ABSTRACT

The literature on the economics of road congestion has not resolved issues about the correct basis for understanding and measuring the related externalities and there does not appear to be an accepted theory of hypercongestion. Thus, the ambition of this thesis has been to develop an economic model that attempts to resolve these issues and provide a basis on which to estimate marginal external congestion time costs.

The new model is based on the view that it is density of road users that causes congestion and a multiperiod model is required to analyse the implied dynamic behaviour. It is shown how the theory relates to the standard speed-flow analysis. Importantly, the conventional speed flow model does deal correctly with a stationary state condition where speeds and flows are constant over time. However, when speed and density vary across time, the conventional model can be reworked in a density multiperiod framework to give an appropriate and correct analysis of the congestion externality costs.

This model is applied to the case of a single vehicle type during ordinary congestion and hypercongestion. In the case of ordinary congestion with constant density speed and density, the marginal external congestion time cost is the same in the new density and conventional models. In the case of hypercongestion, the new model predicts the marginal external congestion cost to be high and the single period conventional speed flow model has difficulty in predicting the externality cost. Additionally, it is shown that all hypercongestion equilibria are unstable and, in general, it suggested that hypercongestion equilibria outcomes are not efficient. The final development of density based model is for the marginal

external congestion time costs caused by different vehicle types. The elasticities of speed with respect to density are important in determining the extent of these externalities and the analysis is complex. The data requirements for appropriate estimation of the external congestion costs are high and presently not available. However, it is suggested that the impact on congestion of large and special vehicles is likely to be in excess of the commonly used factor of two to three passenger car equivalents.

INDEX

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

The fulfilment of the PhD study depended on the sharing of the knowledge and the practical research. Therefore, a number of people contributed to the production of this thesis either directly or indirectly.

Firstly, no one can deny that the academic collaboration is an important basis for the PhD study. This PhD thesis was developed under an excellent supervision of John Peirson. I owe a great deal to him for constructive discussions on every part throughout the writing of this thesis. During the four and a half years of my PhD study, he continuingly encouraged and gave me a clue of each difficulty, not only exchanging ideas but also considering the practical strategies. It is important to acknowledge that I owe a debt of thanks to John for believing in me. I also received beneficial supervision from William Collier on STATA instruction and microeconometric analyses, without his supports the empirical analyses would never be done. In addition, Amanda Gosling and many lecturers of School of Economics shared their helpful comments on my presentation during the PhD seminar workshops. Additionally, it is very important to acknowledge that this thesis was proof read by John and William and their detailed comments were very helpful in preparing the final version.

Not only the knowledge of economics, but the improving of my English skills is also important for writing of the thesis. Hence, my special word of thanks is due to Jane Short, the Director of In-sessional English Language Programmes and English for Specific Academic Purposes at the University of Kent. She gave me a friendly support to enhance my English skills for academic tasks. In addition, Professor Stephen Rowley was also an important English tutor, he gave me many useful lessons of English for academic purposes.

Secondly, without the extensive field data and the related knowledge, this thesis would never be completed. Therefore, I am particularly grateful to Bryn Mills [Trafficlink Chief Technology Officer], Transport for London and the Expressway Authority of Thailand (EXAT) for supplying the extremely valuable speed and flow data used for this thesis. In addition, my special thanks are for Bangkok Expressway Public Company Limited (BECL) for the meeting which introduced the key research persons of EXAT and provided a brief introduction of traffic management on the expressways in Thailand. Additionally, it is a pleasure for me to acknowledge the debt to Mr. Jarux for his knowledge of geographic coordinates and introduction of related computer programs working with Google Earth.

Thirdly, I wish to thank for the Royal Thai Government and Mae Fah Luang University for providing me with an excellent opportunity for PhD study. In addition I am indebted to Professor Songsak Sriboonchitta, Professor Peter Calkins and Professor Aree Wiboonpongse for creating an atmosphere so conductive to my PhD study.

Fourthly, I must thank to Akos Nagy for providing me a cosy accommodation and debating many social topics with me during the past years, to my relatives for all their caring supports, to Fiona King for providing me an opportunity to earn the worthwhile experience of teaching at Concorde International School, to all staffs in the University of Kent for their services and to everybody in the world for sharing experiences which led to the improvement of my analytical skill.

Finally, I dedicate this thesis to the memory of my father and mother.