

June 2018

[View this email in your browser](#)



ACRI Rail Knowledge Bank Update.

Brought to you by the Australian Road Research Board.

Themed Issue: AusRAIL PLUS 2017

A selection of papers is below. To view all papers from the conference:

Click Browse - Rail Knowledge Bank conferences\ARAAusRAIL PLUS 2017\Papers

[An analysis of the viability of upgrading the Aurizon Central Queensland coal network \(cqcn\) from 26.5t to 30.0t axle load](#)

Smith, A

This paper will describe the engineering and financial analysis process undertaken by Aurizon Network to determine if the benefits associated with higher efficiency of trains would be sufficient to offset the capital and operational costs associated with an upgrade of axle load.

[View item](#)

[Asset management – tailoring maintenance to deliver business efficiency](#)

Rabson, D

With the recent issue of the new ISO 55001 standard, asset management is back on the agenda for much of the rail industry. However, there is a risk that with the drive to demonstrate conformance comes the practice of asset management as a bottom-up exercise developed to obtain certification rather than maintaining focus on what should be the intended goal – to ensure assets are delivering value and driving business improvement. This paper intends to provide an insight into this business-led view of asset management, with a focus on Strategic Asset Management (SAM).

[View item](#)

Digital advances in monitoring and planning for natural hazards along networks and remote track sections

Eisenbach, S; Palmer, C

The monitoring of natural hazards and critical meteorological conditions can be a challenge, particularly in large countries with long track sections through uninhabited areas. Using new approaches from meteorology and big data analysis allows for significantly improved monitoring and planning for an entire network, including real time monitoring of remote track sections. The Institute for Ubiquitous Meteorology has developed a special analysis method for the realtime monitoring of rail networks using all available data. This method has already been adopted by European national railway infrastructure companies and has now been adapted for the special requirements and natural hazards of Australia.

[View item](#)

Digital track occupancy authorities for staff working on track

Hjort, G; Hope, B

Two of the biggest risks with work on track activities are location assurance and the reliance on verbal communication to transfer safety critical information. Over the last five years, there have been a number of safeworking incidents in which these elements have been identified as a primary causal factor. Despite this, work-on-track procedures remain largely administrative and are almost entirely dependent on voice communication for information exchanges. The introduction of modern technology specifically targeting the safety and efficiency of work-on-track is unusual, despite most recent deaths in the Australian rail industry being the result of work-on-track procedural failures. This trend has now been halted and through the application of smart phone technology a new generation of work-on-track safety and efficiency has now begun.

[View item](#)

Future railway radiocommunications

Maton, C; Pushparatnam, L; Nham, V

Telecommunications technologies have a relatively short lifespan. Current track-to-train radio technologies, such as Global System for Mobile Communications-Rail (GSM-R), will need to be renewed over the coming years. As GSM-R technology is based on 2G radio mobile technology and there is a clear need to identify evolution due to obsolescence and other requirements. Successor(s) is (are) required starting from 2022 for first implementation to 2030, when support for GSM-R is expected to cease. Until now

European Train Control System (ETCS) and railway-specific voice services such as functional numbering, location dependent addressing, railway emergency calls, group call and call priority depend on GSM-R technology. In the future, ETCS and voice services are likely to become bearer independent so that they may work with a variety of other radio technologies (4G/5G, Wi-Fi, satellite).

[View item](#)

Hands-free pay-as-you-go fare collection system with rapid boarding and seamless transfers for smartcard and smartphone users

Kley, J

This paper presents an electronic ticketing system capable of operating in Be-In/Be-Out (BIBO) fashion to register passengers in real time as they travel across modalities through a public transport system. In a novel hybrid system approach, different user media can be utilised by passengers within a single system for presence detection in the transit system. The system facilitates rapid boarding and seamless transfers by removing access barriers present in conventional systems and provides a cost-effective and precise calculation of journeys travelled. This data further provides real-time vehicle load levels and can be utilised for passenger counting and passenger flow analysis in a transit system.

[View item](#)

How digital technology has revolutionised train control - Australian case study

Fenzi, L et al

Digital Technology has had a major impact on Train Control and Signalling systems, delivering a number of benefits in economic and operational efficiencies, and - significantly - in terms of the increased safety it delivers to track-based workers. Ansaldo STS has developed the world's first digitally-based turnkey railway signalling and communications solution currently under delivery at the Roy Hill Mine in Australia's remote Pilbara region in north-west Western Australia. Additionally it has improved the safe working system with Vital Train Order management (VBTO) and Protection for Wayside Workers (Possession Management System).

[View item](#)

The identification, treatment and use of expansive soils in railway construction

Bridges, C

Expansive clays are highly reactive clays which are subject to shrinkage and swelling with

change In moisture condition. The surface of the clay is known to desiccate and crack on drying. On the surface of slopes it is subject to weathering which can result in rutting and tunnelling erosion. As a subgrade material, the compacted soil will be strong and stiff when placed, but can swell and soften upon water ingress. Hence, expansive clays are typically avoided in earthworks construction. In some regions, however, access to good quality fill material may be difficult due to distance and/or cost and it is preferred that locally available material is used where possible. This paper will present methods of treating and using expansive soils in earthworks fills in order to reduce costs and environmental impacts of large scale earthmoving operations for constructing rail lines.

[View item](#)

The mobile maintenance system

Keens, A

The Mobile Maintenance System (MMS) is a self-sufficient track maintenance “workshop on wheels”. An engineering train with the capability to deliver labour, plant power and materials direct to the site of work. Its unique design allows the workforce direct access to the track, offering a well illuminated, safely enclosed working environment, protected from the weather and the passage of trains on adjacent lines. With the opportunity to work under live overhead line, with the adjacent line open and train in section, the MMS enables rapid work deployment in the most difficult of track locations.

[View item](#)

The network modelling, timetabling and fuel saving computer programs on the market

Fox, I

There are numerous computer programs on the Australian and international market for modelling railway operations, calculating train performance, calculating signal headways, creating timetables, and advising drivers on how to save energy or fuel. There is often a lot of overlap between these programs: sometimes two different programs designed to do different tasks end up using the same methodology, sometimes two different programs designed for different tasks have overlap in their output, and sometimes programs which were designed to do one task evolve into doing other tasks. This paper has been written to provide a brief overview of the some of the main computer programs on the market and what they can do, including TRIMS, Viriato, OpenTrack, Vampire, Universal Mechanism, TPAT, LEADER, EnergyMiser, RailSys, Sketch, Trip Optimizer, to name a few.

[View item](#)

Optimising mainline passenger rail with communication-based signalling

Atchison, B; Hammond, D

This paper describes the application of communication-based signalling to improve mainline passenger rail capacity. The application of European Train Control System (ETCS) is proposed to use in-cab signalling to safely reduce conventional signalling headway. Automatic Train Operation (ATO) is presented to ensure train running-time consistency. Traffic Management System (TMS) is introduced to maintain optimal traffic flow. The integration of all technologies provides real-time optimisation of network traffic. The integrated application of ETCS, ATO and TMS is illustrated using the Thameslink project where the capacity of the Thameslink Core is targeted for increase to 24 trains per hour (tph) in each direction, during peak times. One of the first such deployments, the project illustrates the potential advantages gained and implementation challenges to be faced.

[View item](#)

Practical application of AS 7470:2016 human factors integration in engineering design – general requirements

Hughes, GJ

In November 2016 RISSB published the new standard "AS7470:2016 Human factors Integration in Engineering Design – General Requirements". One of the aims of the standard is to improve the recognition of the application of human factors integration (HFI) during the design process as a tool to improve the effectiveness and efficiency of systems in addition to the more widely accepted benefits for safety. The standard was written in such a way as to be applied by both specialists and non-human factors specialists as a starting point for HFI within the design process. The content was derived from an existing human factors standard developed by the Asset Standards Authority (ASA) in collaboration with the NSW transport industry in 2014. A wider engagement process was facilitated through the Rail Industry Safety and Standards board (RISSB) to review; the existing document from a national perspective, identify any gaps or further material required and to account for industry experience in its application. It provides a scalable and practical approach to human factors integration that enables both HF specialists and non specialists to deliver effective human factors integration into a wide range of projects. Specifically for non human factors specialists it provides an appropriate starting point to determine the HFI requirements for a project and to enable decisions about the level of human factors expertise that may be required.

[View item](#)

Reducing failures in turnouts through automated inspection – dynamically and under load

Nottelmann, M; Santanera, C

Switches and Crossings are key track features, yet they are also key failure points. To avoid service interruptions, railways regularly inspect switches using trained crews and special hand tools including gauges and molds. However, even with regular inspections of switches and crossings, derailments on switches happen all too frequently, resulting in lost revenue, damage to assets, service disruptions, injuries and worse. A change in the inspection paradigm is needed that allows the inspection of switches in a dynamic rather than static manner in real-life conditions, i.e. under load on a moving vehicle that stresses switches in the same way a train does. A comparison of measurement results confirms that the difference between unloaded/static measurements and loaded/dynamic measurements is significant. In fact, differences can be so large that a switch deemed satisfactory in a static test can be classified as in urgent need of maintenance under a dynamic test.

[View item](#)

Standardisation of minimal data collection for condition monitoring and performance management in the Australian rail industry

Lezala, A

SNC-Lavalin believes there is a strong case for introducing standardisation of condition monitoring and performance data collection in the Australian rail industry. The motivation behind this topic is that it is pertinent in the current market. The developments in technology, along with the increased need for more cost effective operations and maintenance, has led to a recent surge in interest towards data collection and more informed decision making. This has been accelerated by the introduction of ISO55001 in 2014. The benefits which data collection could bring to our industry are broad and significant; from increased safety through condition awareness to increased efficiency in maintenance and operations. Standardised data collection allows for a common language to be developed within the industry, facilitating collaboration and reducing process inefficiencies. This has been demonstrated in the UK by the Rail Delivery Group (RDG) and in the petroleum, petrochemical and natural gas industries with the introduction of ISO14224 - Collection and exchange of reliability and maintenance data for equipment. Many stakeholders are working individually to generate their own data and create solutions for condition monitoring. There is not yet a joint effort across the Australian industry to work together and speed up the advancements. Incentivisation by industry leadership is required to encourage collaborative behaviour for the benefit of the industry as a whole.

[View item](#)

Train to wayside information systems

White, J et al

With modern trains now using an Ethernet backbone to connect subsystems, linking the train network to the wayside enables a range of potential features. For new projects, this typically includes remote CCTV live-viewing & footage downloads, route and infotainment database updates, automatic reporting of passenger counting data, periodic uploads of event recorder data and vehicle faults logs, remote triggered PA announcements, Passenger Wi-Fi, monitoring of train configuration, real-time train status and position monitoring and integration of wayside vehicle inspection systems data (brake pad/wheel wear/graffiti monitoring/pantograph profile) with vehicle fault and condition reports. While the on-board and wayside equipment for cellular and Wi-Fi links are now off-the-shelf products, the software requires significant project-specific development. The development activity tends to be complex and must encompass the Operator & Maintainer requirements, train safety requirements, and, integration between the OEMs of the train subsystems, on-board train control, wayside servers and wayside clients. An efficient way of providing this level of integration is to have a common train-to-wayside communications framework which may be adapted to specific customer requirements and yet still allow significant reuse of software to support a compact development schedule.

[View item](#)

Use of 3D scanning in heritage rail tunnel condition assessments

Howe, S et al

Traditional asset risk monitoring and condition assessment techniques in rail tunnels typically use visual assessments and material sampling and testing techniques including non-destructive testing (NDT). The usefulness of these techniques can be augmented with the use of 3D-scanning surveys and associated 3D modelling and analysis. In recent years, SMEC has successfully trialled the use such techniques in brick-lined rail tunnels up to 140 years old. By use of advanced modelling techniques, the scan data can be used to create as-built design plans where none exist, monitor risks and develop detailed defect maps which can be used for comparative studies, estimates of remaining life and failure risk and for scoping remedial works. Examples are presented of data cloud modelling outputs in heritage-listed rail tunnels in Victoria including the generation of tunnel cross sections, comparisons to design profiles and the generation of defect 'heat maps' which show the locations and severity of asset defects and tunnel deformations.

[View item](#)

The Rail Knowledge Bank is supported by ACRI and ARRB.

Developed and maintained by the [Australian Road Research Board \(ARRB\)](#) under the [National Interest Services \(NIS\) program](#), the Australasian Centre for Rail Innovation (ACRI) Rail Knowledge Bank is a managed online resource for the rail industry. It gratefully acknowledges the support of rail sector bodies including the RTSA. The Rail Knowledge Bank was originally funded by the CRC for Rail Innovation.

For more information, visit the ACRI website at acri.net.au or [click here](#) to visit the Rail Knowledge Bank page directly.

[National Interest Services supporting an informed land transport community](#)

New to the ACRI Rail Knowledge Bank?

If you would like your name/organisation added to the ACRI Rail Knowledge Bank alert list, simply email rail@arrb.com.au with your request.

Disclaimer

ACRI and the Australian Road Research Board (ARRB) accept no responsibility for the content of any website link provided in this alert. Inclusion of a website link in this email does not imply any endorsement of website content by ARRB or ACRI, or a statement by ARRB or ACRI on the accuracy of any material a linked website may display.

See the [Rail Knowledge Bank Charter](#) for more information on its objectives and resource coverage.
