OUR FOCUS

Our focus is to provide rail providers and associated industries with the knowledge and tools they need to deliver world best practice and high customer satisfaction.

Our research will contribute to enhancing rail transport as a viable and sustainable option. The outcomes of this work will have major societal impacts across our national economic competitiveness, community liveability and infrastructure resilience.

We have a modern and sustainable, purpose built, four storey research facility at the University of Wollongong (UOW) campus housing 30 integrated laboratories, simulation and modelling hub and 200 higher degree research students.

RAIL RESEARCH PROGRAM

SMART is undertaking research that applies international experience, operational know-how, simulation, modelling and analysis.

SMART is building models for rail service providers that enhance understanding and appreciation of customer behaviour – whether it is freight or commuter customers.

SMART’s Rail Logistics research focus covers the following:

- Systems considerations in asset investment
- Education and training for rail professionals
- Improving customer service
- Constraint modelling to enhance rail capacity
- Sensormatics

SMART established the Rail Logistics research centre, with NSW RailCorp funding of $10 million, to facilitate better rail infrastructure planning and management.

SMART is working with government and industry in the following ways:

- Pursuing and sharing our own research
- Undertaking commissioned research projects
- Providing advisory views
- Producing and delivering executive learning programs

Les Wielinga
Director General, Transport for NSW
Member, SMART Advisory Council

“SMART is in a position to apply high quality thinking to the development of tools to assist land use and transport planning practitioners.”
SMART's five research streams have been developed through a process of industry and government consultation. They reflect the need to cover gaps in existing research and to develop new tools for better planning and management of rail infrastructure.

**ASSET INVESTMENT AND MANAGEMENT**

Rail systems require high investment and yield low returns over a long time. Gaining increased returns from the existing asset is therefore paramount.

SMART's objective is to develop asset system decision modelling which considers the cost and performance impacts of maintenance intervention, modification, reconfiguration, and redesign in addition to replacement. This work can provide cost minimisation tools for decision makers.

We want to enhance the capabilities of rail providers to carry out scenario planning across groups of assets. This will enable decision makers to better evaluate options that balance safety, performance, costs and risk. This can link capital and operational decisions to customer and community goals.

**TRAINING AND EDUCATION**

Organisations and rail professionals need to enhance their multidisciplinary skills and to complement these with risk assessment acumen.

Achieving higher service performance at reduced costs requires workforce education and training.

The Sydney Business School, located at Circular Quay Sydney, and SMART are cooperating to deliver executive development programs.

**IMPROVING CUSTOMER SERVICE**

There is a perceived gap between rail service provision and customer satisfaction. SMART's research aims to close the gap.

Railways are now having to better understand how to identify, capture, serve, segment and most importantly – please their customers.

Understanding where best in class performance lies, through benchmarking, will benefit both rail operators and their customers – closing the gap in service delivery.

Developing methodologies for service benchmarking, enabling comparisons within sectors and beyond, will contribute to implementing better productivity and customer satisfaction plans.

Delivering improved customer satisfaction can also be achieved through survey and modelling of the drivers of customer satisfaction.

**CONSTRAINT MODELLING**

Both Port Kembla Port Corporation and Pacific National have engaged SMART's inhouse analysis, simulation and modelling capabilities to support their decision making in areas of system constraint. This work has set out to provide analysis of systems that provides insights on efficiency gains, design capacity, development options and timetabling coordination.

Constraint models can be developed and simulations carried out to provide options to the rail industry, which enable more capacity in lines, stations and transport interchanges.

**SENSORMATICS**

Infrastructure assets and networks are largely managed by discrete and primitive systems and protocols that are labour intensive, expensive, inefficient, isolated, intermittent and hands-on.

This is starting to change as sensors connected to an information network – make the engineered world more accessible to continuous monitoring and improvements.

SMART is involved with UOW researchers who have demonstrated the effectiveness of sensormatics in landslip monitoring. This is a key area of concern for rail track providers.

Sensormatics provides a web-enabled tool to manage a wide range of infrastructure including bridges, viaducts, culverts, roads, embankments, pipelines and railway lines.

Through a state of the art data centre SMART provides near real time trending, in-depth analysis and a system management service to support resilience and contingency planning together with maintenance optimisation and operation.
RAIL LOGISTICS LEADERSHIP

DIRECTOR, RAIL LOGISTICS

SMART’s inaugural Director of Rail Logistics, Andrew McCusker is a globally recognised exponent of customer focus for railway operations and a world leader in benchmarking service and performance.

Andrew was formerly the Director of Operations for MTR in Hong Kong. MTR is recognised as one of the world’s leading railways – moving around 4 million passengers daily with a 99 percent plus, on-time reliability and another 400,000 passengers on one of the world’s most intensely used Light Rail systems.

He was responsible for implementing their successful customer focused approach over the last 24 years.

Andrew is the past President and driving force behind the establishment of CoMET, which is a program of international railway benchmarking. It is now made up of a consortium of large metro systems from around the world such as – Beijing, Berlin, London, Mexico City, Madrid, Moscow, New York, Paris and Sao Paulo.

At MTR Andrew held various key positions including: Executive Director of MTR Hong Kong, Chairman of NP360 Cable Car, Chairman of Telecoms provider TraxComm HK and a Board member of Octopus Ltd HK. Andrew remains a board member of Metro Trains Melbourne.

ASSOCIATE PROFESSOR OF RAIL LOGISTICS

SMART has appointed Dr Mark Ho as the Associate Professor of Rail Logistics to drive the research capability of SMART to support and champion the role of rail in the broader transport network. Mark will also manage academic and publication activities for SMART together with teaching of research students and staff.

Working together with Andrew McCusker, Mark will liaise and collaborate with researchers across the faculties of UOW such as Engineering, Commerce, Informatics and the Sydney Business School.

Prior to joining SMART, Mark was Associate Professor at the Queensland University of Technology and before that he worked for 18 years at the Hong Kong Polytechnic University.

His research interests include railway simulation and modelling, signalling and train control, maintenance and condition monitoring and open access railway markets. He has been leading a number of government funded and industry-sponsored projects on railway operation and management.
COLLABORATIVE RESEARCH

Drawing on the University of Wollongong’s proven interdisciplinary research track record and its academic strength, SMART is working closely with researchers across UOW and other institutions.

Examples of multidisciplinary and collaborative rail research follow:

COLLABORATION LABORATORY PRODUCING NEW TOOLS

Rodney Clarke is the Manager of the Collaboration Laboratory (Co-Lab) at the SMART Infrastructure Facility. Co-Lab is involved in the development and implementation of new approaches to analysing customers, work and infrastructure.

Rodney is Associate Professor at the UOW’s School of Management and Marketing and is an honorary Associate Professor in Information Systems at Karlstad University, Sweden. Rod uses multimedia to capture and analyse business processes and services.

Rod has developed a research agenda for SMART in Business Rail Freight Services and Rail Passenger Services.

The Business Rail Freight Services project involves freight customers and service providers. Customer and provider side assessments will be undertaken to find service improvement solutions and identify future rail freight services.

Customers will be involved in activities that capture and document their service requirements and expectations plus evaluate the existing rail performance. Business freight providers will be involved in benchmarking and best practice determination.

The Rail Passenger Services project involves a large scale rail passenger survey enhanced with detailed processual studies of passenger use of rail services.

Processual studies are a new tool for researching customer experience. They involve the mapping of passenger communications and interactions over travel routes which then reveal patterns of customer engagement with hard and soft infrastructure. The tool delivers better methods for capturing new insights and assessments of service design and quality.

MODELLING SUPPLY CHAIN MANAGEMENT

Tim Coltman is the Professor of Management and co-Director of the University of Wollongong’s Institute for Innovation in Business and Social Research. Tim has research expertise in supply chain management.

He combines experimental and segmentation techniques to identify the attributes and influencers of customer behaviour and models the supply chain capabilities that align with diverse customer segments. This work draws upon research skills and experience in experimental design, simulation and data analysis. This expertise has contributed to work SMART has undertaken in examining rail networks constraints.

LOGISTICAL AND ECONOMIC FEASIBILITY

An example of research work that has laid important foundations for subsequent SMART research is that undertaken by Dr Joshua Fan, a senior lecturer at the UOW Sydney Business School.

The Port Kembla NSW Coal Terminal commissioned the Sydney Business School to conduct research into the logistical and economic feasibility of transporting Hunter Valley coal to the Port Kembla Coal Terminal for ship loading and export. The research team involved Joshua and two of his colleagues from the Sydney Business School.

The outcomes of the research included: a situation analysis, identification of the main issues surrounding the question, reports from computer simulations and economic modelling, and a suggested implementation plan.

SMART is now providing supplementary research for the Port, using its simulation and modelling capability to run ‘what if’ scenarios on the Port’s freight capacity and timetabling.
The University of Wollongong’s Faculty of Engineering has for many years contributed innovative and practical research to the rail industry. The Faculty participates in the Cooperative Research Centre for Railway Innovation and has established internally the nationally acknowledged Centre for Geomechanics and Railway Engineering. The Centre has been built around interdisciplinary research phases – geotechnical, geological, mechanical and structural.

The Dean of the Faculty of Engineering, Professor Chris Cook, played a key role in the establishment of SMART and is working closely with SMART to ensure both entities deliver collaborative and complementary services to the rail sector.

The Faculty works closely with industry and government and offers various courses for the rail industry including two Masters degrees – Rolling Stock Engineering and Engineering Asset Management.

The Faculty is undertaking significant research projects working closely with industry and other institutions, such as Australian Rail Track Corporation, Queensland Rail, NSW RailCorp, Queensland University of Technology, and MTR Hong Kong.

Researchers at the Faculty have collaborated with an overseas railway company on research into rolling stock and railway fixed assets to deliver whole of life planning models and tools.

Further examples of collaborative research projects underway at the Faculty are as follows:

- **Life Cycle management of railway bridges**
  - Determining relationships between critical factors to enable better data and information for financial decision making regarding bridge repair, replacement, upgrade or remedial actions.

- **Development and validation of nondestructive ballast and formation condition assessment**
  - Aims to deliver a robust and cost effective assessment technique for rail substructure maintenance.

- **Enhanced rail noise mitigation and management approaches**
  - Enhanced rail noise mitigation and management approaches
  - Aims to develop validated and implementable methods of noise management tailored to the Australian rail operating environment

- **Integrated ballast, formation, track – design and analysis**
  - Aims to address two important issues of ballast fouling and degradation of ballast under high impact loads.
COMMISIONED RESEARCH

The SMART Infrastructure Facility is uniquely placed to design, model and simulate the complex interdependencies of infrastructure networks and projects for research clients.

SMART cooperates closely with industry and government to work on projects that can deliver better outcomes for rail.

The Facility’s simulation centre and 30 laboratories can research, test and model networks, what-if scenarios and social and physical impacts of any project or plan.

SMART is undertaking projects for clients that cover everything from information gathering and assessment, researching and reviewing, to developing sophisticated computational decision making tools.

EXECUTIVE DEVELOPMENT PROGRAM

The Sydney Business School and SMART are cooperatively delivering education programs for industry professionals.

SMART’s executive development programs provide access to knowledge and tools that assist infrastructure professionals. Our approach addresses real world problems and solutions.

Building analytical capabilities for people in industry, government and academia is a natural extension of leveraging our knowledge development.

Importantly SMART can be commissioned by organisations to address specific needs and develop bespoke programs for staff and stakeholders.

Mike Mrdak
Secretary, Department of Infrastructure and Transport
Member, SMART Advisory Council

“The Department of Infrastructure and Transport is proud to support the SMART Infrastructure Facility. The work of the Facility is helping to provide a framework for better coordinating the research taking place across the nation on infrastructure and will encourage solutions that foster collaborative action between all research institutions, government and industry.”

RESEARCH SERVICES FOR INDUSTRY
ENQUIRIES

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