BUS AND RAIL TRAVEL MODELLING FOR COLOMBO METROPOLITAN REGION: A THEORETICAL APPROACH TO MODE CHOICE MODELLING

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A THESIS SUBMITTED TO THE DEPARTMENT OF CIVIL ENGINEERING IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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ABSTRACT

The most common approach to modelling in Sri Lanka is based on zoning of the area concerned, and the identification of the travel network within the area, connecting the different zones. The resulting travel patterns of bus and rail are understood as an inter-zonal travel made between the different zones.

The set of models used for transportation planning in the Colombo Metropolitan Region has inconsistent structural forms with the formulation of different types of variables. Most of these variables are not common to each other. As a consequence the model estimation requires a large data base. Pertaining to this, a set of bus and rail passenger demand model forms is calibrated to a common modelling format, on a scientific basis.

These models attempt to explain (a) bus travel demand, (b) rail travel demand using season tickets,(c) rail travel demand using ordinary tickets and (d) total bus and rail travel demand. In these models, the impedance to travel is expressed in a generalized form, which includes travel fare, waiting time, transfer time and travel time. The product of employee population and the housing density between zones are the best fitted variables which explain the travel characteristics of the region.

The Mode choice modelling is one of the most crucial parts of travel demand modelling. With regards to this, the sound theoretical approach to the modelling facilitates the better understanding of traveller behaviour in the mode choice process. The theoretical framework of the bus and rail choice model has been formulated using logit theory, energy theory and economic theory. The variables fitted in this model are expressed by time variables such as, the utility difference between passengers (a) walking time to the mode, (b) in-vehicle travel times of bus and rail and (c) the loss of traveller comfort due to the loading levels and waiting time of the modes. The inclusion of bus and rail loading factors in the model, is important and has a great ability to represent the traveller characteristics of the inter-zonal travel. Therefore, the model can be applied for transportation planning studies not only to the study area but also to any Metropolitan region in the developing countries, which is of a similar nature in the travel characteristics.

The statistical tests reveal that the set of demand models for bus, rail and total public transportation has been successfully calibrated. It indicates the variation of the coefficient of correlation is between 70% and 80%. In fact, the choice model indicates this value is 85%, and 0.289 of the log likelihood index, which makes one conclude that the theoretical choice model has an acceptable fit, of the variables and the data.

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Saman J. Widanapathiranage
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This study is dedicated

to

my wife, Nilanthi

and

daughters, Dinali and Dilani

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ASC – Alternative Specific Constant

BCT – Box –Cox Transformation

BGC – Bus Generalized Cost

B-OBSE – Bus Inter-zonal Observations

CMR – Colombo Metropolitan Region

CTB – Central Transport Board

CUTS – Colombo Urban Transportation Study

DEMIDEPT – Demand Estimation Model for Inter-District Public Transport

DSD -Divisional Secretariat Division

LRI - Likelihood Ratio Index

MGC – Minimum Generalized Cost

MLE – Maximum Likelihood Estimation

MNL – Multinomial Logit Model

OCH – Outer Circular Highway

OD - Origin to Destination

RDO-OB – Rail Inter-zonal Travel Observations.

RSGC – Rail Season ticket Generalized Cost

ROGC – Rail Ordinary ticket Generalized Cost

SLR - Sri Lanka Railways

SPSS - Statistical Package for Social Scientist

TDM – Total Demand Model

TED – Transportation Engineering Division

VOT – Value of Time