

All my dear children,

Afaf Ulyaa, Atif Ulwan and Aafi Uzair.

Hopefully these efforts given consideration and rewarded by Allah.

As the Prophet Muhammad S.A.W said:

“Whoever follows a path to seek knowledge,

Allah will make the path to Jannah (Paradise) easy for them.”

(Shahih Muslim)

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ABSTRACT

The study focused on the evaluation and inspection of existing flexible pavement conditions with various type of pavement distress and the implications of the road rehabilitation cost along federal road in Kuala Krai, Kelantan. The Ministry of Works Malaysia (MWM) was dealing with backlog in maintaining federal roads due to insufficient allocation and increasing traffic volume. This research is significant to assist the government draw up the cost allocation for rehabilitation plan in the state of Kelantan especially along federal road in Kuala Krai district. A case study was carried out on the federal roads under Public Works Department (PWD) management in Kuala Krai district which is the concession contract that awarded to Roadcare Sdn. Bhd. The distress of flexible pavement were divided into four main categories which were potholes, pavement cracks, surface deformation and surface defects. This 54km road has been divided into five segments of road section. The data analysis was conducted based on routine inspection records, notification of defects and Road Traffic Volume Malaysia produced by Roadcare Sdn. Bhd and Ministry of Works Malaysia. From the study, pavement cracks is the dominant defect mechanism from 2016 to 2018. Potholes and surface defects indicates the upward trend from 2016 to 2019 along Jalan Kuala Krai-Gua Musang. Meanwhile, the highest estimated cost for road rehabilitation for 4 years contributed by segment 5 due to the highest area of pavement distress that occurs along this. Because of the location of segment 5 which is near to the city center with lots of industrial and business activities, therefore, the most of the budget in maintenance has been spent along segment 5.

ABSTRAK

Kajian ini memberi tumpuan terhadap penilaian dan mengenalpasti keadaan turapan lentur dengan pelbagai jenis kerosakan serta implikasinya terhadap kos pemulihan jalan persekutuan di Kuala Krai, Kelantan. Kementerian Kerja Raya (KKR) menghadapi isu tunggakan dalam melaksanakan kerja penyelenggaraan jalan persekutuan disebabkan peruntukan tidak mencukupi dengan peningkatan jumlah lalulintas. Kajian ini amat penting untuk membantu kerajaan merangka anggaran kos peruntukan bagi pelan pemulihan jalan persekutuan di negeri Kelantan terutamanya di daerah Kuala Krai. Kajian kes ini dilaksanakan terhadap jalan raya persekutuan yang berada di bawah pengurusan Jabatan Kerja Raya (JKR) Kuala Krai yang mana kerja penyelenggaraan telah diberikan kontrak secara konsesi kepada Roadcare Sdn. Bhd. Kerosakan turapan lentur dibahagikan kepada empat kategori utama iaitu lelubang, retakan turapan, ubah bentuk permukaan dan kerosakan permukaan. Panjang laluan jalan adalah 54km dan dipecahkan kepada lima segmen. Analisis dilakukan berdasarkan data pemeriksaan rutin, notis kerosakan jalan dan bancian lalulintas yang dikeluarkan oleh Roadcare Sdn. Bhd dan Kementerian Kerja Raya. Hasil kajian mendapati retakan turapan adalah jenis kerosakan yang dominan dari tahun 2016 hingga 2019. Jenis kerosakan lelubang dan kerosakan permukaan menunjukkan unjuran menaik dari tahun 2016 hingga 2019 di sepanjang Jalan Gua Musang-Kuala Krai. Selain itu, anggaran kos pemulihan jalan paling tinggi selama 4 tahun berlaku di segmen 5 bertepatan dengan kerosakan jalan yang juga tinggi berlaku di segmen jalan tersebut. Disebabkan lokasi segmen 5 adalah berdekatan pusat bandar dengan pelbagai aktiviti perindustrian dan perniagaan, sebahagian besar kos pemulihan telah dibelanjakan di sepanjang jalan di segmen 5.

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LIST OF ABBREVIATIONS

CBR	-	California Bearing Ratio
km	-	Kilometer
km ²	-	Kilometer square
m	-	Meter
m ²	-	Meter square
mm	-	Millimeter
MWM	-	Ministry of Works Malaysia
MPa	-	Elastic Modulus
NA	-	Not available
No.	-	Number
%	-	Percent
PWD	-	Public Works Department
RM		Ringgit Malaysia
vs		Versus

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CHAPTER 1

INTRODUCTION

1.1 Background of Research

Road infrastructure have been considered as one of the most valuable assets of a nation that leads to a crucial contribution to economic progress and social benefits. There is no way to goods and services to move efficiently without a good infrastructural network in place (Sulaiman Mahbob, 2015). The economy of any area depends on efficiency shipping and receiving products and materials; trucks are the most common form of transport. The condition of the roads directly affects the speed, efficiency and ultimately the cost of transportation (Wisconsin, 1984).

Good maintenance needed a steady and reliable flow of funds. There are several reasons why this often fails to materialize. Those responsible for allocating the budget may have little understanding on the economic and social importance of maintenance or they may believe that fiscal constraints justify deferring maintenance, which only raises future costs. Postponing road maintenance and rehabilitation results in high direct and indirect costs. If road defects are repaired promptly, the overall cost required is usually modest. If defect are neglected, an entire road section may fail, requiring full reconstruction at three times or more the cost, on average of maintenance costs. Delayed maintenance has indirect costs as well. Neglected roads steadily become more difficult to use, resulting in increased vehicle operating costs and a reluctance by transport operators to use the roads (S. Burningham & N. Stankevich, 2005).

The elements work to cause road deterioration: traffic loads, the environment, aging and several research studies have been completed and some are in progress for the purpose of understanding pavement behavior (performance) under different

conditions of traffic volume and loading, climate, subgrade, structural composition and others (B.M Sharma et. al., 1995).

When first constructed or substantially rehabilitated, transportation assets are assumed in good condition and provide service as originally intended. Usage, age, weather and other factors cause assets to deteriorate and causes the level of performance provided by the asset to reduce. Periodic maintenance and rehabilitation activities stops deterioration and improve the assets condition so as to maintain sufficient levels of condition, performance and safety. Each agency decides when to perform these activities usually based on the desired level of serviceability. Figure 1.1 demonstrate the cycle of construction, deterioration and rehabilitation that a typical transportation asset undergoes. As the assets condition nears the minimum acceptable condition, rehabilitation activities are conducted. The rate of deterioration as influenced by pavement preservation practices, dictates the timing of future activities (LCCAP, 2002).

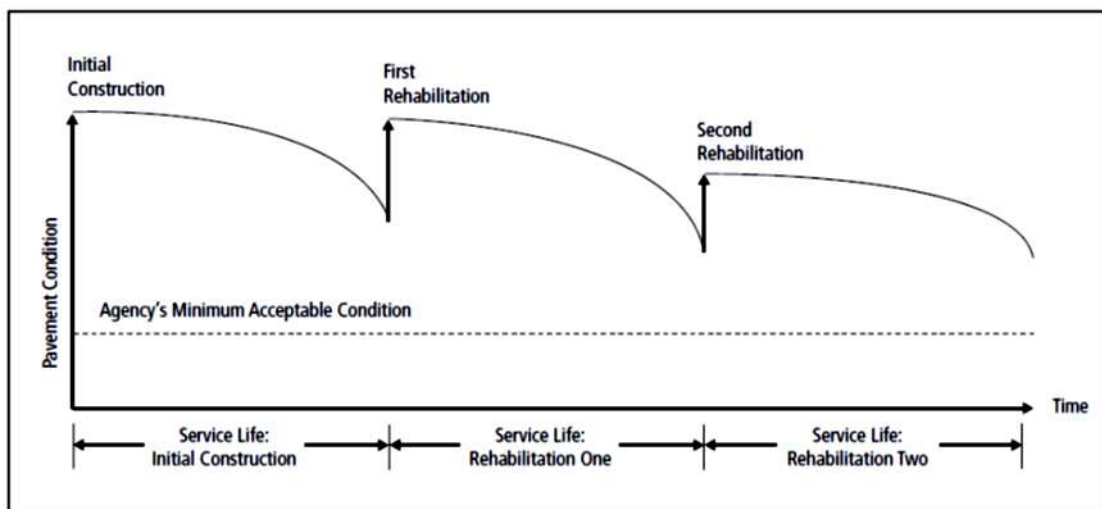


Figure 1.1 Staged Pavement Construction Design Concept (LCCAP,2002)

In Malaysia, two types of pavements were used to construct most of the roads like federal roads, state roads and expressways, namely flexible pavement and rigid pavement. However, majority of the roads are constructed using flexible pavement (Chien T. C., 2006). The flexible pavement has been constructed with asphaltic cement and aggregates that consist of several of layer.

Federal road at Malaysia almost used the flexible pavement compare to rigid pavement because flexible pavement more comfortable to road user. Furthermore, flexible pavements can be use by users once ready. With best design and proper construction method, adequate routine and periodic maintenance are necessary to achieve the determined design life spans and even beyond (Nurul Elma Kordi et. al, 2010). Table 1.1 shows the differences between flexible and rigid pavement.

Table 1.1 The Differences Between Flexible and Rigid Pavement (Nurul Elma Kordi et. al, 2010)

No.	Flexible	Rigid
1	Last for 20 years	Last more than 40 years
2	High cost and schedule maintenance	More economic maintenance, no schedule
3	Cheap and easy to get material	Material shortage problem always occurs
4	Low initial cost	Higher initial cost
5	Easy to upgrade/ stage construction	Cannot upgrade/ no stage construction
6	Rutting and potholes may occur	Free from rutting, potholes and corrugation
7	Less economic for the long duration	More economical for the long duration
8	Can be used once ready	Traffic disturbance, wait for maximum strength (28 days)

In the year 2001, the government of Malaysia has privatized the federal road maintenance in Peninsular Malaysia to three concession companies and divided the nation into the zone as decided by Public Work Department Malaysia (PWD). The main scopes of work for the concessionaire are in routine maintenance, periodic pavement maintenance, periodic non pavement maintenance and emergency work (Zarabizan Zakaria, 2013). List of the company with the selected zone for the maintenance works are as shown in Table 1.2.

Table 1.2 Maintenance Zone and the Concessionaire (Zarabizan Zakaria, 2013)

No.	Zone	State	Concession Company
1.	North	Perlis, Kedah, Pulau Pinang & Perak	Belati Wangsa Sdn. Bhd.
2.	Middle / East	Selangor, Pahang, Terengganu & Kelantan	Roadcare Sdn. Bhd.
3.	South	Negeri Sembilan, Melaka & Johor	Selia Selenggara Sdn. Bhd.

1.2 Problem Statement

The Ministry of Works Malaysia (MWM) reported that the ministry was dealing with a 30% backlog in maintaining federal roads due to insufficient federal allocation and increasing traffic volume. It was informed that the actual yearly cost for maintaining Federal roads was RM2 billion. However the ministry only received between RM600 million and RM800 million a year (Baru Bian, 2019). Malaysian federal roads are not well maintained and so exhibit much surface damage, which causes difficulties for road users (Mohd Hizam, 2009).

Limitation of resources needed to maximize the returns on the limited funds available. Under a limited budget it is very important to minimize the maintenance costs. For the mentioned purpose it is very important to consider and select a simple way or method for inspection and evaluation of flexible pavement failures (S. A. Flamarz, 2017). Selecting of the rehabilitation methods depends on many factors such as condition of the existing pavement, traffic, weather, soil type, availability of equipment and that make it difficult to identify the correct maintenance treatment, the service life and cost for every cases (A. R. Shafie, 2007).

In order to ensure that the road networks is able to satisfy the ever increasing demand placed on it due to increased traffic, there is a need some systematic approach to the maintenance of the road network. The lack of proper engineering records on

construction and maintenance works now necessitates the need for full engineering evaluation to be carried out before the design of further road improvements or rehabilitation. In the evaluation process, the identification and classification of the type of failures is necessary if correct remedial treatments are to be undertaken.

Hence, the focus of this research is to study the evaluation and inspection of existing flexible pavement conditions with the various type of pavement distress and the implications of the road rehabilitation cost along federal road in Kuala Krai, Kelantan. Base on the above, the following questions arise to inspire the research problem:

- a) What are the type of road damages usually occurs
- b) How much is the distance or area affected by pavement distress
- c) How much is the cost involved in repairing the damages of road

1.3 Problem Statement

The aim of the study is to identify the maintenance cost and the various type of road damage that are usually occurs along federal road in Kuala Krai, Kelantan. The main objectives to be archived in the research are as follow:

- a) To investigate a various type of pavement distress
- b) To identify the most affected road sections due to pavement distress
- c) To determine of rehabilitation cost for road damage

1.4 Scope of Research

The study is carried out in Kuala Krai, Kelantan and conducted on federal roads under management of Public Work Department (PWD). Maintenance of the federal road in Kuala Krai district is currently under the concessionaire, Roadcare Sdn. Bhd. Hence, data sources for road maintenance records and estimated cost or reconstruction are only limited to Public Works Department (PWD) management and concession of Roadcare Sdn. Bhd. This study is also limited to flexible pavement and does not include assessment of the road furniture as well as the pavement accessories.

1.5 Significant of Study

Based on problems statement, issues of road maintenance should be given high priority by the government. Road deterioration occurs in flexible pavement once it has been in-use. The damage occurrence of flexible pavement may vary due to various factors, such as differences of traffic volume, types of vehicles and other physical conditions. From this study it can be determine the types of road defects that occurred on the road. These defects will be identify the proper action required to repair and the maintenance cost for every type of defects can be calculated.

The significance of this research is to assist the government draw up cost allocation for reconstruction plan in the state of Kelantan especially in Kuala Krai district. From the data collected, the government will be able to identify the various type of pavement distress that are usually occurs and their frequency. This allows the government to provide priority of cost allocation and appropriate repair methods to be implemented. This condition can make it easier for the government to channel the allocation more efficiently and quickly.

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