MONASH University

TRANSPORT CAPABILITIES

Monash University

Madeleine McManus OAM
Director Industry Engagement Monash University

GROUP OF EIGHT AUSTRALIA

An Introduction to Monash University

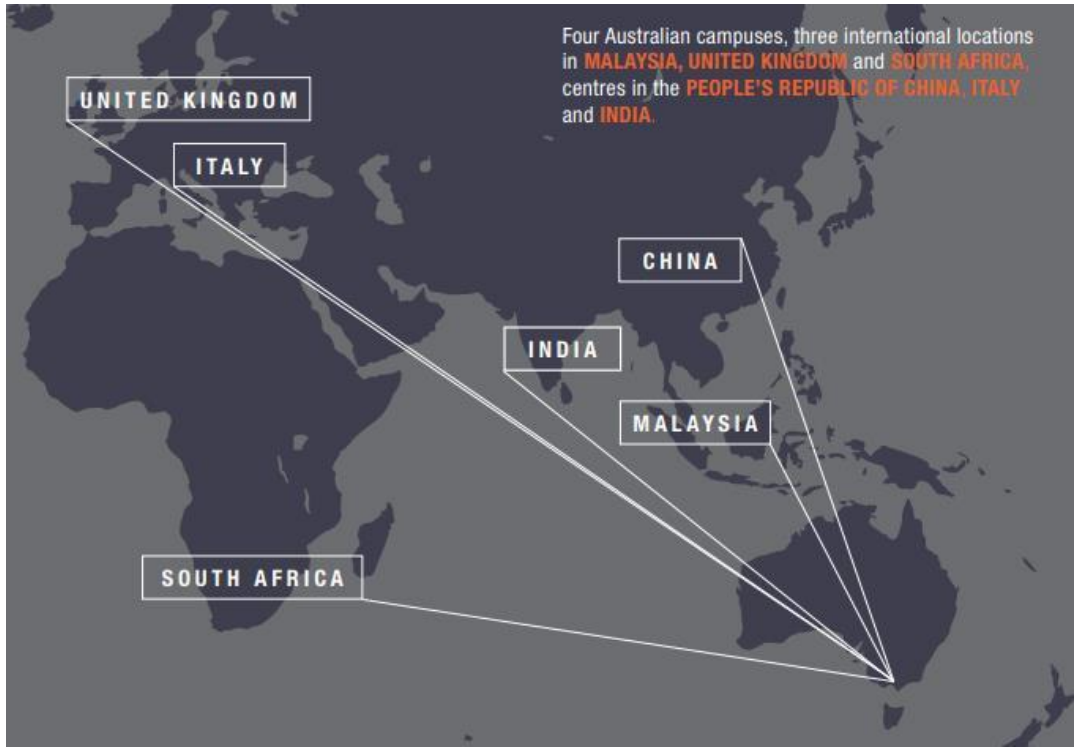
At Monash University, the desire to make a difference informs everything we do. Our work is making an impact across the globe, from developing life saving medicines to significantly influencing road safety injury prevention.

Monash is Australia's largest university, with a global presence on four continents. We are focused on redefining the way a university interacts with the world. Our goal is to unleash the potential of partnering with government, industry and the community to address significant challenges and make meaningful contributions to solving them via enterprising education and research.

Enterprising Research and Development

Monash has a strong track record of an enterprising approach to partnerships and inter-disciplinary collaborations with industries to support research and development.

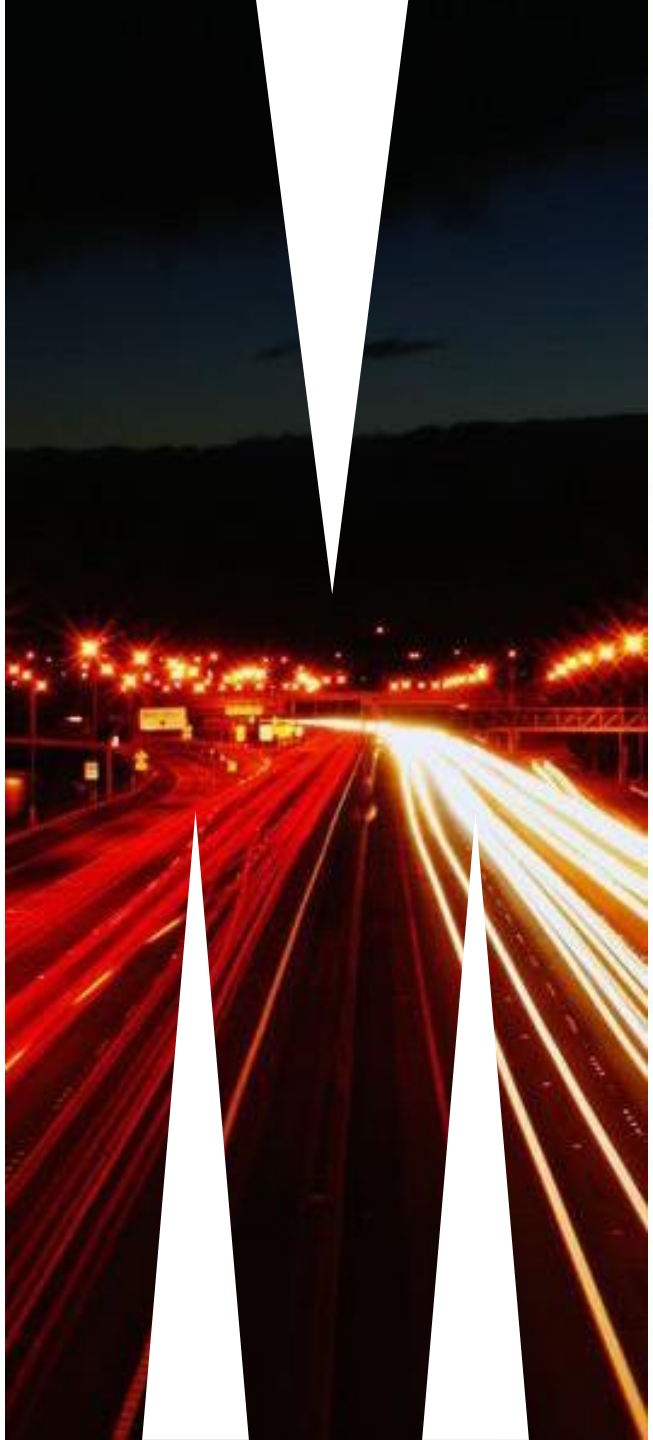
This document focuses on the research and development work that Monash is conducting with the transport industry on a local and global scale.



MONASH University

The Transport Sector & Monash University

Collaborating with industry to develop better economic, social and environmental outcomes for the local and international community.



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The transport, postal and warehousing sector is a sizeable portion of the Australian economy

The transport sector supports a significant portion of economic activity in Australia. As the sector underpins the flow of goods, services and people within Australian society, it needs to keep innovating to support the rest of the economy.

Key Facts

$82 billion in economic contribution

The total economic contribution of Australia's transport, postal and warehousing sector in 2017 was **$82 billion**, representing around **5% of the Australian economy**.[1]

652,000 jobs

This economic activity supported a total of **652,000 jobs** across Australia, which represents over **5% of total employment**.[2]

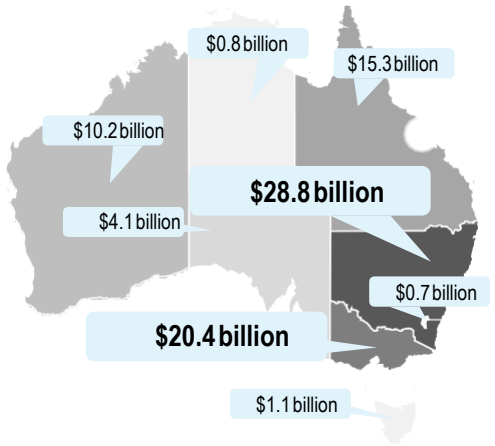
#5 globally for freight transported

Australia ranked 5th globally in 2015 for total freight transported, only trailing behind China, Russia, India and USA.[3]

Key State Contributions[4]

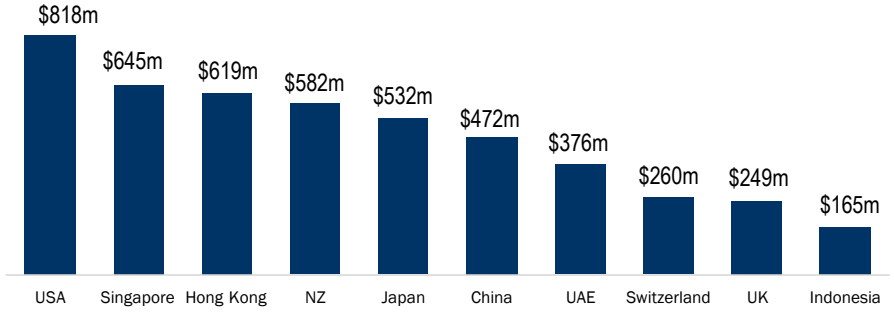
(Industry value added and jobs, ABS data, 2017)

State	Value Added (% total industry economic activity)	Jobs ('000s)
New South Wales	$28.8 billion (35%)	199
Victoria	$20.4 billion (25%)	151



Value of Australia's transport services exported by country[5]

($M, DFAT data, 2016)



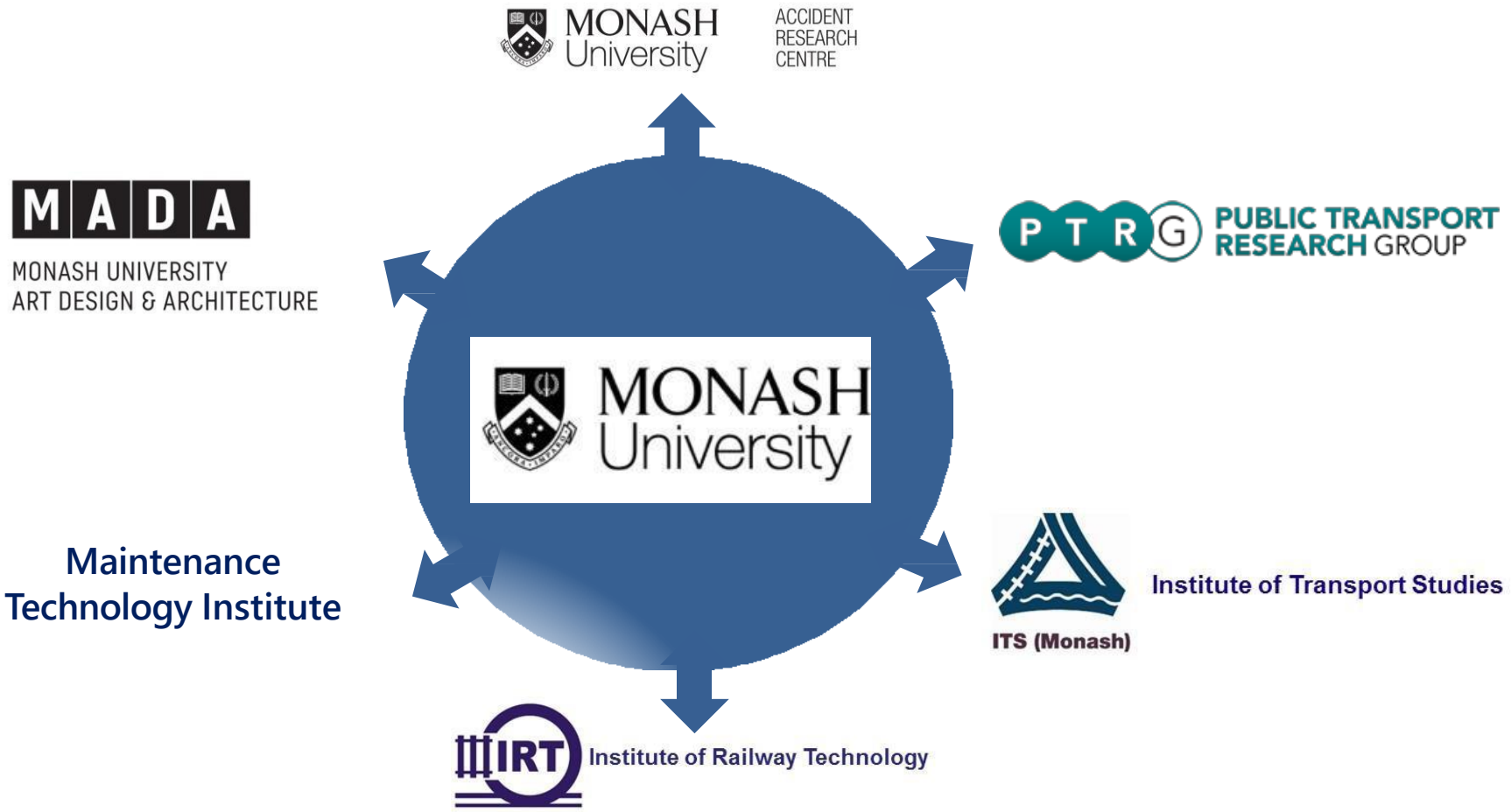
Source: 1. 2. 4. Australian Bureau of Statistics (2017); 3. OECD Data (2015); 5. DFAT (2016); Enterprise Office Analysis (2018). Note, transport services exports includes freight, passenger and other transport services.

Monash is committed to driving innovation in transport capabilities

All over the world, issues such as traffic congestion, safety, environmental impacts and the efficiency of transport operations are everyday concerns. With transport systems under pressure Monash University is committed to researching technologies and practices that deliver better economic, social and environmental outcomes for the community.

Wide collaborative framework in transport capabilities and research

Monash has a breadth of experience in the transport sector, with research activity spanning fields such as technology, design and policy. Transport related research incorporates multiple faculties and research institutes throughout the university, which work together in an interdisciplinary manner.



Collaborative framework delivering key transport related capabilities and expertise

Monash University has one of the largest and broadest capabilities in transport infrastructure research in the world.

Interdisciplinary collaboration across faculties and research institutes

Key Capabilities and Expertise

- Railway Engineering & Technology
- Public Transport Policy & Operations
- Industrial Design & Development
- Traffic & Intelligent Transport Systems
- Materials Design & Development
- Modelling & Optimisation
- Light Weight Vehicles
- Aerodynamics
- Road & Transport Safety
- Training & Education Programs –academia, industry, government
- Hard Infrastructure Engineering
- Sensor technology
- Urban planning & design
- Cybersecurity
- Risk Assessment Management

Innovative research activity supported by technology research platforms and tools

Research and development at Monash is supported by an extensive range of technology research platforms and tools. They combine interdisciplinary expertise and thought leadership to deliver impactful outcomes within the transport industry.

Examples include:

Monash Wind Tunnel Facility – Faculty of Engineering

The leading low speed automotive aerodynamic test facility in Australia. It supports aerodynamic and wind noise research and develop of full-scale production vehicles for Australian and international markets.

Simulators – Monash University Accident Research Centre

MUARC operates a suite of four state-of-the-art simulators for cars, motor cycles, bicycles and specialised defence vehicles for studying the human-vehicle-road interface. The simulators have been used in studies ranging from young driver behaviour to road tunnel design.

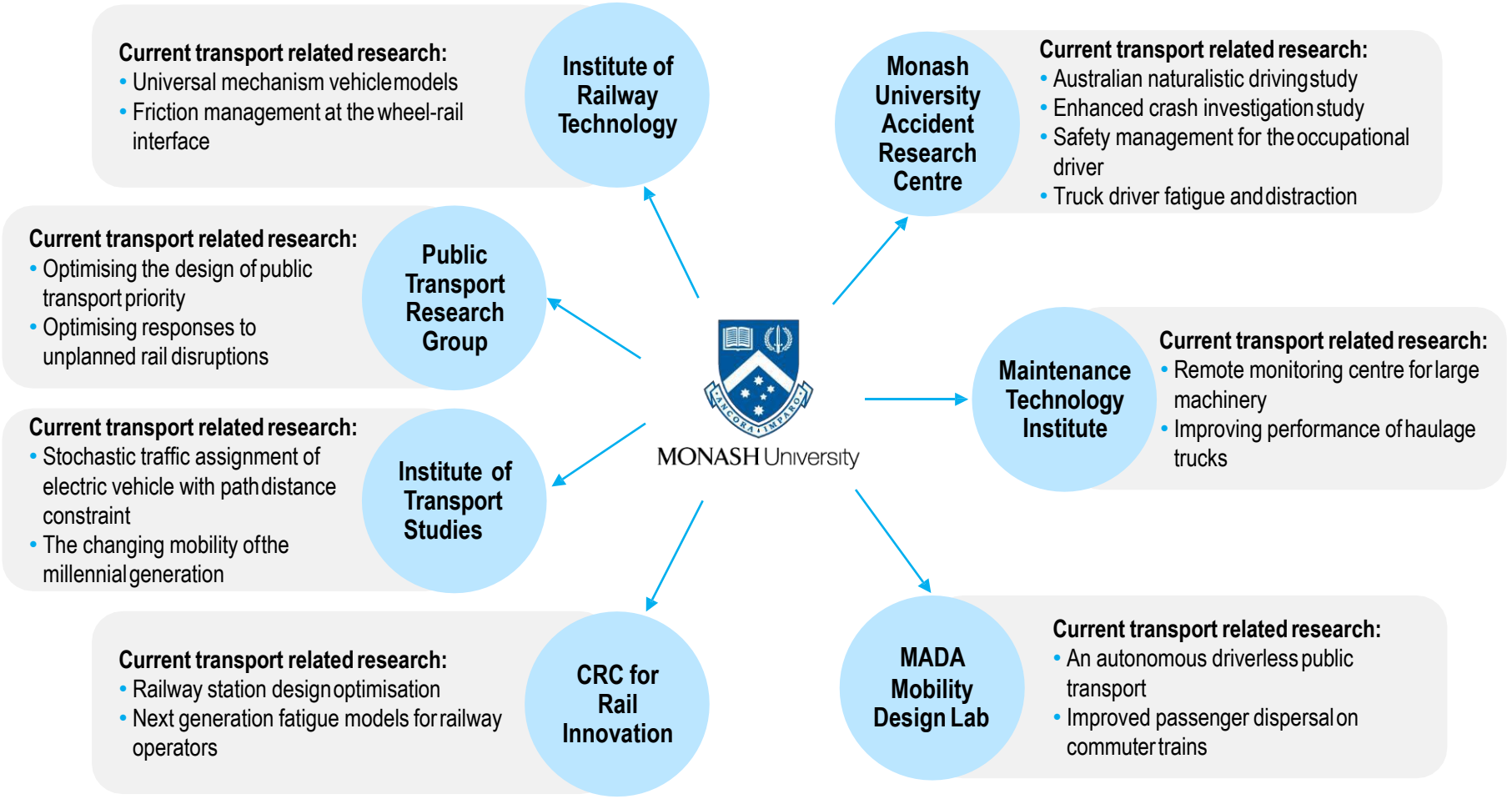
Instrumented Vehicles – Monash University Accident Research Centre

MUARC has 3 highly instrumented research vehicles and access to a fleet of 500 privately-owned volunteers' vehicles fitted with data acquisition systems to MUARC specifications. The vehicles collect real-world driving data and safety critical events; generating an aggregated decade of big data including unique insights into the phenomena of the near miss.

SUBSET OF INITIATIVES ONLY

Monash is actively pursing a number of research initiatives in transport

Monash has a breadth of experience in the transport sector, with research activity spanning fields such as technology, design and policy. It has also drawn the interest of multiple faculties and research bodies throughout the University.



Source: Monash Accident Research Centre; Institute of Railway Technology; Public Transport Research Group; CRC for Rail Innovation; Maintenance Technology Institute; Monash Arts Design and Architecture; Monash University; Desktop Research; Enterprise Office Analysis (2018). Note: This slide has been revised following the forum.

MONASH University

ACCIDENT
RESEARCH
CENTRE

Monash University
Accident Research Centre (MUARC)

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Monash University Accident Research Centre

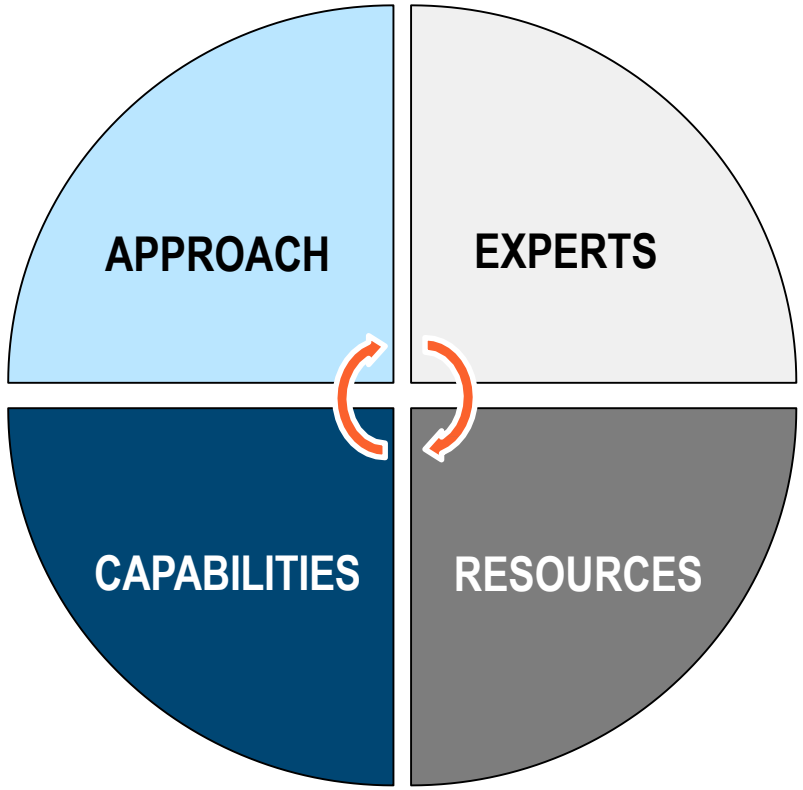
CORE FOCUS

Reducing the incidence and impact of injury

Grounded in scientific and academic excellence to produce high quality and high impact research with real life implications that translate readily into policy and practice.

MUARC'S research is international and interdisciplinary, and applies a systems network to address:

- Transport Safety
- Workplace Safety
- Home & Community Safety



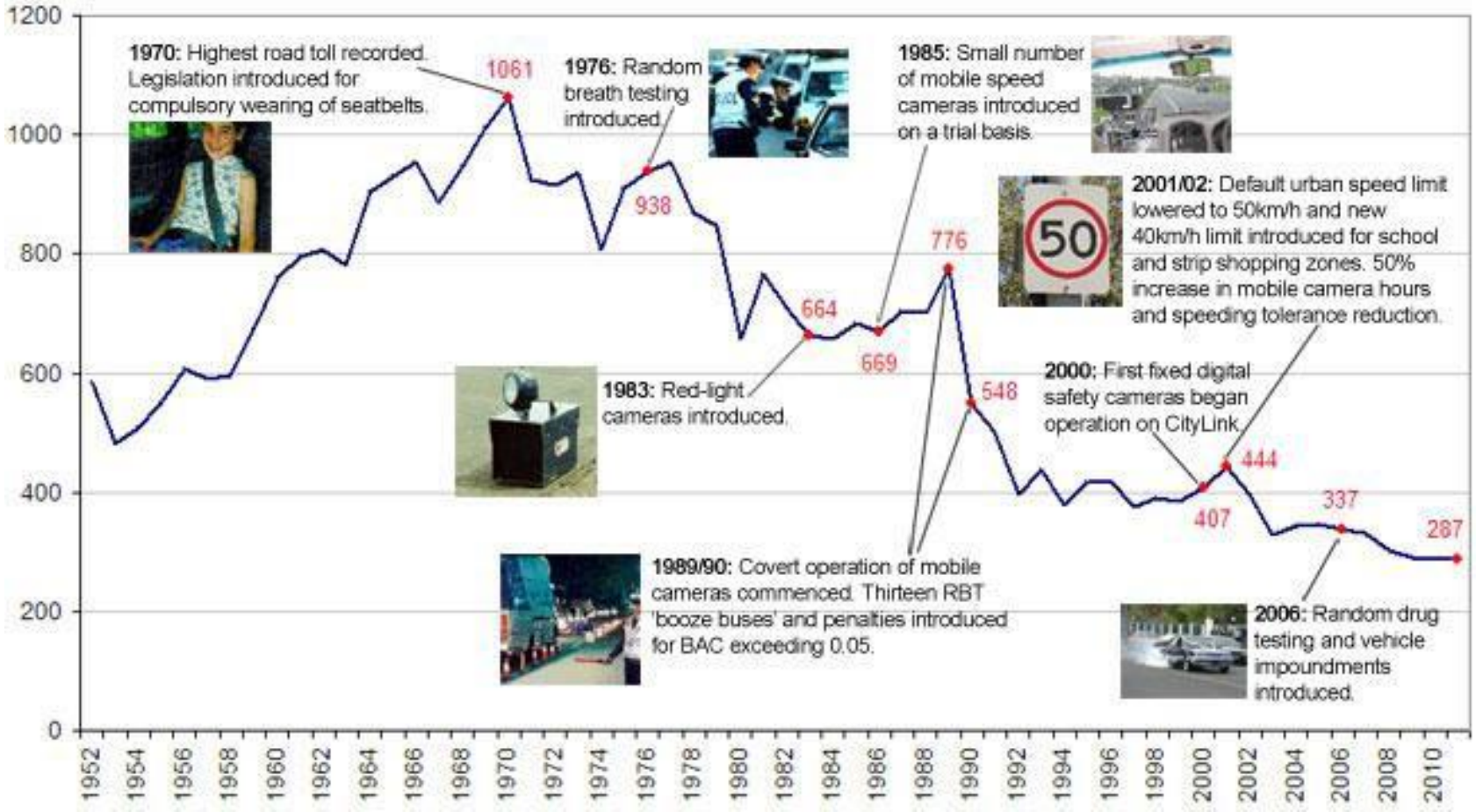
Home to Australia's most respected team of injury prevention experts

- Team of over 100 researchers & post graduate students
- Range of specialised areas, including: statistics, engineering, epidemiology, health sciences, behavioural sciences

- 30 years experience in every line of the injury prevention chain, from problem identification and analysis to program implementation and evaluation
- 30 years of excellence in injury prevention research, training and engagement with government, industry and the community

- Road crash information databases
- Victorian Injury Surveillance Unity
- On-road and simulated driver testing
- Driving simulators
- Purpose built on-road test vehicles

Three decades of influence in road safety prevention



https://www.monash.edu/muarc/timeline

Transport research themes, facilities and projects

RESEARCH THEMES

- In-depth crash investigations and transport regulation
- Injury analysis and data
- Behavioural science for Transport Safety
- Human Factors in Transport Systems
  - Traffic safety
  - Human machine interaction
  - Equipment & infrastructure design
  - Vehicle automation and driver behaviour

SIMULATION FACILITIES

- Full car simulator
- Motorbike simulator
- Portable car simulator
- Truck simulator with full truck cab
- Defence / crew vehicle simulator

- For on-road trails, MUARC has 3 instrumented vehicles and an instrumented motorbike

PROJECT EXAMPLES

- Infrastructure design
  - Signing and tunnel design
  - Intersection design & traffic control
  - Road design for cycle safety
- MUARC Driver Distraction work
- In-Vehicle Technology
  - Intelligent speed adaptation
  - Efficacy of visual &auditory warnings
- Driver and Rider Training
- Driver Fatigue Research

Current partnership project example | The Advanced Safe Truck Concept Project

A research partnership between MUARC, Seeing Machines and Ron Finemore Transport

According to the Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2462 Australians were killed as a result of involvement in heavy vehicle crashes between 2005 and 2014. These fatalities represented 17.5% of deaths on Australian roads.

MUARC along with the key partners Seeing Machines and Ron Finemore Transport, are working towards developing the intelligence that keeps truck drivers and road users safe through future driver monitoring technology.

Phase 1: Extensive Data Collection

- Data collected using car and truck driving simulators in comparable scenarios
- A MUARC truck simulator has been developed, employing a full-size Volvo truck cab
- Drivers are tested in a rested and fatigued state
- Combined data will represent one of the largest datasets available

Phase 2: Australia's first naturalistic truck study

- Driver monitoring technology study
- 10 trucks instrumented with sensing technology for up to 6 months monitoring fatigue & distraction
- Generate over 30,000 hours of real-world data
- 80 car drivers included in study

Phase 3: Development and testing of Human Machine Interface concepts for:

- Driver distraction
- Drowsiness
- Workload

Towards Zero — MUARC and WA Road Safety Commission Collaboration

The WA State Government released their Road Safety Strategy in 2009. This was a long-term plan for the state to reduce the overall incidence of road trauma in the state.

This plan was developed in conjunction with MUARC. The strategy is anchored in the evidence-based research conducted by MUARC, taking into account the state's unique environment.

MUARC Partnership with WA State Government and Road Safety body

MUARC developed a computer-based model to estimate the impact of initiatives on road trauma incidences

Comprehensive Road Safety Strategy developed based on MUARC's research findings

Source: Government of WA Road Safety Strategy 2008-2020 (2009).

Professional Leadership Training in Road Safety

- Five day intensive course
- Understanding core elements of road safety management system and challenges faced in Australia and internationally
- Scientific evidence base & technological innovations
- Managing effective change
- Improving leadership capability
- Engaging/influencing stakeholders

It's been great so far….just eye-opening. Every day I take something new away. The thinking about the whole safe systems concept and road safety…….it's just a different way of thinking.

Palesa Moulusi
Road Traffic Infringement Agency (RTIA),
South Africa

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Monash University
Public Transport Research Group

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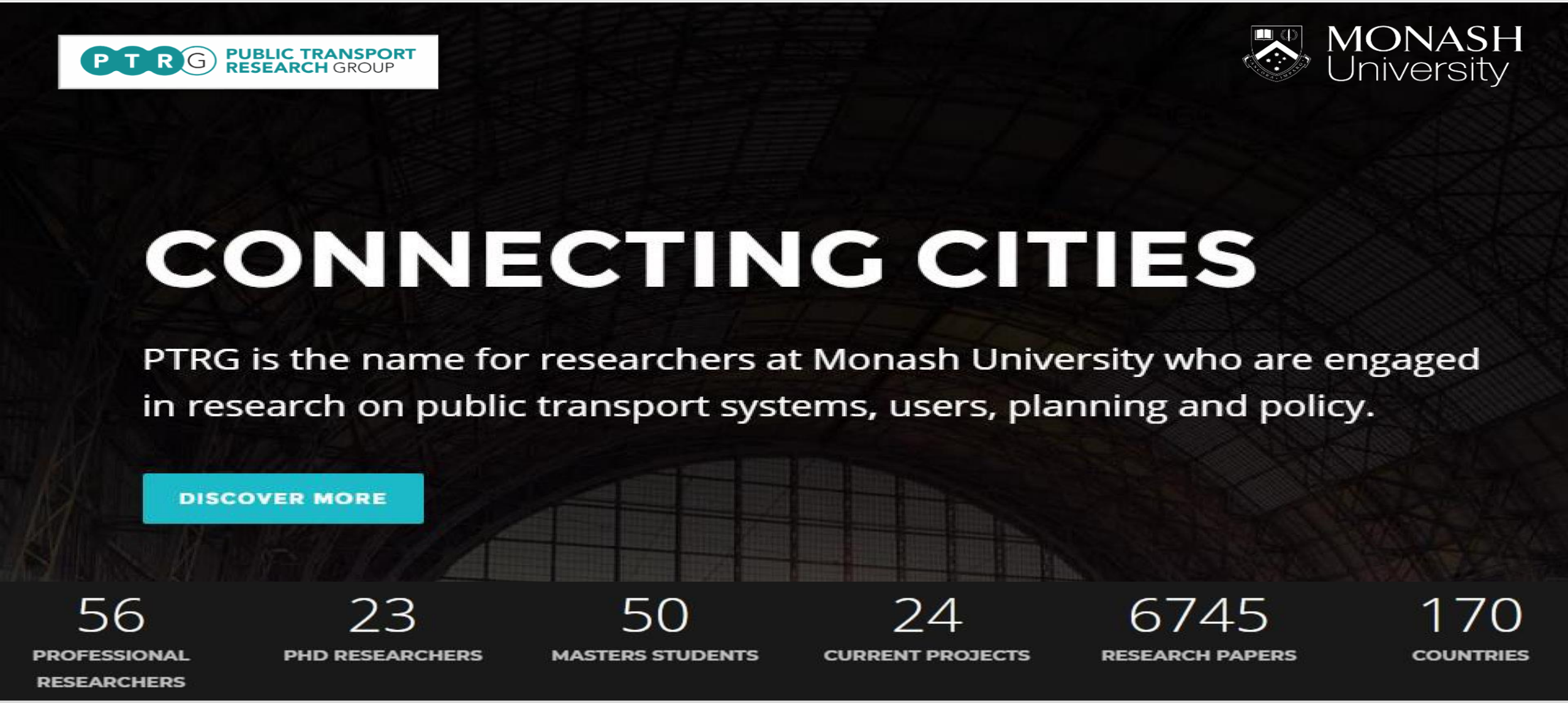
PTRG PUBLIC TRANSPORT RESEARCH GROUP
MONASH University
CONNECTING CITIES
PTRG is the name for researchers at Monash University who are engaged in research on public transport systems, users, planning and policy.
DISCOVER MORE
56
PROFESSIONAL RESEARCHERS
23
PHD RESEARCHERS
50
MASTERS STUDENTS
24
CURRENT PROJECTS
6745
RESEARCH PAPERS
170
COUNTRIES

PTRG Research Focus – highly varied and interdisciplinary

The Public Transport Research Group specialises in applied research and industry engagement, and had undertaken numerous projects with industry clients in Australia and throughout the world. Research interested are cross disciplinary, and cover a wide range of focus topics.

TOPICS

- Public Transport & Strategic Planning
- Travel Demand Management
- Travel Behaviour
- Transit Safety
- Transport Economics
- Land Use & Transit
- Travel Modelling
- Operations Modelling
- Planning for Special Major Events

PROJECTS

PTRG have undertaken hundreds of research projects in many fields and for many research clients throughout the world. Industry clients that PTRG are very diverse, examples include:

- Australian Transit & Regulatory Authorities
- London Olympic Delivery Authority
- US Federal Transit Authority
- Land Transit Authority Singapore
- The Hajj Pilgrimage to Mecca
- The Umrah Pilgrimage to Mecca - Saudi Arabia

Reducing Fare Evasion — PTRG study for Public Transport Victoria

Fare evasion was costing public transport ticket operators in Melbourne nearly $80 per year in lost ticket revenue.

The PTRG studied the psychology of fare evasion for Public Transport Victoria.

The researchers determined that most revenue loss was from a small group of recidivist fare evaders, and that doubling ticket checking rates would likely halve fare evasion rates.

Public Transport Victoria used the research to develop a “freeloader” marketing campaign highlighting the problem of recidivists, and increased ticket checking in hot spot areas.

In May 2015 PTV reported its lowest fare evasion rate, down to 5% of trips, compared to 12% in 2011-12. The impact of lost revenue for PTV, Metro trains, Yarra Trams, V/Line and bus operators together reduced from $80 million to $38 million.

PTRG PUBLIC TRANSPORT RESEARCH GROUP

PUBLIC TRANSPORT VICTORIA PT

A fare evasion study undertaken by Monash’s Public Transport Research Group assisted public transport operators to halve the money lost through fare evasion over three years.

MONASH University

Monash University
Institute of Transport Studies

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Monash Institute of Transport Studies

CORE FOCUS

The Monash Institute of Transport Studies aims to progress transport knowledge and practice to contribute to the prosperity and sustainability of the industry and the wider community.
The institute offers fundamental, applied and industry-relevant research and education that caters to transportation leaders across industry, government and academia.

RESEARCH

- 2 research themes
  1. Enhancing transport system safety, sustainability and resilience
  2. Multimodal urban transport system planning, modelling and optimisation

EDUCATION

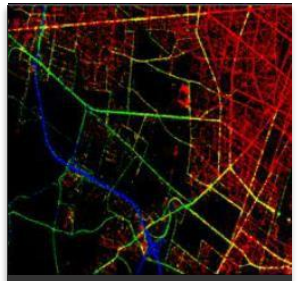
- Undergraduate transport units in Civil Engineering Degree (Clayton and Kuala Lumpur campuses)
- Master of Transport – off-campus / online
- Master of Advanced Engineering (on-campus – Clayton)
- Master of Transportation Systems (On-campus – Suzhou, China)
- PhD
- Continuing education: seminars, short courses and workshops
- Industry programs: Transport Safety, Bus & Coach Management

COMMUNITY & PROFESSIONAL SERVICE

- Annual Ogden Transport Lecture
- Serving as committee members of national and international bodies
- Contributing to the organisation of stare, national and international conferences
- Providing editorial services to professional journals and publications
- Reviewing papers submitted for publication at conferences and in journals

Fields of Research

Transport System Safety



Network Modelling & Optimisation

Public Transport

Travel Demand Management

Cycling and Walking

Transport, Psychology and Human Behaviour

Underpinned by the 2 core research themes:

1. Enhancing transport system safety, sustainability and resilience
2. Multimodal urban transport system planning, modelling and optimisation

MONASH University

Monash University
The Mobility Design Lab

Monash Art Design & Architecture

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CORE FOCUS

The intersection of the passenger and transport infrastructure

MDL is positioned at the forefront of research addressing mobility issues around the world, focusing on how design interventions improve a wide variety of physical, environmental and experiential aspects of mobility.

The MDL has engaged in design research such as:

- Ameliorating anti-social behaviour
- Investigating the reconfiguration of carriage interiors to promote better passenger disposal
- Improving disabled accessibility
- Re-conceptualising mass customisation manufacturing processes

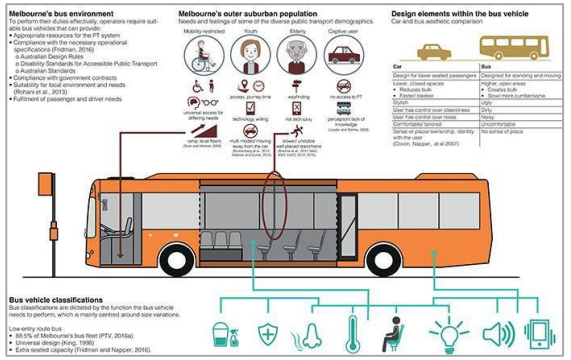
PROJECT EXAMPLES

An Autonomous Driverless Public Transport

Improved Passenger Dispersal on Commuter Trains

Quicker and safer trains for all

Bus Ridership Experience



Monash Arts Design & Architecture (The Mobility Lab) Case Study | Volgren Optimus Bus Redesign

Industrial design development of Australia's best-selling route bus

The Volgren Optimus is Australia's best-selling route bus. Following the release of the Optimus, Volgren worked with MADA to improve the design of the Optimus.

The Optimus team at MADA redesigned the core product, generating new concepts with the core purpose of being functional, but also visually appealing. These concepts were transformed into production components, and were incorporated into the manufacturing process of the vehicles.

MONASH
ART
DESIGN &
ARCHITECTURE

VOLGREN

Collaboration between Monash Arts Design & Architecture and Volgren

Functional improvements were incorporated into the design and manufacturing process for future vehicles

Ongoing collaboration between MADA and Volgren

Source: Monash University MADA Mobility Lab (2018); Desktop Research.

MONASH University

Monash University
Institute of Railway Technology

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CORE CAPABILITY

Advancing the railway industry through technology

IRT is a leading technology and research service provider to heavy haul railway operations and mass transit railway systems. The interdisciplinary team of experts at IRT is continuously developing new technologies and building industry capacity to drive productivity increases and safety benefits at the same time as reducing risks and costs for the international railway industry.

KEY AREAS OF EXPERTISE

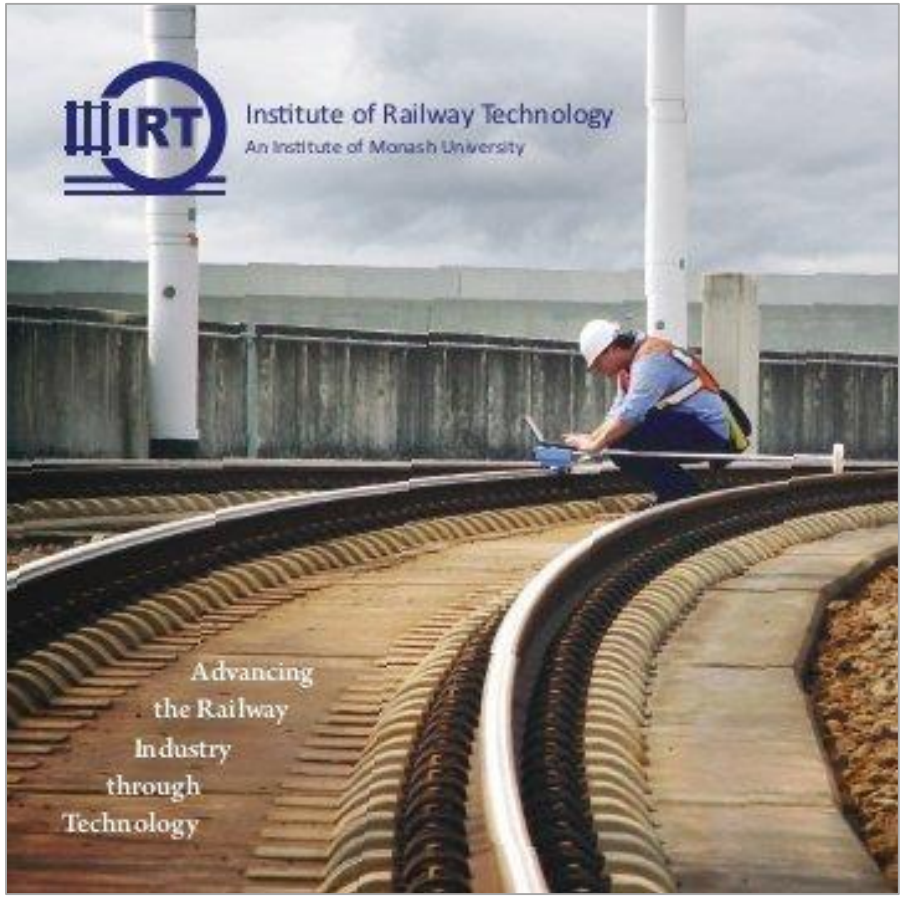
Track & Rolling Stock Infrastructure	Rail Management & Maintenance	Rail Welding
Wheel – Rail Interference	Wheel Performance	Dynamic Modelling
Onsite Instrumentation of Track & Vehicles	Complex Data Sampling & Analysis	Testing & Laboratory Capabilities
Component development, testing, failure analysis & quality control auditing	Development of Railway Specific & National Standards	Professional Training

Premier track and vehicle railway research centre in Australia

Industry Involvement

The Institute of Railway Technology has provided technical support to over 150 national and international businesses within the railway industry.

These include mining companies BHP Billiton, Rio Tinto, FMG and Vale (Brazil) that operate heavy haul railways and freight and passenger rail authorities such as V/Line, Metro Trains Melbourne, Australian Rail Track Corporation, MTR Corporation in Hong Kong and SMRT in Singapore.



Rio Tinto commissioned state of art IRV Technology throughout its fleet after ongoing collaboration

Rio Tinto manages the largest privately-owned and operated rail system in Australia. They need constant and reliable data about its fleet and tracks to detect faults before failures occur.

Stemming from previous collaborations, Rio Tinto worked with IRT to reduce the incidence rate of derailments across their network. In 2015, Rio Tinto officially commissioned IRT's Instrumented Revenue Vehicle (IRV) technology on a five-year agreement. Since then, Rio Tinto has seen a dramatic decrease in derailments, resulting in significant cost savings.

MONASH University Engineering | IRT | RioTinto

Ongoing collaboration between IRT and Rio Tinto resulted in a long-term commercial agreement

2015 Award for Best Research and Development Collaboration

Decreases in derailment incidents and significant cost savings

Source: Monash University (2018); Institute of Railway Technology (2016); Rio Tinto (2018); Desktop Research.

MONASH University

Monash University
Maintenance Technology Institute

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CORE CAPABILITY

The Maintenance Technology Institute (MTI) provides innovative and comprehensive industry focused research and development to achieve optimum plant and equipment performance across the mining and heavy engineering industries in Australia and overseas.

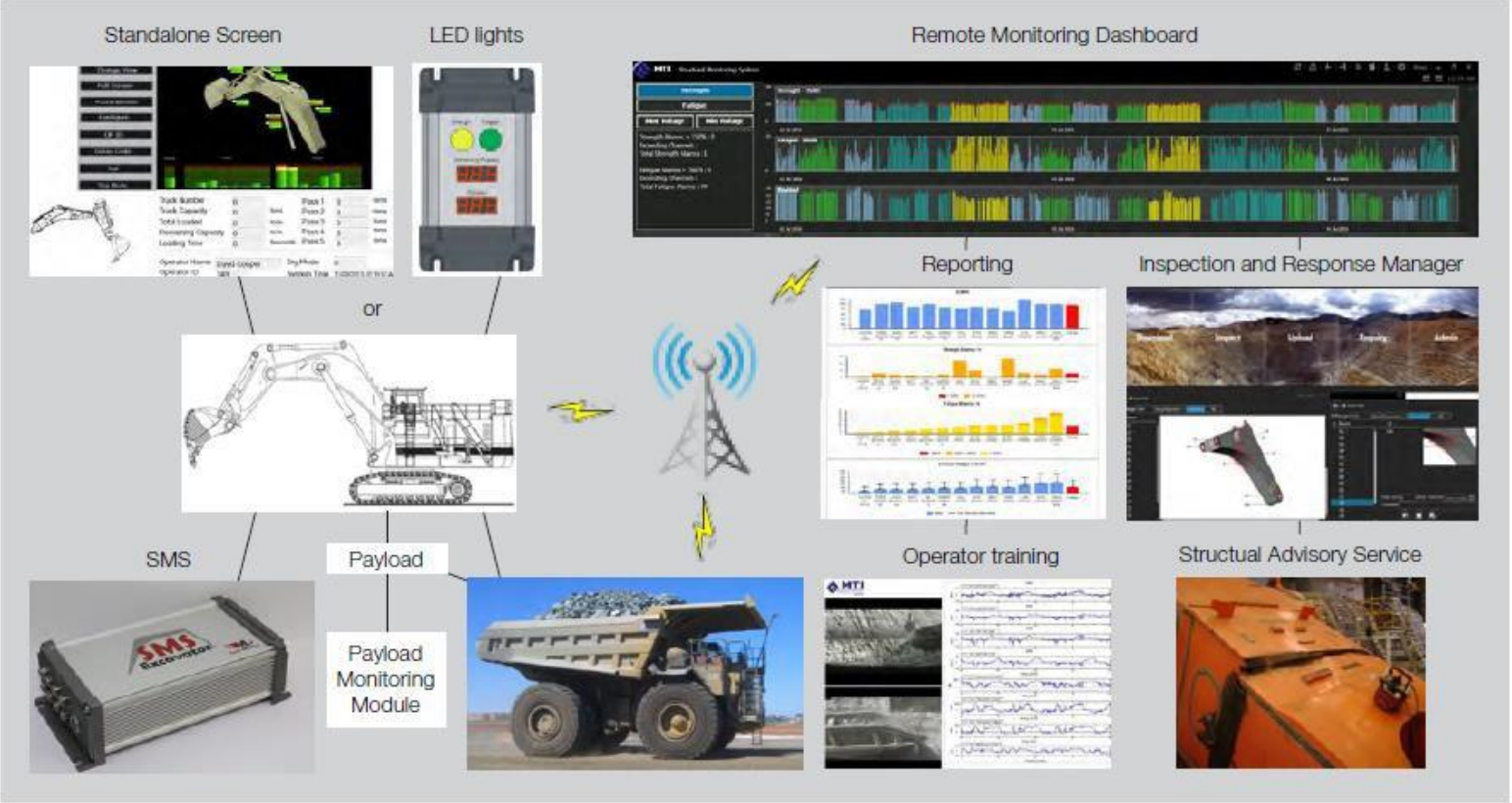
FOCUS AREAS

- Operational and Maintenance Improvements
- Monitoring of Large Equipment
- Improving Operator Performance
- Condition Assessments
- Capacity Improvements
- Life Extension of Aging Equipment
- Replacement Strategies
- Catastrophic Failure Investigations
- New Designs and design reviews

MTI has completed over 300 case studies and repeatedly delivered significant returns on investment in providing superior economic and technical solutions for a board range of industry clients.

MTI Facility | Remote Monitoring Centre Facility

MTI has developed solutions for remote data acquisition and condition monitoring using the latest in mobile data communication technology. MTI is currently monitoring more than 50 draglines, 15 excavators, one reclaimer and two stackers, some of which are operating overseas. All data is streamed to Monash Clayton for detailed processing and safe storage. Embedded algorithms provide instant feedback to operators to ensure safe and optimum operation of the machine. Monthly reports provide detailed assessment of each operator's performance and information for overall management of the machine including maintenance planning.



Increasing capacity and financial benefits for an iron ore mine

The mine engaged MTI to investigate the possibility of an increase in capacity. The team undertook an investigation, analysing the structure system design and the relevant Australian standards.

As a result of MTI's research based investigations, the capacity of a large machine operating in an iron ore mine was increased by 24%, giving the mining company increased operational capacity.

MONASH University Engineering

Collaboration between the Maintenance Technology Institute and industry

Increase in large machine operating capacity by 24%

Overall financial benefit is estimated to be several tens of millions of dollars per year

Source: Monash University MIT (2018); Desktop Research.

Contacts Page

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