

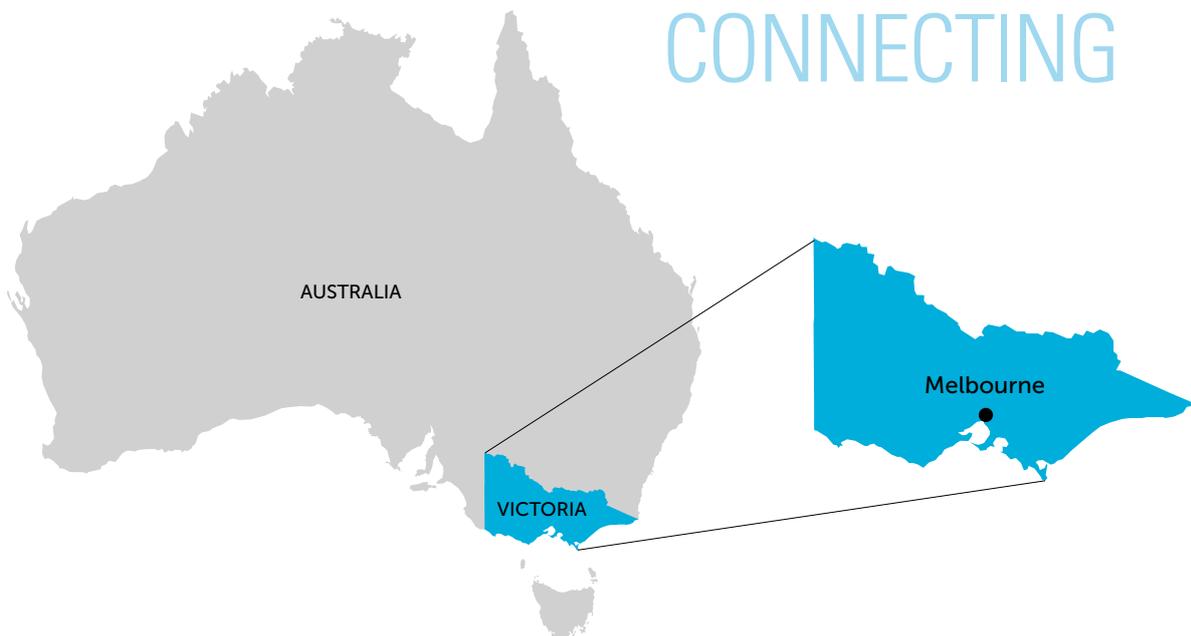
MELBOURNE RESEARCH, EDUCATION AND TRAINING



TRANSPORT



MELBOURNE: LEADING INNOVATING CONNECTING





Melbourne and regional Victoria are a perfect blend of economic strength and dynamism, with a lifestyle that is envied around the world. Talented people, a world-class education system, supportive government and superior infrastructure make the state of Victoria a global leader in research, education and vocational training.

Victoria's research centres, universities and vocational training providers partner with industry, governments, non-government organisations (NGOs) and other educational institutions around the world.

They offer extensive opportunities for partnerships and program collaborations, including joint research initiatives, research and development services, licensing of materials, tailored curriculum development, joint program delivery, staff/student exchange, consultancy services and customised employee development programs.

For more information about Victoria's research, higher education and vocational training capabilities, contact your region's Victorian Government Business Office at: **invest.vic.gov.au/offices**.



TRANSPORT IN MELBOURNE AND VICTORIA

Melbourne has been the transport gateway to the rest of Australia for nearly two centuries. The capital city of the state of Victoria, Melbourne is Australia's centre for manufacturing, automobile engineering and design, aviation, distribution and logistics.

Melbourne and regional Victoria are also the Southern Hemisphere's global leader in automobile research and development (R&D) and design and engineering, with more engineers per capita than Japan, Canada or the USA.

AUTOMOTIVE R&D AND ENGINEERING

Melbourne's history of more than 100 years in vehicle R&D and manufacturing has resulted in generations of expertise and broad industry capability. With its cluster of manufacturing, tooling and design facilities, it is one of the few locations in the world that can take a vehicle through the entire design and engineering spectrum.

This comprehensive capability has resulted in a number of global companies, including GM Holden, Toyota, Ford, Kenworth and Iveco, having their design and engineering capacity in the state.

Independent research by IBM Plant Location International demonstrates that operating costs for design and OEM (Original Equipment Manufacturer) assembly in Victoria are well below those in locations of comparable quality, such as Stuttgart, Sydney and Tokyo.

Automotive R&D

Victoria's universities produce the highest numbers of IT, computing and engineering graduates in the country. This talent is supported by excellent public and private research and development, with Victoria boasting 75 per cent of Australia's automotive R&D.

Key capabilities include:

- light metals technology
- safety and comfort
- instrumentation
- networking and data communications
- 'green' manufacturing
- heating, ventilation and air conditioning
- fuel cells and hybrid power trains
- intelligent vehicle systems
- composite materials
- computer-aided engineering software
- joining, forming and machining technology.

Melbourne is home to design and R&D centres for the world's largest car makers:

GM Holden's design centre in Port Melbourne plays a key role in global design for General Motors; it is their third largest design centre, after their centres in the United States and Germany.

Ford's regional design headquarters in Melbourne plays a lead role in the design and engineering of a range of vehicles including the AWD Ford Territory, winner of an Australian Design Award.

Toyota's Technical Centre in Melbourne forms part of a global network of five integrated design centres. It contributes to the development of innovative vehicles for regional and global markets.

The Victorian and Australian governments have also undertaken considerable investment in automotive R&D infrastructure, including:

Commonwealth Scientific & Industrial Research Organisation (CSIRO) Automotive Transport: a collaboration of six leading vehicle and component manufacturers, two state governments and 10 research institutions focusing on four areas: materials and sustainable manufacturing; powertrains, fuels and emissions; safety and intelligent vehicles systems; and virtual design and manufacturing.

Advanced Centre for Automotive Research and Testing (ACART): a collaborative venture between Ford Australia and the University of Melbourne.

Victorian Centre for Advanced Materials Manufacturing (VCAMM): a portal to Victoria's considerable expertise in advanced materials and advanced manufacturing technologies.

Cooperative Research Centre for Advanced Automotive Technology (AutoCRC): a collaboration of leading vehicle and component manufacturers, two state governments and 10 research institutions.

AVIATION & AEROSPACE

Melbourne has been at the centre of aircraft manufacturing and maintenance in Australia for over half a century. Victoria's aviation and aerospace sector employs over 22,000 people in more than 500 businesses – making it the biggest in Australia.

Melbourne boasts Australia's largest concentration of aviation and aerospace education and training facilities, ensuring a steady supply of high-calibre skilled people are ready to enter the workforce.

Victoria is also well placed to support the predicted growth in the aviation industry internationally, particularly through its ability to provide high-value, long-term and European Air Safety Agency (EASA) aligned training to markets with high training demand and a lack of capability. Victoria also has high levels of simulation capacity, with several flight simulator companies based in Melbourne.

An established aerospace precinct at Fishermans Bend in Port Melbourne brings together manufacturers, design organisations, educational providers and research facilities.

A Centre for Maintenance, Repair and Overhaul (MRO)

Situated in one of the world's most vibrant growth corridors for aviation, Melbourne is well positioned to become a major global MRO centre. Leading players already based in Melbourne include BAE Systems, Qantas, Virgin Tech, Honeywell Aerospace and Rockwell Collins.

Victoria is home to the Aviation Industry Training Centre (AITC) at the Kangan Institute. The AITC is a major supplier of quality accredited aerospace training for domestic and international markets within the Asia-Pacific region.

A recent study by IBM Plant Location International highlights Melbourne's quality offering for MRO as one of the best in the Australasian region.

Design, Manufacture, Testing

Melbourne is Australia's Centre of Excellence for aerospace design, manufacture and testing, attracting global companies such as BAE Systems, Boeing and Thales Group.

Victorian firms supply components, tools and services to the world's prime aircraft manufacturers, including Airbus, European Aeronautic Defence and Space Agency (EADS), Boeing, Eurocopter, Lockheed Martin and Northrop Grumman.

Local companies such as Aerostaff Australia, Hofmann Metaltec and Marand Precision Engineering are globally competitive in aerostructures, precision machining, robotic systems, tooling and ground handling equipment. This is highlighted by their integral role in international supply chains for the Boeing 787 and Joint Strike Fighter programs.

Aviation and Aerospace R&D

Melbourne has an excellent R&D base, with proven success in global design projects. Key organisations include:

Australian Advanced Manufacturing Research Centre (AusAMRC): this collaboration between Boeing and Swinburne University will develop technology-driven solutions to ensure Australian suppliers are among the most innovative, competitive and capable in the world.

Cooperative Research Centre for Advanced Composite Structures (CRC-ACS): this CRC has built a global reputation for composites research in close collaboration with industry over the last 20 years.

Advanced Manufacturing Cooperative Research Centre (AMCRC): based at Swinburne University, this CRC develops next-generation technology platforms across numerous manufacturing sectors.

Defence Materials Technology Centre (DMTC): the DMTC provides technological solutions to enable industry to enhance Australian defence capability.

The Platform Sciences Laboratory (PSL): also located at Fishermans Bend, and part of the Defence Science and Technology Organisation, the PSL is Australia's leading aeronautical research institute.

The Sir Lawrence Wackett Aerospace Centre: based at RMIT University develops next-generation aerospace technologies.

LOGISTICS

As the transport, distribution and logistics centre of Australia, Melbourne boasts extensive expertise in supply and logistics management. Its universities and vocational training institutes provide research, solutions and vocational training in areas including:

- supply chain performance and productivity
- automation and optimisation tools
- system dynamics
- mathematical modelling
- formation congestion and isolation
- visibility of applications and extendable infrastructure
- supply chain strategy
- value management
- procurement and operations
- shared data
- intelligent systems
- information processing.

Solutions can be tailored for particular environments and markets and offshore delivery options are available.

Melbourne's universities are also engaged in a wide range of important research in engineering, urban land use, transport and fuel efficiency questions.

For more information see the Melbourne Infrastructure and Urban Design booklet in this series.

CASE STUDY



“THIS RESEARCH NOT ONLY CONTRIBUTES MATERIALLY TO FUTURIS’ PRODUCT PORTFOLIO BUT ALSO **GIVES US A COMPETITIVE ADVANTAGE.**”

*Tony Baxter – Engineering Manager,
Seating Structures, Futuris*

SITTING PRETTY

RMIT's Applied Optimisation Group is helping industry partner Futuris Automotive efficiently design better seat systems.

RMIT's Applied Optimisation Group, led by Dr Martin Leary, is working with industry partner Futuris Automotive on automotive seat optimisation. Futuris designs and manufactures automotive interior components including seat systems and seat hardware.

The Applied Optimisation Group develops theoretical and physical models to provide optimal solutions to applied engineering problems. These solutions are of direct relevance to industry needs, and provide competitive advantage to industry partners. The Group is working with Futuris Automotive on a variety of research projects related to automotive products and processes.

"Once a design has been rolled out, it will stay in use for as long as possible to keep manufacturing costs economically viable, so it is imperative that the design process is supported by smart engineering," Leary says.

Engineering Manager, Seating Structures, at Futuris Automotive, Tony Baxter, says working with RMIT over the past two years has been extremely beneficial to both parties.

"It has enabled us to pursue novel, difficult and time-consuming developments that we would not have otherwise had the resources, including the intellectual resources, to deliver."

RMIT worked with Futuris Automotive on a very stylish car seat for the American Tesla Model S high-performance electric vehicle.

"Within the Tesla Model S seat system, which we have designed and are now supplying, mass optimisation is critical – but this has to be without compromise to the very high level of comfort, safety and functionality required by the American consumer," says Baxter.

"The seating system will be fully articulated and electronically powered. The motors and gearboxes that drive the seat kinematics (movement between points) are heavy and this weight poses a considerable problem."

Leary, together with his team of researchers and product engineers from Futuris, developed a computer model that did a lot more than find an acceptable solution to this problem.

Leary says, "We developed an extremely efficient model to allow over 250,000 simulations. Normally this would be done by manual calculation, prototyping and iteration until an acceptable solution is found – all of which takes time and money."

However, the new model delivered a comprehensive list of solution sets optimised for different combinations of parameters.

From this, Futuris were able to build a physical model and confirm the result, with the entire project completed within a few weeks.

Baxter says, "This new model is now the basis for the kinematic layout for the Tesla front seat system and, in performance terms, this system is around 15 per cent more efficient than previous designs.

"It's difficult to quantify the mass saving, since the previous designs were never developed, but this in itself avoided months of development work and significant prototyping costs.

"This research not only contributes materially to Futuris' product portfolio but also gives us a competitive advantage."

The new model can be applied widely to various mechanisms and is not restricted to seating systems.

Other joint projects in progress include work on shape memory alloy actuators, high strain rate fracture, and integrated actuators – potentially more groundbreaking research and products to keep Futuris ahead in the global automotive market.



CASE STUDY

DEVELOPING INTELLIGENT TRANSPORT SYSTEMS

La Trobe University is collaborating with leading multinational company, HCL Technologies, on research and development of Intelligent Transport Systems.

La Trobe University's Centre for Technology Infusion is working in partnership with HCL Technologies (headquartered in India) to develop and commercialise intelligent transport systems that let vehicles 'talk' with other vehicles and transport infrastructure, with the potential to address traffic management problems, enhance driver safety and provide logistics support for transport operations.

Population increases globally have put considerable strain on transport infrastructure and transport management resulting in large social, environmental and economic costs. The Centre for Technology Infusion is developing innovative solutions for multi-modal Cooperative Intelligent Transport Systems that can improve drivers' commutes, provide better information to city planners, increase the productivity of businesses, raise citizens' quality of life, reduce congestion, shrink fuel use and cut carbon emissions.

The project with HCL Technologies will follow on from a system trialled by Professor Jugdett (Jack) Singh and his colleagues at the Centre for Technology Infusion aimed at reducing accidents at rail level crossings. Based on GPS and mobile-phone style dedicated short-range technology, it enables cars to receive warnings of approaching trains. Part of a A\$5.5 million rail safety crossing project, the trial of the technology in Victoria involved 100 vehicles fitted with special wireless communication systems.

HCL Technologies will also provide opportunities for students to undertake internships on community and government ICT projects. The company will recruit graduates from La Trobe who, after completion of training, will be allocated to projects in Victoria, or at other HCL locations globally.

EXPECTED OUTCOMES INCLUDE IMPROVED TRAFFIC FLOW FOR COMMUTERS, FEWER ROAD ACCIDENTS AND REDUCTIONS IN FUEL CONSUMPTION AND CARBON EMISSIONS.



“WE DEVELOPED AN **ANCHORAGE SYSTEM** THAT IS ADDED TO THE CARBON-FIBRE LAMINATES BUT ALSO USES CARBON-FIBRE MATERIAL. THIS SYSTEM INCREASED THE EFFICIENCY OF THE FIBRES BY UP TO 260 PER CENT.”

CASE STUDY



TAKING THE HIGH LOAD

The largest carbon-fibre retrofitting project in the world saw Melbourne's iconic West Gate bridge widened thanks to cutting-edge technologies.

The West Gate Bridge spans Melbourne's Yarra River, linking the inner city of Melbourne with its western suburbs. When the bridge opened in 1978, it carried 40,000 vehicles, but today it carries more than 160,000 vehicles per day, including numerous heavy vehicles.

In 2011, the bridge was strengthened to support an additional lane of traffic in each direction. The West Gate Strengthening Project was the largest retrofitting project of its kind in the world, and Swinburne University of Technology played a major part in delivering a solution that ensured the bridge could withstand the increased traffic loads.

Sinclair Knight Mertz (SKM), consulting engineers, sought to design a bracing solution using carbon-fibre reinforced polymer (CFRP) – a strong, lightweight fabric of interlocking carbon threads with up to 10 times the strength of steel, twice the stiffness, yet only one-seventh the weight. However, the design guidelines normally used for steel and concrete bracing would have only harnessed 20 per cent of the CFRP's strength.

Sinclair Knight Mertz bridge engineer Grahme Williams approached Professor of Structural Engineering at Swinburne, Riadh Al-Mahaidi, whose research focuses on retrofitting structures with advanced composite materials, to analyse alternative bracing design solutions using the CFRP to strengthen the bridge.

Professor Al-Mahaidi and his teams at Monash University and Swinburne University tested possible anchoring solutions to the point of failure using concrete blocks to mimic bridge sections and the position of areas prone to stress fractures. Computer simulation gave a deeper understanding of what was happening in these zones.

The anchorage system developed as a result of the research is simple and cheap – a 25 centimetre-wide strip of carbon-fibre fabric that runs across the end of all the carbon-fibre beams, like a line of super-strong adhesive tape. The fabric anchor is a different weave so the strength-bearing threads run in two directions. It anchors the laminates and spreads their load to surrounding concrete to increase the overall strength of the system.

"We developed an anchorage system that is added to the carbon-fibre laminates but also uses carbon-fibre material. This system increased the efficiency of the fibres by up to 260 per cent," Professor Al-Mahaidi says.

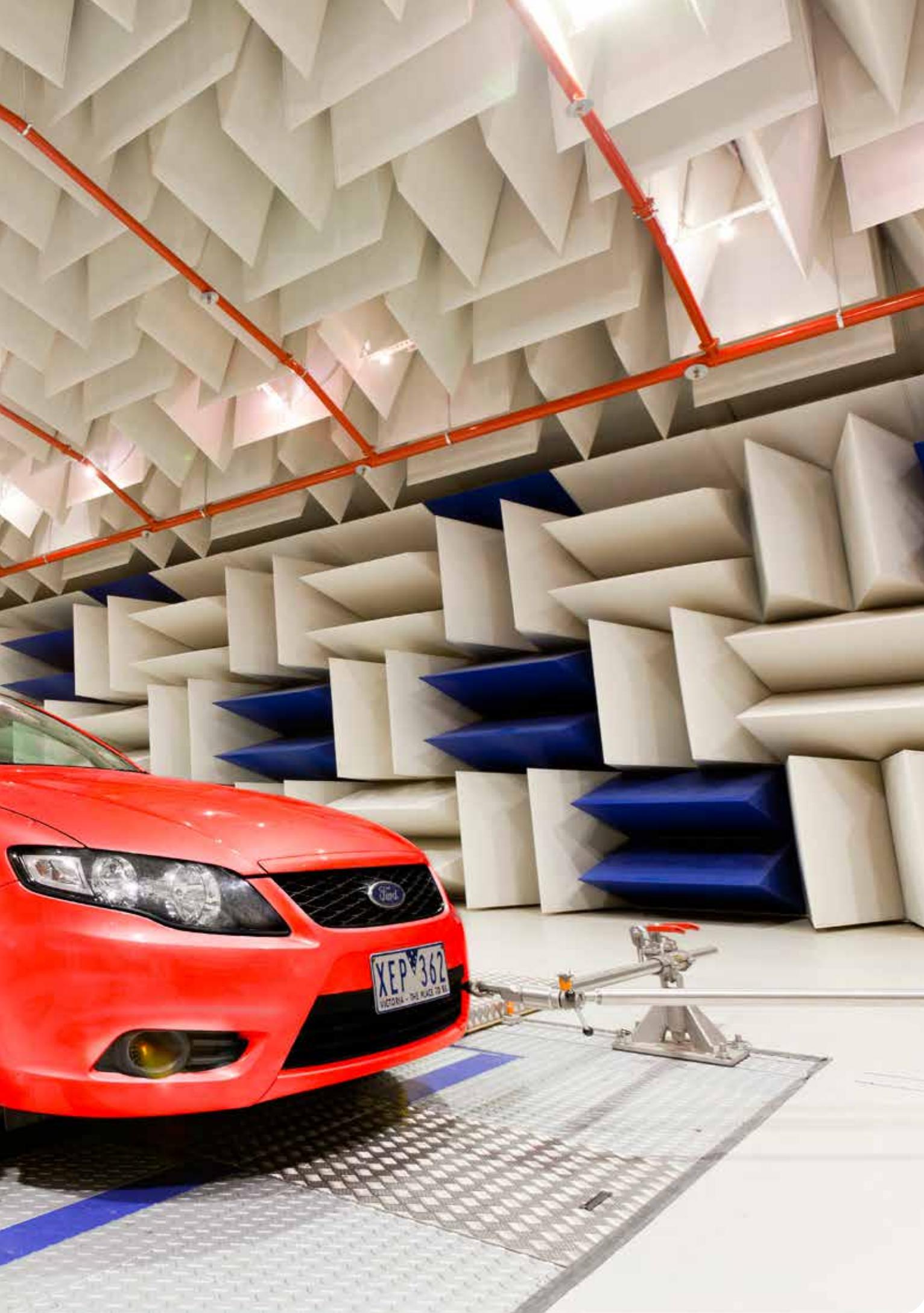
As Williams explains, the collaboration with Swinburne was invaluable.

"Typically in construction we go for the quickest and cheapest method, which often relies on standard methodologies. It's rare we get projects of this magnitude, with this much scope for potential savings. By spending a little bit of money upfront on this research program we were able to save millions of dollars in implementation down the road."

This work was commissioned by the West Gate Bridge Strengthening Alliance comprising SKM, VicRoads, John Holland and Flint & Neill, with funding from the Commonwealth and Victorian governments.

CAPABILITY STATEMENTS







INSTITUTE

Global Educators

Melbourne - Australia

Key areas of expertise

- Logistics and Supply Chain Management
- Transport
- Automotive
- Distribution and Warehousing
- Driver Instructor Training

Research/program delivery capabilities

Logistics and Supply Chain Management

Between 2012 and 2013, 24 employees from the consortium of manufacturers and suppliers have participated in the new Diploma of Logistics and Supply Chain Management program. The Return on Investment (ROI) of this training to date, based on the evaluation of the project savings achieved by participants during the program, has been confirmed by the respective management of these participants to be between A\$48,000 and A\$230,000.

Transport (Driving Instructors)

BHI has developed the Driving Instructor course with flexible modes of online, classroom and practical delivery. It aims to develop competent driving instructors for the state of Victoria. BHI has direct industry links with assessments and question banks on road laws, regulations and codes of practice relating to vehicle learner drivers and driving instructors.

BOX HILL INSTITUTE

Box Hill Institute (BHI) is a leading Victorian vocational and higher education provider known for its collaborative and creative approach to education in Australia and overseas. It has been the recipient of many awards and achievements including the coveted Victorian Large Education Provider of the Year 2012, and the International Training Provider of the Year at the Australian Training Awards 2013.

BHI operates a highly successful faculty for Automotive, Transport and Engineering for the industry.

Since 2006, BHI has worked with a consortium of 21 manufacturers and suppliers in Victoria to address the serious shortage of skilled professionals in the supply chain and logistics. A customised supply chain and logistics management program has been designed in consultation with the industry and for the industry.

BHI has strong links with the industry:

A number of teachers are members of a variety of steering committees relating to driving instructors. These include the Australian Driver Trainer Association, Transport and Logistics Industry Skills Council, Department of Transport Review of the Victorian Driving Instructor Scheme Stakeholder Workshop.

BHI staff were involved in the revision and modification of the course requirements for the current Certificate IV in Transport and Logistics.

BHI has regular contact with state road authority VicRoads via industry visits, publications, VicRoads Driving Instructor meetings and licence assessments.

Automotive

BHI also works closely with employers in the automotive retail, service and repair industry to support their workforce development needs to ensure the ongoing success of their operations.

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Key areas of expertise

- Automotive Mechanical Technology
- Diagnostics
- Diesel Fitting
- Forklift Mechanical
- Light Vehicle
- Heavy Road Transport
- Heavy Mobile/Plant Equipment
- Agricultural
- Panel Beating
- Automotive Air Conditioning
- Vehicle Paint
- Automatic Transmission
- Warehousing
- Logistics
- Management
- Business

Research/program delivery capabilities

Automotive technology is evolving quickly and the demand for a full range of automotive skills is increasing. Chisholm meets that demand by delivering programs on campus, in its specialist training facilities, and at industry sites throughout Australia and overseas.

Chisholm's innovative learning methodologies and course designs, and computer-based learning resources are designed to meet the needs of an industry that is consistently changing.

Chisholm uses the latest technologies available. For example, its Lucas Neulle automotive diagnostic laboratory provides structured diagnostics training onsite or remotely via interactive web access. And its new Bosch diesel pump test bench can simulate the full functionality of these engines.

Chisholm's staff have extensive industry experience, and many also have experience in international business contexts that utilise their extensive capability. Chisholm works with a wide range of industry advisory groups to ensure its training is consistently relevant to employers.

CHISHOLM INSTITUTE

Chisholm Institute is a highly successful Registered Training Organisation that delivers government funded and fee-for-service training and consultancy services to industry, business, government and community organisations across Australia and internationally.

Chisholm offers quality industry-based research and training expertise in all areas of transport, light and heavy automotive, panel beating, vehicle paint, warehousing, logistics and related areas.

Chisholm's state-of-the-art facilities include a new A\$15 million Automotive and Logistics Centre that provides training in a fully simulated work environment using the latest cutting-edge industry technologies.

Skills development ranges from basic mechanics through to advanced technical and management programs.

Examples of Chisholm's customised training include:

- A long-standing association with Toyota, up-skilling hi-tech robotic maintenance staff, providing training in specific and new technology, developing training tools and training trainers; Chisholm also established their Toyota Training Centre
- A mentoring and individualised skill development program for Ethiopian trainers-of-trainers across automotive and related trade groups
- Assisting Iran to design courses and build the capacity of trainers to support the Iranian automotive industry under the Japan Aid Agency
- Programs with Volvo heavy transport have been in operation for a number of years
- Development and delivery of BMW and Mercedes vehicle body repair programs conducted Australia-wide.

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chisholm.edu.au



Key Areas of Expertise

- Advanced Materials Research
- Intelligent Systems Research
- Facilities Management

Research/program delivery capabilities

At the Geelong Technology Precinct advanced knowledge drives advanced technology that supports industries. The Precinct offers significant opportunities for collaborative and contract research. It has strong links with the Faculty of Science, Engineering and Built Environment and has a number of research groupings.

The Institute for Frontier Materials researchers work in collaboration with industry to develop new materials, material technologies and material processing techniques suitable for the automotive, aerospace and high performance materials sectors.

deakin.edu.au/research/ifm

DEAKIN UNIVERSITY

Deakin University is one of Australia's largest and fastest growing universities providing learning, teaching and research opportunities across multiple campuses and innovative use of online technologies through Cloud Deakin. World university rankings evidence Deakin's well established reputation for excellent teaching, innovative course delivery, high level student satisfaction and world-class research aligned to industry and community needs.

Deakin's Geelong Technology Precinct hosts several research centres and institutes, including the internationally recognised Institute for Frontier Materials, which undertakes groundbreaking research relevant to the automotive and aerospace industries. The School of Architecture and Built Environment offers expertise in the Facilities Management discipline.

Deakin University offers courses at both undergraduate and postgraduate levels, including PhDs.

The Centre for Intelligent Systems Research, together with major industry and research partners, investigates and develops state-of-the-art algorithms and methodologies that provide practical solutions to real-world problems. Robotic controls systems that improve process reliability, product quality and operator safety in complex environments are one example of the centre's mission to make a substantial difference for society through its research.

deakin.edu.au/research/cisr

The School of Architecture and Built Environment offers the opportunity to work with academic research professionals in the emerging discipline of Facilities Management. This centres on the management of existing facilities and the strategic alignment of physical infrastructure to an organisation's core business goals, adding value through enhancing workforce productivity, high quality service delivery, operational efficiency and sustainable practices. It operates across traditional professional boundaries, from property investment and development through to space management and workplace logistics.

deakin.edu.au/sebe/ab

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Key areas of expertise

Automotive – all aspects such as mechanical, light and heavy vehicles, automotive body, motorcycle and customised training

Aviation – aircraft maintenance engineers in avionics, structures and mechanics, as well as Skills Recognition incorporating overseas licences and category conversion training in Categories A, B1 and B2

Logistics – customised training with a purpose-built fully-functioning warehouse operation

Program delivery capabilities

Automotive

Kangan Institute's Automotive Centre of Excellence is the largest automotive training facility in the Southern Hemisphere, specifically designed to meet modern training needs.

Kangan offers a range of nationally accredited qualifications and short courses from light and heavy vehicles, vehicle body and spray painting to outdoor power equipment, marine mechanics and motorcycles.

Kangan Institute won the 2013 Victorian Industry Collaboration Award for its partnership with the Victorian Automobile Chamber of Commerce and the Victorian GM/ Holden Dealers Service Managers Association.

Internationally, the Institute has worked with Boart Longyear (Laos) in the auspiced delivery of the three-year Certificate III in Automotive Mechanical (Diesel Fitting) – Diesel Mechanics for employees working in heavy vehicle positions in a mining environment.

kangan.edu.au/ace

KANGAN INSTITUTE

As one of Australia's largest government technical and further education (TAFE) institutes and a major training provider for the automotive, aviation, fashion and health industries, Kangan Institute has been delivering vocational education and training services internationally for over 15 years.

Kangan's programs are delivered at state-of-the-art training facilities by industry-experienced trainers, and range from certificates and diplomas through to apprenticeships, traineeships, customised industry training and professional short courses.

Programs may be customised to clients' preferences and provided nationally and internationally on demand. Kangan is also one of Victoria's biggest providers of Skills Recognition for experienced workers, incorporating overseas licence and category conversions.

Aviation

Kangan Institute's Aviation Industry Training Centre (AITC) is a purpose-built training facility offering accredited courses and tailored training to industry. Kangan is one of only two providers in Australia to offer the Diploma of Aircraft Maintenance Engineering (alignment with the European Aviation Safety Agency (EASA) Cat A1, B1 and B2). Students train on Kangan's very own Boeing-737 at Melbourne Airport.

Kangan also provide training for major airlines such as Qantas and Virgin, as well as for the Australian Defence Force, Lufthansa Technical Training and the general aviation community.

Kangan's offshore auspicings programs includes the delivery of aviation training at the Australian College in Kuwait, a quality vocational college delivering Australian qualifications in Kuwait.

kangan.edu.au/aitc

Logistics

Kangan Institute offers a number of Logistics and Warehousing courses from its purpose-built warehouse facility at our Broadmeadows campus.

Its approach can be implemented across various industries including automotive, aviation and transport.

kangan.edu.au/logistics

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LA TROBE
UNIVERSITY • AUSTRALIA

Key areas of expertise

- Improving Safety at Level Crossings
- Traffic and Infrastructure Management
- Security
- Enhanced Driver Safety
- Transport Logistics
- Wireless Communication

Research/program delivery capabilities

Improving Safety at Level Crossings

La Trobe University is developing a new technology-based solution to improve safety at level crossings.

The A\$5.5 million three-year project uses Dedicated Short Range Communication (DSRC) – a wireless technology providing vehicles and drivers with a 360-degree level of awareness of the surrounding traffic situation.

The technology establishes wireless communication between trains and vehicles approaching the crossing. If the system detects the possibility of a collision, a warning message is presented inside the driver's vehicle.

The system has already undergone three large-scale field trials at both regional and urban crossings in the largest-known rail crossing safety study of its kind in the world.

LA TROBE UNIVERSITY

La Trobe University's Centre for Technology Infusion (CTI) is active in developing innovative solutions for multi-modal Cooperative Intelligent Transport Systems to address problems associated with traffic management, infrastructure management and security, as well as enhanced driver safety and logistics support for transport operations.

The solutions will improve drivers' commutes, provide better information to city planners, increase the productivity of businesses and raise citizens' quality of life, reduce congestion, shrink fuel use and cut CO₂ emissions.

CTI received the Victorian Merit Recipient iAward in the 2013 Australian Information Industry Association (AIIA) Awards for the category of Research and Development.

HCL Intelligent Transport System

Latrobe is collaborating with HCL Technologies to develop an Intelligent Transport System, targeting traffic and infrastructure management, security, enhanced driver safety and transport logistics.

The project aims to improve traffic flow for commuters, reduce road accidents, provide better transport information for city planners, increase productivity for business and reduce fuel consumption and carbon emissions.

HCL Technologies will provide opportunities for students to undertake internships on community and government ICT projects. The company will recruit graduates from La Trobe who, after completion of training, will be allocated to projects in Victoria, or at other HCL locations globally.

Partners

- HCL Technologies
- Automotive Cooperative Research Centre
- Public Transport Victoria
- Metro Trains Melbourne
- V/Line
- Embedded Systems Technology
- Victorian Partnership for Advanced Computing
- Queensland University of Technology
- Cohda Wireless
- Tongji University – Shanghai, China
- Tsinghua University – Beijing, China

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latrobe.edu.au/technology-infusion



MONASH
University

Key areas of expertise

- Transportation Technology
- Travel Behaviour
- Road Safety
- Transport/Traffic Engineering
- Vehicle and Track Instrumentation
- Vehicle and Train Performance
- Condition Monitoring
- Component Testing
- Failure Analysis
- Quality Control and Auditing
- Wheel-Rail Interface
- Rail Welding
- Track Structure Design and Maintenance
- Standards Development and Personnel Training
- Metaheuristics
- Constraint Programming
- Artificial Intelligence

Research/program delivery capabilities

Monash research is helping the transport sector increase productivity of transport infrastructure with new technologies and developments in equipment performance, railway technologies, new materials and design engineering.

The Institute of Transport Studies at Monash conducts transport-related research in the fields of transport technology, travel behaviour, road safety and transport/traffic engineering. Its partner institute within the Faculty of Engineering, the Institute of Railway Technology, provides a one-stop technology access point for the international transport and rail industry.

Monash, through its Faculty of Information Technology, and software optimisation company partner Constraint Technologies have a joint research institute dedicated to technology for planning and operational control in the travel, transport and logistics sector.

MONASH UNIVERSITY

Monash University has become the largest university in Australia, renowned for our outstanding teaching, transformative research, international reach and extensive alumni network. Monash is a global university possessing the ambition and ability to address momentous global challenges. Monash has campuses in Australia, Malaysia and South Africa and major partnerships with universities in China, India and the United Kingdom.

Monash has a long history of driving technological advances in rail, aviation, and vehicle performance. Rail research is a key area of research, with the Maintenance Technology Institute and the Institute of Railway Technology both enjoying an international reputation for excellence in solving rail industry issues and providing engineering-based research and development services. Monash also provides various industries with fundamental aerodynamic and materials research, and houses the Monash Wind Tunnel.

Monash has worked with industry leaders such as BHP Billiton and the Hong Kong and Singapore public transport networks to provide substantial operational savings and sustainable transport systems with environmental benefits. Researchers within the sustainable transport program have advised on transportation issues at the last four Olympic Games as well as on the Hajj/Umrah Event 2010. Most recently the Monash team was asked to assess spectator travel demand and transportation management approaches for the 2012 London Olympic Games.

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Key areas of expertise

College of Science, Engineering and Health

- Aerospace Engineering
- Automotive Engineering
- Integrated Logistics Management
- Mechanical Engineering
- Systems Support Engineering

College of Business

- Logistics
- Logistics and Supply Chain Management
- Applied Logistics and Supply Chain Management
- International Business and Trade
- Strategic Procurement

College of Design and Social Context

- Industrial Design
- Textile Design
- Textile Technology

Research/program delivery capabilities

In Automotive and Aviation, RMIT's research focus is on advanced aerospace technologies, sustainable automotive technologies, renewable energy systems, transition fuels, biofuels, and renewable energy research for automotive systems.

Aviation and aerospace engineering research includes aircraft design, aircraft composite materials and structures, air traffic management and aviation systems, astronautics and unmanned aircraft systems.

Research in mechanical and automotive engineering focuses on energy conservation and renewable energy; advanced automotive technologies (Formula SAE including hydrogen and electric race cars and Aurora solar car); and dynamics, vibrations and control.

RMIT UNIVERSITY

RMIT University is a global university of technology and design with campuses in Australia and Vietnam, and international partners worldwide.

RMIT is internationally recognised for its transport studies and research, which include excellent capabilities in automotive, aviation and logistics.

Other research includes digital business and logistics, industrial and product design, automotive and aviation textile design, advanced textile technology, intelligent fabrics and sustainability.

The Platform Technologies Institute leads RMIT's cross-disciplinary research in the integration of smart materials and systems into technology platforms. Research focuses on informatics and networks, innovative engineering systems and nanomaterials and devices.

RMIT's Sir Lawrence Wackett Aerospace Centre was established in 1991 with a vision to be a world leader in aerospace-related science and technology research. Research includes aerospace materials, structures and aerodynamics; sustainable aviation and through-life support; aerospace systems and autonomy; and aerospace design, certification and manufacturing processes. The Centre also works in partnership with the Defence Materials Technology Centre.

RMIT's Green Engine Laboratory is focused on improving fuel efficiency and reducing emissions for the road transport and aviation sectors. The Laboratory's research in biofuels aims to increase production and quality fuel sources, including algae, wheat and straw.

RMIT is a key participant in a number of projects with Cooperative Research Centres including: Advanced Composite Structures, Advanced Automotive Techniques, and Auto.

Relevant Transport programs:

rmit.edu.au/programs/engineering

rmit.edu.au/programs/business

rmit.edu.au/programs/architecture

rmit.edu.au/programs/art

Key contact

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rmit.edu.au/industry



Key areas of expertise

Aviation:

- Biodynamic implications of super-agile flight
- Disruption management in airline operations control
- Fatigue in high-intensity helicopter operations
- Government airline policy and strategy
- Injuries associated with ejection from aircraft
- Multimodal transport
- Operational decision-making
- Operational performance and productivity
- Retinal perfusion in the aviation environment under the effects of high G and hypoxia
- Schedule robustness
- Situational awareness in transport operations
- Workforce planning

Electric Vehicles:

- Battery technology and management
- Clean21 manufacturing
- Drivetrain and electric motor technologies
- Light-weighting
- Vehicle architecture and design
- Vehicle-to-vehicle and vehicle-to-infrastructure communication

Rail:

- Fatigue modelling and damage mechanics of wheel–rail contact and rail weld
- Modelling and optimisation of new rail and wheel materials to improve performance
- Modelling of wheel–rail interface
- Simulation of wear and rolling contact fatigue at wheel–rail interface for performance optimisation
- Stress analysis of railway rails and effects of irregularities

SWINBURNE UNIVERSITY OF TECHNOLOGY

Swinburne is an internationally recognised research-intensive university. Its emphasis is on high quality, engaged teaching and research in science, technology and innovation – teaching and research that makes a difference in the lives of individuals and contributes to national economic and social objectives.

In 2014 Swinburne's new A\$100 million Advanced Manufacturing and Design Centre opens. The centre will provide a purpose-built teaching and learning environment for engineering, design, business and information technology students.

Research/program delivery capabilities

Relevant research areas:

- Australian Advanced Manufacturing Research Centre
- Aviation Research Group
- Centre for Sustainable Infrastructure
- Electric Vehicle Research Group
- Impact Behaviour of Structures and Materials Group

Aviation research is undertaken in a number of areas, including aviation medicine and physiology, human factors, operations control and airline schedule optimisation and disruption management.

The Electric Vehicle Research Group draws on expertise across the university to investigate:

- consumer behaviour and public policy
- new business models and entrepreneurship
- electric vehicle promotion, training and education.

The group has research programs in light-weighting, battery charging and infrastructure integration, electric vehicle architecture, control and energy management systems in electric vehicles, and electric vehicle drive train technologies.

swinburne.edu.au/engineering/aviation/research.php

swinburne.edu.au/engineering/electric-vehicle

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Key areas of expertise

- Built Environment and Design
- Business and Economics
- Engineering
- Science

Research/program delivery capabilities:

Australasian Centre for the Governance and Management of Urban Transport (GAMUT)

GAMUT is a collaborative research centre dedicated to promoting and supporting sustainable urban transport in Australia and the Asia-Pacific region. Based at the University of Melbourne, the Centre works with a network of researchers to focus attention on the need for innovative institutional design for integrated transport systems. Research focuses on integrated urban passenger transport systems under resource and environmental constraints, innovation (and barriers to change) in urban transport, and finance and resource allocation for urban transport.

abp.unimelb.edu.au/gamut/gamut-research

UNIVERSITY OF MELBOURNE

The University of Melbourne is a public-spirited institution that makes distinctive contributions to society in research, learning and teaching, and engagement.

Ranked number one in Australia and 34 in the world for the quality of its research, the University of Melbourne harnesses interdisciplinary research to solve some of the most difficult problems facing the world.

Research across transport is both discipline-focused and multidisciplinary in nature and includes collaborations with universities, governments, industry and communities worldwide to further developments cooperatively.

Students interested in careers in transport sectors may undertake relevant bachelor, masters level and research degrees across Commerce, Built Environment and Design, the Sciences and Engineering.

Melbourne Advanced Transportation Research Initiative

Urban traffic congestion is a result of an increasing population on a network infrastructure not designed to support it. This University of Melbourne initiative is developing new tools for government and industry that enable quantitative assessments of how different vehicle technologies, information and communication technologies, new infrastructure and policy will influence the performance of the overall transportation network.

ie.unimelb.edu.au/matrix/

Advanced Centre for Automotive Research and Testing

This centre is a collaborative venture between the Ford Motor Company of Australia and engineering academics from the University of Melbourne. Research and development activities are focused on achieving improved fuel consumption and lower emissions for passenger vehicles and trucks through alternative fuels, modelling and visualisation of combustion, engine calibration and control, and emissions reduction.

eng.unimelb.edu.au/research/centres/acart/

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Key areas of expertise

- Supply Chain Functions – including procurement, process and systems planning
- Supply Chain Strategy
- Infrastructure Development
- Policy and Planning Frameworks
- Risk and Sustainability Assessment
- Mechanical Engineering
- Electrical and Electronic Engineering

Research/program delivery capabilities

Victoria University's Institute for Logistics and Supply Chain (ILSC) provides consultancy services, education and research in Australia and overseas, and is becoming the first point of reference for sectors of the industry seeking advice on supply chain strategy, policy and skills development.

The Institute meets the needs of traditional logistics disciplines from transportation and warehousing, through to sophisticated supply chain functions, including procurement, process and systems planning, and supply chain strategy. Objective, industry-based research and education is provided across a range of supply chain issues in association with government, industry and other universities.

VICTORIA UNIVERSITY

Victoria University provides world-class education, research and training, and has more than 100 exchange partners across Asia, Europe, Africa and the Americas. Victoria University has 10 campuses and more than 51,000 enrolled students, including 4,000 international students studying at its Melbourne campuses and 9,000 studying at offshore partner institutions.

Victoria University's Institute for Logistics and Supply Chain (ILSC) brings together government, industry and Victoria University resources in the development, support and facilitation of logistics 'know-how' to benefit Victorian, Australian and regional economies.

The University's College of Engineering and Science undertakes research with a focus on developing innovative technologies with direct application to industry and the community.

ILSC's many partners include:

- Victorian Transport Association
- Victorian Freight and Logistics Council
- Department of Infrastructure and Regional Development
- Intelligent Transport Systems Australia
- Logistics Information and Navigation Centre
- Australian Freight Councils Network
- Customs Brokers and Freight Forwarders Council of Australia
- Supply Chain and Logistics Association of Australia
- Transport and Logistics Industry Skills Council.

ILSC is one of the few tertiary providers in Australia accredited by the Chartered Institute of Logistics and Transport Australia (CILTA), and is the only provider to receive international accreditation from CILTA for the Diploma of Logistics. This enables students to obtain both the Australian diploma qualification and an international diploma in Logistics and Transport through the one program.

Mechanical engineering undergraduate students lead the student group Victoria University Motorsport (VUM). VUM is open to all undergraduates studying at Victoria University. Students design, build and race a race car, which helps students improve their working knowledge of a car as well their time management skills.

Key contact

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vu.edu.au/international



Key areas of expertise

- Supply chain and logistics
- Warehousing & distribution
- Defensive driving high-risk work licences
- Bus and coach driving
- Taxi driver training
- Civil construction and traffic control
- Motorcycle and scooter
- Passenger vehicle
- Driver fatigue management
- Pilot escort vehicle
- Four-wheel drive
- Road transport and truck licences
- Heavy vehicle stability rollover
- Forklift operations
- Forestry and chainsaw operations
- Transporting/handling dangerous goods

Research/program delivery capabilities

The Institute's Driver Education Centre of Australia Ltd (DECA) and the National Industrial Skills Training Centre (NISTC) are leaders in the provision of industry-focused, quality and flexible training. With accreditation at state and national levels, DECA and NISTC have worked alongside some of Australia's largest industries, sharing knowledge and expertise to develop a wide range of engaging and industry-relevant training courses. Both are devoted to creating a modern learning environment that equips all learners with the skills and knowledge needed to ensure their own safety and that of others.

Working successfully with major corporate industries and Government Departments such as the Department of Defence, DECA and NISTC also operate as agents for WorkCover New South Wales (NSW), WorkSafe Victoria, Environment Protection Authority NSW, VicRoads and the Roads and Maritime Services in NSW. They also provide a range of industry licences and endorsements on behalf of national and state industry training boards and skills councils. Consultancy services are also offered in relation to workforce planning and training needs analysis.

WODONGA INSTITUTE OF TAFE/DECA

Wodonga Institute of TAFE is located in Albury Wodonga, one of Australia's largest and fastest-growing regional centres,

Wodonga TAFE has delivered training in every mainland state and territory of Australia and has a current, successful delivery project in logistics training within China.

The Driver Education Centre of Australia Ltd (DECA) and the National Industrial Skills Training Centre (NISTC) are business divisions of Wodonga Institute of TAFE. Each division is committed to providing training that increases the capability of relevant industry enterprises, and enhances the personal skills of people to work safely, effectively, and efficiently in the workplace.

Building on their strong reputation within these industry sectors, and acknowledging the importance of workforce training for business growth, both DECA and NISTC have well developed relationships with several higher education sector partners to promote training pathways that recognise and build on the qualifications gained through NISTC or DECA.

Over the last two years a successful relationship has been forged with the Yellow River Conservancy Technical Institute in the Kaifeng Province within China. Wodonga TAFE delivers the Diploma of Logistics to the Chinese students on-site at this Institute.

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The Melbourne: Research, Education and Training series profiles the capabilities of Victorian education providers across 13 sectors:

Advanced Manufacturing
Agriculture and Food Security
Business, Governance and Finance
Clean Energy
Creative Industries
Education and Development
Health and Communities
ICT
Infrastructure and Urban Design
Mining
Tourism and Hospitality
Transport
Water Management

For more information on Melbourne's research, education and training capabilities contact your local Victorian Government Business Office at: invest.vic.gov.au/offices

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