REPORT OF THE SMART RAIL LOGISTICS RESEARCH DIRECTIONS WORKSHOP
HELD ON MONDAY 19 MARCH 2012
SMART INFRASTRUCTURE FACILITY,
UNIVERSITY OF WOLLONGONG

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1 EXECUTIVE SUMMARY

A rail research workshop for decision makers and senior representatives from the rail industry was held at the SMART Infrastructure Facility, University of Wollongong on the 19th of March 2012. The workshop was designed to listen and elicit the concerns and challenges for industry and government and consequently identify the priorities for practical research.

Beyond the workshop SMART has continued engagement with those who attended and can report that the industry representatives considered the bringing together of academia and industry to directly focus on the rail industry across a broad range of concerns was novel, refreshing and a welcome development. They also considered that the workshop content was highly appropriate to the industry today and found that the involvement of university representatives particularly advantageous due to their independence.

To provide the workshop with a comprehensive contemporary picture of rail in Australia a number of organisational leaders, representing the freight and passenger services along with the rail construction sector, first addressed the forum. The audience of fifty was comprised of senior representatives from the rail logistics sector - operators, customers and policy makers plus researchers from various disciplines.

A view emerged from these presentations that rail in Australia first needs to be seen against the historical forces which have affected its position in the present transport mix. Since the 1960’s there has been low levels of investment in rail compared to other modes as successive governments pursued the policy of building national and state road infrastructure as the principle transport system for Australia.

The focus on road investment has resulted in a lack of modernisation within the rail networks. This has resulted in rail infrastructure being seen to not be at a level commensurate with supporting modern intra-city and intercity passenger mobility and freight logistics.

In competitor markets such as Asia rail transport is playing a significant role in supporting economic growth and is increasing its market share in passenger and freight transport. Increasing the role of rail transport is occurring to alleviate issues such as road congestion, environmental concerns such as air pollutants and energy use, and increasing the efficiency of the freight transport mix.

In recognising the importance of rail to economic competitiveness the forum developed the view that a strategic imperative for rail was to transform the present performance and productivity of rail networks. A contributing tool for such a transformation would be to better understand and adopt world’s best practice in critical functions and services. The workshop concluded that research plays an imperative role in collecting best practice case studies, metrics and operational processes.

Research is based on quality data and to better support the industry it was considered that there was advantage in SMART utilizing its structured and secure data management capability to build up a data repository in rail.
Another priority issue for action is the development of efficient intermodal terminal precincts facilitating the interconnection of rail and trucking. An important element to the design of such precincts is access to rail and road corridors suitable for such tasks. Land use and transport planning play a key role in delivering the optimal circumstances to allow such terminals. Assisting planners with decision making tools is a research area that would add practical value.

Linking the issues of intermodal efficiency and industry best practice is the strategic approach of rail becoming an active and informed member of the customer supply chain. This was seen as an critical leadership position for industry so that it would be better placed to undertake customer service benchmarking that would identify service delivery gaps. This is the foundation for then being able to introduce solutions that set out to meet customer needs and enhance customer value.

The issue of how to leverage better performance from the existing rail transport networks was a repeated topic of discussion. Solutions put forward to this matter covered a range of areas including sustained investment to add capacity, resolving constraints and uplifting productivity.

The continual growth and structural change within the economy was reflected in the workshop through examination of the conflicts and problems that arise as more of the industry transfers from public to private enterprise. Innovation through adopting international standards and best practice to the Australian environment and the inertia in accomplishing change within the present technical and regulatory frameworks were seen to be impediments to improved efficiency and productivity.

The forum recognised the need for rail transport to focus on its complementary role in the broader transport system of passenger and freight market. This can be achieved through understanding the changing needs of customers and then responding by placing customers at the heart of decision-making.

By becoming more customer-centric rail can increase its attractiveness to users. The connection between better service and increasing patronage has been shown overseas, such as in Hong Kong, and can deliver to rail a competitive advantage in the market. By increasing its attractiveness to customers rail can enhance the liveability of the community – alleviating road congestion, delivering efficient and attractive mobility, with a safety and environmental upside.

The workshop also amplified the role of social science in relation to the many human factor elements required to improve the passenger experience, boost staff productivity and in developing high performance organizations all of which indicated an imperative for research in this area. Research into customer tolerance in crowded environments, organizational competency building, understanding factors that drive customer value along with workforce ability, innovation and adaptability were, among others, raised.
Critical to developing and implementing these solutions to rail will be a motivated, skilled and available workforce. But an emerging issue in the discussions at the forum was how industry is faced with a generation change in rail professionals. The effects of this were going to be the problems of attracting and retaining the best people, capturing and distributing expert knowledge, plus introducing flexible approaches to professional development.

In summary the speakers and attendees resolved that research and analysis should unlock new insights and create new tools for decision makers in the Industry to deliver relevant and meaningful change. The following areas were highlighted for research to upgrade the capability, performance and attractiveness of rail logistics to rail customers.

1. Strategic issues in delivering intermodal freight hubs
2. Maximising the worth of rail assets across the project and operational life cycle
3. Driving productivity and capacity uplift in existing rail infrastructure
4. Re-examination of Australian rail standards to deliver cost efficiency
5. Identifying and understanding what customers need
6. Mapping the routes to world’s best customer service through benchmarking
7. Organisational learning and knowledge management best practice.

The workshop successfully captured and identified the industry priorities for research.

The University and SMART are committed to delivering timely and relevant research to support the industry. The following are the immediate actions arising from the workshop:

**Action 1 - Customer service benchmarking & workforce development**
- Initiate a customer service benchmarking study for delivery April 2013
- Analyse and identify best practice for capturing tacit knowledge of an ageing rail sector workforce and its dissemination to next generation of engineers.

**Action 2 - Network performance enhancements**
- Undertake research which will contribute to greater productivity outcomes for existing networks – with a focus on capacity uplift and improving systems availability

**Action 3 – Social and Behavioural Development**
- Commencing with customer crowding tolerance SMART are to develop a portfolio of research in human behaviour aspect, relevant to the Rail Logistics Industry

**Action 4 – Noise Management**
- Research possible engineering solutions to noise and vibration
- Research into the application of cost-benefit analysis of available noise management methodologies
2 BACKGROUND

The purpose of the workshop was to develop a research agenda through the engagement of senior representatives, leaders and decision makers of the rail logistics.

3 WELCOME
GARRY BOWDITCH
CEO, SMART INFRASTRUCTURE FACILITY

Garry Bowditch welcomed the workshop attendees and noted that a comprehensive cross section of the rail sector was represented. He outlined that SMART is the world’s largest integrated infrastructure research organisation with 30 laboratories, a state of the art simulation and modelling hub, plus the capacity for 200 higher degree research students.

SMART brings together the entire range of resources existing within the University of Wollongong (UOW) including Engineering, Informatics, Commerce, Law and Business. He acknowledged that UOW has an international reputation for multidisciplinary research and commercial engagement.

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

4 SMART RAIL LOGISTICS PROGRAM
ANDREW MCCUSKER
DIRECTOR, RAIL LOGISTICS

Andrew McCusker’s address provided an opportunity to introduce his experience and outline the progress in developing five research streams for SMART to undertake over the next three years.

Andrew summarised his role at head of rail Operations at Hong Kong’s railway company MTR. MTR HK which was a high performance organisation that delivered 99 per cent train punctuality. MTR HK does not receive a government subsidy to run the railway and the rail business is financially sustainable operating at a 50 per cent EBITA margin and a 30 per cent margin including amortisation.

Andrew gave an update to the workshop on the research focus developed so far for SMART Rail Logistics. He also summarised the outcomes of the inaugural SMART Rail research directions workshop of November 2010 and how they have contributed to the strategic direction outlined for SMART.
He emphasised how SMART’s research activity is guided by the concept of bringing the benefit of productivity and efficiency to rail logistics through research innovation and SMART’s independence.

Since being appointed in late 2011 Andrew has been developing a program of research for SMART based on his consultations within the industry and the results of the previous workshop. As a result five research areas have been programmed:

- Asset investment & management
- Training & education for rail professionals
- Constraint modelling to enhance rail capacity
- Improving customer service
- Sensormatics - intelligent sensors & networks

The Industry was experiencing many challenges and a number of these will be with us for some time such as establishing capital funding priorities and high speed rail. Presently transport strategies were being developed in NSW and other states. There is confidence that all strategies developed will have a need for generating greater productivity from existing assets. A further expectation was that customer focus would feature in all future strategies. As a consequence Rail Logistics at SMART was already focusing on two areas of research.

**Improving passenger and Freight networks**

It was recognised considerable opportunity existed to enhance rail performance through research using modelling, analysis and simulation. For example, improving the productive use of assets through constraint or bottleneck modelling is a research application that SMART can undertake due to its expertise in simulation and network analysis.

**Improving customer service**

The SMART best practice benchmarking model outline was shown to the workshop.

This model seeks out the gaps between the customer’s desired outcome and the rail provider offering. It is important for rail service providers to identify the gap in service provision and then focus on working to improve customer satisfaction by addressing this gap in service delivery.

Research into best practice is valuable for industry as it can articulate the standards of excellence, whereby the processes and measures necessary for delivering improved performance become known and manageable.

Speakers from the sectors of Freight Networks, Passenger Networks and Rail Construction addressed the workshop on challenges and priorities for the industry.
5 RAIL STAKEHOLDER CHALLENGES AND PRIORITIES

5.1 INTERSTATE NETWORK AND FREIGHT CHALLENGES – JOHN FULLERTON, CEO, AUSTRALIAN RAIL TRACK CORPORATION

John Fullerton, CEO of Australian Rail Track Corporation (ARTC), was unable to personally deliver his presentation due to an issue with his air travel on the morning. However his presentation was shown to the workshop and Andrew McCusker highlighted the main issues raised within the paper.

ARTC owns or leases an extensive 8500 klns of track providing an interstate network from Queensland through NSW, Victoria, South Australia and WA. The NSW track includes the Hunter Valley coal network and has 830 employees with annual revenue in 2010/11 of $652 million.

An overview of the existing competitiveness for the East West, North South and Hunter valley corridors outlined the following.

a) The East West corridor is a vital logistics connection to and from WA. It is attractive to the freight transport market with rail capturing 81 per cent of the freight market.

b) This is in contrast with the North South corridor from Melbourne to Brisbane. Rail is not competitive with road. The rail market share has fallen steadily since the 1960’s. Presently rail has 24 per cent of the Melbourne-Brisbane land freight market with more than half that when looking at the Brisbane to Sydney or Sydney to Melbourne land freight market share figures.

c) The lack of capacity in intermodal terminals and the interface between road and rail were highlighted as draw backs to increasing the attractiveness and competitiveness of intermodal freight in the North South corridor.

d) Reliability is seen as a crucial factor in competitiveness that is critically impacted by bottlenecks and time of day restrictions imposed within the Sydney metropolitan system.

e) The Hunter Valley, bulk freight corridor capacity is subject to suppressed demand and coal volumes are forecast to double to 200mtpa in the next five years. Building capacity ahead of demand is the strategy being adopted.

ARTC indicated that rail has seen limited investment in the past decades. To achieve modal shift in line with national environmental policy and enhance national productivity to support economic growth, investment in intermodal hubs and infrastructure along with productivity improvement are critical factors.

It was observed that safety performance is a challenge and that the industry needs to improve customer focus and work collaboratively to meet customer needs while interpreting and applying safety standards.
Five imperatives for delivering intermodal freight were highlighted:

- Delivering network performance, with respect to travel time and certainty
- Focus on the customer and improve performance
- Invest in efficient intermodal precincts that are integrated with roads
- Attract and retain the best people
- Advocate policy and regulatory reform to optimise investment across transport modes

### 5.1.1 Issues and research support

a) Deliver Network Performance: Enhancing network performance through continuous improvement in asset performance and making better use of condition data to optimise costs and downtime are areas where research can bring benefit.

b) Become an active and informed member of the customer supply chain: Fostering customer focused management can be achieved by gathering knowledge gained from customer service benchmarking research.

c) Research was required to improve asset utilisation through qualitative evaluation of capacity restraints and optimisation of reliability maintenance.

d) Improving process efficiency through better use of condition data to construct models to optimise track occupation and minimise downtime.

e) Understand and better meet customer needs through customer experience surveying, understand the factors that drive customer value and identify gaps in process delivery.

### 5.2 TRANSPORT REFORM – CHRIS LOCK, DEPUTY DIRECTOR GENERAL, TRANSPORT PROJECTS, TRANSPORT FOR NSW

Chris Lock outlined the reform taking place in NSW to deliver improvements to the administration of transport. There has been an amalgamation of transport, roads and ports under one department – Transport for NSW (TfNSW).

This structural change separated policy from service delivery and amalgamated policy into one cohesive and integrated approach. The first ever ‘customer experience’ division was established with freight and regional development also being raised to divisional level for the first time. Importantly the alignment of service provision integrating both the public and private operators was highlighted as another exercise for improving service delivery. The new structure has ensured a high level focus on the integration of transport, roads and ports which had not existed previously.

A single Design Authority is to be established to take control of all major design functions and to support the major project portfolio across transport, roads and ports.

An impediment to design and maintaining the safety integrity in rail projects is the significant lack of engineers and this is an area that the University of Wollongong can contribute.
Of particular interest was the matter raised of evaluating value for money and in benchmarking project costs. It was noted that very little benchmarking existed in this area and this was in need of research.

The Transport Projects division is responsible for the delivery of projects across all transport areas including the design and purchase of strategic assets such as ferries, buses, LRT, trams and trains. For instance, equipment purchases such as trains would now be carried out centrally under the project team, and traditional standards that increased expense or seemed outdated or unnecessarily narrow would be subjected to revision.

RailCorp reform would release that organization from all activity not related to service provision thus providing an opportunity for greater focus on operations and maintenance in the daily provision of passenger services.

The new TfNSW organisation would seek to achieve value for money in open international competition within which international standards adapted for Australian conditions would compete on equal terms with Australian suppliers.

5.2.1 Issues & Research Support.

a) **Train Purchase**: To deliver value for money to the tax payer international train standards, suitably adapted to Australian conditions were required for future purchases. For example, the weight of Australian trains compared to those overseas was highlighted as one key concern. Overall the standards to which Australian trains were manufactured needed to be addressed to drive requirements closer to what is acceptable internationally. A comparative review of key requirements between Australian and International specifications to identify key design assumption variances is an area for further research.

b) **Noise**: Train Noise is an emerging issue with residents in close proximity to the railway. Understanding the sources of noise generation, their relationship to total noise and opportunities for mitigation by building models to assist decision makers is an area for research.

c) **Engineering resources**: A significant lack of engineers was highlighted and areas where the University can assist are:
   - Analysis of resource constraints and the building of resource models
   - Provide transitional training in priority specialist areas
   - Consider placing undergraduates on work experience programs
   - Work with TfNSW to allocate students to internships

d) **Project Costs**: Benchmarking of project costs was generally not available and research may support this through literature search followed by a focused benchmarking exchange in areas of particular interest involving cooperative institutions.
e) **Standards:** A value for money review and revision to international standards is required.

### 5.3 RAIL REFORM AND MEDIUM TERM OUTLOOK – JIM MODROUVANOS, CHIEF ENGINEER, NSW RAILCORP

Jim Modrouvanos covered the following headline matters – NSW public transport reform, plus better understanding the customer and value propositions.

RailCorp is Australia’s largest passenger rail network carrying approximately one million passengers every week day and operating a fleet of 1,792 electric and diesel carriages over a network of 1,600 klm’s with 1,141 bridges, 70 klm’s of tunnels and 377 stations. It has an asset base value of $19 billion.

RailCorp is working closely with TfNSW to plan and shape its future and to put the customer at the centre of everything they do. They are setting out to be known as Australia’s ‘world class railway’.

This goal requires a substantial change to the highly subsidised business. Reforms need to deliver a more sustainable financial position while delivering real improvements to customers.

RailCorp’s $19 billion of assets require continual maintenance and upgrade through replacement programs. Controlling whole of life costs in line with best practice is an issue of major concern.

To improve customer service it is essential to renew railway infrastructure within the ageing asset base in a manner that minimises the disruption to customers and delivers the highest levels of service possible.

RailCorp has also been analysing the needs of customers by examining different generation segments to better understand how to respond to emerging needs such as ‘anywhere and anytime’ expectations.

The needs of customers and to some extent staff indicate a much greater requirement to incorporate modern communications and digital technologies within the service offering and the working environment.

RailCorp is seeking research to better understand customer requirements, to identify opportunities for use of social media and in identifying the channel preferences of customers.

Research in identifying best practice in customer service in rail and comparable industries was seen to be another research area by RailCorp and for the RailCorp SMART Partnership it was essential that outcomes were tangible, practical and focused.
In common with other industries a strategic level issue was foreseen with a surge of retirement forecast in the near future. For example, 20 per cent of engineers are now 58 years old and will leave the organization and although intake of graduates in much greater numbers is in hand the capture and transfer of knowledge remains a key concern.

Minimizing delay to customer journeys through crowded stations and at platforms to reduce train dwell times in line with best practice was a further area for research.

Managing and reducing the noise and vibration generated by the railway work was a concern.

5.3.1. Issues and Research Support

a) Cost Minimisation: Analysis of key high cost processes such as train maintenance, build models representing the cost drivers incorporating decision makers, run scenarios of cost reduction options.

b) Minimising Disruption from rail work: Benchmark methodologies adopted by best practice rail operators and rail constructors to minimize service downtime.

a) Asset Availability: Availability analysis of principle asset performance, build availability/cost model, simulate options on availability growth.

b) Construction Noise: Review of construction with respect to noise generation factors, noise model development, and mitigation options identification.

c) Expert Knowledge: Due to the generation change there is a significant influx of new graduates who require to gather expert knowledge. Benchmarking methodologies employed by other organizations can benefit decisions on the suitable knowledge transfer methods that can be employed. Research to understand the social interactions in the work place and learning preferences of the younger generation can provide insights to improve learning efficiency.


e) Passenger flow & station constraints: Customer comfort and tolerance evaluation for movement through trains, platforms and stations. Constraint modelling and simulation to develop mitigation options.

f) Assurance framework: The reform brings in a new model where there are split and duel responsibilities in design for safety and in safety delivery. How will safety be maintained and what assurance model is appropriate in this situation. A search to establish models of assurance employed in railways and other high safety industries where safety is distributed across several parties. Developing a preferred model and enhancing this with agent based modelling that can support decision makers in this adaptive safety assurance environment is a further consideration.
g) **Energy efficiency and supply limitation:** Consideration to technologies that reduce power demand and research to identify leading practice and application of energy efficient equipment in the rail environment is an area research can support.

h) **Customer skills and social media:** Research on staff development in customer skills and benchmarking of training & learning in leading customer service organizations can be performed.

### 5.4 AUSTRALIAN CONSTRUCTION INDUSTRY CHALLENGES - KARL MOSIAK

**EXECUTIVE GENERAL MANAGER, TRANSPORT SERVICES, JOHN HOLLAND**

Karl Mosiak outlined the extensive participation John Holland Group has in the rail industry throughout Australia from the construction of the Alice Springs to Darwin line, involvement in the rapid growth projects in Western Australia to maintenance and renewal works such as the Sydney southern improvement alliance and Adelaide rail revitalization.

Through the Country Regional Network (CRN) and Metro Trains Melbourne (MTM) service contracts, the company was involved with operating and maintaining. In international markets the company designs constructs and maintains railways in several countries from the Middle East to India and in Hong Kong.

Private companies in the construction industry experience difficulties in productivity and efficiency when dealing with government authorities. Construction and rail service companies often face difficulties to bring innovation and cost effectiveness to the rail industry. The particular case of type testing was an example. New technology and the use of standard materials and components suitable for other railway systems were often unacceptable to state rail authorities. Rail supplied from China was accepted by private rail operators in Australia but not by government run railways.

A stark contrast exists between the practices adopted by private sector operators such as MTM or rail operations in Western Australia and government controlled rail companies. In the case of type testing, for example, the former when considering alternative standards, or new technology, can carry out type testing directly and deliver cost effective solutions rapidly. Attempting to carry out the same activities with government controlled railways often failed or took so long as to become impractical commercially. This may go some way to explain why the private sector can deliver public rail services cheaper than state rail companies.

Karl outlined that here in Australia we must begin to consider ourselves within the international market place. Due to the economic downturn in America and Europe investment in Australia was dominated by four countries, Japan, China, Korea and India. These countries are bringing their influence to bear in demanding that design capability and equipments manufactured by them can enter the Australian market.
Faced with commercial pressure and the desire to improve costs and productivity, John Holland’s experience mirrors this. Railway design for new build is sourced in India where there is no shortage of skilled railway designers and the cost of a designer are one eighth that of Australian costs. A similar situation exists with major equipment supply for the construction of the rail systems the company is involved with.

This situation will lead to the penetration of railway expertise, products and services into the Australian market sooner rather than later. The only counter to this situation is to bring in much greater productivity, flexibility and agility in combination with the use of appropriate standards to the rail industry here in Australia.

5.4.1 Issues and Research Support.

a) Internationalisation of standards: To improve productivity and competitiveness a review and revision of standards should take place.

b) Innovation and value for money: Approval of equipments and materials needs to cater for self or third party certification. Practices in design and safety regulation for the rail industry and the identification of process and practices that are more productive than those practiced today in Australia are all areas that research can support.

6 INTERACTIVE ROUNDTABLE TOPIC REVIEW

The forum proceeded to a breakout session where the following topics were reviewed:

- How can research support rail service delivery.
- How can research support productive use of assets.
- How can research support customer service advancement.
- What does the Industry critically require in Education and Learning?
- How can research support development of high performance rail business.

Emerging from the review the following topics were judged to be further areas for focus in research and development.

Customer Service
Identifying customer needs and developing methodologies to guide decision-making through better understanding of customer needs in Freight and passenger services. Mapping a route to world’s best practice in customer service, building models that identify gaps, reflect customer value streams and opportunities to grow value streams.
Recommendation for Action by SMART
- Conduct a study on the customer experience, identify customer-side requirements and expectations, evaluate gaps in supplier-side provision and develop a set of superior service KPI's.
- Public transport operators should explore opportunities to leverage the availability of people's time in transit towards commercial or more productive endeavours.

Education and Learning
Identifying and capturing knowledge from an ageing workforce and how to retain and build capability within the elder workforce.
Attracting young professionals and equipping them with expert knowledge through accelerated teaching supported with appropriate knowledge management systems.

Recommendation for Action by SMART
- Conduct research to understand the social interaction in work place learning and interaction between the student and the asset.
- Benchmarking best practice in knowledge management and deliver a methodology for improved knowledge transfer.

Maximising the productive capacity of existing rail systems
Enhancing the capability of existing systems to move more passengers and freight to reduce the impact of bottlenecks in the integrated rail supply chain for lines, mode interchange facilities and passenger facilities through data acquisition and modelling.

Recommendation for Action by SMART
- Research to improve asset performance and network capacity
- Modelling and simulation of capacity restraints in rail networks, quantitative evaluation of rail asset capability and utilisation.
- Research to build intermodal hub simulation and modelling to evaluate and impose bottle necks.
- Research into reliability maintenance in trains and infrastructure to increase availability.

Energy and Noise
Identifying the best practice in equipment procurement to minimize energy usage and understanding best practice in cost effective noise management.

Recommendation for Action by SMART
- Research into cost- benefit analysis of available noise mitigation methodologies.
7 THE WAY FORWARD
Reflecting on the day the SMART CEO Garry Bowditch congratulated the forum for their highly interactive and productive participation a wealth of issues had been raised, explored in detail a number of actions were identified and noted for follow up.

Action 1 - Customer service benchmarking & workforce development
- Initiate a customer service benchmarking study for delivery April 2013
- Analyse and identify best practice for capturing tacit knowledge of an ageing rail sector workforce and its dissemination to next generation of engineers.

Action 2 - Network performance enhancements
- Undertake research which will contribute to greater productivity outcomes for existing networks – with a focus on capacity raising and improving systems availability

Action 3 – Rail Industry Social and behavioural research
- Customer Comfort and tolerance to crowding in trains, platforms and stations
- Generation gap Resource modelling and simulation.
- Learning and social interaction in the workplace.
- Analysis and modelling for customer skills for the social media.
- Benchmarking best practice in Knowledge transfer.

Action 4 – Noise Management
- Research possible engineering solutions to noise and vibration
- Research into the application of cost-benefit analysis of available noise management methodologies

Action 5 - Customer behaviour/expectation study
- Survey on customer experience
- Customer demand characteristics study
- Service performance cost benefit analysis – how does improved service benefit the customers

Action 6 - Systems and equipment efficiency
- Quantitative evaluation of rail asset capacity utilisation
- Optimisation of asset allocation and reliability-based maintenance regimes
- Optimal timetabling for freight/passenger services
- Disturbance recovery strategies
- Station design and passenger flow modelling
- Intermodal transport hub simulation and modelling
- Asset condition monitoring and intelligent remote sensing
**Action 7 - Sustainable services through engineering and technologies**
- Noise and vibration management
- Train control and energy consumption
- Traction supply system capability and efficiency study
- Impact of signalling system on line throughput
- Rail-wheel interface analysis
- Human factors on train control

**Action 8 - Education and training**
- The industry may elaborate further on the levels (e.g. short courses, workshops, continuing professional development (CPD) activities, award courses at graduate-certificate or master level) and areas (e.g. traction supply, signalling, rolling stock, track, operation) where education and training are desperately needed. Discussion on the long-term demand is essential, which must commence as soon as possible, or the knowledge/expertise disappears with retirement and talent drain.
- Publicity and promotion of rail industry to young professionals
- Field trips, scholarships, internships, seminars from experienced practitioners

**Action 9 - Simulation tools**
The above also calls for some common tools which may need to be developed to support projects.
- Train movement simulation (multi-train and single-train)
- Power network simulation
- Station facility and passenger flow simulation
- Simulation platform for multi-modal transportation system

**Action 10 – Railway data Repository**
- Develop a repository for rail industry data that can be accessed by researchers and industry.

In order to consult with the group that what the group wanted has been gathered a written document on the day’s proceedings would be circulated within fourteen days. Garry thanked the forum for attendance and their enthusiastic participation.

This document contains the priority for research gathered during the Rail Logistics Workshop and from review of the draft report by participants of the workshop.

The workshop is only a first step in engagement with rail industry stakeholders. At SMART we see that to build and sustain a relevant, viable and appropriate research agenda, which will continue to enhance the capability of the rail industry and deliver economic benefit to our economy, we must participate in continual dialogue with a wide spectrum of stakeholders.

We are interested in your perspective and will be greatly encouraged by receipt of your views on the attached report and any other relevant concerns about the rail industry here in Australia.