Transport @ UQ 2006

Centre for Transport Strategy & Intelligent Transport Systems Research Laboratory
School of Engineering — The University of Queensland

Research Program

Transport Sustainability

Public transport, active transport, demand management & land use.

Transit Oriented Development

Project Leader: Prof Phil Charles CTS

Researcher: Chris Hale

ARC Linkage Project research on transit oriented development (TOD), comprising: architectural and urban environment of TOD (UQ architecture); global trends in urban sprawl and TOD (Columbia); threat management and counter-terrorism in the urban and architectural environment (Rand Corp) & institutional issues and success factors (UQ CTS). Collaboration with Queensland Transport & Queensland Rail.

Institutional structuring principles for successful Transit Oriented Development in Brisbane

Effective implementation of TOD requires a number of organisational and policy impediments to be overcome. The diverse range of public and private partners in TOD initiatives bring special challenges for making them work. The literature outlines the types of challenges being faced. What is needed is a road map for effective implementation – a plan about how to implement a TOD plan. Making TOD strategy and policy work requires a integrated implementation framework, comprising strategic direction, partner integration, program operation, structure and incentives and controls. Underlying this framework are contextual factors: leadership, change, culture and influence. Developing and following the framework and considering success factors will ensure TOD strategy and policy has a much higher probability of working. Chris Hale commenced full-time PhD in February 2006.

Undergraduate research project:

- *Success Factors for Transit Oriented Development in South East Queensland* by B Zemek, M Fradgley & S Richardson

Bus Operations in Malaysia

Project Leader: Prof Phil Charles CTS

Researcher: Zulkufli Aziz

Sustainable policy framework for express bus transport in a developing country such as Malaysia

Presently there is no transport policy in Malaysia for express bus transport. In developed countries, public transport is promoted as a means to discourage people from using their cars, to save energy, to offer accessibility to the handicapped and to reduce pollution besides providing basic mobility. In contrast, developing countries provides public transport as a basic mobility at a reasonable cost and quality. Basic mobility should not be seen as compromising efficiency and effectiveness service. Malaysia needs a sustainable policy framework to ensure the viability of express transport industry, which benefits the operators, consumers and the government. This research aims to identify the optimum sustainable policy framework and determine the key success factors for express bus transport in a developing country such as Malaysia.

Demand Responsive Transport

Project Leader: Prof Phil Charles CTS

Researcher: Paul Logan

Developing a policy framework for demand responsive transport in Queensland

Urban and rural communities are undergoing major socio-economic and structural changes, which require new ways of providing public transport. These changes have forced passenger transport administrators and service providers to embrace new thinking about ways to provide more relevant passenger transport services with diminishing funding allocations. This new thinking is expanding from a purely engineering orientation (operational efficiency and resource allocation) to include societal concepts such as quality of life, liveability, access and mobility. One of the innovative solutions being considered and trialled is Demand Responsive Transport (DRT). The problem is that there is no policy framework in place for future planning and implementation of DRT services and no performance indicators for best practice DRT service delivery.

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Sustainability in Transport Projects

Project Leader: Prof Phil Charles CTS

Researcher: Frederik Preisler

Analytical Techniques to Incorporate Sustainability in Transport Projects

There is a growing emphasis on sustainable development as an objective in many strategic plans and mission statements for wide variety of organisations, both private and public. Apparent lack of a clear understanding of transport sustainability evidenced by wide variety of interpretations and a lack of guidance and tools for implementation of sustainability objectives.

The objective of this study is to propose a method for translating the objective of sustainability into application. This means developing a method which can be applied in project appraisals to determine how well an individual or group of projects assist in achieving the objective of sustainable development. The individual project is seen as being the basic unit of investment activity for an organisation. An organisation may undertake any number of projects, however the sum total of all the project an organisation undertakes is what drives the organization towards achieving its sustainability objectives.

Funding of Road Transport Infrastructure

Project Leader: Prof Phil Charles CTS

Researcher: Chris Begley

Funding of Road Transport Infrastructure in South East Queensland

Queensland is facing an unprecedented demand for a reliable, safe and efficient road network that can meet the expanding transport challenges for both passengers and freight throughout Queensland. As a major part of its overall strategy to provide this network with the best transport infrastructure available, the Queensland Government recently released its South East Queensland Infrastructure Plan and Program (SEQIPP) for the 2005 – 2026 planning horizon. Total transport infrastructure projects in SEQIPP amounted to $35 billion. Given the very high proportion of the total SEQIPP program which is attributed to transport infrastructure projects, the scope of this research will address the State's road funding strategies for the same time frame

Fares and Ticketing Policy Reform

Project Leader: Prof Phil Charles CTS

Researcher: Mark Streeting

Desirable fares and ticketing policy reform in a contactless smartcard environment

The research project seeks to develop recommendations regarding desirable fares and ticketing policy reform in a contactless smartcard environment. At the outset, it is important to recognise that there is unlikely to be a single 'one size fits all' policy direction. Detailed consideration will need to be given to the impact of the policy and regulatory environment, mass transit operator characteristics and market characteristics as key drivers of fares and ticketing policy.

Travel Demand Management

Project Leader: Prof Phil Charles CTS

Researcher: Sean Weier

Travel Demand Management: integrated and collaborative institutional model and principles

The transport sector is having a significant impact on the quality of life in urban areas through increased traffic congestion and greater reliance on car travel. Governments are attempting to address the impacts of transport through a variety of policy responses. One of the categories of policy response has been Travel Demand Management (TDM). The challenge has been in its implementation. This research will seek to understand the process of policy implementation and the role institutions.

System Performance

Strategic information & planning, evaluation frameworks.

Regional Transport Strategy Implementation

Project Leader: Prof Phil Charles CTS

Multi-jurisdictional Institutional Framework for the Effective Implementation of Regional Traffic Incident Management Strategy.

The research will develop and validate an implementation framework for successful planning and implementation of regional traffic incident management strategies. The research will investigate implementation barriers, including integration and coordination mechanisms, effective institutional roles and procedures and incentive instruments. A framework for effective implementation will be developed and tested by questionnaire, survey and interview techniques involving experts, practitioners and stakeholders. The outcomes of this research could be used as guidance for the effective use of public funds, to ensure successful implementation and significant benefits to regional communities.

Undergraduate research project:

- *Implementation of Regional Transport Plans* by A Fenwick

Operations & Safety

ITS, safety, traffic & incident management.

Advanced Traffic Management and Information Systems (ATMIS)

Project Leader: Dr Hussein Dia ITS

Advanced Traffic Management Systems aim to maximise the efficiency of existing infrastructure, and include examples such as Adaptive Traffic Control Systems, automated incident detection, freeway ramp control, electronic road pricing and dynamic speed control. Advanced Traveller Information Systems, on the other hand, aim to influence driver behaviour on departure time, route and mode choice decisions by providing up-to-date real-time travel information such as traffic conditions; location of incidents; estimated travel times to destinations; and weather conditions. The ITS Research Laboratory will be equipped with Australian Traffic Management Systems, namely SCATS and STREAMS.

Development and Evaluation of Agent-Based Adaptive Traffic Signal Control System

Researcher: Suphasawas Nigarnjanagool

The primary objective of this study is to demonstrate the feasibility of using agent technologies to develop a decentralised adaptive traffic control system. By modelling the signal controllers as intelligent agents, it is possible to tune the actions of individual controllers through the agent concept of collaboration. The study also aims to evaluate the performance of the agent-based traffic signal control system by comparing its performance to other adaptive signal control systems. This will be achieved in simulation studies by developing an interface to link the agent-based traffic signal control system with a microscopic traffic simulation tool. The successful completion of this research will result in the development of agent–based models for traffic signal coordination. The project will also demonstrate the benefits of applying a decentralised control approach by performing comparative evaluations between the proposed system and other adaptive control systems through simulation experiments.

Modelling Driver Behaviour Using Intelligent Agents

Researcher: Sakda Panwai

This research aims to develop a new generation of driver behaviour models using the Belief-Desire-Intentions agent framework. The BDI Theoretical dRiver Agents Model (BDI-TRAM) will be used to model driver behaviour under the influence of real-time traffic information. The agent-based driver-vehicle-units will have a knowledge base; a set of goals to achieve and some plans or actions to perform. These units will also have a learning capability to cope with environment changes. This will be accomplished using fuzzy-neural network techniques where a number of route choice decision rules can be generated and adapted when necessary. The data needed for model development will be collected from behavioural surveys of drivers to be conducted on a selected commuting corridor in Brisbane. The data will also be used to determine the factors affecting driver behaviour and compliance with travel advice. Unlike previous studies which attempted to validate the performance of the behavioural models using surveys, this study proposes the use of a driving simulator, to be interfaced to a traffic simulation tool, for model validation. The feasibility of the approach will be demonstrated for a case study on the evaluation of Advanced Traveller Information Systems impacts using microscopic traffic simulation. The successful completion of this research will result in the development of a robust new generation of driver behaviour models that can be used to evaluate various traffic management and traveller information systems and their impacts on the road network performance.

Evaluation of Adaptive Traffic Management Systems in Developing Countries

Researcher: Caroline Sutandi *[awarded PhD]*

Development and Evaluation of Ramp Metering Algorithms

Researcher: Sarintorn Winyoopadit

Modelling the Impacts of Incident Management Strategies using Traffic Simulation

Researcher: William Gondwe

Traffic Simulation and Modelling of Environmental Emissions

Project Leader: Dr Hussein Dia ITS

The ITS Research Laboratory provides researchers with access to state-of-the-art microscopic traffic simulation tools for modelling new ITS applications and evaluating their environmental and traffic impacts. The Laboratory equipment is also used to collect data for use in development of transport-related environmental emissions models. The lab's high-end servers and workstations also provide researchers with opportunities to test new algorithms for advanced traffic management and information systems. The Laboratory simulation tools include AIMSUN, PARAMICS and VISSIM. A number of travel demand forecasting tools, including EMME/2 and VISSUM, are also available in the Lab.

Modelling Environmental Emissions using Microscopic Traffic Simulation

Researcher: Noppakun Boongrapue

Public Transport, Emergency and Commercial Vehicle Operations

Project Leader: Dr Hussein Dia ITS

The technologies developed under the research program can be applied to a number of areas, including commercial vehicles; public transport and emergency management operations.

Human Factors and Safety

Project Leader: Dr Hussein Dia ITS

The ITS Research Facility's in-vehicle driver behaviour monitoring equipment, simulation and visualisation tools will be used to develop solutions to road safety that are firmly grounded on the understanding of the personal & social factors influencing unsafe driver behaviour. Drivers choices, behavioural adaptation or risk compensation when driving vehicles equipped with advanced technologies and the social acceptance of ITS technologies will also be evaluated using the Facility's equipment.

Sensor, Information and Decision Control Technologies

Project Leader: Dr Hussein Dia ITS

These systems are mainly concerned with improving the safety and efficiency of vehicles, such as collision avoidance, traction and dynamic skid control, adaptive cruise control, and parking distance control. A range of advanced vehicle control systems aimed at improving vehicle safety by allowing vehicles to communicate with road-side infrastructure will also be developed and tested. The aim of these systems is to produce an intelligent vehicle and relieve the driver of some of the driving tasks.

Traffic Incident Management

Improving Traffic Incident Management

Project Leader: Prof Phil Charles CTS

Undertaking Austroads research project identifying best practice improvements across Australia and New Zealand. Undertook reviews for Brisbane, Perth, Adelaide & Melbourne, and prepared reports. Found an increasing emphasis on traffic incident management, including deploying intelligent transport systems on the major road network and establishing traffic operations centres, real-time information and incident response services. Good cooperation is experienced between incident responders at an operational level. Some key performance measures and targets have been established and are regularly reviewed and reported.

Cost of Major Traffic Incidents

Project Leader: Prof Phil Charles CTS

Researchers: Prof Luis Ferreira (QUT), Damien Bitzios

Prepared a research report on the cost of traffic incidents in Brisbane for Main Roads. The cost of major traffic incidents can be more accurately estimated using appropriate specific cost impact factors and microscopic simulation for specific locations and adjacent networks.

Incident Response Services

Project Leader: Prof Phil Charles CTS

Series of research reports on incident management services and incident support units including literature review of international best practice, draft policy and guidelines, performance measurement framework and business case guidelines prepared for MR.

Quick Clearance of Major Traffic Incidents

Project Leader: Prof Phil Charles CTS

Developed a discussion paper on potential options Main Roads for quick clearance of traffic incidents, to facilitate the reduction in the duration of major traffic incidents that obstruct traffic flow on State controlled roads, including franchised roads. Reviewed current international practices, identified barriers and outlined potential options in terms of policy framework, partnerships, legal framework, procedures and practices and infrastructures and services.

Reducing Impacts of Traffic Incidents

Project Leader: Prof Phil Charles CTS

Reducing Impacts of Traffic Incidents, including clearance and crash investigation (ARC Linkage Project research grant application in conjunction Melbourne University).

Factors Influencing the Duration of Major Traffic Incidents in South East Queensland

Researcher: Shaun Kan

Identifying the factors that influence the duration of major traffic incidents and affect the extent of road closures in south east Queensland to identify opportunities for quicker clearance and improved incident management.

Undergraduate research projects:

- *Factors that affect the time to clear traffic incidents* by M Barry & T Gilmour
- *Recent Developments in Traffic Incident Management* by J Baxter & C Brown
- *Factors that affect the time to clear traffic incidents (stage 2)* by C De Vere & A Murphy

Research Students

PhD

Zulkufli Aziz
Sustainable policy framework for express bus transport in a developing country such as Malaysia

Supervisors: Prof Phil Charles & Dr Hussein Dia

Noppakun Boongrapue
Modelling Environmental Emissions using Microscopic Traffic Simulation

Supervisors: Dr Hussein Dia & Prof Phil Charles

Chris Hale
Institutional structuring principles for successful transit oriented development in Brisbane

Supervisors: Prof Phil Charles & Dr Kathi Holt-Damant (Architecture)

Paul Logan
Developing a policy framework for demand responsive transport in Queensland

Supervisors: Prof Phil Charles & Dr Hussein Dia

Suphasawas Nigarnjanagool
Development and Evaluation of Agent-Based Adaptive Traffic Signal Control System [submitted PhD thesis]

Supervisors: Dr Hussein Dia & Prof Phil Charles

Sakda Panwai
Modelling Driver Behaviour Using Intelligent Agents [submitted PhD thesis]

Supervisors: Dr Hussein Dia & Prof Phil Charles

Frederik Preisler
Analytical Techniques to Incorporate Sustainability in Transport Projects

Supervisor: Prof Phil Charles

Caroline Sutandi
Evaluation of Adaptive Traffic Management Systems in Developing Countries [awarded PhD]

Supervisors: Dr Hussein Dia & Prof Phil Charles

Sarintorn Winyoopadit
Development and Evaluation of Ramp Metering Algorithms

Supervisors: Dr Hussein Dia & Prof Phil Charles

MPhil

Chris Begley
Funding of Road Transport Infrastructure in South East Queensland

Supervisors: Prof Phil Charles & Dr Hussein Dia

William Gondwe
Modelling the Impacts of Incident Management Strategies using Traffic Simulation

Supervisors: Dr Hussein Dia & Prof Phil Charles

Shaun Kan
Factors Influencing the Duration of Major Traffic Incidents in South East Queensland

Supervisors: Prof Phil Charles & Dr Hussein Dia

Mark Streeting
Desirable fares and ticketing policy reform in a contactless smartcard environment

Supervisors: Prof Phil Charles & Dr Hussein Dia

Sean Weier
Travel Demand Management: integrated and collaborative institutional model and principles

Supervisors: Prof Phil Charles & Dr Hussein Dia

Publications

Charles P (2006) *Emerging issues and trends in road transport and traffic in the coming decade*, discussion paper for Austroads Council, May 2006

Charles P (2006) *Incident Response Services*, series of research reports including literature review, draft policy and guidelines, performance measures and business case guidelines prepared for Main Roads Queensland

Charles P (2006) *Quick Clearance of Major Traffic Incidents*, discussion paper on new policy initiatives for Main Road Queensland, June 2006

Charles P (2006) *Review of Current Traffic Incident Management Practices*, submitted for publication as research report to Austroads, June 2006

Charles P (2006) *Traffic Control by Wireless,* ITS International May/June edition

Charles P (2006) *Submission to AusLink on Brisbane-Cairns Corridor Strategy,* prepared for Rail Bus and Tram Union

Charles P (2006) *Submission on Smart Travel Choices for South East Queensland A Transport Green Paper*, prepared for Rail Bus and Tram Union

Dia H and Cottman N (2006) *Evaluation of Arterial Incident Management Impacts Using Traffic Simulation*. In Press. IEE Proceedings on Intelligent Transport Systems, UK.

Dia H and Cottman N (2006) *Modelling the Environmental Benefits of ITS using Power-Based Vehicle Emissions Models*. Accepted as a scientific paper to the 2006 ITS World Congress to be held in London, October 2006.

Dia H and Panwai S (2006) *Modelling Drivers' Compliance and Route Choice Behavour in Response to Travel Information*. In Press. Special Issue on Modeling and Control of Intelligent Transportation Systems, Journal Nonlinear Dynamics.

Dia H, Panwai S, Boongrapue N, Ton T and Smith N (2006) *Comparative Evaluation of Power-Based Environmental Emissions Models*. Proceedings of the IEEE Conference on ITS, Toronto, Canada.

Ferreira L & Charles P (2006) *Submission on Improving the Regulatory Framework for Transport Productivity in Australia,* prepared for Rail Bus and Tram Union.

Ferreira L, Charles P and Tether C, *Evaluating Flexible Transport Solutions*, submitted to Transport Planning & Technology journal.

Gondwe W & Dia H (2006) *Evaluation of Incident Management Impacts on an Integrated Motorway and Arterial Network using Traffic Simulation,* presented at Australian Transport Research Forum, Sep 2006.

Hale C (2006) *Moreton 2030 – A Vision for Efficient Urban Structure in South East Queensland*, presented at CAITR Dec 2006

Hale C and Charles P (2006) *Making the Most of Transit Oriented Development Opportunities*, presented at Australian Transport Research Forum, Sep 2006.

Hale C and Charles P, *A Step-by-Step Approach to Transit Oriented Development Project Development*, accepted for the World Congress on Transport Research, University of California Berkeley, June 2007.

Karl C and Charles P (2006) *Improving Traffic Incident Management - Evaluation Framework*, submitted for publication as research report to Austroads, May 2006.

Logan P, *Best Practice Demand Responsive Transport (DRT) Policy: An investigation of world trends in DRT planning, decision making and service delivery*, submitted to Road and Transport Research journal.

Nigarnjanagool S & Dia H (2006) *A Multi-Agent Approach to Real-Time Traffic Signal Optimisation*, presented at Australian Transport Research Forum, Sep 2006.

Panwai S and Dia H (2006) *Neural Agent Car Following Models*. In Press. IEEE Transactions on Intelligent Transportation Systems.

Panwai S and Dia H (2006) *A Fuzzy Neural Approach to Modelling Behavioural Rules in Agent-Based Route Choice Models*. Proceedings of the Agents in Traffic and Transportation Workshop, Conference on Autonomous Agents and MultiAgent Systems, 2006, Hakodate, Japan.

Panwai S & Dia H (2006) *Comparative Evaluation of Route Choice Modelling Approaches*, presented at Australian Transport Research Forum, Sep 2006

Panwai S and Dia H (2006) *Stability Analysis and Macroscopic Evaluation of Agent-Based Car Following Models*, Proceedings of Asia-Pacific Forum on ITS, Hong Kong, July 2006.

Sayeg P and Charles P (2006) *Guidelines for ITS to Assist Sustainable Transport In Developing Cities*, presented at ITS Asia-Pacific conference, Hong Kong, July 2006

Stirzaker C and Dia H (2006) *Evaluation of Transportation Infrastructure Management Strategies Using Microscopic Traffic Simulation*. In Press. Journal of Infrastructure Systems, American Society of Civil Engineers.

Streeting M (2006) *Lessons learned in customising smartcard systems to operator needs: An Australian perspective*, presented at 5th UITP Asia-Pacific Congress, Seoul, Korea, 18-23 June 2006.

Streeting M and Charles P (2006) *Developments in Transit Fare Policy Reform*, presented at Australian Transport Research Forum, Sep 2006

Thomas K and Dia H (2006) *Comparative Evaluation of Freeway Incident Detection Models Using Field Data*. In Press. IEE Proceedings on Intelligent Transport Systems, U.K.

Professor Phil Charles
Director, Centre for Transport Strategy
e-mail: p.charles@uq.edu.au
web: www.uq.edu.au/cts

UQ Centre for Transport Strategy supported by Queensland Transport, Main Roads and Queensland Rail

Dr Hussein DIa
Director ITS Research Laboratory
e-mail: h.dia@uq.edu.au
web: www.itslab.eng.uq.edu.au

School of Engineering — The University of Queensland
