Institute of Transport Studies

The Australian Research Council Key Centre in Transport Management
On behalf of our entire staff and students, it is my great pleasure to welcome you to the Institute of Transport Studies (ITS Monash) at Monash University.

ITS (Monash) has a long and proud history in Monash University and Australia. The transport group at Monash was established in 1969. The Institute of Transport Studies was established in 1995 as the key National Centre of Excellence in Teaching and Research in transport management, recognised by the Australian Government (a joint venture between The University of Sydney and Monash University). For more than four decades the transport group has played a crucial role in the transport field through fundamental, applied and industry-relevant research and education. Through our excellent education programs we continue to educate transportation leaders for industry, government and academia.

At ITS (Monash), we recognise that the next important challenge and opportunity will present itself through availability of live data and low-priced technology to travellers. There will be soon over 3 billion people with connected devices and more than 210 billion sensors out there that will provide a once-in-a-generation opportunity to tackle issues of complex transport and urban mobility for modern cities. At ITS (Monash) we have aligned our research focus and efforts to take advantage of this new leap in mobility, opportunity to change the way we travel, create sustainable transport, and work toward more liveable cities.

This brochure highlights ITS (Monash) activities in research, education, industry and society engagement. We are very excited about our research and education activities and the opportunities that lie ahead. We look forward to working with you.

Sincerely,

Majid Sarvi
Associate Professor,
Civil Engineering Department
Director,
Institute of Transport Studies, Monash University

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Academic Members and Researchers

Majid Sarvi  
Director of ITS (Monash)  
Associate Professor in Civil Engineering  
Large transport multimodal network modelling, vulnerability analysis and optimization, pedestrian crowd dynamic modelling, traffic flow theory and operations.

William Young  
Professor in Civil Engineering  
Traffic engineering, traffic simulation, parking management, land-use/transport/environment interaction, simulation and safety, engineering management.

Graham Currie  
Professor and Chair in Public Transport  
Public transport network and service planning methods, transport needs measurement and planning, on-road transit priority system design and evaluation, rural and regional public transport in Australia, public transport and major special events planning.

Geoff Rose  
Professor, Monash Sustainability Institute and Civil Engineering Department  
Travel behaviour change, sustainable transport, education for sustainability.

Meead Saberi  
Lecturer, Civil Engineering Department  
Traffic flow theory and characteristics, network modelling, travel demand modelling, travel behaviour modelling, complex systems in transportation, urban transportation data visualization.

Terry Liu  
Lecturer, Civil Engineering Department  
Transportation network modelling, transportation planning, transit network assignment and design, road pricing, logistics network analysis, applications of parallel computing in transportation.

Alexa Delbosc  
Research Fellow  
Changes in car licensing and driving among young adults, psychology of fare evasion, social impacts of public transport.

Amir Sobhani  
Research Fellow  
Human behaviour modelling, simulation of safety, transport safety, microsimulation, transport optimization.

Kayvan Aghabayk  
Research Fellow  
Traffic flow theory and operations, driving behaviour modelling and analysis, network modelling and optimization.

Bill Kilpatrick  
Senior Research Officer  
Program Leader, Safety Management Course for Bus Operators.

John Clements  
Senior Research Officer  
Program Support, Bus and Coach Management Programs

Brenda O’Keefe  
Administration Manager

Marilyn Johnson  
Research Fellow  
Cycling, cyclist safety, cyclist-driver interactions, naturalistic cycling methods and electric bike use in Australia.
Advisory Board

Michael Kennedy
ITS (Monash) Advisory Board Chair
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Mornington Peninsula Shire

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Executive Director
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Gerard Waldron
Managing Director
ARRB Transport Research

Brian Negus
General Manager, Public Policy
RAOV
Department of Transport, Planning and Local Infrastructure

Department of Transport, Planning and Local Infrastructure together with Public Transport Victoria is collaborating with ITS (Monash) for a better management of crowds in emergency conditions. Associate Professor Majid Sarvi and his team are working with Public Transport Victoria to plan public transport hubs with improved crowd flow. Public Transport Victoria’s director of Network Operations, Norman Gray, says: “We are always searching for ways to improve passenger flow at major stations. For example, at New Year’s Eve there were about 250,000 passengers going through Flinders Street Station. Crowd management is critical to both passenger safety and station efficiency at times like this.” Mr Gray also adds: “If we can develop tools and methods from this ARC research project to simulate and test different plans, it would mean we could base station design and management decisions on scientifically proven findings.”

Public Transport Victoria

Public Transport Victoria (PTV) is working with ITS (Monash) to understand the psychology of fare evasion. Professor Graham Currie and Research Fellow Alexa Delbosc explore how fare evasion occurs in Melbourne through a series of focus groups and an online survey of a representative sample of public transport users. A model of fare evasion psychology is developed which fused concepts related to the psychology of shoplifting with a range of research exploring fare evasion behaviours and influences. The model is tested using a structural equation modelling platform. The research is the first in the world to identify an important ‘recidivist’ repeat evasion cohort which is responsible for most revenue lost through fare evasion. Recommendations to address fare evasion are made and incorporated into the PTV ‘Freeloader’ publicity campaign. On completion of the project, follow-on research uses the methods developed to study fare evasion in London, Toronto, Boston, Washington D.C., New York City, San Francisco, Sydney, Brisbane and Perth.

VicRoads

Transport infrastructure is one of the seven types of nationally significant critical infrastructure identified by federal government to ensure the continuity of essential services in the face of extreme events including terrorist attacks and natural disasters. Australian road networks due to their sparse and long spanning nature pose substantial and growing challenges in responding to extreme events. Natural disasters such as flooding, landslides and bushfires are becoming more prevalent. With limited budget available for the maintenance and rehabilitation of road infrastructure, there is a need to develop improved methods for reducing the substantial costs associated with the restoration of road pavements and bridges that have been damaged by extreme events. VicRoads, the state road and traffic authority in the state of Victoria, is engaged with ITS (Monash) through Professor Frieder Seible and Associate Professor Majid Sarvi to study road transport network resiliency and vulnerability. The ultimate aim of this project is to develop tools for determining the most cost efficient schedule of preventative strengthening works for road networks for reducing the disruption and recovery costs after extreme events.
Research Themes

Research at ITS (Monash) is focused into two main themes, each covering a range of topics.

1 Multimodal urban transport system planning, modelling and optimisation

This research theme is focused on developing algorithms to study large transport network and land use characteristics of modern cities through advanced mathematical and optimisation techniques. Taking advantage of technology and the opportunity that comes with it is the cornerstone of this research theme.

2 Enhancing transport system sustainability, resilience and human interface

The focus of this research theme is on the issue of sustainable transport and the important impact of human interface and transport system from engineering point of view to social aspect of sustainable transport systems.
Facilities

Institute of Transport Studies at Monash University has one of the most advanced transport laboratory (Smart Cities Laboratory) in Australia (Established in 2005). Some of the facilities are:

**Laser Based Instrumented Car**
This instrumented vehicle is able to find moving objects with very high accuracy in high traveling speed.

**Driving Simulator**
The driving simulator is used for studying human behaviour in traffic systems.

**High Performance Computing Facility**
The complex modern problem in transport engineering requires high performance and cloud computing facilities. These facilities are developed as part of transport laboratory at Monash.

**Multi-disciplinary Crowd Dynamics Laboratory**
A small scale biological lab to use animal as proxy to human crowd motion is established as part of the transport laboratory.

**Portable Data Monitoring (CCTV) and Acquisition Unit**
This facility is used for quick and accurate mass data collection of traffic and transport systems.
Research

Road Pricing

In dense urban cities, the space for road construction is usually quite limited, thus new construction of road infrastructure is not a sustainable solution for the development of transport systems. In view of the expanding population and car ownership in urban areas, how to satisfy the people’s travel desires becomes a big challenge. Hence, traffic demand management is a sound solution for congestion mitigation: diverting traffic demand from congested areas to uncongested roads, so as to achieve a reasonable use of network resources. By reasonably setting toll charges in congested areas, drivers with lower value-of-time and low trip emergency would detour on the less congested or un-tolled roads. Our study on urban congestion pricing focuses on the determination of optimal charging locations as well as the optimal toll rate, with the aim of minimizing congestion level on the entire transport network.

Pedestrian Crowd Dynamic Modelling and Simulation

The number of severe incidents involving large pedestrian crowds has been increasing worldwide over the last decades. Tragedies like the 2010 Love Parade in Germany clearly show the need for improved management of such large gatherings. The causes for this increase are manifold: in different industrialized countries we see a strong tendency towards re-urbanization, there is an increased frequency of large gatherings that are either centrally organized (sport events) or not (Facebook parties, political rallies), etc. The management of these large flows requires a thorough understanding of crowd flow dynamics. Pedestrian flow theory is however, a very young research field, which has not received much attention. This multidisciplinary research aims to further theoretical development and understanding of crowd dynamics, while keeping a strong focus on the application perspectives in flows and crowd management and the design of crowd facilities.

Electric Bicycles

Electric bikes have the potential to overcome some of the barriers that prevent Australians from riding a conventional pedal bike. Electric bikes offer assistance to overcome hilly terrain or a lack of fitness and they can assist in rehabilitation. While electric bike sales are increasing, they remain relatively uncommon and little is known about electric bikes in Australia. Using a nation-wide, on-line survey this research has identified the characteristics of electric bike owners in Australia and it explored the factors underlying the decision to purchase an electric bicycle. This research has provided insight into the gender distribution and age profile of electric bicycle owners along with the reasons for purchase, the alternative modes that were considered at the time of purchase and the extent to which they replace car or bicycle trips. Electric bikes are a potentially important option for sustainable urban mobility.

Social and Psychological Impacts of Transport

ITS (Monash) has specialised in research on the social and psychological impacts of travel on individuals through a large number of research engagements with a range of industry partners. Innovative research on the impacts of transport disadvantage on social exclusion and psychological well-being has provided world first tools to monitor the performance of transport and social policy. A range of projects have also illustrated how problems such as personal safety in trains and anxiety while waiting or transferring from buses can act as significant barriers to mobility.
Response to Unplanned Rail Disruptions

ITS (Monash) was engaged by Metro Trains Melbourne to explore patterns of unplanned disruptions to Melbourne urban rail services, to better understand current responses by Metro and to identify future improvements. A survey of disruption frequency, cause and responses was undertaken including consultations with front line and management staff to better understand problems and issues. A series of focus groups and on-line discussion groups sought passenger experiences followed up by a major web based panel survey of users. The study included an international survey of over 100 railways to explore management approaches in other cities. Recommendations included a long term program of measures to improve disruption management including innovative use of social media to improve passenger communication and the use of crowd sourcing to better understand disruption development.

Complex Networks in Transport

Cities are inherently complex socio-economic systems. Complex network theory is a highly active interdisciplinary research area inspired by numerous empirical studies of computer and social networks. Transport demand in cities, consisting of millions of origin-destination trips, can be viewed as a complex network. This research introduces an innovative approach to model travel demand and applies complex network theory to understand patterns of human mobility and community structure in cities. The resulting insights from viewing travel demand as a complex network uncovers fascinating spatial phenomena in cities.

Simulation of Safety

Recent decades have seen considerable growth in computer capabilities, data collection technology and communication mediums. This growth has had considerable impact on our ability to replicate driver behaviour and understand the processes involved in failures in the traffic system. This project sets out to assess the state of the art in the use of computer models to simulate and assess the level of safety in existing and future traffic systems. It reviews developments in the area of road safety simulation models. It focuses on stochastic numerical models of traffic behaviour and how reliable these are in estimating levels of safety on the traffic network. The project also explores the general data types used to develop, calibrate and validate these models. Recent technological development in in-vehicle data collection, driver simulators and machine learning offers considerable potential for improving the behavioural base, rigour and application of road safety simulation models.

Urban Data Visualization

With the recent advancements in information and communication technologies (ICT), high-resolution urban data are more available than ever before. Data visualization is a branch of descriptive statistics. The main goal is to communicate large amount of data clearly and effectively through graphical means. Several visualizations have been developed recently at ITS (Monash), including: Melbourne Ethnicity Dot Map, Melbourne Age Dot Map, Australian Air Travel Network, Melbourne Bike Crash Map, Melbourne Population Growth, and Melbourne Dwelling Density Distribution. Some of the ongoing visualization projects include Melbourne Income Dot Map, Melbourne Car Ownership Dot Map, Crime Map of Victoria, etc.
Education Programs

Undergraduate Programs
ITS (Monash) in conjunction with the Department of Civil Engineering offers a number of units:

- Spatial Communication (new elective unit for first year engineering students)
- Traffic and Transport Engineering
- Road Engineering
- Project Management
- Transport Systems
- Transport Planning
- Civil Engineering Practices

Postgraduate Programs
ITS (Monash) in conjunction with the Department of Civil Engineering offers different postgraduate programs in transport and traffic engineering.

Off-Campus Learning Master's Program

- Advanced Traffic Engineering
- Traffic Engineering and Management
- Quantitative Methods
- Transport Planning and Policy
- Intelligent Transport Systems
- Transport Modelling
- Case Studies in Transport
- Fundamentals of Urban Public Transport
- Road Safety
- Transport Economics
- Infrastructure Project and Policy Evaluation

Southeast University - Monash University Master's Program
(in partnership with South East University in China)

- ITS: Engineering and Management
- Modelling Transport Systems
- Quantitative Methods for Transport
- Sustainable Transportation System
- Public Transport
- Case Studies in Transport

Clayton On-Campus Master's Program
(Master of Advanced Engineering with specialization in transport, 1-year qualification)

- Advanced Topics in Traffic Engineering
- Transport Planning and Policy
- Traffic Engineering Systems and Management
- Advanced Transport Modelling

Clayton On-Campus PhD Program
The Ph.D. in transport is for those seeking a scholarly career or wanting to develop an understanding of related fields in depth through original research.

Industry Programs
ITS (Monash) also offers the only accredited Bus and Coach Program in Victoria.

- Safety Management Course for Bus Operators
- Transport Management Course for Bus Operators

For more information please visit: eng.monash.edu.au/civil/research/centres/its
Postgraduate Students

The Institute of Transport Studies (Monash) has more than twenty Ph.D. students.

Our students come from all over the world to research in a diverse range of transport fields that have been mentioned in this brochure.