RUTTING POTENTIAL OF HOT MIX ASPHALT
IN VARIABLE CONDITIONS

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A project report submitted in partial fulfillment of the
requirements for the award of the degree of Master of Engineering
(Civil - Transportation and Highway)

Faculty of Civil Engineering
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APRIL 2007
“TO HUMAN KIND”
“RACE TO PERFECTION HAS NO FINISH LINE...”
“CARPE DIEM”
ACKNOWLEDGMENTS

I would like to express my gratefulness to Allah S.W.T for giving me strength and wisdom in my project work. In preparing this thesis, I was in contact with many people, researchers, academicians and technicians. They all have contributed to my understanding and valuable thoughts during my project.

First and foremost, I wish to express my sincere appreciation to my main project supervisor, PM Dr. Abd. Aziz Chik for encouragement, guidance and critics. His kindness and encouragement made me always active and confident. I am also very thankful to my co-supervisors Mohd Rosli bin Hainin and Tn. Hj. Che Ros bin Ismail for his guidance, advices and motivation. Their ideas enlighten my curiosity. Without their continuous support and interest, this thesis would not have been written.

My fellow postgraduate students should also be recognized for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space.

I offer my special thanks to Ir. Shujaatullah Sheikh editing this dissertation and his proof-reading. I am grateful to him for the countless hours of constructive discussion and his informative revisions of my work.

I would like to thank Usman Ullah Sheikh for his help during this research. Also, many thanks go to the laboratory manager Suhaimi for assisting me during the experimental work.

Last but not the least, many thanks go to my mother (Asmara Izzat) who kept praying for me, my wife (Eliza Mazmee), my sister (Sheeba Izzat) and Sulaiman Rosli without whose love, care, encouragement and continuous support I could not complete this work.
Flexible pavements are designed to withstand structural and functional failures. Rutting is a structural defect associated with functional implications. Rutting is mainly caused by wheel loads and accelerated by environmental factors. Although rutting is contributed by all the five layers in flexible pavement (*subgrade, subbase, road base binder coarse and wearing coarse*) the behaviour of wearing coarse is least understood and contributes significant effect to the overall pavement. The objective of this study is to identify the rutting behaviour of wearing coarse subjected to repetitive vehicle load and exposed to different environments. This study is carried on scaled down pavement stretch of 22.6m consisting of two mixes ACW14 and ACW20 which is then subjected to repetitive load with exposure to different environmental effects such as wet stretch, heat condition, spillage of petrol, diesel and cooking oil. For each selected pavement, section rut is measured after 50 cycles of the wheel track which has a weight of 280kg. A multivariate regression analysis is carried out to determine the relationship of rut depth and number of wheel track passes. The results show exposure to petrol and diesel has a very detrimental effect to the pavement.
ABSTRAK

Turapan anjal direkabentuk untuk menampung kegagalan berbentuk struktur mahupun kegagalan yang ada kaitan dengan fungsi turapan itu sendiri. Fenomena rutting merupakan kegagalan struktur turapan yang ada kaitan dengan fungsi turapan. Fenomena ini diakibatkan terutamanya oleh beban roda kenderaan dan diburukkan lagi oleh faktor-faktor persekitaran. Walaupun fenomena rutting ini disumbangkan oleh kelima-lima lapisan yang membentuk turapan anjal (subgrade, subbase, road base, binder course and wearing course), kelakunan lapisan wearing course adalah yang paling kurang difahami oleh para pengkaji walhal lapisan inilah yang menyumbangkan kesan yang paling signifikan kepada keseluruhan struktur turapan anjal. Objektif kajian ini adalah untuk mengenalpasti fenomena rutting pada lapisan wearing course yang telah dikenakan beban roda kenderaan yang berulang-ulang pada keadaan persekitaran yang berbeza-beza. Kajian ini dijalankan pada model turapan sepanjang 22.6 meter yang terdiri daripada dua jenis bancuhan konkrit asfalt iaitu bancuhan ACW 14 dan ACW 20. Model turapan ini dikenakan beban roda kenderaan seberat 280kg yang berulang-ulang pada keadaan persekitaran yang berlainan seperti kelembapan, haba dan limpahan minyak seperti limpahan minyak petrol, limpahan minyak diesel dan limpahan minyak masak.
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LIST OF ABBREVIATIONS

ACW14  Asphaltic Concrete Wearing Course with Nominal Maximum Aggregate Size of 14mm

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HMA    Hot Mix Asphalt
CHAPTER I

INTRODUCTION

1.1 Introduction

Permanent deformation or rutting is the primary failure mode of hot mix asphalt pavements. Failure due to rutting compromises serviceability of pavement and can pose danger to road user. A variety of laboratory test methods have been developed in order to gain a better understanding of rutting of hot mix asphalt pavements. Wheel tracking is the latest addition to laboratory equipment. Wheel tracking devices subject asphalt pavement to cyclic loads by a moving wheel so that the permanent deformation or rutting experienced by the pavement can be determined.

This test enables engineers and researches to mimic the actual condition experienced by the pavements, thus enabling them to design pavement mixes which are more durable and less costly to maintain.
1.2 Problem Statement

After a new pavement is constructed, both environmental and traffic stresses cause it to deteriorate. The rate of deterioration depends on the severity of the traffic loads and the variability of the road materials. In the evaluation process, the identification and classification of the type of failure is necessary if correct remedial treatments are to be undertaken. Pavement engineers are faced with the difficult task of evaluating pavements that have been subjected to varying traffic loads under variable environmental conditions and material properties. Field measurements are valuable practical tools in the evaluation of road performance and in the identification of the causes of failure. The task becomes more difficult if the pavement has gone through a series of previous unrecorded maintenance treatments.

To ensure a good return on the investment in road construction, a cost benefit analysis is needed to ensure that the most cost effective method of maintenance is employed. If the future performance of the road is not correctly predicted, then large sums of money may be wasted in maintenance alone. Thus, there is a need to carry out research on the rutting potential of hot mix asphalt in variable conditions so that pavement engineers can estimate the right time frame within which the pavement is mostly likely to undergo repair or rehabilitation works.

1.3 Objectives of the Study

The objectives of this study are as follows:

1. To develop regression equations to predict rut depths for different environment exposure conditions and number of wheel track passes.
1.4 Scope of the Study

The scope of this study involves calibrating the wheel track gauges and developing regression equations to predict rutting potential of hot mix asphalt in variable conditions. The entire test is conducted at Makmal Pengangkutan, UTM Skudai.

1.5 Significance of the Study

From the result of the study, the relationship between rutting potential of hot mix asphalt in variable conditions will be established. Number of wheel passes and rut depth is correlated to derive a mathematical equation based on respective exposure conditions. By establishing this mathematical equation, future rut depth respective to number of wheel passes on variable exposure conditions can be determined. Therefore, this study would not only give pavement engineers a better understanding of hot mix asphalt behaviour under different variable conditions, but enable them to carry out rehabilitation and repair works in a more scheduled and systematic manner.
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