



UNIVERSITI PUTRA MALAYSIA

WASTE OIL-BASED PAINT AS ADDITIVE IN STONE MASTIC ASPHALT

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WASTE OIL-BASED PAINT AS ADDITIVE IN STONE MASTIC ASPHALT

By

CHEONG SIN SOON

This Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in fulfillment of the **Requirement** for the **Degree of Master of Science**

November **2013**

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ABSTRACT

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

WASTE OIL-BASED PAINT AS ADDITIVE IN STONE MASTIC ASPHALT

By

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November 2013

Chair: Professor Ratnasamy Muniandy, PhD

Faculty: Engineering

The cost of asphalt is crucial in determining the cost of road construction. In the year 2008, the average price of Malaysian crudes is more than 100 USD per barrel. As a result, a hike in the price of asphalt is observed within the same year. Studies on replace asphalt as binder or reduce the amount of asphalt used should be carried out to reduce the construction cost. On the other hand, there is more than 15000 metric tonnes of ink and paint sludge generated yearly since the year 2006. Thus waste oil-based paint was chosen to blend with asphalt since it has better bonding when mixed together.

Three type of binders, i.e. 80/100 penetration graded asphalt, 60/70 penetration graded asphalt and performance grade, PG 76 were used to blend with waste oil-based paint. The amount of waste paint used in the blending with asphalt binders were 5%, 10% and 20% of the total weight. The physical tests on asphalt binder were carried out in accordance with ASTM standards. The maximum amount of waste paint blended into these three binders that met the minimum requirement of PWD standard were chosen. It was found that the 80/100 penetration graded asphalt blended with 5% of waste paint, the 60/70 penetration graded asphalt blended with 10% of waste paint and the PG 76 blended with 20% of waste paint met the minimum requirement of the PWD standard.

SMA was used in this study. It is hot mixture asphalt consisting of a coarse aggregate skeleton and a high binder content mortar. The performance tests such as Resilient Modulus, moisture susceptibility and permanent deformation tests were carried out on the paint modified asphalt binder specimens. These results were compared with the samples that used original binder as control. It was found that the asphalt mixtures with paint modified asphalt had lower performance compared to the control asphalt mixtures. However they still meet the requirements of the PWD standard. Therefore waste oil-based paint can be used to replace 5% of 80/100 penetration graded asphalt, 10% of 60/70 penetration graded asphalt and 20% of PG 76 used in road construction.

The length of PLUS highway is 772 km. Assume that PLUS highway undergo rehabilitation yearly with overlay thickness of 50 mm, the cost of asphalt for rehabilitation (one lane per km) can be saved up to RM 902.50 if 80/100 penetration graded asphalt is used, RM 6,136.50 if 60/70 penetration graded asphalt is used and RM 25,258.50 if performance grade, PG 76 is used.



ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

SISA CAT BERASASKAN MINYAK SEBAGAI BAHAN TAMBAHAN DALAM ASFALT BATU MASTIK

Oleh

CHEONG SIN SOON

November 2013

Pengerusi: Profesor Ratnasamy Muniandy, PhD

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Kos asfalt adalah penting dalam menentukan kos pembinaan jalan raya. Pada tahun 2008, purata harga minyak mentah keluaran Malaysia melebihi 100 USD setong. Sehubungan itu, harga asphalt pada tahun tersebut turut meningkat. Kajian dalam menggantikan asphalt sebagai pengikat atau mengurangkan kandungan asphalt patut dijalankan untuk mengurangkan kos pembinaan. Kumbahan dakwat dan cat yang terhasil setiap tahun melebihi 15000 ton metrik sejak tahun 2006. Dengan ini, sisa cat berasaskan minyak dipilih untuk bercampur dengan asphalt kerana mempunyai ikatan yang lebih baik apabila dicampur.

Tiga jenis pengikat iaitu asphalt gred penembusan 80/100, asphalt gred penembusan 60/70 dan PG 76 digunakan untuk bercampur dengan cat berasaskan minyak. Kandungan cat yang dicampur ke dalam pengikat adalah sebanyak 5%, 10% dan 20% berdasarkan jumlah berat masing-masing. Ujian fizikal yang dijalankan ke atas pengikat berdasarkan piawai ASTM. Kandungan cat maxima yang dicampur ke dalam tiga jenis pengikat tersebut yang memenuhi kehendak minima piawai JKR dipilih. Didapati asphalt gred penembusan 80/100 bercampur dengan 5% cat, asphalt gred penembusan 60/70 bercampur dengan 10% cat dan PG 76 bercampur dengan 20% cat memenuhi kehendak minima piawaian JKR.

SMA telah digunakan dalam kajian ini. SMA adalah asphalt campuran panas yang terdiri daripada rangka agregat yang kasar dan kandungan pengikat mortar yang tinggi. Ujian prestasi seperti Modulus Resilient, ujian kerentanan kelembapan dan ujian ubah bentuk kekal dijalankan ke atas sampel yang menggunakan asphalt diubahsuai cat sebagai pengikat. Keputusan dibandingkan dengan sampel yang menggunakan pengikat asal sebagai kawalan. Didapati campuran asphalt yang mengandungi cat mempunyai prestasi yang lebih rendah berbanding dengan campuran asphalt kawalan. Walau bagaimanapun, campuran asphalt diubahsuai cat masih memenuhi kehendak piawaian JKR. Oleh itu, sisa

cat berasaskan minyak boleh digunakan untuk mengganti 5% asphalt gred penembusan 80/100, 10% asphalt gred penembusan 60/70 dan 20% PG 76 dalam pembinaan jalan raya.

Panjang lebuh raya PLUS adalah 772 km. Andaikan PLUS lebuh raya menjalankan rehabilitasi setiap tahun dengan ketebalan hamparan sebanyak 50 mm, kos asphalt untuk rehabilitasi (satu lorong bagi setiap km) boleh dijiat sebanyak RM 902.50 jika asphalt gred penembusan 80/100 digunakan, dijiat sebanyak RM 6,136.50 jika asphalt gred penembusan 60/70 digunakan dan dijiat sebanyak RM 25,258.50 jika PG 76 digunakan.



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I certify that a Thesis Examination Committee has met on 29th November 2013 to conduct the final examination of Cheong Sin Soon on his thesis entitled "Waste Oil-bases Paint As Additive In Stone Mastic Asphalt" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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TABLE OF CONTENTS

	ABSTRACT	Page
	ABSTRAK	ii
	ACKNOWLEDGEMENTS	iv
	APPROVAL	vi
	DECLARATION	vii
	LIST OF TABLES	ix
	LIST OF FIGURES	xiv
	LIST OF ABBREVIATIONS	xix
		xxiii
 CHAPTER		
1	INTRODUCTION	1
	1.1 General Background	1
	1.2 Problem Statement	2
	1.3 Objectives of Study	4
	1.4 Scope and Limitations of Study	5
2	LITERATURE REVIEW	6
	2.1 Asphalt Pavement	6
	2.2 Stone Mastic Asphalt (SMA)	6
	2.2.1 Materials of SMA	7
	2.2.2 Mix Design of SMA	9
	2.3 Paint	10
	2.3.1 Production of Paint	11
	2.3.2 Paint Wastes	12
	2.3.3 Paint Wastes Management	14
	2.3.3.1 Chemical Composition of Paint Wastes	15
	2.3.4 Research on Waste Paint	17
	2.4 Modified Asphalt	19
	2.4.1 Modification of Asphalt	19
	2.4.2 Blending Procedure of Modified Asphalt	21
	2.4.3 Physical Tests on Modified Asphalt	22
	2.4.4 Performance of Modified Asphalt Mixture	24
	2.4.4.1 Polymers	25
	2.4.4.2 Rubber	25
	2.4.4.3 Thermosetting Polymers	26
	2.4.4.4 Fiber	26
	2.4.4.5 Fillers	27
	2.4.4.6 Antistripping Agents	29
	2.4.4.7 Summary of Performance of Modified Asphalt Mixture	29

3	METHODOLOGY	31
3.1	Introduction	31
3.2	Physical Properties of Aggregate	33
3.2.1	Los Angeles Abrasion Test	33
3.2.2	Aggregate Impact Value Test	33
3.2.3	Aggregate Crushing Value Test	34
3.2.4	Ten Percent Fine Test	34
3.2.5	Soundness Test	35
3.2.6	Flakiness and Elongation Test	35
3.2.7	Specific Gravity Test	35
3.2.8	Angularity Number Test	36
3.3	Paint Content Analysis	36
3.4	Physical Properties of Asphalt	36
3.4.1	Asphalt and Paint Blending	37
3.4.2	Viscosity Test	38
3.4.3	Penetration Test	39
3.4.4	Softening Point Test	39
3.4.5	Selection of Paint Modified Asphalts	40
3.4.6	Specific Gravity Test	40
3.4.7	Flash and Fire Point Test	41
3.5	Marshall Mix Design	41
3.6	Performance Tests on Marshall Samples	42
3.6.1	Density and Voids Analysis	43
3.6.2	Resilient Modulus Test	43
3.6.3	Moisture Susceptibility Test	43
3.6.4	Permanent Deformation Test	43
3.7	Cost Analysis	44
4	RESULTS AND DISCUSSION	45
4.1	Introduction	45
4.2	Physical Test Results of Aggregate	45
4.2.1	Los Angeles Abrasion Test Results	45
4.2.2	Aggregate Impact Value Test Results	46
4.2.3	Aggregate Crushing Value Test Results	47
4.2.4	Ten Percent Fine Test Results	47
4.2.5	Soundness Test Results	48
4.2.6	Flakiness and Elongation Test Results	49
4.2.7	Specific Gravity Test Results	50
4.2.8	Angularity Number Test Results	50
4.2.9	Gradation of Aggregate	51
4.2.10	Summary of Physical Test Results of Aggregate	52
4.3	Paint Content Analysis Result	53
4.4	Physical Test Results of Asphalt	55
4.4.1	Proportioning of Asphalt and Waste Paint	55
4.4.2	Viscosity Test Results	55
4.4.3	Penetration Test Results	59
4.4.4	Softening Point Test Results	61

4.4.5	Determination of Optimum Paint Modified Asphalt Content	64
4.4.6	Specific Gravity Test Results	64
4.4.7	Flash and Fire Point Test Results	65
4.5	Result of Marshall Mix Design	66
4.5.1	Mixing and Compaction Temperature	66
4.5.2	Theoretical Maximum Density	70
4.5.3	Optimum Asphalt Content (OAC)	72
4.6	Performance Analysis of Paint Modified SMA Mix	92
4.6.1	Density and Void Analysis Test Results	92
4.6.2	Resilient Modulus Test Results	95
4.6.3	Moisture Susceptibility Test Result	97
4.6.4	Permanent Deformation Test Result	105
4.6.5	Summary of Performance Analysis of Paint Modified SMA Mix	117
4.7	Cost Analysis	117
5	CONCLUSION AND RECOMMENDATION	121
5.1	Introduction	121
5.2	Conclusions	121
5.3	Recommendations	122
5.4	Contributions	122
	REFERENCES	123
	APPENDICES	130
	BIODATA OF STUDENT	141