TRANSPORT RESEARCH@ITS
MONASH:
TACKLING CHALLENGING TRANSPORT ISSUES

PRESENTED BY: DR SUSILAWATI
susilawati@monash.edu
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RECURRING TRAFFIC CONGESTION

Externalities:
• Loss of productivity that cost 3% of national GDP
• Fuel consumption lead green house emission
• Traffic accident
TRANSIT SERVICE DISRUPTIONS

Courtesy: The Jakarta Pos
PRESENTATION OUTLINE

ITS Monash

Public transport
  - Movement and place

Urban traffic management
  - Traffic Incident

Vulnerability road network modelling
  - Extreme weather
  - Natural disaster

Sustainable Intelligent Transport Ecosystems
Transport Group in Civil Engineering was established in 1969 with appointment of Ken Ogden

- Celebrating our 50th Anniversary in 2019
- Ken emphasised ‘Rigour’ and ‘Relevance’ as key characteristics of the group’s work

The Australian Research Council National Key Centre in Transport Education and Research was formed in 1995

- Collaboration between Monash ITS and the Institute of Transport and Logistics Studies (ITLS) at the University of Sydney
- Two nodes became self funding after the Commonwealth seed funding ended in 2000

In 2019 Monash Institute of Transport Studies has

- 12 academic staff
- 3 research staff
- 3 admin staff
- 33 PhD students
The Research and Education activities of Monash ITS are focused on the development of safe, efficient and sustainable multimodal transport systems

- Fundamental, applied and industry-relevant research
- Undergraduate, postgraduate and industry-focussed education programs offered on-campus and on-line
- Community and Professional Service activities
  - International Committees (TRB) and conference organising committees (Australasian Transport Research Forum)
  - Annual public lecture: The Ogden Transport Lecture
MONASH ITS EDUCATION PROGRAMS

- **PhD**
- **Masters**
  - Master of Transport and Traffic (On-line, part time)
  - Master of Advanced Engineering (Transport Specialisation): On-campus Clayton, full time
  - Master of Transportation Systems: On-campus Suzhou (China)

- **Undergraduate:**
  - Bachelor of Engineering (on-campus, Clayton and Kuala Lumpur)

- **Industry-professional development (non-award)**
  - Bus Safety and Bus Business Management (distance education)
  - Professional short-courses (Traffic Eng. & Management – 2019)

Monash GRIPs aim to encourage cross-disciplinary collaboration and the development of transferable skills, leading to cutting edge outcomes for both research and industry leaders.

- The Sustainable and Effective Public Transport (SEPT) GRIP aims to break down barriers between disciplines to further understanding and generate innovative solutions in the field of public transport.
13. Placemaking & Street Redesign

MOVEMENT PLACE FRAMEWORK FOR TRAM DEVELOPMENT ACTIONS

INTEGRATED NETWORK MANAGEMENT - FRAMEWORK

CONTROL

Supervision

Coordinated in network

Coordinated in sub network

Coordinated in strings

Local

MEASURES

SUPERVISION

Control within layer

Control space Effects

Supervision units

Control rules
Control scenarios
Control algorithms
Event agenda

ESCALATION

Space Bottlenecks

In network

In Sub networks

In strings

PERFORMANCE

At locations

MONITORING & DIAGNOSIS

In network
CONTROL METHODOLOGY

Based on information from the queue estimator, originating bottlenecks are detected (i.e., inflow is higher than available space). The intersection controller increases the outflow towards downstream roads.

Protected roads are provided with more green time to process additional traffic.

Upstream traffic signals will reduce the inflow if required.

Traffic is buffered on roads that have conflicting signal phases with the critical road.
AMSTERDAM PILOT
AMSTERDAM RESULTS

- Total travel time reduced by up to 50%
- 1 million EUR annual reduction in congestion cost
Road segments on Forster Rd (between sites 263 and 3963) and Blackburn Rd (between sites 264 and 451) are studied.
ESTIMATED BENEFITS FOR MELBOURNE NETWORK

- Economic gains of HERO for the Monash freeway inbound is estimated at $94,000 AUD per day*
- With sufficient buffers on arterials, the effective storage space and active period of HERO can be increased with a factor 2 to 3
- Quadratic relation between active period and the economic benefit on the freeway resulting in large expected benefits (~$400,000 AUD cost saving per day)
- Urban traffic that does not travel towards the bottleneck experiences additional delay; however, if buffers are properly configured, this adverse effect can be minimised.

References:
Road Network Vulnerability

Assessing the weakness of road network to incidents and what adverse impacts of the degraded road network serviceability on the

Definition

- **a node** is vulnerable if loss (or substantial degradation) of a small number of links significantly diminishes the accessibility of the node, as measured by standard index of accessibility.

- **a network link** is critical if loss (or substantial degradation) of the links significantly diminishes the accessibility of the network or of particular nodes, as measured by standard index of accessibility.
ARIA INDEX

- Developed by the Department of the Health and Aged Care
- The index measures remoteness in terms of access along the road network between populated localities and service centres
- The range of ARIA+ index is from 0 to 15 which means the greater the index value, the more remote the particular area
- The service center can be defined as populated localities where the population exceeds 200 persons

<table>
<thead>
<tr>
<th>Service Centre Category</th>
<th>Population</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 250,000</td>
</tr>
<tr>
<td>B</td>
<td>48,000 - 249,999</td>
</tr>
<tr>
<td>C</td>
<td>18,000 - 47,999</td>
</tr>
<tr>
<td>D</td>
<td>5,000 – 17,999</td>
</tr>
<tr>
<td>E</td>
<td>1000 – 4,999</td>
</tr>
<tr>
<td>F</td>
<td>200-999</td>
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</tbody>
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\[ ARIA_i = \sum_{L} \min \left\{ 3, \frac{x_{iL}}{x_L} \right\} \]

\( x_{iL} \) is the mean road distance of all localities to the nearest category L service centre.
THE SELECTED LINKS

The most severe (3.5 - 5)

The most severe (3.5 - 4)
RELIABILITY BASED USER EQUILIBRIUM FOR ROAD NETWORK VULNERABILITY ANALYSIS
Sustainable Intelligent Transport Ecosystems (SITE)

- Artificial Intelligence
- Internet of Things & Sensor Technology
- Information & Technology
- Public Health
- Behavioural & Medical Studies
- Public Transport & Active Transport
- Traffic Modelling
- Transport and Traffic Engineering

Traffic conditions

Human behaviour

Intervention strategies
Sustainable Intelligent Transport Ecosystems (SITE)

Open Traffic Data
• To model adaptive and responsive dynamic traffic loading
• To assess traffic level of service at critical junctions
• To evaluate traffic network performances

Sensor

Data Analytic

Accessibility analysis
PT Accessibility Analysis
• To assess the spatial-temporal accessibility of public transport in study area
• To measure the efficiency of PT in providing connectivity to all
• Develop an accessibility assessment suitable for Malaysia

Walkability Analysis
• To assess outdoor and indoor walkability
• Develop walkability assessment tool to assist transport planner

Social and economic & behavioral studies
• To investigate key factors that encourage and hinder commuters’ willingness to use sustainable transportation
• To examine the impact of the use of ST on socioeconomic benefits to residents/non-residents
• To identify the key policies and strategies that will enhance commuters’ to adopt ST

Dynamic traffic modelling
• To model adaptive and responsive dynamic traffic loading
• To assess traffic level of service at critical junctions
• To evaluate traffic network performances

Medical Research
• To investigate the current and past health aspects of stakeholders
• To investigate the future perspectives of health aspects of stakeholders
• To assess possible interactions between current road/traffic systems and health aspects stakeholders
To assess the walkability of a working adult in the township using 7C category.
Public Transport Accessibility Levels (PTALs) measures user’ walking time and average waiting time and reliability of public transport services.
POTENTIAL RESEARCH AREAS

- Dynamic ride sharing
- Driverless car
- Shared autonomous cars with public transport
CONCLUSION

- ITS Monash has conducted fundamental and applied research in the area of active transport, public transport, intelligent transport systems and advanced technology and future transport to tackle challenging issues in relation to traffic congestion reduction and minimizing impact of road network disruption through ITS adoption and promoting sustainable transport ecosystems.

- Opportunity for collaborative research for knowledge transfer and sharing facilities.
To keep informed through the Monash ITS web site or

Join the **Monash ITS LinkedIn group**

by emailing **Alexa.Delbosc@monash.edu**

Or go to: **https://www.linkedin.com/groups/4384724/**
Terima Kasih