RiSSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

FASTTRACK

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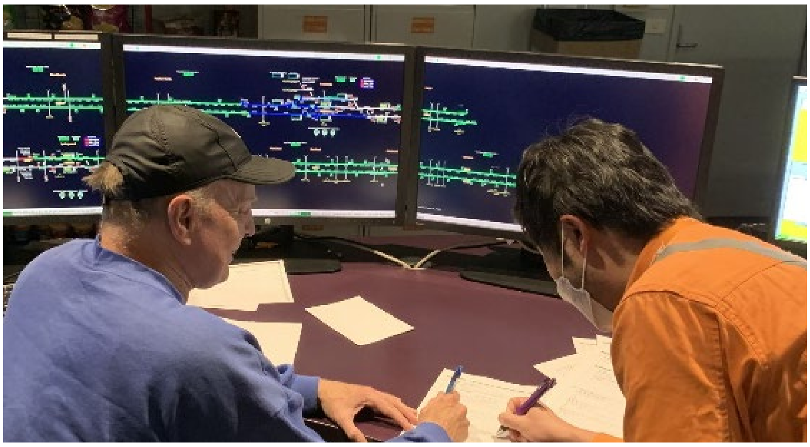
The Hitatchi WSP2G Computer Based Interlocking System – A First for Sydney Trains

Mt Victoria Signal Box, on the Blue Mountains Line in NSW, was one of the last mechanical interlockings remaining on the Sydney Trains Network. In operation since 1911, the 48-lever signal branch type A lever frame was decommissioned on the 6th of June.

The Hitachi WSP2G (an Italian computer based interlocking signalling system) – A first use of this system for Sydney Trains – has been integrated with the Sydney Trains Advanced Train Running Information Control System (ATRICS) train control system, enabling it to be remotely controlled from the Blacktown Signal Control Centre.

Over the past 3 years, staff from Sydney Trains and Transport for NSW have worked collaboratively with Engineers from Hitachi Rail to adapting the new interlocking's Generic Application Data for Sydney Trains. The GA data developed will apply the Sydney Trains Signalling Design Principles and has been purpose-written for Sydney Trains.

Along with the new CBI interlocking, axle counters have been installed for train detection. The axle counters have been used in some local and temporary situations previously, such as the now decommissioned Carlingford Line, and as a temporary solution between Newnes Junction and Zig Zag after signalling equipment was damaged during the 2019 Bushfires.



This is the first time this technology has been applied in a significant mainline application on the Sydney Trains network, replacing current track circuit technology.

As Sydney Trains continues to upgrade aging signalling technology, the incredible work of the project team has laid the foundation for future signalling upgrades and remodelling which will apply the same technology.

The Role of Rail in Driving Safety & Resilience in Tasmania's Forestry Industry

Since 2013, when TasRail began its journey with the forestry sector in Tasmania, the business has invested into a continuous business improvement program to simultaneously increase (1) safety, (2) capacity and (3) efficiency. The primary objective of these improvements is to provide industry with a safe, reliable, resilient and efficient supply chain linking the southern forest estates with the export hub in the north at Bell Bay.

Figure 1:Log train utilising logtainers at Brighton Terminal

TasRail has considered this objective in the contents of the entire supply chain, not just the rail component. It has done this by investing into infrastructure that enables safe and efficient log truck deliveries to the rail head, safe and productive log storage/handling and seamless integration with the customer's facilities.

In working directly with customers and suppliers, TasRail has engineered out risk while improving resilience, productivity and capacity. The business views these as complementary objectives rather than the premise that 'risk management impacts efficiency'.

Examples of TasRail's historical improvements for the forestry supply chain included:
- Engineering design & commercialisation of the 'Logtainer' a dedicated container base that carries logs on a standard intermodal wagon in one direction, that can then be nested up to allow the same wagon to transport containers on the return leg.
- The design & development of three modernised customer sidings.
- Partnering with a specialist forestry business to provide log handling services in the log rail yards.
- Installation of 'legal for trade' truck weighbridges at the Brighton and Parattah log yards.

As a result of TasRail's demonstratable impact in driving safety and efficiency improvements within the industry, in November 2020 the Tasmanian Government announce a $5.0 million forestry funding package which has allowed TasRail to continue in its complementary objectives of improving safety and efficiency.

Key elements of this program included:

- Engineering design and purchase of 54 x Logtainers with new electric hydraulic control systems which eliminates manual handling risks when raising and lowering the log stanchions as well as increasing the efficiency of their operation.

- Provision of 2 x in-track weigh bridges to ensure log wagons are loaded correctly and provide industry with real time inventory data as their product moves through the supply chain.

- Engineering design and purchase of 80 x Log Wagon End Gates which reduces the risk of loads shifting during shunting and transit and improves loading times by reducing the need for

Figure 2: New Generation Logtainers

a 'belly strap'. The removal of the 'belly strap' requirement also eliminates the manual handling risk to employees whenever they were required to remove them.

- Engineering design and purchase of 12 x Book Ends for use in the Brighton Intermodal & Log Yard. These increase safety by ensuring any log stack failure risk is eliminated and it significantly increases the storage capacity and inventory segregation within the yard.

- Engineering design and installation of a de-twitching station that provides a permanent engineering control to protect the truck driver when unstrapping logs on arrival at the rail yard.

- Extension of the run-around loop at Bell Bay to reduce shunting of log trains, thereby increasing supply capacity to customers, efficiency and reducing the amount of time Rail Operators are located within the Danger Zone.

Figure 3: Bookends used in Brighton Intermodal Yard

Figure 4: Loading a Bookend in Brighton Intermodal Yard

Each of these improvements have been developed with the dual expectation of delivering safety and efficiency increases to the state-wide forestry industry. In having a continuous business improvement focus, TasRail has provided these complementary benefits not just to the business or the railway component of the supply chain, but also to road operators, forestry customers and the wider community.

It is an exciting time within the State for growth of a critical primary industry and TasRail is committed to continuously improving the safety, resilience and efficiency of its end-to-end supply chain by maintaining a future-focus on the way it supports the industry.

Safety is good for business.

Improving CQCN Performance with New Generation Technology

Aurizon operates and maintains approximately 2100km of electrified traction network in the Central Queensland Coal Network (CQCN). Ensuring the availability and reliability of the traction system requires the provision of fit for purpose engineering solutions and application of contemporary asset management practices.

Like any overhead assets, the CQCN's exposed overhead traction network can experience faults and outages due to external events due to the weather, flora, or fauna. These faults occur in remote locations and as a result diagnosing and rectifying faults can lead to extended power supply outages.

Electronic devices called Fault Locators are installed in substations throughout the CQCN to detect and locate power faults on the high voltage traction network. These units monitor the voltage and current of the overhead line and use this data to estimate the location of faults when they occur.

Locating and rectifying faults on the network requires response teams to mobilise to site, inspect the overhead wire, locate the cause of the fault, remove any obstructions from the overhead line infrastructure and inform the electric control operator when it is safe to re-energise.

Given each section of the overhead network is up to 50km long, this can result in a significant amount of time spent driving in the corridor. This driving risk only increases further at night. These outages can also lead to significant train delays on the network, meaning the ability to quickly and accurately locate faults is important for both personnel safety and operations.

In 2017, the ageing fleet of fault locators suffered from serious reliability issues which prevented the units from detecting and locating many faults. They also had a rudimentary user interface and suffered from obsolescence of components.

Between 2017 and 2019, Aurizon engaged with an electronics manufacturer to design and develop a new and improved generation of fault locators with modern components, additional inputs, an improved user interface and a new detection algorithm to locate faults more accurately and reliably. The full fleet of 180 units were commissioned in 2019.

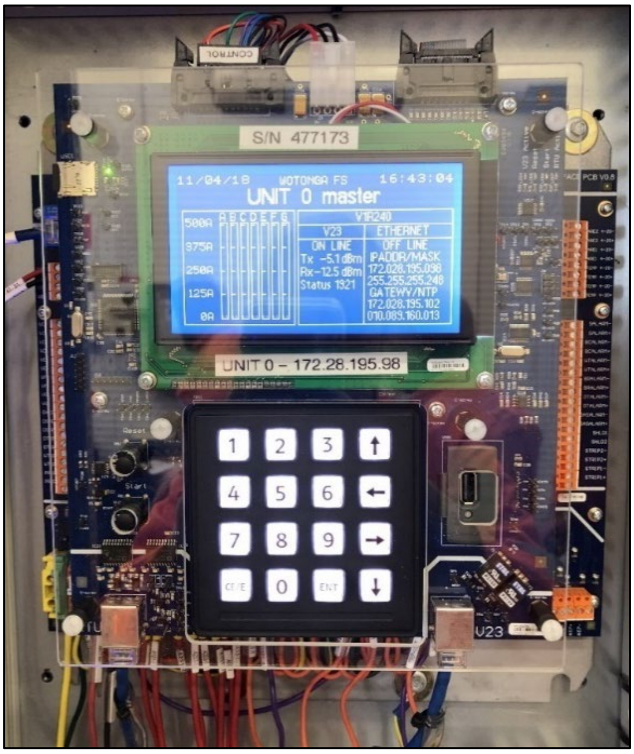


Figure 1 - New Generation Fault Locator

Figure 2 - Manufacturing of Fault Locators

The new devices have significantly improved the accuracy of locating traction faults, reducing the response times, and minimising potential train delays with approximately 85% of faults being located within 2.5km of the source, and some within a range of 100m (i.e. 1 to 2 structures from the actual fault location). The success of these devices has led to Queensland Rail purchasing units from Aurizon for replacement of their own existing fleet.

Applications of Virtual Reality within Human Factors

Introduction

With recent advancements in technology and a Global shift towards attaining sustainable outcomes, there is an opportunity for the Rail Industry to capitalise on current and upcoming innovative trends to shape the future of Rail transportation.

Virtual Reality (VR) has numerous applications which span across multiple industries such as Entertainment, Healthcare, Architecture, Education, Defence, etc. With the rise in accessibility and availability of VR consoles, its use has been widely adopted within the Transport industry to facilitate safe, efficient, cost-effective, and immersive business outcomes.

The Human Factors (HF) discipline applies methods and tools which take into consideration human behaviour, abilities, and limitations when designing products and processes to optimise the human-system interaction. As such, VR has become a key tool for HF Practitioners in effectively simulating real world scenarios for the user to interact with.

The following are examples of VR applications within the rail industry:

- Training: VR can provide safe, immersive, cost-effective, and time-efficient training experiences by simulating rail environments that are difficult, hazardous, or disruptive to access.
- User Centred Design: VR can be used to mock-up designs and allow early feedback from end-users or customers to support meaningful iterative design progression and assurance.
- Stakeholder engagement: Placing customers within a VR environment can increase customer satisfaction, support consultation initiatives, and improve safety awareness.
- User Testing: VR simulations can provide immersive experiences of the rail corridor and worksites that can help improve the safety of rail infrastructure workers.

A Real-World Application:

A Human Factors study was conducted by Sydney Trains and Transport for NSW (TfNSW) to evaluate the impact of front-of-train design on the detectability of trains for track workers. The external livery of a new Sydney Trains rollingstock deviated from previous fleets. It was therefore critical to ascertain whether the change in train design carried a human performance risk for track workers on the rail network.

The experiment required participants to complete a train detection task in VR, in which they were presented with six conditions – three different train types under daylight and dusk ambient conditions. All trials were played to participants in a continuous sequence, using a virtual reality headset (model: Oculus Go). Participants were asked to respond to 360-degree video footage of approaching trains by clicking a response key when they detected the train and by calling out the colour when they detected the colour of the train. Participant responses were audio recorded for detection time analysis.

The collection of data provided all Rollingstock delivery Projects across the Transport Cluster with practical implications of the change in train design; ensuring the human performance risks associated with train detection were considered for both existing and new trains being introduced onto the rail network.

For this study, the use of VR allowed for the creation of experimental settings in a controlled virtual environment that replicated Lookout Working which would otherwise be too onerous to conduct. In addition, to increase validity of results, it allowed for efficient and effective repeatable testing with a large sample size of track workers which would be difficult to achieve within the live rail environment.

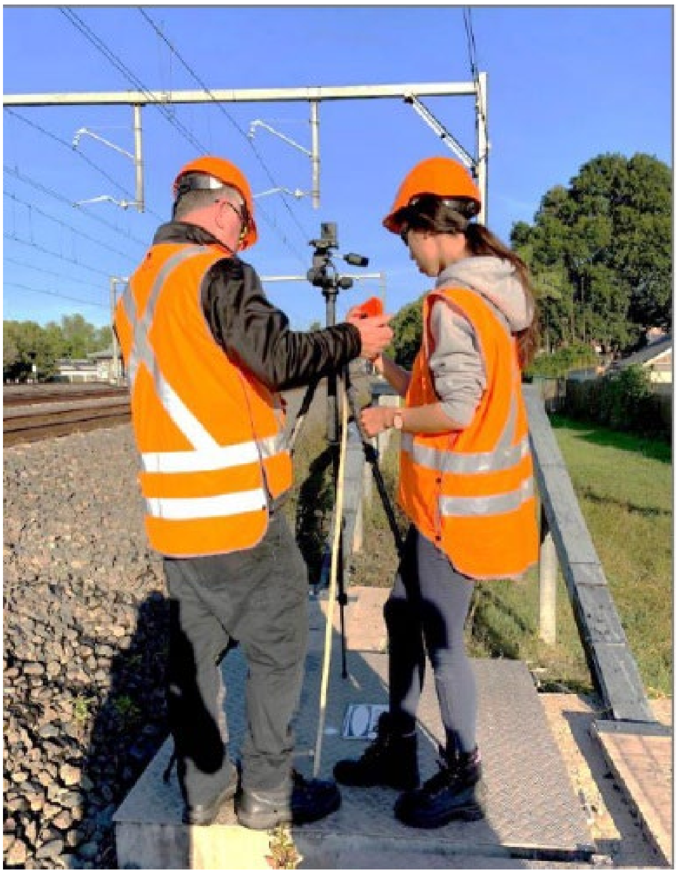


Figure 5: Capturing video footage to embed into VR

Benefits

The benefits of VR applications within the rail industry:

- User testing with VR simulations reduces project costs as design issues are identified and rectified early in the design process; reducing the risk of re-work which would otherwise cost the project both time and money.
- VR reduces the need for physical mock-ups to confirm that designs meet the needs and expectations of customers and staff.
- It enables rapid prototyping (particularly early in design) by updating 3D models in real time to input back within the VR software instantaneously.
- The advancement and accessibility of VR means it can be transported anywhere, enabling safe, flexible, and economical business outcomes.

Figure 2: Testing track workers in classroom environment using VR

Limitations

- Immersive VR solutions have the potential to induce cyber-sickness, which is a form of motion sickness that can occur when users interact with virtual environments.

- When wearing head-mounted displays, users are interacting with the virtual world without visual or auditory feedback from their external environment. This may impact the validity of some exercises when comparing it to a real-life scenario.

Future Opportunities within Transport:

With the use of VR becoming more common, Sydney Trains has developed a HF VR Design Guideline to support the business in understanding key Human Factors issues related to VR for those involved in the development of VR tools or considering the use of VR in their Project work.

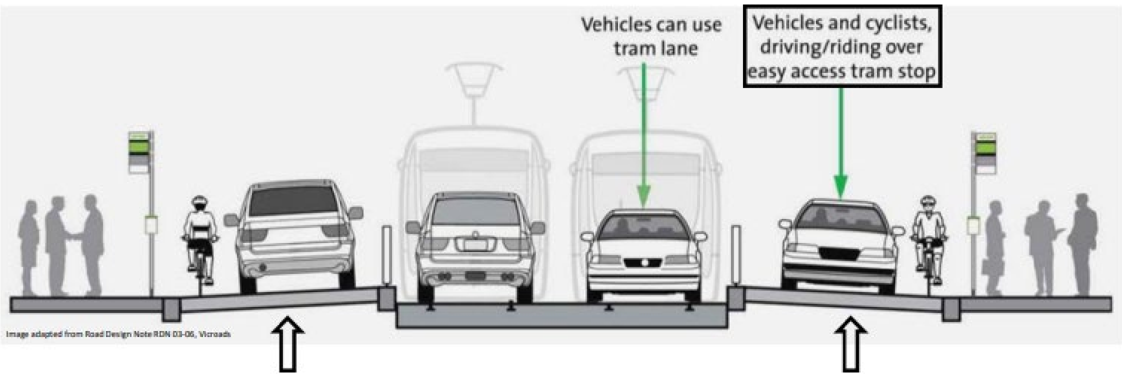
This Guideline enables the business to maximise the opportunities and benefits that VR brings by i) highlighting key considerations for its application, ii) identifying the relevant standards and protocols for its use and development, and iii) supporting the user in determining whether VR is the right tool for their needs.

There is potential for other transport modes or safety critical industries to also develop similar VR Guidelines to support their business in its safe and effective implementation and drive the future of transport innovation.

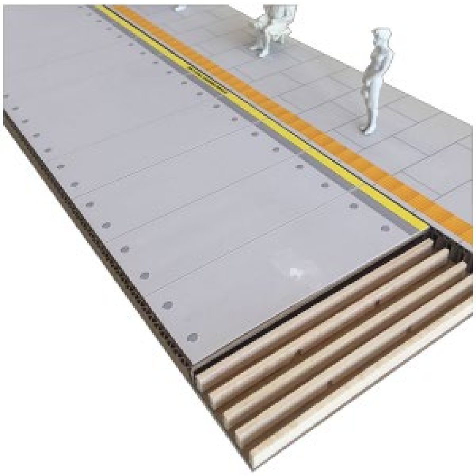
From Trash to Tram Stop

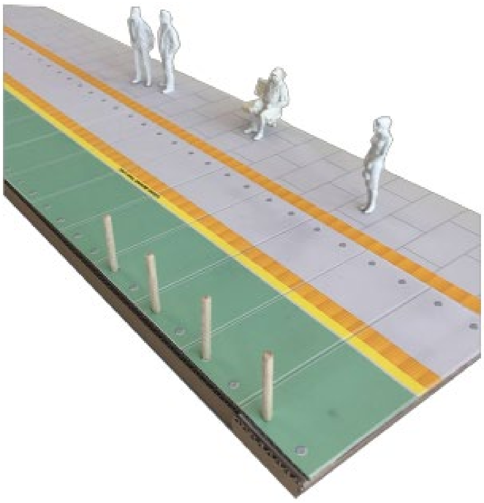
Kerbside waste could soon be used to create innovative modular tram stops across Melbourne's tram network. Monash University's Institute of Railway Technology (Monash IRT) was awarded a $300,000 grant from the Recycling Victoria Research and Development Fund – Materials to research the use of recycled plastics for the construction of future tram stop platforms.

Melbourne's tram network is the largest in the world and features 24 routes, 250km of double track and more than 1750 tram stops. The recycled plastic would be used to create modular components, which would then be assembled in a platform arrangement connecting the kerbside to the tram.



The design promotes environmental sustainability whilst also providing greater accessibility for passengers boarding and alighting trams. Hollow drainage features would reduce the impact of flash flooding events. The modular components will enable quicker and more cost-effective construction and maintenance and lessen the disruption to traffic during these activities.





A number of recycled materials will be considered before a protype is manufactured and tested in a laboratory. Recycled rubber well also be considered for damping components.

The project has the ability to deliver a circular economy framework involving a total supply chain of recycled materials.
The project is a partnership between Monash IRT, Yarra Trams, Integrated Recycling and Advanced Circular Polymer. Advanced Circular Polymer will supply the recycled plastic from kerbside waste which will be used by Integrated Recycling to manufacture the modular components.

Monash IRT and Integrated Recycling have teamed up in the past when Monash IRT performed rigorous testing for Integrated Recycling's Duratrack sleepers. The Duratrack sleepers are made from 85% recycled plastic and are used on Victoria's railways, including Richmond Station, Tottenham Station and Wyndham Vale stabling yard. The recycled plastic sleepers last three to four times as long as timber sleepers and are recyclable at the end of their lifespan.

Thanks for reading

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