ADHESION OF CHIP SEAL USING DIFFERENT TYPE OF PRE- COATING MATERIAL

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

Faculty of Civil Engineering
Universiti Teknologi Malaysia

JANUARY, 2012

ACKNOWLEDGMENTS

Firstly, I would like to express my gratefulness to my supervisor, Dr. Haryati Yaacob for her comments guidance, dedication and idea throughout this project. Without her guidance, this project will not be completed on time. I also would like to thank to all panels for their advices and concern.

I would like to appreciate all the help and assistance provided by the the laboratory technicians team of UTM Highway Laboratory, who laboriously give guidance, opinions and suggestions to me during conducting the laboratory work.

Also, I would like to give my appreciation to my fellow course mates and friends for the support and encouragement during the completion of this project.

Deepest thanks to my family members who always giving encouragement and support for everything I do and not forgotten my friends and course mates for their help and support.

ABSTRACT

Chip seal is the common surface treatment that is used in Malaysia recently. A chip seal (also called a “seal coat” or “surface dressing”) is essentially a single layer of asphalt binder that is covered by embedded aggregate with its primary purpose being to seal the fine cracks in the underlying pavement’s surface and prevent water intrusion into the base and sub grade.The construction of chip seal should be monitored and the technique must be used correctly from the beginning of the sieve analysis, pre-coating, spreading the binder and the aggregate. The objective of this study is to evaluate the adhesion of chip seal using the different pre- coating material. Three different type of pre-coating emulsion was used which were K 140, RS 1K and SS 1K. Chip seal with uncoated and unwashed chipping was used as control specimen. The penetration grade 80/100 pen bitumen was used as a binder with spray rate 10 l/m^3. Single size chipping was used that is 6, 10 and 14mm. Vialit test and pull out test was conducted on every sample to investigate and determine the best adhesion of chip seal. As a result, the coated aggregate gives a slightly better reading than uncoated aggregates. Although, the different are less than one percent, it can generally say that the pre-coating emulsion does improve the bond of the binder to the aggregate.

ABSTRAK

Dandanan permukaan merupakan rawatan permukaan yang biasa digunakan untuk jalan raya dia Malaysia. Dandanan permukaan (juga dikenali sebagai "seal coat" or "surface dressing") merupakan satu lapisan tunggal pengikat asfalt yang disalut oleh agregat dan ditanam dengan tujuan utama untuk melindungi dari retak yang halus di permukaan turapan yang boleh mengakibatkan air meresapai permukaan turapan dan seterusnnya ke lapisan asas jalan. Penurapan 'chip seal" perlu dipantau dan teknik penurapan haruslah dipraktikan dari awal iaitu bermula dari analisis ayakan, pra-salutan, mendamparkan pengikat dan agregat. Objektif kajian ini adalah untuk menilai rekatan "chip seal" dengan menggunakan pra-bahan salutan yang berlainan. Tiga jenis emulsi pra-salutan telah digunakan iaitu K140, RS1K dan SS1K. "Chip seal" yang tidak bersalut dah tidak dicuci dijadikan sebagai specimen kawalan. Bitumen Pen 80/100 digunakan sebagai pengikat dengan kadar semburan 10 l/m^3. Saiz tunggal agregat yang digunakan ialah 6, 10 dan 14 mm. Ujian Vialit dan Ujian Tarik-Keluar telah dijalakan ke atas setiap sampel untuk menilai dan menentukan rekatan yang terbaik untuk "chip seal". Sebagai hasilnya, agregat yang bersalut memberikan bacaan yang lebih baik dari agregat yang tidak bersalut. Walaupun perbezaan adalah kurang dari 1 percen, secara amnya, dapat disimpulkan bahawa emulsi pra-salutan tidak membantu menigkatan kekuatan agregat kepada pengikat.

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LIST OF ABBREVIATIONS

AC	Asphaltic Concrete
AASHTO	American Association of State Highway and Transportation Officials
ADT	Annual Daily Traffic
ASTM	American Society for Testing and Meterials
BS	British Standard
CCSA	Carlifornia Chip Seal Association
JKR	Jabatan Kerja Raya
MS	Malaysia Standard
MRP	Malaysian Rock Product
N	Newton
NCHRP	National Cooperative Highway Reserch Program
RS	Rapid Setting
MS	Medium Setting
SS	Slow Setting
UTM	Universiti Teknologi Malaysia
kN	kilo Newton
l/m^2	litre per meter square
max	maximum
min	minute
mm	millimeter
pen	penetration
s	second
g	gram
%	percent
^oC	Degree of Celsius

CHAPTER I

INTRODUCTION

1.1 Introduction

Chip seal is the common surface treatment that is used in Malaysia recently. A chip seal (also called a “seal coat”or “surface dressing”) is essentially a single layer of asphalt binder that is covered by embedded aggregate (one stone thick), with its primary purpose being to seal the fine cracks in the underlying pavement’s surface and prevent water intrusion into the base and sub grade. The aggregate’s purpose is to protect the asphalt layer from damage and to develop a macro texture that results in a skid-resistant surface for vehicles. Chip seals and similar surface treatment use originated in the 1920s (Hinkle, 1928). The chip seal is a good surface treatment to be expended in Malaysia because it has potential to ensure the better performance and cost effective.

These early uses were predominantly as wearing courses in the construction of low-volume gravel roads. In the past 75 years, chip seals have evolved into maintenance treatments that can be successful on both low-volume and high-volume pavements. The popularity of chip seals is a direct result of their low initial costs in comparison with those of thin asphalt overlays and other factors influencing treatment selection where the structural capacity of the existing pavement is sufficient to sustain its existing loads.

Chip seals are expected to provide at least 5 years of service, therefore, three or four chip seals may be necessary for a pavement to reach its design life. Chip seals are mostly used on low volume roadways with ADT<5,000 although some countries like South Africa and Australia use it on higher volume roads with ADT up to 50,000 (Gransberg *et.al*, 2005). The main reason most agencies have a limit on traffic volume for chip seals is because of traffic control. If speed can be limited for sufficient amount of time, there are no limits on traffic volume (Janisch & Gaillard, 1998).

The primary reason to chip seal an asphalt pavement is to protect the pavement from the deteriorating effects of sun and water. When an asphalt pavement is exposed to sun, wind and water, the asphalt hardens, or oxidizes. This causes the pavement to become more brittle. As a result, the pavement will crack because it is unable to bend and flex when exposed to traffic and temperature changes. A chip seal combats this situation by providing a waterproof membrane which not only slows down the oxidation process but also helps the pavement to shed water, preventing it from entering the base material.

A secondary benefit of chip sealing is an increase in the surface friction it provides. This is accomplished by the additional texture the cover aggregate adds to the pavement. With time, traffic begins to wear the fine material from an asphalt pavement surface. This results in a condition referred to as raveling. When enough of the fine material is worn off the pavement surface, traffic is driving mostly on the course aggregate. As these aggregate particles begin to become smooth and polished, the roadway may become slippery, making it difficult to stop quickly. A chip seal increases the pavement texture and increases the surface friction properties.

1.2 Problem Statement

Malaysia is categorized as an upcoming country and also among the developed countries in South East Asia. Malaysia development after fifty years of

independent, are amazing and still develop accordingly to the needs. There were drastic change in economic, social- economic, education and living style of Malaysian. It is give big impact and challenge to the field of science and technologies, where they have built the infrastructure that perpendicular with the development achieved and will be achieved by 2020.

Due to the world oil price become uncertain and swings in time of shortage or oversupply lately, it is burden to everybody and also for whom which are dependent with oil so much, including construction field. Road construction especially, extremely dependent with oil for every work in construction sequences.

Road consisted of layers such as subgrade, subbase, road base, binder course and wearing course. Pre-coating is essential to minimize the lost of aggregate due to flying stone and also to promote the good adhension between aggregates and binder which will increase the service life of the surface. The success of a chip seal depends mainly to the adhesion of the aggregates to the road surface. Due to the above mentioned factors, this study was conducted to determine the effective water based emulsions for pre- coating adhesion and to evaluate the performance of the different pre- coating materials in achieving the accepted standard for chip seal.

1.2 Objective of the Study

The objectives of this study are followed:-

1. To evaluate the adhesion of chip seal using the different pre- coating material.
2. To suggest the best pre- coating material on chip seal in term of performance.

1.4 Scope of the Study

This study is limited to the scope below:-

a) The use of emulsion
   - K 140
   - RS 1K
   - SS 1K

b) Percentage of 80/100 bitumen penetration.

c) Chip seal with uncoated and unwashed chipping as a control specimen.

d) Single size chipping of 14mm.

e) Spray rate 1.5 to 2.2 liter/sq.m.

1.5 Significance of Study

Pre-coating is essential to minimize the lost of aggregate due to flying stone and also to promote the good adhension between aggregates and binder which is increasing the service life of this surface treatment. But still, the long life of the surface treatment will also increasing the cost.

This study is conducted to minimize this burden of this problem with using the cost effective material to get the same performance or close similarity with the existing material used now.

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