RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

FASTTRACK

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INSIDE THIS ISSUE – WHAT IS SHAPING THE RAIL INDUSTRY TODAY AND INTO THE FUTURE

Cybersecurity in the Rail industry

The Rail industry is becoming more modernised with digital systems, moving from the conventional fixed-block signalling to the new Communication Based Train Control (CBTC). This new technology is built on a secure, highly available wifi network. This "moving block" technology improves the headway performance of the existing fix-block system and improves rail operation safety. However, as the physical world becomes more digitalised, cybersecurity is becoming increasingly important with the potential to cripple infrastructure. Up until now, cybersecurity was seen as an IT problem rather than a whole-of-business concern. Cyber attacks on operational technology are becoming increasingly sophisticated with today's interconnecting business information systems and train control systems in the rail industry. Many organisations lack visibility over their vast and complex networks, leaving the systems vulnerable to cyber-attacks.

In September 2018, RISSB and representatives from the industry created the *Australian Rail Network Cyber Security Strategy*. The strategy identifies five key cybersecurity objectives for successful implementation by rail transport operators and suppliers to manage their cyber risks, namely:

1. Our people will understand cybersecurity risk and act responsibly to ensure that the risks are managed
2. We will understand the extent and potential impact of our vulnerabilities on our organisation and those that depend on it
3. We will appropriately protect our information, technical systems, physical sites, and organisations.
4. Our cybersecurity capability will be developed and managed to keep pace with evolving threats.
5. We will be prepared to limit damages from incidents.

Through legislation, companies have been undertaking certain defensive activities, such as developing cybersecurity incident response plans, cybersecurity monitoring and control exercises, accessing cyber vulnerabilities and taking a risk management approach.

Awareness and accountability are critical to ensure a robust cybersecurity strategy in the rail industry. Cybersecurity awareness at every level of an organisation is vital to achieving a more holistic and effective approach to mitigating cyber risks in operational technology before they arise.

The Future of Rail

- Mega Projects
- Digital Transformation
- Artificial Intelligence
- Data-Driven Decisions
- Climate Change

We've all heard the above buzz words thrown around, but what does it mean for the Rail Industry and our future skills?

The Australian Government is investing a record $110 billion over the next ten years through its rolling infrastructure plan, of which a substantial component is under the Infrastructure Investment Program. Rail is entering an era where investment in infrastructure and megaprojects is at an all-time high with no sign of slowing down. The way the railway operates today will be impacted significantly regarding this investment and the industries ways of working being disrupted by technological advances.

The following rail infrastructure projects seek to unlock capacity, connect communities and evolve the rail industry to be more safe, efficient and reliable in providing the service to rail passengers and freight transporters. The skillset required to do this will be vastly different in the future, with a greater need for the coexistence of technology-based systems and skilled professionals to maintain and operate the future rail infrastructure. Examples of emerging technology include automation, complex system integration, data collection, cybersecurity, enterprise architecture, rollingstock, and network control, to name but a few. Examples of projects which draw on these new skills include:

- Inland Rail
- Cross River Rail
- Sydney Metro
- Western Sydney Rail
- METRONET
- Melbourne Airport Link
- Beerburrum to Nambour Rail Upgrade

The Rail Industry in its current state is already experiencing difficulty attracting and retaining skilled professionals due to significant growth in infrastructure and construction globally, with demand far outweighing supply. This is further impacted by limitations of access to the global talent market due to COVID. Other emerging shortcomings include the industries ageing workforce, lack of knowledge retention, changing skills for the future of rail, and a chronic shortage in trainers and assessors to provide vocational courses specifically relative to the rail industry. There is no panacea - an industry level commitment to making change and setting ourselves up for success is the only way to avert this looming crisis.

The need for action is now with the following actions arising from the Australasian Railway Association Skills Capability Study undertaken in 2018 as critical strategic imperatives for addressing current and future deficiencies:

1. Smoothing the investment pipeline
2. Develop a National Rail Industry Skills Development Strategy to provide fit for purpose training for the now and future skills
3. Boost awareness, education and attraction to rail careers
4. Developing a more collaborative, partnership culture between the three main stakeholders affecting skills development in the rail industry, namely public/private sector rail organisations, jurisdictional and national governments and the education system

Mobility as a Service

Nearly 100 years ago, New York road builder Robert Moses learned that every time the city opened a new motorway, it was immediately overrun with traffic jams. He reasoned that getting better utilisation out of existing assets may be a better way to solve traffic congestion.

Mobility as a Service – An Overview

Imagine if a subscription-based service was applied to urban transport. Could that change the way city dwellers move around? Indeed, could it mean the end of private car ownership in large cities, because the use of urban transport is more appealing?

Mobility as a Service (Maas) is a type of service where users plan; book; and pay for different types of mobility services. MaaS focusses on enabling transport for any user through using existing or emerging technology. Bookings may be made through an existing App (Uber, Lyft) with user verification through facial recognition technology.

MaaS asks users questions and considers their preferences. While some users want a service to get them directly from A to B and are happy to pay a premium, others are happy to use different modes and interchange at C and pay a lesser fare. Similarly, a premium fare may be charged for travel during peak times, with substantial reductions during night or weekend times.

What is needed?

MaaS is data-driver and user-focussed and takes advantage of user's smartphones. For maximum effectiveness, MaaS requires:

- Widespread use of smartphones on at least a 3G network.
- Secure, dynamic, accurate information on travel options, schedules, and updates.
- Cashless payment methods.

For this to work, collaboration is required by:

- Transport Providers, including Rail Transport Operators.
- Telecommunication Companies, ensuring connectivity.
- Payment processors.

Physical infrastructure to permit seamless interchange between modes will increase the desirability of interchange. Consider: are users going to want to walk 300 meters unprotected in Melbourne weather, or is there a better connection method? Only after all organisations – both public and private – are working towards a common goal will the full benefits of MaaS be realised.

Current Examples

There are few cities around the world with true MaaS, but some come close. Tokyo has used the Suica card since 2006, which is used not only on public transport but also at retail locations within transport hubs, while nationwide implementation is on track in time for the (somewhat delayed) Olympic Games. Helsinki is on track with its plan to make it unnecessary for any city resident to own a private car by 2025, having worked on this plan for the last five years. Work is underway in some South American cities to charge a subscription service, rather than a point-to-point or "A La Carte" fare system.

The Future

Increased demand for personalised transport has created the market for MaaS. Existing initiatives such as carpool and ridesharing companies started this trend, while the anticipated rollout of autonomous road vehicles is putting to question the economic benefit of owning a private vehicle. By increasing the choices that users have, wider societal benefits will come in the form of less congestion; higher productivity; better air quality; fewer traffic accidents; and less space used for parking.

Nearly 100 years after he made his revelation, no doubt Moses would be astounded at how MaaS will be used to improve the mobility of all without the need for additional fixed infrastructure.

Human factors contribution to rail investigations

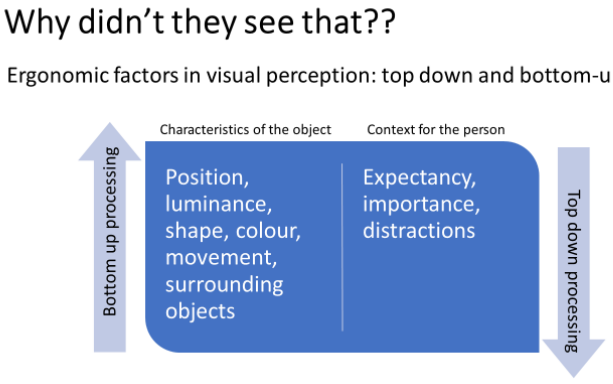
The Australian Transport Safety Bureau has legislated responsibility to conduct transport safety investigations, including those associated with rail incidents and accidents. The ATSB conducts investigations using a no-blame approach, and one of the main objectives for ATSB investigations is to improve transport safety.

Transport safety accidents and incidents often involve an individual action or omission which was different to what we might want or expect. That is, sometimes people make errors. There is a tendency to view the errors of skilled professionals as some indication of a personal shortcoming – that the individual either lacks the skills or was undisciplined.

Although transport safety investigations must identify what happened, including the actions of individuals, usually the more important question is 'why'? This is the question which moves us forward as an industry, enabling us to identify factors which may prevent similar accidents from happening again.

Human factors investigators may provide support to rail investigations to answer questions such as 'why did this make sense to the person at the time'? and 'what factors contributed to this form of error'? Human factors investigators apply specialist knowledge about the limits of human performance and the factors which contribute to human error. In this article, I will provide a summary of two common areas of involvement for human factors investigators in rail investigations.

Visual perception: The human visual system is our most powerful perceptual tool. Nonetheless, there are thousands of examples of accidents and incidents where an observer might wonder 'why didn't they see that'? Human factors investigators seek to support these questions with specialist knowledge about the factors which influence the conspicuity of different objects. These factors include an object's physical position and luminance, its colour and movement, and most significantly the contrast between the object and the surrounding environment. During an investigation, human factors investigators may support an analysis of the conspicuity of objects such as rail signs and signals, or other warnings and indicators, with a view to identify any features which increased the likelihood of those objects not being detected, or which may have contributed to the wrong information being detected.



While these characteristics of an object may be considered the 'bottom up' determinants of perception, perception is also influenced by the preconceptions, biases and other activities of the person doing the perceiving – so-called top-down factors. Regardless of how conspicuous an object is, we are prone to missing crucial information if we are distracted or we are not expecting it – as is highlighted in the 'invisible gorilla experiment' which some may be familiar with. For example, train driver expectancies for signal aspects are a known factor in signals passed at danger and subsequent accidents. Train drivers can miss red aspects if they have a high expectancy of green aspects, which may be based on previous experience at that location or a run of clear signals that day. This was found to be a likely factor in the Ladbroke Grove accident in the UK in 1999.

Fatigue: Fatigue is a known risk factor for rail accidents and has been identified as a contributor to major accidents such as the collision of two coal trains at Beresfield in 1997. Fatigue can have a range of adverse influences on human performance, such as slowed reaction time, decreased work efficiency, reduced motivational drive, and increased variability in work performance. Fatigue can lead to lapses or errors associated with attention, problem-solving, memory, vigilance and decision-making.

Human factors investigators support rail investigations through assisting with determining whether the individuals involved were fatigued, and examining systemic factors related to increased fatigue risk and organisational management of fatigue. During rail investigations, ATSB investigators may collect information including rosters, reported hours of sleep and self-assessed fatigue. In order to understand how an individual came to be fatigued, investigators may collect information on rostering practices, the use of biomathematical models of fatigue, and other aspects of fatigue management systems.

High-Speed Rail in Australia

In Australia, we've been in a golden age of railways in the last decade. However, the railway investments are largely disjointed without a national strategic focus. They tend to copy existing international practices without an in-depth consideration of the transportation needs of Australia or the major cities where these developments occur. So before deciding what sort of railway investment the country needs, we first have to define the fundamental problems and how transportation systems could help alleviate some of these.

The key 'problems' of Australia (in terms of infrastructure and being able to support growth) are:

- urbanisation,
- the way wealth is created in the 21st century,
- mass immigration, and
- a predisposition of the society for low-density living.

I am not implying these to be undesirable factors – these are some of the best things that can happen to any country. However, they must be managed in a sustainable transport policy.

To elaborate on this: wealth in our current day and age is primarily created where there is a high concentration of brainpower: cities. For example, Greater Melbourne accounts for about 83% of the economic product of Victoria but accounts for 4% of the land area. However, the Australian population simply refuses to live in medium or high-density environments, which causes our cities to sprawl. With increasing city sizes, our cities become unmanageable by public transportation (as it is inefficient at serving vast low-density areas) and generating extreme demands on the road. Australia has the world's largest low-density cities (Demographia, 2019), and as a direct result, some of the worst traffic congestions (INRIX Traffic Scorecard, 2018). This leads to economic inefficiencies, substantial carbon output and a real impact on human happiness with ever-increasing commuting times.

In a nutshell: low-density cities have a size limit, after which they become more and more unliveable. Most of our major cities have arguably surpassed this limit, but we have not fully realised that most decision-makers and key voter groups are not affected. These issues predominantly affect new Australians, people of lower economic status and those without accumulated wealth from previous generations.

As a result of the aforementioned factors, we face three options. We could give up or compromise on low-density living and build more apartment blocks. While most of our policies appear to be supporting such a change, the population is simply refusing this option - and houses are built further and further from the city centres. We could also 'crack on' with our existing low-density cities. It is unlikely that any public transport investment could keep such cities running (due to the low number of people in the catchment areas of stations). This would lead to inevitable traffic congestions outside of the areas that public transport can effectively service. Building local city centres with the necessary transport infrastructure could be alleviated to a certain extent. Still, it can only be achieved at high cost and disruption as these constructions would have to be conducted in already built-up areas. While it is noted that such an option exists, there has been no genuine attempt at it in Australia. This leaves us with one remaining option (and the most sustainable option in my opinion), which is to build more low-density cities – and this is where High-Speed Rail (HSR) comes into play.

Australia has one of the busiest air corridors in the world between Sydney and Melbourne. On comparable international routes (without any government intervention), the proportion of people choosing the railway over air travel is between 50% and 70% (travel time on rail between 5 to 3 hours respectively). It is clear (and this has been confirmed in previous government studies) that a Sydney to Melbourne HSR corridor can be operated in an economically viable (profitable) manner. This also means that there is an option to open up largely undeveloped areas of the country to build the economic powerhouses of the 21st century: cities. By utilising the Japanese approach to servicing smaller stations, it would be possible to have about nine intermediate stations on the corridor without having a real impact on journey times. This can be achieved by services stopping at different stations following a pattern. While a service could leave Sydney for Melbourne every 20 minutes, regional stations would only have a train every hour. Nevertheless, it would certainly be a gamechanger for cities such as Albury – Wodonga if they could reach both Sydney and Melbourne within two hours by rail. This could be the nudge required to build more cities of the size and type that the Australian public prefers.

It would not be sufficient on its own, though. While urbanisation appears to be a dependable, long-term force of change, it is not straightforward to determine *why* particular cities grow and how to *make* particular cities grow. Any such attempt would require strong backing from all levels of government, including higher education investments, tax subsidies and various other measures to ensure that such cities become self-supporting (instead of becoming more remote suburbs of Sydney and Melbourne).

The critical question is what type of cities we would like to live in in the future and whether our current railway investments are getting us to a more liveable and sustainable future?

I will be presenting for Engineers Australia on the matter very shortly - in a lot more detail.

Industry Growth Driving Local Freight Rollingstock Manufacturing opportunities

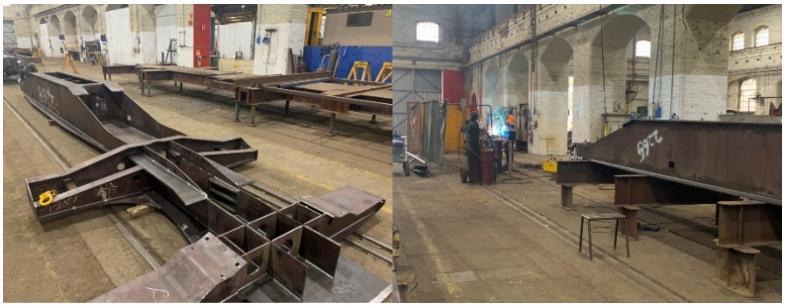
While a relatively small section of the rail industry, a combination of both strong domestic and foreign demand for local goods, a more competitive Australian dollar, and an increasing government commitment to the local industry has made it opportunistic for companies to enter, or in the case of my own company RailFirst (re-entering) the Rail Manufacturing market.

In 2019 rail contributed over $29 billion to the Australian economy, with freight rail contributing the largest share of $15 billion and Rollingstock manufacture making up the smallest portion, at 4%.

Recently, local manufacturing has focused on passenger rollingstock, including the V/Line Vlocity sets (by existing Victorian manufacture Bombardier) and the upcoming Perth Metronet C-sets (to be produced by Alstom in Perth). Without the government's support or a mandated local content requirement, the freight rollingstock market has always been driven entirely by cost. As a result, Australian operators have been looking overseas for their freight rolling stock needs.

The term essential worker was thrown around numerous times during the peak COVID year that was 2020. While many people worked from home, resulting in a decline in patronage on the passenger network, the freight industry was growing. This, along with a competitive dollar, has seen the resumption of Freight rolling stock manufacture.

Now it is easy to say but more difficult to execute. Challenges include a shortage of skilled labour, particularly in the more regional areas where heavy industry are located, in competition with larger mining jobs, and the attraction of moving to the larger cities.



The other challenge is to ensure rollingstock meets the current and ever-changing, and multiple requirements of all networks. The Australian rail network is a fragmented one, a historical legacy from decades past. Highlighting this is each state's own needs and operations, limiting local manufacturing's ability to expand and compete globally.

This lack of standardisation can act as a de facto barrier to competition from export competitors. But it also operates as a barrier to achieving scale and volume within the domestic rail rolling stock production industry.

A more strategic approach is also required from both Industry and Government when planning future investment. To maintain a viable local manufacturing capacity, a certain level of continuity in work maintains a skilled workforce and supports investment in new plant and equipment for further growth opportunities.

However, realising these economic and employment benefits depends on the government committing to local manufacturing and taking a more strategic approach to planning for future investment. A viable local manufacturing capacity requires a certain level of continuity to maintain a skilled workforce and support investment in new plant and equipment.

A local manufacturing environment, particularly for the freight market, will always be a challenging one. However, with contented investment from industry and support from both local and federal government, freight rail can continue to provide future skilled employment, not to mention reducing carbon emissions and safer and healthier alternative to road freight.

Thanks for reading

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