HEAVY HAUL, INTERMODAL AND FREIGHT RAIL
DISCLAIMER

Austrade does not endorse or guarantee the performance or suitability of any introduced party or liability for the accuracy or usefulness of any information contained in this Report. Please use commercial discretion to assess the suitability of any business introduction or goods and services offered when assessing your business needs. Austrade does not accept liability for any loss associated with the use of any information and any reliance is entirely at the user’s discretion.

©Commonwealth of Australia 2013

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from the Commonwealth, available through the Australian Trade Commission. Requests and inquiries concerning reproduction and rights should be addressed to the Marketing Manager, Austrade, GPO Box 5301, Sydney NSW 2001 or by email to marketing-commshelpline@austrade.gov.au

Publication date: October 2013

Cover and inside cover images courtesy of Laing O’Rourke

Austrade gratefully acknowledges the assistance of Martin Baggott in the preparation of this report.
INNOVATIVE AND PROVEN SOLUTIONS DELIVERING SUCCESS
World-leading rail infrastructure and operations have long underpinned Australia’s success in the resources and freight logistics industries, allowing the sector to operate efficiently and reliably as a major global competitor.

Established partnerships between Australian resources and rail companies support the delivery and long-term sustainability of resources projects, which are often critical for national economic development and growth. Australia has the heaviest and longest heavy haul trains in the world and is pioneering several world firsts, including remotely located train control centres and automated, driverless heavy haul trains.

Australia can deliver state-of-the-art solutions across every step in a heavy haul or freight rail project – from planning, design, construction, equipment, operation, safety and maintenance through to training and research and development (R&D).

This industry capability statement gives you an overview of Australian capability in the heavy haul, intermodal and freight rail industries, including examples of some of the many Australian companies with specialist expertise. Talk to your local Austrade representative for more tailored advice and information about connecting and partnering with the Australian heavy haul, intermodal and freight rail industries.
Australia can deliver state-of-the-art solutions at each stage of a heavy haul or freight rail project.
Australian heavy haul, intermodal and freight rail expertise is broad and diverse. It encompasses not only ‘below-rail’ capabilities such as planning and design, infrastructure construction, facilities, infrastructure systems and technologies, but also ‘above-rail’ capabilities like rail system operation, maintenance, rolling stock and related technologies, and training (including management-level training, safety and environmental training and technical training for operations and maintenance).

Australia runs the world’s heaviest and longest heavy haul trains, with axle loads of 40 tonnes and train lengths of 2.5 km or more. It is implementing world firsts for heavy haul rail, including train control centres located more than 1800km from the train networks, driverless trains which operate 24 hours a day, every day, and fully automated maintenance facilities.

Australian companies and research centres have a strong record of innovation and R&D across all aspects of freight and heavy haul rail. This allows the industry to be flexible, efficient and resourceful and provides tailored solutions to challenging and sometimes unique problems.

A harsh climate, huge distances to cover and remote mining locations are some of the challenges that the Australian industry has met with innovative and proven solutions to transport resources successfully by rail from ‘pit to port’. Similarly challenging conditions exist in regions such as the Middle East, Mongolia, South America, North Africa and South Asia – and Australia has the capacity to deliver heavy haul and freight solutions worldwide.

Training, safety and the reliable continuous operation of pit-to-port rail infrastructure are also essential for the viability of resources projects and Australia has considerable expertise to offer in all these areas.

Australian capabilities in leading-edge design, planning, operation and maintenance can minimise downtime and interruptions in the operation of resources projects over their lifetime, which can significantly reduce costs and improve efficiency.
Australia’s heavy haul capabilities are closely linked to its position as a major resources producer and exporter. The resources industry has led to the development of capabilities in long haul freight and innovative solutions to harsh conditions and remote locations. Australian expertise in minerals transport also encompasses the design and delivery of mine site loading, port unloading and materials handling facilities throughout Australia and overseas.

The logistics chain is very dependent on its longest arm – the railway. This has meant that a number of systems have been developed in Australia to schedule operations and permit transparency of operations to all the elements of the chain. Many of the strengths Australia’s intermodal and freight rail sectors possess have been developed from Australia’s heavy haul rail capabilities.

For any rail operation to run smoothly, safely and reliably, a skilled and well-trained workforce is essential. Australia is a world leader in many fields of education and training, and the rail freight and heavy haul sectors are no different, providing training and education for everything from capacity building for government officials through to management, operational, technical and trades-related requirements.

As well as engineering degree courses provided by a number of Australian universities, Australia delivers a wide range of vocational education and training options, some via the Technical and Further Education (TAFE) system, relevant to the rail freight sector.

A framework of education pathways has been pioneered by the Australasian Railway Association so that employees can progress their careers through continuous learning. Areas of learning with formalised accredited courses are:

- rail infrastructure and rollingstock design
- rail infrastructure construction
- rail infrastructure maintenance
- rollingstock maintenance
- operations employee training including drivers, train controllers and freight handlers
- signalling design and maintenance
- rail communications and networks
- rail operations management including business continuity and RAMS
- track maintenance
- rail logistics and supply chain management
- rail safety management.

Further information can be found at training.gov.au
**ITTD delivers the right people**

**Case study: training**

In heavy haul and freight operations, skilled personnel are as vital as state-of-the-art equipment. Australian firm International Transport Training and Development (ITTD) has earned an international reputation providing experienced personnel and training services to the transport industry.

Since being established in 1996, ITTD has expanded to open offices in the Middle East, the UK, South Africa and Dubai.

Recent projects include:

- specialist advice to Bovis Lend Lease Dubai on all facets of operations and operator management for its Dubai Metro project. This included a full training needs analysis, investigating and sourcing overseas development options and developing and delivering in-house, tailor-made training courses.
- delivering an international training program for freight rail drivers and on-job trainers, conducted in Melbourne and South Africa, on behalf of Transnet Freight Rail, the largest freight haulage company in Africa. ITTD worked with Transnet in other areas, including advice and guidance on staff recruitment and retention, organisational development and carrier paths, and continuing development of its training programs.
- conducting an independent audit on training and competence, developing a competence matrix for drivers, and developing and delivering an advanced course for trainers on behalf of RapidKL in Malaysia
- measuring and evaluating skill sets of revenue protection officers (Authorised Officers) for Yarra Trams in Melbourne to ensure they met the competency requirements for a new government qualification
- providing engineering input for maintenance documentation supplied for the Citadis tram operated by Yarra Trams in Melbourne.
TTG delivers savings all around the world

Case study: fuel minimisation technology

An in-cabin Driver Advisory System (DAS) developed in Australia is helping international rail operators save energy and costs.

The Energymiser® System, produced by TTG Transportation Technology, provides real-time driver advice and web-based reports that has typically achieved up to 10 per cent savings for heavy haul trains in Australia, the UK and Africa (coal or iron ore trains); to 10 per cent or more for freight trains in Australia, the UK and India; and 10 per cent to 20 per cent or more for passenger trains in UK. Results depend on variables such as the terrain over which trains travel and the extent to which individual drivers comply with the real-time advice.

The system is attracting growing industry attention. The UK rail operator First Group received an innovation award in 2012 for implementing Energymiser® on its high-speed train fleet.

Energymiser® works by advising drivers how to achieve an efficient use of energy (fuel or electricity) based on a given location and specific arrival time.

The system uses a control strategy based on algorithms developed by the Signalling and Control Group at the University of South Australia. It automatically adjusts control and speed profiles so that the train arrives at the next target location at the specified arrival time, not just at the earliest time, while also minimising energy consumption.

Other benefits include improvements in on-time arrivals of about 10 per cent, reduction in braking reductions of up to 30 per cent, which reduces maintenance costs, and smoother train handling due to increased coasting and reduced powering.
HEAVY HAUL, INTERMODAL AND FREIGHT RAIL

TECHNOLOGY AND INNOVATION

In response to the challenging demands of the environments and markets in which they operate, Australian firms produce a broad range of technologies to help increase efficiency, reduce costs and assist with asset management and resource optimisation, particularly for pit-to-port infrastructure in remote locations.

Driver assistance IT systems enable freight trains to reduce fuel use while maintaining schedules by processing data including train type, weight, speed, fuel consumption, track conditions, GPS location and driving techniques, then providing instructions that allow the driver to optimise power.

In-motion wagon weighing technology reduces stoppages and improves efficiency by allowing trains of 300 wagons or more to be weighed with legal-for-trade accuracy at speeds of up to 100 km/hr.

The world’s first automated heavy haul network, incorporating driverless trains, is due to be launched in the Pilbara region of Western Australia in 2014 and 2015 by mining company Rio Tinto, which currently runs a 1,500km rail network to service its mining activities.

Other Australian companies provide software packages to optimise mine-to-port logistics, including transport scheduling solutions.

Innovations developed by Australian companies and implemented throughout the world include:

• multi-array ultrasonic inspection
• rail grinding profile measurement
• fuel optimisation
• multi-factor railway alignment optimisation
• weld parameter technology for stress relief in rail welds
• signal display and switching
• longitudinal train dynamics simulation.
RESEARCH AND DEVELOPMENT

Australian rail industry bodies and research centres are actively involved in developing products and technologies to enhance all aspects of rail transport, including the heavy haul and freight sector.

The Cooperative Research Centre (CRC) for Rail Innovation links participants from major rail industry companies throughout Australia and New Zealand with several leading Australian universities. Its areas of research include climate and environment, performance, safety and security, workforce development, smart technology and urban rail access. Current projects range from exploration of future power technologies and human factors analysis to building best practice models for safety culture management, to development of new steels for rail wheels, track stability management and life cycle management of bridges. railcrc.net.au

Rail Innovation Australia, which was created from the former Cooperative Research Centre for Railway Engineering and Technologies (Rail CRC), commercialises technologies and intellectual properties developed by rail companies as well as Australian universities and institutes of technology. Its current projects include:

- Train Health Advisory System (THAS), a low cost on-board train monitoring system for multiple wagon use
- Rail Noise and Wear Assessment System, software for an on-board noise monitoring system that can identify areas of track in bad conditions requiring attention
- D-Track – a computer-based model that allows track engineers to model track design, track modification and the effects of additional or worn rollingstock on track.

railinnovation.com.au

The Institute of Railway Technology (IRT) at Monash University, Melbourne, is working on a number of projects with heavy haul applications, such as:

- increasing axle load capacity
- improving vehicle components to increase service life and decrease costs
- increasing rail life through better understanding of wheel-rail interaction
- optimising ore train dumper operations to reduce component damage and energy use.

eng.monash.edu.au/railway
The Centre for Railway Engineering (CRE), based at CQUniversity in Queensland, is applying a number of engineering disciplines to rail research. Some of its current projects are:

- Intelligent Train Monitor (ITM), an in-cabin device that provides the train driver with information that can potentially save up to 15 per cent on energy consumption and improve rolling stock life
- Train Health Advisory System (THAS), a monitoring technology with the capability to detect flat wheels, hunting, abnormal wagon behaviours, derailment and track irregularities
- A prediction model to improve management of track buckling risks and speed restriction settings
- Integrated wear-fatigue-lubrication models and economic models for assessment of rail-wheel degradation and operational risks
- Design and testing of new insulated rail joints.

cqu.edu.au/research/research-organisations/institutes/resource-industries-and-sustainability/centres2/centre-for-railway-engineering

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is applying statistical, optimisation and simulation expertise to assist the transport and logistics sector, including heavy haul, improve safety, and simulate and streamline processes to reduce costs. Recent projects include:

- Optimisation modelling for a coal producer that helped identify capacity requirements and cost effective capacity improvement initiatives, as well as software that assists operators to create optimal rail schedules.
- Innovative simulation and optimisation models for bulk materials like coal, minerals or agricultural commodities that can improve the efficiency of use of yard machines, observe constraints on the use of the facilities, allow for maintenance and streamline rail schedules.

csiro.au/Outcomes/ICT-and-Services/TTL.aspx
TOUGH CONDITIONS, INNOVATIVE SOLUTIONS

- Pit-to-port (P2P)
- Remote, harsh conditions (50°C)
- Need for reliability
- Heavy axle loads
- Rail asset management
- Automated operations and maintenance
- Remote train control

27 mines
Multiple operators
Narrow-gauge system
5 ports, 220 million tonnes

3000km supply chain
Remote condition monitoring
Communications and data
Train control
Large intermodal terminals
Simulation

PILBARA MINING REGION
QUEENSLAND MINES AND PORTS
TRANSCONTINENTAL RAIL LINK
NSW MINES AND PORTS

Multiple operators
Fuel minimisation
Coal and mixed operation
200 million tonnes port
AUSTRALIAN CAPABILITIES ARE IN GLOBAL DEMAND

Remote, harsh conditions (50°C)

Pit-to-port (P2P)

Simulation

Fuel minimisation

Pit-to-port (P2P)

Simulation

Remote, harsh conditions (50°C)

Pit-to-port (P2P)

Rail asset management

Pit-to-port (P2P)

Rail asset management

Narrow-gauge system
PLANNING AND DESIGN

With its long history of rail transport, Australia has substantial experience in the planning and design of heavy haul and all types of rail infrastructure as well as the rehabilitation and maintenance of existing routes. In heavy haul railways, operations costs have been minimised using grade and curve optimisation, while in intermodal tasks the need for improved transit times has led to innovation in curve design and structure to permit higher speeds.

Specific engineering capabilities include:

- alignment design
- environmental planning
- construction and track laying
- tunnelling and bridges
- rail management in welding, grinding and inspection
- geotechnical analysis
- simulation and modelling
- remote asset protection and monitoring

Australian companies are designing and delivering rail infrastructure and engineering services for freight and heavy haul rail all over the world, including recent projects in Africa, Middle East, Asia and South America.

SAFETY AND SECURITY

Australian intermodal and heavy haul rail freight capabilities include products and solutions to many aspects of safety and security, as well as training and management.

Trespassing and road vehicle incursions are significant safety and security problems that have been addressed with the use of remote CCTV monitoring. This has become more important with increasing automation of systems. Remote radiofrequency identification (RFI) tagging has substantially improved consignment tracking.

Other areas of innovation and expertise are:

- fire detection and response
- remote monitoring and detection for tunnels, railyards, tracks and unattended or secure locations
- video surveillance and analysis
- train schedule monitoring
- track maintenance and detection of damage or obstructions
- railway crossing management and detection of objects on the line
- detection and recognition of overspeeding
- detection of objects protruding from moving freight trains.
Australian company Aurizon is a leader in bulk freight, logistics and infrastructure solutions. Every day, Aurizon moves thousands of tonnes of coal, iron ore and other minerals as well as agricultural and general freight around the country, including more than 500,000 tonnes of coal each day bound for international markets such as Japan, China, India, South Korea and Taiwan. It is one of the world's largest rail transporters of metallurgical coal from mines to ports for export markets.

Aurizon operates and manages the Central Queensland Coal Network, the largest export coal rail network in Australia, comprised of 2670 km of heavy haul rail infrastructure. The system schedules scores of train movements daily in a logistics process that transports coal from the loaders at the mines to the conveyor systems for ship loading at major export ports.

As well as coal, Aurizon is Australia's largest haulier of iron ore outside the Pilbara region and is an integral supply chain partner, with customers exporting through three major ports on the west coast.

With a national rail network covering all major states and with 40 distribution centres across Australia, Aurizon's intermodal business provides vertically integrated rail and road solutions. It also has a network of regional maintenance depots and heavy maintenance workshops to deliver all aspects of rollingstock maintenance.
Trimble has the plan for project success

Case study: alignment planning software

Identifying the best corridor and ultimately the right alignment for transport projects can make a big difference to their cost and overall viability. Software developed in Australia is helping planners and engineers find optimised alignments quickly and economically while addressing social and environmental considerations.

Created in the 1980s by the Australian Government as a CSIRO research project and commercialised in 2000, The Trimble® Quantm® alignment planning system was quickly adopted by governments and private companies around the world. In 2006 Quantm was purchased by navigation and positioning technology specialists Trimble, who established the Melbourne-based Trimble Planning Solutions Pty Ltd.

The result of a unique mathematical algorithm, Quantm enables the project team to analyse alignment options efficiently while also considering client, agency, stakeholder and community needs and concerns. Where a benchmark alignment is available, Quantm has also enabled government planning departments, engineering consultants and civil contractors alike to identify significant capital construction cost savings and reduce long term operating costs.

Fortescue Metals Group in Western Australia used Quantm to minimise environmental impacts and maintenance costs for a 280 km open-access, heavy-haulage railway, completing the project in just nine months.

Quantm has been chosen by many governments and private companies for planning major infrastructure projects, including high-speed rail, regional rail and freight rail, in Australia, New Zealand, the US, Canada, Mexico, India, China, Portugal, Brazil, Malaysia, Indonesia, Mongolia and Russia. The technology has also been used on a broad range of road and highway projects, including mine haul roads.
ENGINEERING
Short project timelines have seen the Australian engineering sector implement modern methods of survey and drafting that work together with contractors who may be appointed at the same time or in cooperation with the engineering organisations. Engineering, Procurement and Construction Management (EPCM) combines the two activities.

Delivering projects to timelines and accuracy of engineering requires layering of activities and high levels of communication between engineers, drafters, contractors, material suppliers and clients.

Methods used to improve project timelines, functional outcomes and environmental targets are:

- LIDAR (Laser) survey for 2mm accuracy
- GIS (Geographic Information System) for information layering
- BIM (Building Information Management) for 3-D representation of structures and interface of railway with loading/unloading facilities
- on-site testing and commissioning with GPR (Ground Penetrating Radar) and on-site validation tools
- engineering software permitting interactive ‘mark-up’ facilities
- use of global resources placed in other countries permitting same day turnaround.
Resource and intermodal projects need fast response times in order to meet financial targets. For this reason, commercial projects may be required to meet faster implementation timelines than similar-sized government social projects.

The boom in Australian resource development has stimulated miners, engineering and construction companies to look for new ways to improve the delivery timeframes without incurring additional costs or risk. Australian engineering and construction companies have developed new and unique methods and expertise in the implementation of contractual engagement by using:

- EPCM (Engineering, Procurement and Construction Management)
- ECI (Early Contractor Involvement)
- Double ECI (Competitive Tender ECI)
- PPP (Public Private Partnership)
- Equity Participation
- BOOT (Build Own Operate Transfer)

These methods provide opportunities to distribute risk and rewards fairly throughout the partnership and has led to many examples where all parties have been able to benefit from expedited project delivery.
Track IQ technology keeps ore trains on the move

Case study: wayside monitoring technology

Australian firm Trackside Intelligence Pty Ltd (Track IQ) is building a global reputation as a specialist manufacturer and supplier of wayside detection equipment to the railway industry.

Reliability is vital in remote mining operations, and in the Pilbara district, all major mining companies rely on a technology developed by Track IQ for acoustic monitoring of railway wheel bearings, the Railway Bearing Acoustic Monitor (RailBAM). RailBAM can detect and monitor bearing faults in heavy haul wagons at speeds of 25-160 km/hr, minimising expensive delays associated with vehicle setouts when bearing failures are detected by traditional thermal monitoring systems.

Other Track IQ sensor systems include:

- Wheel Condition Monitor (WCM), a trackside system that can detect wheel spalls, shelling, surface roughness and long period defects
- RailSQAD (Railway Squeal Acoustic Detection System), an acoustic array system that measures wheel speed and direction and wagon identification AEI tags, uses advanced signal processing techniques to follow individual wheelsets of a train and records and analyses the noise emitted by wheel/rail interaction
- PhotoTag, a wayside high-speed camera that captures vehicle identification during pass by without the need for RFID vehicle tagging.

Track IQ also works with other industry specialists to integrate a wide range of wayside sensors (such as bogie geometry, wheel profile and brake wear sensors) into asset monitoring ‘Supersites’ where sensor data is integrated into the Track IQ-developed FleetONE database, allowing the system owner to perform scheduled condition monitoring reporting, fleet analysis and repair scheduling.

Currently Track IQ has over 120 systems installed worldwide.

Image courtesy of Track IQ
SMEC builds success in Bangladesh

Case study: infrastructure and engineering

With over 30 years of experience in railway engineering consultancy services, Australian company SMEC has undertaken a range of projects from the design of new routes for urban, main line and provincial railway networks to the rehabilitation and maintenance of existing routes.

SMEC focuses on the practical application of advanced technologies to provide innovative, cost-effective and appropriate solutions. The company also has significant experience in the delivery of large infrastructure projects using Design and Construct, Private Public Partnerships and Alliance delivery models.

In late 2011, SMEC was the lead consultant and engineer for the Tongi-Bhairab Bazar Double Line Project in Bangladesh, which involved the construction of 64 km of main line and 22 km of loops and sidings, widening of embankment and construction of new embankment for bridge approaches alongside the existing operating main line. The new embankment of more than 2 million cubic metres is intended to accommodate future broad gauge (BG) tracks. Geotechnical investigations undertaken identified unstable foundation conditions over 20 km of the length requiring specific soft ground treatment including PVD and sand piles to be undertaken during embankment construction.

SMEC provided the Project Manager (Engineer) as well as specialists in railway design, bridge design and construction, geotechnical matters (including review of the contractor’s geotechnical investigations and soft ground treatment designs), track and signalling works.

With 5000 employees worldwide, SMEC operates from an established network of more than 70 offices in Australia, Asia, the Middle East, Africa and North and South America.
CONSTRUCTION AND CONSTRUCTION MANAGEMENT

Influenced by the vast number of resource based projects, railway construction in Australia has modified its approach in many ways to improve environmental outcomes, reduce cost, reduce risk and implement projects faster. The techniques now used to balance these goals are global best practice.

Construction starts with design, but also includes the correct use of machinery and making the best possible use of materials at hand.

The Australian construction industry now utilises:

- LIDAR (Laser) aerial surveying for accurate knowledge and control of cut and fill requirements
- alignment designs capable of taking into account available materials for construction
- mobile crushing plants and materials handling
- prefabricated solutions for structures
- Procurement and Construction Management (PCM) and other ‘fast implementation’ contract techniques
- ‘best for project’ fly-in fly-out workforces
- cooperative and flexible partnering approaches based on relative strengths and capabilities.
ENVIRONMENTAL SUSTAINABILITY

Australia is justifiably proud of its record on environmental sustainability when it comes to project management and railway development.

The sustainability equation starts at the beginning of a project and carries through design, construction and operation.

Australian railway construction companies have now achieved close to zero impact on the landform footprint with the use of material recycling and reprocessing, construction of fauna natural habitat and water management.

Design plays a major role in the achievement of these goals: not only the design of the finished product, but also for temporary works during construction and use of materials.

Design and construction principles have been shaped by the awareness that 30 to 50 years of operation will follow the construction, so that the effect of the operation on the environment is likely to be higher than that of construction alone.

Australian companies have used design, construction and operation principles such as:

• alignment optimisation for minimisation of corridor footprint on environmentally sensitive areas
• alignment optimisation for minimisation of fuel in balance with other potential ‘pollutants’
• waterway design to promote natural flow through greater use of culverts and ‘wet areas’
• use of all available materials by the addition of ‘enhancers’ where usually understrength
• positioning of precasting and manufacturing locations to reduce transport footprint
• containment provisions for chemicals and other polluting materials
• zero spillage, zero overfill fuel management and transfer systems
• ‘off-set’ creation for instances of last resort
• end of lifecycle planning, including restoration
• waste minimisation, energy and water saving technologies and practices in rail network operations and maintenance.
IRT reduces the burden of track maintenance

Case study: remote monitoring

A novel approach to track condition assessment developed by Monash University’s Institute of Railway Technology (IRT) is reducing downtime for heavy haul operators in Australia and internationally.

Conventional assessment involves using a dedicated track recording vehicle to travel along the line, which means assessments must be fitted in to busy rail schedules and around the availability of recording vehicles. It also requires additional processing of results to take into account the different effects of a comparatively light recording vehicle and a fully loaded heavy haul train travelling at speed on the same track.

Developed in 2002, the IRT’s Instrumented Ore Car (IOC) overcomes many of these limitations. It is a standard track car, fitted with custom-designed instrumentation and data collection systems, which can be integrated into ore trains running on the regular schedule. Track condition data is recorded continuously while the vehicles are in operation and transmitted back to a central base at the IRT facilities at Monash University’s Clayton campus for processing and reporting once the vehicles are in mobile phone range.

Having engineered the IOC for operation in remote and harsh environments, solving challenges such as power supply and the need to withstand loading and unloading movements, the IRT is now supplying its technology around the world. There are now 70 IOCs in operation, including three in Brazil which are used by iron ore miner Vale on the major Estrada Ferro Carajás and Vitória a Minas railroads.

Image courtesy of IRT
CSIRO is helping haul transport into the future

Case study: planning and simulation

CSIRO research is helping mining and freight companies plan for the future as well as optimising their current operations.

The Infrastructure Futures Analysis Platform (IFAP), a GIS-based freight transport network optimisation tool co-developed by CSIRO and the Queensland government, uniquely combines layers of maps with a mathematical optimiser and allows planners to determine the infrastructure needed to ensure efficient, cost-effective transport from mines to port and processors up to 25 years ahead.

Other CSIRO freight planning platforms include long-term capacity planning modules. These are used by the Hunter Valley Coal Chain Coordinator (HVCCC) to select future assets. They also drive simulation studies of whole-of-chain future performance, with options for modelling inland coal terminals, stockyard expansions, rail duplications, inloader/outloader upgrades.

CSIRO research into rollingstock and materials handling design has produced innovative physical simulation platforms that account for particles, fluid flow and free surfaces. These have been applied to coal hopper wagon designs to evaluate unloading times and identify optimal rail wagon designs vehicle designs based on discharge time and transient stress loading of the wagon walls. Discharge time depends on coal flowability, which is a complex function of particle size and shape distributions, material properties and cohesive forces in wet coal.

The same technologies have been applied to material handling equipment that is integral to bulk rail infrastructure such as conveyors, chutes, hoppers, reclaimers, dump stations and silos.

Image courtesy of CSIRO
ABOVE-RAIL SYSTEMS

Most resources and railway logistics chains in Australia have been developed in remote regions where there is little access to maintenance and repair services. As a result, the workshop repair facilities created in these locations have had to be highly self-sufficient and they rely on highly reliable and maintainable equipment. Australia is a world leader in the management of its above-rail assets, locomotives, wagons and asset protection (bearing, wheel, dragging equipment and flood detection) equipment.

Management of above-rail systems is highly dependent on the asset management methods used and also on innovation in areas like condition monitoring and repair equipment. Australian companies have developed a number of innovative methods and products to support its asset management principles and the operation of above-rail assets such as:

- driver support fuel optimisation software
- CBCT (Communications Based Train Control) for freight train application
- lightweight heavy axle load ore cars (40 tonne axle load) design
- driver relay methods, reducing train stop requirements
- aerodynamic ore car design
- ECP (Electronic Controller Brake) implementation
- robotic and automated wheel, axle and wagon repair
- combined ‘hot bearing’, ‘hot wheel’, ‘flat wheel’, ‘angle of attack’ and ‘sonic signature’ technology
- network scheduling optimisation.
OPERATIONS AND MAINTENANCE

Australian companies offer solutions for all aspects of heavy haul rail operations and maintenance, plus innovative technologies for extending the life of rail lines, rolling stock and equipment.

In operations, Australian companies have optimised fuel consumption, improved reliability in supply chains and reduced maintenance costs in harsh and remote environments to improve cost competitiveness.

Some examples of Australian expertise in this area are:

• operations simulation, network scheduling and capacity improvement
• driver related human factors analysis and implementation including drug and alcohol and fatigue avoidance
• information systems for customers including operations control transparency in multi-operator environments
• signalling systems design and manufacturing
• railway workshop equipment, such as lathes, wheel and bearing presses, drop tables, and test equipment
• workshop automation enabling high productivity and improved safety
• rail welding, repair and profiling equipment and training
• extending rail life with rebuilding, repairing and recycling technologies
• wagon weighing technologies, including high speed in-motion systems
• highly accurate, zero spillage fuel management and transfer systems with flow rates of up to 1000 litres per minute
• wheel and wheel bearing condition monitoring systems
• wayside sensor systems that can measure the operating condition of rail vehicles
• innovative track monitoring and inspection systems and solutions using ultrasound, eddy currents, thermal imaging, video-optical, mechanical and electronic technologies.
ATTAR brings inspection technology up to speed

Case study: automated inspection and maintenance

Australian company ATTAR has developed an automated process for rail vehicle component inspection that delivers accurate flaw detection and measurement of residual stresses in an entire rail wheel set in just eight minutes.

Non Destructive Testing (NDT) has been a crucial part of the rail industry since its inception. With increased rail traffic at higher speeds and with heavier axle loads today, critical crack sizes are shrinking, while efficiency and access to historical information are becoming more important.

As well as time savings, automated inspection of components offers the benefits of accurate, repeatable collection of data that can be analysed, evaluated and categorised according to set criteria. Using Phased Array Ultrasonics and EMAT (ElectroMagnetic Acoustic Transducers), ATTAR developed an accurate and repeatable means to identify components that do not meet established criteria for Atlas Rail, an Australian supplier of high quality machine tools and engineering services to the rail industry.

Designed by ATTAR and built by Atlas (a division of Marand Precision Engineering), the new Wheel Qualifying Machine (WQM), is expected to run for 20 years. Fully automated and operator-configurable, the WQM can run in full cycle, individual testing or manual modes. Integrating accurate measurements into systems allows rail maintenance planners to move to condition maintenance, which in turn helps optimise asset availability while reducing costs. The WQM is now part of Atlas Rail’s product range and is currently in operation at BHP’s facilities in Port Hedland.

Image courtesy of ATTAR
No slowing down for Meridian

Case study: train loading and in-motion weighing technology

Reliable train loading systems and accurate weighbridges are essential for mining operations, and Australian consultancy Meridian Engineers is producing state-of-the-art systems that combine high-speed performance with international legal trade accuracy standards.

Its Train Loading Improvement System (TLIS) controls in real time the loading of wagons to better than 1 per cent tolerance. Because operators can be confident that the wagons will be loaded to an accurate level, in some cases it has allowed them to bring in larger wagons as authorities had confidence they would be loaded accurately and comply with the stringent local rail infrastructure limits on wagon loads.

Its in-motion train weighing systems can weigh ore, freight and passenger trains from 0-100 km/h and in excess of 300 wagons length with multiple locomotives, with legal-for-trade accuracy better than 0.5 per cent.

Major mining company BHP Billiton’s BHPBIO high-speed train weighbridges at Port Hedland and Newman (Western Australia) weigh 30000 tonne trains on the move at speeds up to 80 km/h. Project requirements included the capacity to handle thousands of trains each year (equating to millions of wheel crossings) without any operator input, to withstand extreme environmental conditions (cyclones, frequent lightning strikes and ambient temperatures up to 50° C) and achieve 99.9 per cent availability. The system also needed to comply with international legal trade accuracy requirements. Meridian Engineers is one of the few companies in the world with the skills and technology to have achieved these results.
ASSET MANAGEMENT

Asset management begins with good design and construction, but extends throughout the 30 to 50 year life of a project to optimise the performance and cost of the railway and its mining venture or intermodal distribution network.

RAMS (Reliability, Availability, Maintainability and Safety) discipline is used to deliver the outcomes needed from the mine or logistics chain while at the same time minimising costs over the full life of the project.

Asset management requires a whole-workplace culture that looks to the future and training of all levels of management.

Railways have a special place in most pit-to-port or logistics supply chains because they are the longest and most vulnerable arm. A railway has no easy ‘bypass’ available if it is not working.

Methods used for effective asset management in Australia’s railways have included:

• ‘design to completion’ mentality, involving training and reinforcement from all levels of management
• ‘management by measurement’ approach
• condition monitoring
• condition-based maintenance
• failure analysis and mitigation strategy
• cost implication analysis
• work order-based maintenance and project controls
• sophisticated fuel management and transfer systems.
The following table provides some examples of companies and their capabilities.

Contact your local Austrade representative for assistance with connecting with the Australian businesses that best suit your requirements.

[austrade.gov.au]
<table>
<thead>
<tr>
<th>Company name</th>
<th>Provides advice/consulting</th>
<th>Supplies product, technology or service</th>
<th>Conducts research</th>
<th>Provides training or education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldridge Railway Signals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Turntable Company</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abigroup Contractors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aurecon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aurizon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austrak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australasian Transport Risk Solutions (ATRS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banlaw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery Energy Power Solutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bradken</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibre Global</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.A.T.E.R.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre for Railway Engineering, CQU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre for Excellence in Rail Training, (CERT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffey Geotechnics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comsteel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQUUniversity and Train@CQUUniversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company name</td>
<td>Operations and maintenance, asset management</td>
<td>Planning and design, engineering and architecture</td>
<td>Training, education and personnel</td>
<td>Signalling</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>CRC for Rail Innovation</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>C.S.I.R.O.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Gemco Rail</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>GHD</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Hardface Technologies</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>HMA Techniplan</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Inspired Systems</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Institute of Railway Technology (IRT)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>International Transport Training &amp; Development</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>JD Rail</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>John Holland</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Laing O'Rourke</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>MRX Technologies</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Keech Australia</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Marand (Atlas Rail)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Melvelle Equipment Corp</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Meridian Engineers</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Company name</td>
<td>Operations and maintenance</td>
<td>Planning and design</td>
<td>Training, education and personnel</td>
<td>Signalling</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
<td>-----------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>OEM Technology Solutions</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUT</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Rail Personnel</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Rail Skills Australasia</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Sedgman</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Sinclair Knight Merz</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SMEC</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SolveIT Software</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>TAFE NSW</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>TSG Consulting</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Trackside Intelligence</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Trakblaze Global</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Trimble Planning Solutions</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>TTG Transportation Technology</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>UGL</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>University of Wollongong</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>WorleyParsons</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
HEAVY HAUL, INTERMODAL AND FREIGHT RAIL

The following are some of the government and industry bodies involved in the Australian heavy haul and freight rail industry.

Contact your local Austrade representative about connecting and partnering with the Australian heavy haul and freight rail industry.

Contact your local Austrade representative about connecting and partnering with the Australian heavy haul and freight rail industry.

The Australian Railway Association (ARA) is a not-for-profit member-based association that represents passenger, freight, track, construction, supply and other rail companies across Australia and New Zealand. ARA.net.au

The Industry Capability Network (ICN) is a business network for Australian and New Zealand companies. The ICN Rail Directory is an Australian government initiative to help link buyers and suppliers of products and services. rail.icn.org.au

The Rail Supplier Advocate is part of the Australian Industry Participation Plan run by the Department of Industry. Rail Supplier Advocate. Innovation.gov.au/Industry/AustralianIndustryParticipation/SupplierAdvocates/Pages/RailSupplierAdvocate.aspx

Rail Skills Australasia is a not-for-profit industry body that provides workforce education and training advice across the rail industry. rsa.org.au

Plan run by the Department of Industry and works to raise competitiveness of Australian rail suppliers, promote capabilities and link suppliers to customers. innovation.gov.au/Industry/AustralianIndustryParticipation/SupplierAdvocates/Pages/RailSupplierAdvocate.aspx

Further Information

Contact your local Austrade representative about connecting and partnering with the Australian heavy haul and freight rail industry.
The Australian Trade Commission – Austrade – is the Australian Government’s trade, investment and education promotion agency.

Through a global network of offices, Austrade assists Australian companies to grow their international business, attracts productive foreign direct investment into Australia and promotes Australia’s education sector internationally.

Austrade helps companies around the world to source Australian goods and services. We can help you reduce the time, risk and cost involved in sourcing suppliers by:

• helping you identify and contact Australian suppliers
• providing insight on Australian capabilities
• alerting you to the latest products and services out of Australia to help you grow your business.

Austrade partners the strengths of Australian businesses with the needs of international markets. We can open the door to a world of opportunities for your business.

austrade.gov.au