

**DEVELOPMENT OF A ROAD CONSTRUCTION MATERIAL SELECTION
SYSTEM**

By

TEH KIAN TECK

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

March 2006

To

My parents, my teachers and my friends

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

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March 2006

Chairman: Ir. Salihudin Hassim

Faculty: Engineering

Millions of ringgits have been spent annually for road maintenance. The causes of road problems may be due to incorrect selection of pavement material. The study shows that there is the tendency for using the same pavement material for the whole stretch of a project. Some important factors that affect pavement material were not considered by road designers, because there is no systematic pavement material selection system available. At present, road designers refer to some road design standard procedures which are not updated consistently and there is little exposure to some other pavement materials. A systematic pavement material selection based on expert guidance to guide the road designers is needed.

This thesis looks into the first development of a Road Construction Material Selection System (RC-MSS), based on the outcomes of questionnaires from the selected pavement experts using the Friedman' statistical analysis and documented sources. The study also

looks into what the practitioners want if a pavement material selection system is developed. The survey shows that pavement materials were governed by soil conditions, expected load repetitions and geometric features of vertical gradient and horizontal curvature. Besides, the selection of the appropriate construction materials for the various layers for various traffic-loading under the type of terrains such as flat, rolling and mountainous was incorporated as important parameters. All these factors were found to be indispensable in the formulation of a material selection system for road construction.

In the Friedman hypothesis testing of this study, it was found that there is significant difference in terms of durability, performance and ease of construction from each suggested pavement material in nine site conditions out of 30 site conditions. Multiple comparisons have been used to the rejected null hypothesis to determine which materials were significantly different in these nine rejected null hypothesis site conditions respectively. Positions were then given to the pavement materials based on the outcomes from the multiple comparisons method. The factors were then incorporated into developing of the specific rules of the system framework and the 30 site conditions were associated with the documented source and used as knowledge database for the system. In order to make the system user-friendly, compatible and flexible, the system was developed into the software using a programming language. RC-MSS developed interfaces are easy to use and have non-complicated procedures. The user can go straight to the output fast. The system can help the user in better decision-making of pavement material selection as it provides more feasible alternative materials.

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

PENGHASILAN SATU SISTEM PEMILIHAN BAHAN PEMBINAAN JALAN

Oleh

TEH KIAN TECK

Mac 2006

Pengerusi: Ir. Salihudin Hassim

Fakulti: Kejuruteraan

Setiap tahun, berjuta-juta ringgit telah dibelanjakan untuk penyelenggaraan jalan. Ini mungkin disebabkan tidak sesuai dalam pemilihan bahan turapan. Kajian ini menunjukkan terdapat kemungkinan penggunaan bahan turapan yang sama dalam satu projek. Seseengah faktor yang memberi kesan keatas turapan jalan diambil kira oleh pereka jalan, dan tidak ada satu cara pemilihan bahan turapan jalan yang sistematik. Kini, pereka jalan merujuk pada sesetengah prosedur piawai mereka jalan yang tidak dikemaskini dan kurang terdedah kepada bahan-bahan turapan yang lain. Satu pemilihan bahan turapan yang sistematik berdasarkan tunjuk ajar dari pakar-pakar untuk menunjukajar kepada pereka jalan diperlukan.

Tujuan thesis ini adalah untuk menghasilkan *Road Construction Material Selection System (RC-MSS)* yang pertama, berdasarkan hasil keputusan daripada soal-selidik daripada pakar-pakar turapan jalan yang terpilih dengan menggunakan analysis statistik Friedman and juga sumber document-documen. Kajian menunjukkan bahan turapan dipengaruhi oleh keadaan tanah, ulangan anggaran muatan dan ciri-ciri geometrik seperti

kecondongan lanjar serta kelengkungan mengufuk. Selain itu, pretasi bahan dan kesesuaian memilih bahan binaan untuk jenis-jenis lapisan jalan untuk jenis-jenis muatan trafik dalam jenis rupa bumi seperti rata, gulingan dan berbukit telah digabungkan sebagai parameter-parameter penting. Kesemuaan faktor-faktor yang ditemui tidak harus diabaikan dalam formulasi sistem pemilihan bahan pembinaan jalan.

Dalam pengajian hipotesis Friedman, adalah jelas perbezaan dalam kelasakan, pretasi dan kesenangan pembinaan terhadap setiap bahan turapan jalan yang dicadangkan keatas sembilan keadaan tapak daripada kesemuaan 30 keadaan tapak. Pelbagai perbandingan telah digunakan terhadap sembilan keadaan tapak yang ditolak hipotesis nol masing-masing. Tempat kedudukan telah diberikan keatas bahan turapan jalan berdasarkan hasil keputusan daripada cara pelbagai perbandingan. Faktor-faktor tersebut telah digabungkan dalam penghasilan peraturan spesifikasi dalam sistem rangka dan 30 keadaan tapak telah digabung bersama dengan sumber dokumen serta dipergunakan sebagai pengetahuan pangkalan data sistem. Untuk membolehkan sistem menjadi senang diguna, serasi, dan fleksibel, sistem telah dihasilkan kedalam perisian dengan menggunakan bahasa pengaturacaraan. RC-MSS mempunyai penghasilan antara muka yang mudah digunakan serta mempunyai kaedah-kaedah yang tidak rumit. Pengguna dapat terus masuk ke output jawapan dengan pantas. Sistem tersebut dapat membantu pengguna dalam memberi membuat keputusan bahan turapan yang dapat memberikan pelbagai alternatif bahan.

ACKNOWLEDGEMENTS

Endeavor a dissertation will be virtually impossible without the help of many knowledgeable people and associates. The most enjoyable part of this research is acknowledging their help.

First of all, the author wishes to express his sincere gratitude and appreciation to his supervisor committee chairman, Ir. Salihudin Hassim, for his patient and continuous supervision, valuable advice, and guidance throughout the course of the study. The author would also like to express his great thankfulness and appreciation to other supervisor committee member, Prof. Madya Dr. Husaini Omar and Dr. Azmi Hassan for their valuable suggestion and advice. The author would also like to express his special appreciation to Dr. Ratnasamy Muniandy for his invaluable patient advice, guidance and suggestion throughout the study while undertaking this project.

Special appreciation goes to Prof. Madya Dr. Meor Othman, Mr. Zuklamal Suffian and Mr. Mutalif for their technical assistance and experience sharing in the providing the vital info of road construction materials.

Equally important and thanks to author's family members, especially his brother, Teh Kian Lai, for his support, suggestions and provide guidance which contributed to make this project success. And to all my close friends for their support, giving creative suggestions and provide guidance which contributed to make this project success.

The author wishes to acknowledge the financial support from IRPA. The study would not been accomplished without this fund. The appreciation also extended to author's colleagues, friends and all other individuals who have directly or indirectly delivered their generous assistance in completing the study.

I certify that an Examination Committee has met on 6th March 2006 to conduct the final examination of Teh Kian Teck on his Master of Science thesis entitled “Development of a Road Construction Material Selection System” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Ratnasamy Muniandy, PhD

Professor
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

Abdul Halim B. Ghazali, PhD

Professor
Faculty of Engineering
Universiti Putra Malaysia
(Internal Examiner)

Ahmad Rodzi B. Mahmud, PhD

Professor
Faculty of Engineering
Universiti Putra Malaysia
(Internal Examiner)

Ir. Mohamed Rehan Karim, PhD

Professor
Faculty of Engineering
Universiti Malaya
(External Examiner)

HASANAH MOHD. GHAZALI, PhD

Professor/ Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master Science. The members of the Supervisory Committee are as follows:

Ir. Salihudin Bin Hassim

Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

Hussaini Bin Omar, PhD

Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

Ir. Azmi Bin Hassan, PhD

Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

AINI IDERIS, PhD
Professor/ Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

TEH KIAN TECK

Date:

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