RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

FASTTRACK

THE NEWSLETTER OF THE HORIZONS PROGRAM I APRIL 2021

INSIDE THIS ISSUE – *Achieving seamless customer experiences*

Kicking off the first Fastrack newsletter for the 2021 Horizons 3.0 program, the authors explored technology and new initiatives that provide seamless customer experiences. Railways can't operate in a vacuum and must continue to meet changing demands of customers that expect more in terms of information and innovation.

Read on for a discussion on:

- interoperability of railways in Australia;
- the maturity of open data exchange and management practices;
- augmented reality technology that enables quick service interchanges;
- mobility-as-a-service and what it means for operators and future customer journey planning; and
- the integration of electronic track work authorities and 360-degree cameras and how these improve safety for customers.

A customer's seamless journey

For years, passengers have been able to travel seamlessly throughout countries in Europe. Yet, Australians have not had the opportunity to travel seamlessly throughout each state and territory.

Like other continents, each jurisdiction has a different rail operating system. So what exactly is interoperability?

Interoperability, defined by The Railways (Interoperability) (High-Speed) Regulations 2002, is the ability of the different rail systems to allow the safe and uninterrupted movement of rolling stock.

Harmonisation

The benefits of interoperability to passengers is invaluable. By introducing interoperability in Australia, passengers can seamlessly travel not only interstate, but even intrastate. Even in one state alone, there are multiple railway operating systems including freight lines. So by allowing interoperability, limitations and constraints on the network are eased.

Safety

Australia has the Rail Safety National Law (RSNL) which Rail Transport Operators (RTOs) have a duty to fulfil their safety obligations. However, Interoperability also brings added level of safety to customers. Across Australia, there are numerous Rail Infrastructure Managers (RIM) and each time a RIM implements new or alters their rail infrastructure, they comply with a set of technical standards. Across different jurisdictions, these technical standards will differ. As interoperability involves harmonisation of the differing railway systems, it also promotes the use of open standards to allowing states and jurisdiction to have a co-operative approach to safety.

Cost Savings

It was found that rail costs within Australia vary. In particular, interstate project expenditure and training, was found to be two and half more times than international competitors for fleet procurement. One of the contributing factors for this escalated cost is the lack of interoperability of railway operating systems in Australia. Taxpayers, also rail customers, would benefit from these cost savings if full interoperability was implemented.

With all these benefits in mind, how can Australia make rail journeys more seamless? There is opportunity to move towards interoperability, as we continue to enhance our railways. As each jurisdiction rolls out a new project, interoperability should be considered and implemented SFAIRP.

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Network operators and open data

Knowing the customer and understanding their need

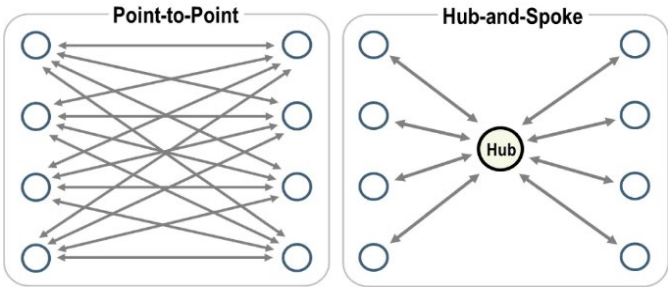
Operators of multi-use rail networks face a different sort of challenge when it comes to optimising their customer's experiences. For these types of organisations, the customer is rarely an individual, operators partner with other supply chain participants. For these customers, a streamlined experience doesn't end with the supply of network paths. It is becoming increasingly critical that operators supply accurate, timely information feeds and forecasts leading to improved supply chain visibility at all points.

This becomes increasingly important when freight or passengers move across more than one network, state, or mode. For example, NSW Trains operate services that cross multiple networks yet have a need to provide the same level of insight across all services to their passengers. Similarly, rail-haulage providers need to be able to track and report on their consignment moving throughout the journey, regardless of which network operator.

The challenging nexus of technology and innovation

Rapid technological advancement and increasing digitization in rail operations means that data can be collected, processed and shared in completely new ways than ever before, by small and large organisations alike.

When it comes to maturity of data exchange and management practices, rail lags its counterparts in other large-scale infrastructure industries such as oil and gas. The rail industry can't maximise the effective use of available rail capacity and achieve our shared goal to the reputation of rail and its desirability as a mode of transport for freight and passengers without the sharing of information in real time across these boundaries.



With many interacting organisations, the complexity quickly grows. Point to point data integrations between parties rapidly proliferates the number of interchange formats required, increasing the overhead and management burden for all parties and constraining innovation.

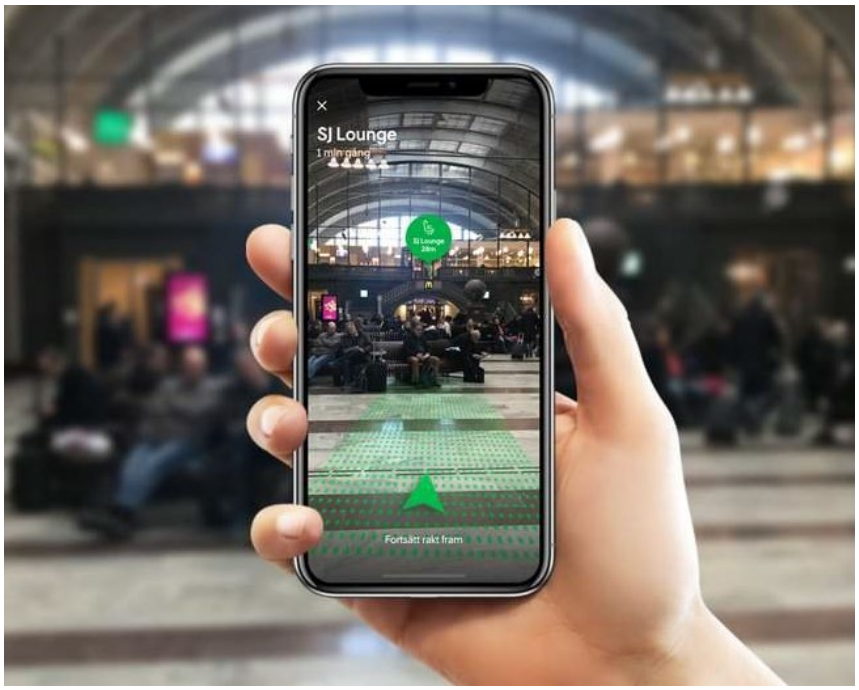
Establishing a common set of conceptual data models and interchange formats removes unnecessary complexity. Empowering organisations to focus on the implementation of technological innovations made possible by this new data ecosystem.

The Australian Government Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) has established a series of projects to improve national freight data, including the design of a National Freight Data Hub. The business case and prototype website were due to be launched at the end of 2020 or early in 2021.

In the European setting, there are several approaches and technology in various stages of advancement that could form the establishment of a standard approach to inter-organisational data sharing in Australia. The table below highlights a selection of noteworthy projects in this space.

PROJECT	DESCRIPTION
RailML	Central body that publishes an information sharing standard of elements of railway operations under an open-source model
GTFS	General Transit Feed Specification and GTFS-Realtime extension. Originated at Google and designed to integrate public transit data with Google maps. Often used for multi-modal journey planning and could be further adapted to freight movements as well.
SIRI / NeTEx	Combination of two standards, one describing the Standard Interface for Real-time Information (about public transport services and vehicles) and another describing network timetable exchange.
Smartrail Project	Broad scale initiative aiming to improve the freight rail services across European supply chain, includes a data sharing solution architecture in a similar initiative to the Australian DITRDC program
RailNet Europe	Web-based application delivering real-time train data concerning international passenger and freight trains. Data is obtained directly from the participating organisations.

Augmented reality keeps passengers moving



The movement of customers slows down as passenger numbers increase using public transport causing congestion in vehicles and stations. Main stations are particular important to enable easy and quick line inter-changes, service interchanges or transfer to other modes of transportation. The customer movement can be assessed based on passenger throughput during peak hours, quick evacuation upon incidents and access to major streets or buildings.

The passenger movement can be improved by physical changes to stations and vehicles. Simulation methods can be used to identify critical areas and develop potential measures, e.g.:

- Removal of obstacles,
- Change of moving directions of escalators,
- Installation of additional fare gates.

Further to physical changes, the implementation of augmented reality can be used to help passengers navigating in stations. Augmented reality apps can be used to help passenger find their way within station, e.g. to platforms, elevators, shops or ATMs.

The use of augmented reality apps was trialled in Sweden. After downloading the app, passengers could scan a QR code and enter their destination. The app would then show the passengers superimposed digital pointers which guide them to their destination.

Furthermore, the passenger distribution within stations can be improved with the use of such apps by guiding passengers to less congested areas and therefore improving passenger flow. Augmented reality apps can also help guiding passengers when construction periods make it harder to find the way from one platform to another.

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Downsizing the Carbon footprint in the heavy haul industry

The binding Paris agreement has led to countries take a proactive step to find every way possible to decarbonise and reach net-zero emissions by 2050. Rail transport accounts for 4.2% of global CO2 emissions, although a small contributor the industry still needs to play its part help nations achieve the targets.

There is increased pressure on companies from investors, communities, governments and customers to understand the upstream impacts or over emissions downstream is something which can no longer be a low priority.

What technologies are currently out there/being developed to help achieve these targets?

WABTEC have developed a new freight battery powered locomotive with its focus on reducing greenhouse gases. The system operates on 100% battery comprising of approximately 20,000 battery cells on board, the locomotive also utilises a trip optimizing software to improve performance and reduce energy usage. The battery electric locomotive has an energy capacity of 2,400 kilowatt hours and can run at full 4400 HP operation for 30-40 minutes. The technology to be utilised in the heavy haul operations in Western Australia may be far apart due to the energy capacity, however there is growing focus on developing battery technology to be more applicable in this context.

Hydrogen powered locomotives are being explored by various national and international organisations. The main challenges around this technology for Heavy Haul applications is that hydrogen is a less energy dense fuel and will require larger/more equipment to run in the consist to maintain the same capabilities. BNSF had trialled a hydrogen powered switcher in 2008-09 and more recently Canada Pacific have detailed plans to develop a hydrogen powered locomotive. The capacity for this to be adapted in heavy haul operations has yet to be explored.

Swedish iron ore company LKAB utilise IORE-locomotives which use kinetic energy to convert to electric power when the locomotive is using dynamic brakes. In a consist LKAB will carry 6800 tonnes of iron ore with 68 cars, very miniscule when comparing to the heavy haulers down under. The use of catenary technology in the context of long-distance heavy haul operations in Australia also proves difficult.

In 2018, the council of Australian Governments Energy council set a vision for Australia to be a global player in the hydrogen industry by 2030. Without early-stage development, Australia will fail to secure important supply relationships and market share. This in turn should encourage leading heavy haulers in Australia to help develop and innovate possible hydrogen technologies to be used in the transport of heavy haul freight.

Ticketing that keeps customers moving

From paper tickets to smart cards, mobile devices and debit cards; there are a multitude of ticketing solutions available to customers all boasting a seamless customer experience.

For those who cross city and state borders, this simply isn't the case. In my wallet, I have a Victorian 'myki' card, NSW 'opal' card and Queensland 'Go' Card. To travel on regional services in Victoria, I need a paper ticket. But to travel on the XPT to Sydney, that's another operator with different booking requirements. Simple right!

Contactless payment: making things simpler

While contactless payments offer a convenient means to pay for travel without purchasing a dedicated smart card, journey planning continues to be mode-specific (public transport vs. car vs. walking vs rideshare vs carshare.

Mobility-as-a-Service: a new way of journey planning

To provide that seamless customer experience, governments and operators around the world are now exploring the concept of Mobility-as-a-Service (MaaS).

MaaS allows customers to use whichever mobility service is the best fit or most efficient to get them from their front door to their destination, planning and paying seamlessly based on what and how much they use (Masabi, 2020).

This means you could easily plan travel from A to B, via bus, train, ferry, tram, ride share, bike share, e-bikes, car hire, taxi, on-demand public transport, electric scooter, rickshaw, Segway. More options mean more flexibility for customers, ultimately making the system more enticing for customers and providers.

MaaS also has the potential to solve a major customer pain point in deciding whether to use public transport; how do I get to the station and destination when I arrive?

What about Google maps you ask?

Google maps provides a journey planner offering multiple modes of transport. However, Google assumes only one method of transport at a time and directs the user to the relevant operator to book and pay for their journey.

MaaS would utilise both public and private operations, who would all be willing to enter into a shared accounting system in order to be paid for their share of the services provided.

MaaS in Australia

MaaS in Australia is still just an idea; the challenge from a government and operator perspective is adapting our fare systems into 'mobility subscriptions'. Data models and sharing amongst operators is also still a challenge for some operators.

A recent report produced by the iMove project, "MaaS and On-Demand Transport – Consumer Research and Report" indicates Australians have a desire for it following a recent trial in Sydney.

A six-month experiment allowed participants to use a customised app 'Tripi' to plan, book and pay for all transport services, either as a PAYG user or monthly subscriber. Four transport 'bundles' were available, ranging in price from $25 - $125 per month with some bundles offering unlimited public transport and discounts across ride share and car hire options.

The main lessons learned from this trial included:

- there was demand for subscription-based transport bundles with over 57% of participants subscribing to a 'mobility bundle' by the end of the trial.
- MaaS can achieve societal goals; well-designed and attractive subscription bundles actively reduced participants private car kilometres and increase public transport; and
- there must be financial incentives for customers; in general, they are not willing to pay for MaaS app alone. A financially sustainable model for MaaS will require cross subsidy as discounted public transport was the backbone of the offer.

MaaS examples internationally

- **Denver, USA** - Regional Transportation District (RTD) in Denver have partnered with Uber to offer customers the opportunity to combine public transport ticketing with ride share, allowing users to use the Uber app to do end to end journey planning.

- **St. Catharines, Canada** – In 2019 the St. Catharines Transit Commission launched a mobile ticketing solution that allowed customers to buy tickets through the Transit app, combining public transport with Transit's other private mobility services such as Uber, Bikeshare, Car share and more.

- **Ohio, Kentucky and Michigan** - NEORide, a joint venture between 13 transit agencies working together to launch the 'EZfare' which allows for coordinated mobile ticketing across Moovit, Transit and Uber apps.

- **Japan** – Fukuoka and Kitakyushu City, Toyota Motor and Nishi-Nippon Railroad (Nishitetsu) have launched a multi-modal smartphone mobility service called "my route" that lets users plan an outing by inputting a destination and then selecting from different routes and means of travel, including walking, buses, trains and taxis. Japan now boasts 17 other cities that have implemented MaaS mobile ticketing solutions.

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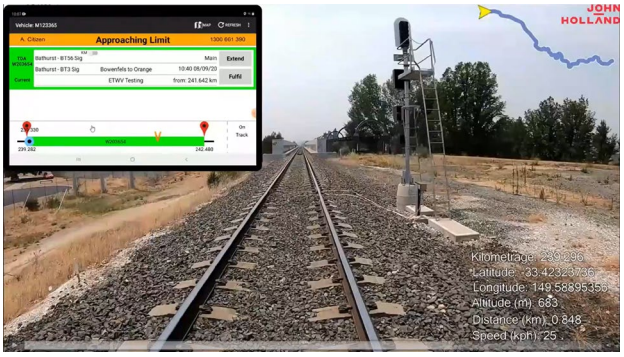
How rail safety-tech customers gain an advantage

Technology is continually evolving and iterating to support better performance and a safer environment for rail operators and maintainers, however the adoption of new technology is typically slow as innovations must be tried and tested before confidence in the technology is built. Discussed are two technologies that have been successfully integrated into existing projects to improve safety for their customers.

*Electronic Track Work Authorities for Track Vehicles (**ETW-V**) Application*

What is it?

Electronic Track Work Authorities for Track Vehicles (ETW-V) is a software application aimed at reducing the risks associated with a rail track vehicle exceeding the limit of their work authority. It is currently implemented on the Country Regional Network (CRN) in NSW.



What is the risk?

Track vehicles travel typically travel between protective limits of authority, into which other rolling stock cannot travel. A vehicle operator may overshoot their limits of protection, where they are no longer protected from the travel of other rolling stock. This can occur due to:

- a lack of visual indicators of the limits of authority;
- the speed at which at which the vehicle may be travelling; and
- the task that the operator is performing.

How is this mitigated?

The ETW-V application raises an alarm which alerts the vehicle operator when they are approaching the limits of their authority and requires acknowledgement from the vehicle operator. Should the vehicle continue past the limits of authority, another alarm is raised to alert the vehicle operator, as well as an alarm to the network operations centre, such that additional protection can be established. While this technology is already implemented for rolling stock, the solution provides hi-rail vehicle operators additional risk reduction for this hazard.

360-degree Cameras for Mobile Plant

What is it?

Advances in camera and anti-collision technologies in the automotive industry have created opportunities to integrate with mobile plant, particularly those with significant blind spots.

What is the risk?

Plant-people collision remains one of the key risks in both construction and maintenance activities. These risks are often higher in confined worksites and tunnels and when excavators or slewing machines are involved, caused by blind spots or operator / worker distractions.

How is this mitigated?

Key considerations when selecting a mitigation include:

- Is the plant slewing vs. bi-directional;
- Compatibility and interoperability; and
- Operating conditions and auxiliary equipment.

Existing technologies that may meet these conditions:

- Back Eye 360 - 360 camera system for vehicle fleets
- 3Dtection - detection of safety vests
- Seen IRIS - lidar detection of reflective tape

How do these technologies better serve customers?

Safety incidents can have wide consequences beyond the safety and wellbeing of workers and customers, including cost of damages to infrastructure and plant, lost time due to injury and investigations, and reputational damage.

Further resources

https://brigade-electronics.com/products/backeye360/
https://efa-controls.com/en/project/3dtection-kit/
https://www.seensafety.com/seen-products/p/sensor

Thanks for reading

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