

**DEVELOPMENT OF A GIS BASED TRANSPORT
DEMAND ESTIMATION MODEL THAT INTEGRATES
LAND USE AND TRANSPORTATION
INFRASTRUCTURE DEVELOPMENT SCENARIOS**

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Degree of Doctor of Philosophy

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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Thesis submitted in total fulfillment of the requirements for the degree of
Doctor of Philosophy

Department of Civil Engineering

University of Moratuwa
Sri Lanka

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out this research for the PhD thesis under my supervision.

.....

Signature of the supervisor

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Date

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ABSTRACT

Transportation issues are becoming severe day by day in Sri Lanka. Ignoring the importance of integrating transport and land use properly in the travel demand estimation process, due to its vast complexity and not having a proper mechanism to understand it easily, is the main reason for those issues. Identifying that, this research developed a GIS based transport and land use model that helps relevant authorities to easily understand and incorporate the complex interaction to the travel demand estimation process, as the first attempt in Sri Lanka until now. The model has two sub models called macro and micro models that separately look after the regional level and local level travel demand estimations respectively, although final results at any level combine both models' outputs.

The macro model has been developed for whole Sri Lanka taking the Divisional Secretariat (DS) divisions as Traffic Analyzing Zones (TAZs). Algorithms calibrated by the linear regression analyzing technique incorporating the Origin-Destination (OD) matrix data and socio-economic data are the main modeling technique for the macro model. Optimum counting locations derived through a new approach named as the "top-down approach" for OD surveys enhanced the accuracy of the OD matrix and thereby increasing the accuracy at all stages. As a prototype, a micro model was built for the Colombo DS division. The study area of the micro model can be any geographic area according to data and time availability. The activity based approach in the microsimulation modeling technique was used to develop the micro model, which uses household and railway passenger OD surveys, for calibration. Finally, a GIS based computer program was developed to improve the effectiveness and user-friendliness of these models.

Keywords: *transportation, land use, integration, modeling*

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LIST OF ABBREVIATIONS

ALS	Area Licensing Scheme
CA	Cellular Automata
CAST	City Analysis Simulation Tool
CBD	Central Business District
CDS	Colombo Divisional Secretariat Division
CL	Counting Location
CLP	Constraint Logic Programming
CMR	Colombo Metropolitan Region
DRAM	Disaggregated Residential Allocation Model
DS	District Secretariat
DSD	District Secretariat Division
EMDA	East Midlands Development Agency
EMPAL	Employment Allocation Model
EMRA	East Midlands Regional Assembly
ERP	Electronic Road Pricing
ESRI	Environmental Systems Research Institute
GA	Genetic Algorithm
GIS	Geographic Information Systems
GN	Grama Niladhari
GOEM	Government Office of the East Midlands
GPS	Global Positioning Systems
ILUMASS	Integrated Land Use Modeling and Transportation System Simulation
ITLUP	Integrated Land Use Transportation Package
LA	Local Authorities



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MCC	Manual Classified Counts
MPRE	Maximal Possible Relative Error
NOO	Number of Occurrences
NPPD	National Physical Planning Department
OCL	Optimum Counting Locations
OD	Origin Destination
PCL	Possible Counting Locations
POLIS	Projective Optimization Land Use Information System
RDA	Road Development Authority
RPTA	Regional Public Transportation Authority
RS	Remote Sensing
SPARTACUS...	System for Planning and Research in Towns and Cities for Urban Sustainability
TAZ	Traffic Analysis Zone
TUS	Urban User Cell
UDA	Urban Development Authority
USA	United States of America
UK	United Kingdom
VB	Visual Basic
VMT	Vehicle Miles Travelled
VQS	Vehicle Quota System



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