FASTTRACK

THE NEWSLETTER OF THE HORIZONS PROGRAM | JULY 2022

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

Ibrahim Elsoukmani

Transport Accessibility

The impression of disability has gradually but significantly transformed from an individual medical problem to a major socio/political conversation and movement. The need for society and transport providers and operators in particular to evolve at a local, national and international level, is more important than ever.

People with impairments whether physical, sensory, or cognitive and labelled 'disabled' experience a range of environmental, cultural, and built environment-based discrimination. This can contribute to social and economic barriers to participation. We need to shift our thinking to society being disabling, as it was built in a non-accessible way that does not enable a person with an impairment.

The social model of disability and universal design principles need to be applied to all new innovations and upgrades. Retrofitting accessibility is not ideal, but it may be necessary for instances of legacy and inherited infrastructure.

Yarra Trams have matured and adopted this approach to accessibility. The development of our new Accessibility Action Plan 2022 – 2024, has been the catalyst for this advancement in our approach, with the aim being to achieve more equitable outcomes for all our passengers with accessibility requirements.

We will do this by purposefully identifying and eliminating barriers to our services. With a strong connection to people with disability as experts with lived experience, we can become more proficient in understanding the evolving needs of our passengers and the barriers they face. As public transport providers and operators, the onus is on us and the opportunity is always now to make improvements and enhance the accessibility of our services, with a focus on the wider whole of journey experience of passengers.

Wireless Axle Counter Solution

Veronica Wu

Railway is playing a key role in shifting towards a more sustainable and climate-resilient world. Railway infrastructure features quantities of mechanical and electrical trackside equipment requiring cables for power supply and data transmission. Digital innovations will allow rail operators to dispense with most of their trackside equipment and create a centralized digital train control system. Trackside equipment such as axle counters will be wireless.

What is happening worldwide and what changed?

5G Wireless axle counter is jointly developed by ProRail and Rail Connected in Europe first which is looking to speed up the roll-out of ERTMS (European Rail Traffic Management System). The introduction of this technology not only means rail constructors don't have to dig for cables which substantially cut the cost of implementation and maintenance, but also increase the possibility of higer density of measuring points along the tracks, resulting in more efficiency and capacity in operations.

Figure 1 Wireless Axle Counters developed by Rail Connected

What did we achieve and implement in Australia?

The Frauscher Axle Counter system has been widely used in Australia rail networks and their axle conting systems are modular and scalable which satisfys various basic conditions and different call for felxible and individual adapation possibilities. Wireless axle counter soluitions can be provided for yards, crossings or heritage sites with cultural restrictions by introducing wireless LAN devices complemented with interconsist antenna to Frauscher train detection system network.

Figure 2 Pole mount wireless axle counters wayside junction box with solar

The rails sensor RSR180 itself mounts on the rail via rail claws. A wayside junction box with solar panel and antennas is located nearby the axle counters housing the electronics to power the axle counting system, control the collection of train data and communicate back the information to interlocking via a reliable WIFI modem

(Westermo RT-320-LV). A trial site is currently organized by V/line in Farrells Lane, Stratford, VIC and the Type Approval of this wireless axle counter solution expected to be obtained by Q1 2023.

John Bae

Warning Lights and Lookout Working

What are Warning Lights?

Warning lights are used in the Sydney Trains network to provide indication of oncoming rail traffic, where sighting distance is limited, to provide adequate time for workers on track to move to a safe place. They are operated by track circuit occupancy and designed to extinguish when a train approaches.

The original purpose for warning lights is for crossing or accessing the danger zone and had been naturally adopted for use for lookout working on live track. Following a human factors assessment for rail safety incidents involving warning lights, their use for lookout working has been restricted outside of a few exempted areas.

These locations are in tunnel environments where the risk factors identified in the assessment are reduced. These factors include:

- Likelihood of rail traffic not reliably shunting track circuits
- Type/configuration of warning lights
- Likelihood of confusion with other lights in an open environment

Impact of ETCS Implementation

With the planned implementation of the digital systems program and future ETCS Level 2 operation, Sydney Trains will be moving away from track circuits that warning lights operate off.

As warning lights are heavily relied upon in the permitted locations for lookout working to meet maintenance requirements, alternative solutions and ways of working are being investigated and will be subject to consultation.

Industry Best Practice

In the railway industry, workers are typically banned from accessing the live track where ETCS Level 2 is implemented,

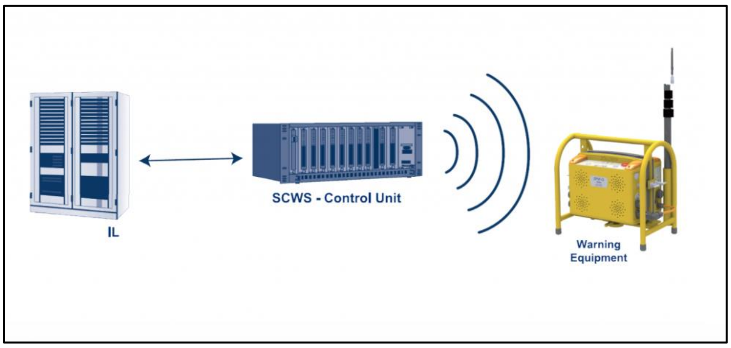
Where necessary, urgent work is carried out under local possession/track occupancy arrangements to eliminate the hazard of working on live track. Planned maintenance is typically completed under allocated windows.

Most operators are moving to Condition Based Maintenance & Remote Monitoring to reduce maintenance frequency; reduce unnecessary maintenance and increase planned vs reactive maintenance.

Other warning systems implemented in railways around the world include:

- Automatic Warning System (AWS) operated off mechanical switches placed on tracks, providing both optical and acoustic warning signals
- Mobile Warning Systems such as Zolner ZPW
- Signal Controlled Warning System (SCWS) which is automatically triggered by an interlocking system





Managing e-Scooters and Light Rail

Samuel Palmer

In 2020, ACT regulations enabled the use of e-scooters for personal mobility in the ACT, supporting both private ownership and dockless shared programs. There are two commercial providers of the latter operating under the ACT Government's Dockless Shared Micromobility Policy and Guidelines.

As uptake of these shared schemes increased, regular trespasses on to the Canberra Light Rail alignment were observed, such as riding along the concrete trackform and parking eScooters at light rail stops. The result of these trespasses impeded access for passengers, creating a challenging environment from a safety perspective.

The Micromobility policy requires service providers to have a GPS-enabled geofencing capability, which has been instrumental in assisting to manage some of the resultant safety issues for light rail. Two key interventions occurred, in partnership with service providers: introducing a 10km/h speed limit zone along Light Rail tracks and listing the light rail operating area as a no-parking zone for e-Scooters. These interventions discouraged travel along the trackform, as it is less convenient than using the adjacent footpaths, and prevent users from parking e-Scooters on the tracks or at stops.

Working directly with service providers and intervening early, has assisted in addressing safety and operational risks, while encouraging e-Scooter users to follow rail-safe habits. The impact on the shared schemes has flowed through to privately owned e-scooters.

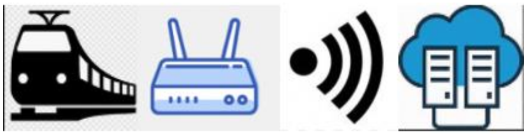
IoT Remote Monitoring for Predictive Maintenance

Jessica Fallico

With a growing population, the rail industry is under great pressure to increase capacity and frequency of train running to meet passenger and freight demands. Safety, Reliability, efficiency, and customer satisfaction become key performance target areas with the need for fewer maintenance and incident delays that impact the operation of the network. With fewer and shorter maintenance access windows traditional manual inspections are no longer feasible and with extreme weather events from climate change there is a greater need for efficient and reliable predictive maintenance to maintain high performance in the target levels.

IoT Technology can create systems to collect data and transfer the data through the internet for human operators to receive information without physically being present. IoT sensors and solutions can be utilised to remotely collect and report near real time data on track infrastructure, equipment and embankment stability. This allows to intervene before undesirable downtime and maintenance delays occur or inform operations of immediate failure due to severe weather event to cease train running over unstable conditions. The data can be utilised with trigger levels to identify early detection of asset degradation/failure and assist with optimising service schedules and maintenance plan cycles.

There are IoT sensors available on the market that are wireless, non-intrusive and battery powered that can collect data under live operating rail conditions. IoT long range, low powered solutions with minimal maintenance can cater for remote locations with poor access.



The sensors can be attached to the rail, track infrastructure and embankments to measure and track multiple different asset condition factors such as track stress, rail temperature, track stability, subsoil monitoring, slope stability, obstacle detection and flooding levels. Data collected can be sent to devices such as mobile phones and computers where a software platform can analyse data to suit the individual business and maintenance requirements. This can remove the need to send personnel out to obtain data and undertake inspections reducing the safety risk to staff. The Asset maintainer can be alerted to review data and respond accordingly in a timely manner. Sensors are easy to install allowing for minimal access time for installation. The system allows for historical data to be tracked and visualised providing assistance with track performance reviews to determine more accurate maintenance requirements and predict long term issues and life of the asset.

The opportunity for IoT remote monitoring to be extended to other aspects of operating rail such as wheelsets, engines, platforms, train operations and track and stability monitoring during construction works. IoT systems have the potential to digitalise the rail operating network to achieve a system with complete visibility of the network asset performance through a holistic cloud based system to improve reliability, efficiency, safety and prolong the asset life.

New Kit on the Block

Lee McLaughlin

Rail construction and maintenance contractors in Australia often struggle to justify investment in new track machines. The high initial costs, short term nature of contracts and varying track gauges throughout the country make it difficult to ensure companies can obtain a return on investment. For these reasons contractors usually purchase second-hand machines that are outdated, unreliable and require extensive maintenance and modifications to run.

When new track machines are designed and constructed to provide flexibility, reduce down time, improve quality and reduce maintenance costs, it is easier to justify the initial spend. That is why Laing O'Rourke and Select Plant Hire have committed to the purchase of a brand new MATISA B35C universal tamper. This small and compact unit punches well above its weight class. Some of the standout features of the B35C is it tri-gauge compatibility, LED lining system and self-jacking ability.

Tri Gauge Convertible Machine

The B35C is the first tamper that is purposely designed and constructed to enable Tri Gauge conversion. Its modular solution will reduce gauge conversion from two weeks down to two days. Ensuring that there are less unproductive shifts and greater flexibility on networks the machine can work on.

The B 35 C has a common chassis for a wide range of track gauges and a design enabling rapid conversion.

Optical Measuring Base

MATISA's unique technology for optical measuring base (NEMO) ensures levelling and lining measurements are completed in a single operation. It utilises intensity-adjusting LED lights on the front and rear trollies to project information to the optical receiver mounted on the middle trolley. The absence of mobile mechanical components leads to increased reliability and the technology improves flexibility and accuracy.

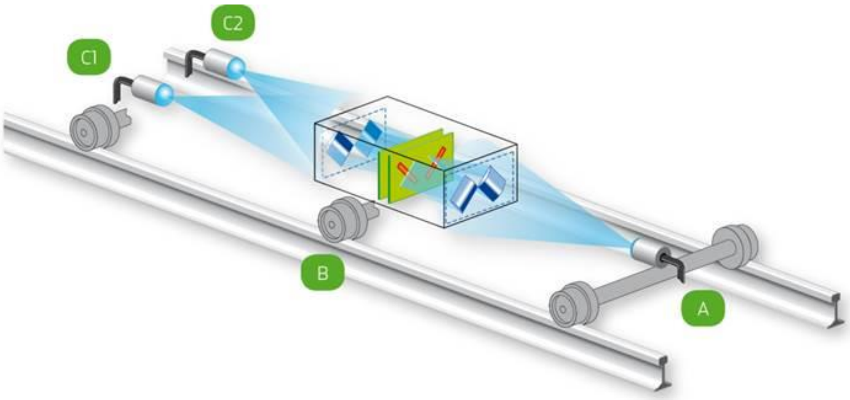


Image provided by MATISA Australia

Self-Jacking Capabilities

Loading and unloading the unit can be self-sufficient. This will reduce the need for cranes to mobilise to sites and depots to lift the tamper onto a truck to transport. The potential for significant reduction in running and maintenance costs ensures this small addition to the machine provides maximum return.

Image provided by MATISA Australia

The first B35C will be touching down on Australian shores in early 2023. Be sure to keep an eye out for it on a network near you.

Steps Towards Digitalisation

Derrick Limadinata

The Vision

The increase in population has led to a requirement to increase the network capacity to better meet customer demands now and into the future. Like other states, the ageing heavy-rail network in NSW contains legacy infrastructure which are often obsolete or incompatible with the current systems being introduced.

The alteration of existing network can vary from land purchase to add extra lines, to expanding the corridor and introduce new tracks. These solutions can often be expensive and contentious in planning terms, especially in highly dense areas where space is at a premium, disruptions are higher, and logistics are complex.

To meet the ever-increasing demands for reliability and availability, most older networks will require an upgrade that can best be achieved not through altering existing network, but through step changes in technology.

Challenges – Interoperability

Because a minimum safe distance between trains must be maintained (a distance which varies, depending on where each train is on the network), the signalling system allows a train to proceed into the next rail segment only after the preceding train has vacated it. This interdependency means that a small delay in one service can cause significant knock-on effects, creating further delays on other services.

As more and more services are introduced, and networks become more congested, the likelihood of these knock-on delays increases. This means the capacity of traditional signalling systems to keep trains moving becomes increasingly challenged.

To achieve a higher efficiency and unlock the full capacity of the network, improved interoperability is needed to enable the safe and efficient movement of freight and passengers across the nation's rail networks. One way to achieve this is by replacing traditional signalling systems with appropriate Train Protection and Control systems, that allow the rollingstock to move more independently across the network, but still with accuracy and precision and above all, safety.

The introduction of the European Train Control System (ETCS) is helping the challenge on interoperability through digitalisation of the Sydney Trains network. The step change is set to bring enhanced safety, increased capacity, reduced costs and higher service reliability.

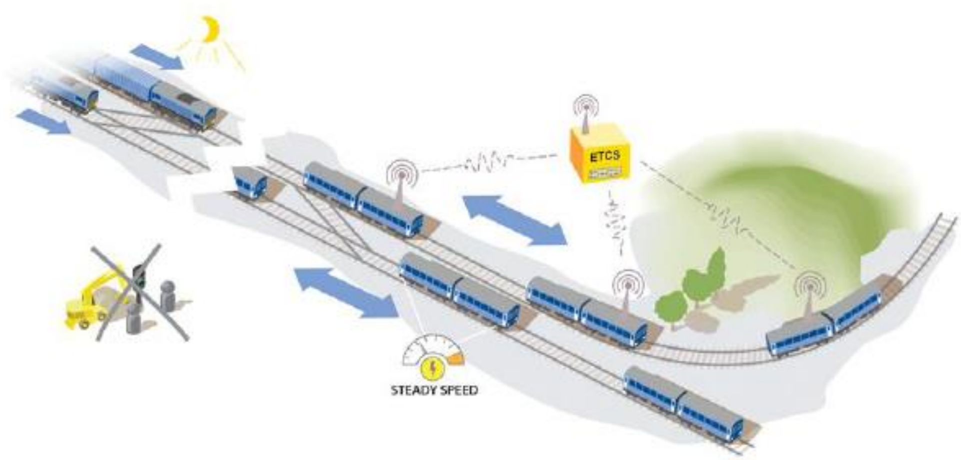
Train Protection and Control

ETCS has two levels of operability, introducing more sophistication in each increment. Sydney Trains have implemented Level 1 at Limited Supervision, with line speed enforcement using fixed balises, and for higher risk areas Level 1 control balises provide protection (e.g. from areas not covered by a mechanical trainstop). The figure below depicts a configuration whereby each service is constrained in the minimum distance from the preceding train (headway), warning lights and other signs that needs to be adequately visible for drivers.

Figure 1 ETCS Level 1 with Conventional Signalling

ETCS Level 2 introduces the use of radio to communicate with the train in addition to the existing train detection inputs (Track Circuits or Axle Counters) to provide the drivers with information on speed and occupancy of the next segments of track on board. This effectively removes the requirements for any trackside signals such as warning lights out on the corridors.

Figure2 ETCS Level 2 - Radio without Signals



Example of Digitalisation: Mt Victoria Resignalling

Several legacy segments of the network in NSW still operate on mechanical interlockings which are over a century old and obsolete. The knowledge and expertise in maintaining and operating this equipment also adds to the risk associated with reliability and asset integrity.

Figure 3 Mechanical Interlockings - final days before decommissioning

As part of the Digitalisation of the network, the Mt Victoria Resignalling project forms part of the mainline towards the Blue Mountains. The project was commissioned mid-2022. It includes a new ETCS level 2 compatible interlocking still using lineside conventional signals and axle counters for train detection ready for ETCS Level 2 implementation in the future.

Sydney Trains replaced one of the last mechanical interlockings (Figure 3) left on the network with a Hitachi WSP2G (an Italian computer based interlocking signalling system) – a first use of this system for Sydney Trains. And also, for the first time, Frauscher Axle Counters have replaced conventional track circuits for train detection on the main line.

The new interlocking system has been integrated with the Sydney Trains ATRICS train control system, enabling it to be remote-controlled from the Blacktown Control Centre.

The step towards a digital railway is by no means simple, and will require supporting reforms in every part of the railway. From planning, construction, operations, to maintenance of the systems that eventually will rely on it. Some examples of areas that may require reforms and therefore support are the:

- changes in-cab where track side signalling are no longer as relied on, but replaced with onboard digital/radio information coming in
- changes in train control which requires operators to be trained in new sets of skills
- changes in operation and maintenance of these new assets.

The resignalling upgrade in Mt Victoria can be considered the first time this technology has been applied in a significant main-line application on the Sydney Trains network. And although the there are many more steps ahead towards digitalisation, the success has laid the foundation for future projects where similar technology will be applied.