**UNIVERSITI PUTRA MALAYSIA**

# *MODELLING OF ACCIDENTS ON TWO-LANE SINGLE CARRIAGEWAY ROADS IN MALAYSIA*

**JAMILAH MOHD MARJAN**

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# MODELLING OF ACCIDENTS ON TWO-LANE SINGLE CARRIAGEWAY ROADS IN MALAYSIA

**JAMILAH MOHD MARJAN**

**DOCTOR OF PHILOSOPHY**
**UNIVERSITI PUTRA MALAYSIA**

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# MODELLING OF ACCIDENTS ON TWO-LANE SINGLE CARRIAGEWAY ROADS IN MALAYSIA

**By**

**JAMILAH MOHD MARJAN**

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**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Doctor of Philosophy**

**April 2011**

## DEDICATION

In the name of Allah, Most Gracious, Most Merciful,
Praise Be to Allah, the Cherisher and Sustainer of the Worlds,
and Peace and Prayer be upon the final
Prophet and Messenger.

In memory of My Father and My Mother
Mohd Marjan bin Ismail and Salmah Binti Jais.
Thank you for all the love you had given me,
moulding me into who I am today.

and a special dedication

To the cancer survivors who go through life every day while silently
encouraging the rest of us to live life to the fullest.

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Abstract of Thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

**MODELLING OF ACCIDENTS ON TWO-LANE SINGLE CARRIAGEWAY ROADS IN MALAYSIA**

**By**

**JAMILAH MOHD MARJAN**

**April 2011**

**Chairman: Dato' Ir. Radin Umar Radin Sohadi, Ph.D**

**Faculty: Engineering**

Road safety management in Malaysia comprises implementation of road safety auditing, blackspot treatment, maintenance management and the safe system approach road assessment programme. All these efforts are implemented on two-lane carriageway roads where a high percentage of accidents occur. Currently the interventions are based on guidelines from developed countries and studies from local research.

The purpose of this research is to develop accident prediction models with respect to traffic and road geometry on a two-lane single carriageway road network. This research focused on modeling accident rates in relation to various categories of roadway conditions. The models derived would be used by engineers to guide them in making choices in terms of road safety enhancement to the road network.

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This research was carried out in the State of Selangor on the Federal trunk roads and it was a representative of Federal road network in the country in terms of conditions and environment. The research was focused on accidents along a two-lane single carriageway road. Traffic and geometric data were collected, analysed and modelled using the GENSTAT software. Poisson regression was used in the modeling of accidents; which is the common method in analysing accident data.

Two groups of model were developed. The 'Engineers' models' were developed for the use of practicing engineers in the region and the 'HDM models' developed for the use of road managers in accident prediction and economic analysis in the maintenance management HDM4 system. These models are very useful to compute accident cost savings with the implementation of specific infrastructure improvement.

It was found that different explanatory variables affect differently for different types of accidents. Total and damage accidents were very similar, while casualty and injury accidents resulted in different variables in the models developed. Casualty is fatal and injury accidents combined in this research. Fatal accident model was the most difficult to model as most of the variables were not significant in explaining fatal accidents. The 'Engineers' models' and the 'HDM models' are very similar in the fact that the variables that had a significant effect on total, damage, casualty, injury and fatal accident were similar in both models.



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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**MODEL KEMALANGAN DI JALAN DUA LORONG DUA HALA DI MALAYSIA**

**Oleh**

**JAMILAH MOHD MARJAN**

**April 2011**

**Pengerusi: Dato' Ir. Radin Umar Radin Sohadi, Ph.D**

**Fakulti: Kejuruteraan**

Di Malaysia, pengurusan keselamatan jalan raya merangkumi perlaksanaan audit keselamatan jalan, memperbaiki lokasi-lokasi yang kerap berlaku kemalangan, pengurusan penyelenggaraan dan pendekatan mengadakan persekitaran jalan yang selamat dengan perlaksanaan program penilaian jalan. Kesemua usaha-usaha dilaksanakan dijalan dua lorong dua hala dimana banyak berlakunya kemalangan. Usaha pembaikan ini adalah berdasarkan kajian-kajian yang dijalankan di luar dan juga didalam Negara.

Tujuan kajian ini adalah untuk pembentukan model-model ramalan kemalangan dari aspek trafik dan kejuruteraan jalan bagi jalan jenis dua lorong dua-hala. Kajian ini tertumpu kepada pembentukan model-model dengan kaitan kepada keadaan dan geometri jalan yang berbeza-beza. Model-model ini dapat membantu jurutera-jurutera memilih jenis dan kaedah pembaikan keatas jalan raya untuk meningkatkan tahap keselamatan.



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Kajian ini dijalankan di Negeri Selangor di jalan Persekutuan yang menggambarkan jalan-jalan Persekutuan di seluruh Negara yang ada persamaan dari segi keadaan dan persekitaran. Kajian ini tertumpu kepada jenis jalan dua lorong dua-hala. Pengumpulan data trafik dan ciri-ciri kejuruteraan jalan dilaksanakan, dianalisa dan pembentukan model dengan menggunakan perisian GENSTAT. Regressi 'Poisson' yang lazim digunakan dalam pembentukan model-model kemalangan telah digunakan dalam kajian ini.

Pembentukan model ini terbahagi kepada dua kumpulan. Model pertama di namakan model 'Engineers'' yang direkabentuk khusus untuk diguna oleh jurutera-jurutera di Daerah manakala model kedua dinamakan model 'HDM' dimana model ini boleh digunakan oleh jurutera yang ditanggungjawab dengan pengurusan penyelenggaraan untuk menjangka kadar kemalangan dan menjalankan penganalisaan ekonomi di dalam sistem pengurusan penyelenggaraan HDM-4. Model kemalangan ini diguna membantu dalam pengiraan penjimatan kos kemalangan dengan perlaksanaan pembaikan infrastruktur yang tertentu.

Adalah didapati dari kajian ini bahawa pembolehubah yang berbeza menyebabkan jenis-jenis kemalangan yang berbeza. Model jumlah kemalangan dan kemalangan rosak mempunyai banyak persamaan, sementara model kemalangan mengakibatkan kecederaan mengandungi pembolehubah yang agak berbeza. Model kemalangan maut adalah yang



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paling rumit dalam pembentukan model. Kebanyakan pembolehubah tidak signifikan untuk model kemalangan maut. Walaubagaimanapun model 'Engineers'' dan 'HDM' mempunyai banyak persamaan dimana pembolehubah yang signifikan adalah sama bagi kedua-dua model untuk semua jenis kemalangan.



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Pejabat JKR Daerah Gombak
Pejabat JKR Daerah Hulu Langat
Pejabat JKR DaerahKuala Langat
Pejabat JKR Daerah Sepang
Pejabat JKR Daerah Kuala Selangor
Pejabat JKR Daerah Hulu Selangor
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Pejabat Polis Daerah Sungai Buloh
Road Safety Research Centre, Universiti Putra Malaysia.

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I certify that a Thesis Examination Committee met on 7th April 2011 to conduct the final examination of Jamilah binti Mohd Marjan on her thesis entitled "Modelling of Accidents on Two-Lane Single Carriageway Roads in Malaysia" in accordance with the Universities and University College 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 Doctor of Philosophy.

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## DECLARATION

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

JAMILAH MOHD MARJAN

Date: 24 December 2010

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