JOHN HOLLAND

ETW-V

2020 PWI NSW Ken Erickson Innovation Award Submission

Author: David Mackney
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Glossary

limit of authority	Defines the location to which rail traffic may travel under a Proceed Authority or the limits of a work on track authority. The limit may be defined by a sign, a signal capable of displaying a STOP indication, or a specific kilometrage point on a line.
Network Control	The function responsible for managing rail traffic paths and issuing Occupancy Authorities.
Rail Vehicle Detection (RVD) Territory	The portions of line where the system of Safeworking relies on track circuiting or axle counters.
track vehicle	A vehicle, usually self-propelled, used for inspecting and/or maintaining infrastructure.
track vehicle operator	A Competent Worker controlling the movement of a track vehicle.
Track Occupancy Authority (TOA)	An authority for Competent Workers and their equipment to occupy a defined portion of track for an agreed period.
Train Order	An instruction issued by a Network Control Officer in Train Order territory to direct the movement of a train.
work on track authority	An authority to work on track such as a Local Possession Authority (LPA); Track Work Authority (TWA); Track Occupancy Authority (TOA) – used with the ETW-V app.

1 Executive Summary

ETW-V is an innovative app introduced on the Country Regional Network (CRN) in mid-2020, specifically developed for the issuing of Electronic Track Working authorities for Track Vehicles (ETW-V). ETW-V was jointly developed between John Holland Pty Ltd and 4 Tel Pty Ltd. (See YouTube video – duration 1m54s).

The CRN is operated and maintained by John Holland as the accredited rail infrastructure manager (RIM), on behalf of Transport for NSW under a 10-year contract that commenced in January 2012.

ETW-V successfully delivered its primary aim to reduce the risks associated with a rail track vehicle operator (TVO) exceeding the limit of their work on track authorities by:

- providing the TVO with a tool to improve their situational awareness in relation to work on track authority limits, including the provision of a warning on approach to the authority limits; and
- monitoring the location of rail track vehicles within a work on track authority and providing an Out-of-Authority alarm to the rail track vehicle operator (TVO) and controllers at the Network Management Centre should the TVO exceed authority limits.

The CRN covers just under 2,500km of operational lines within regional NSW (green lines in Figure 1 below). To understand the quantum of the potential risk, track patrols alone account for at least 137,000km of track vehicle journeys undertaken on the network every year. This equates to around 100 rail vehicle trips per week requiring on track authorities.

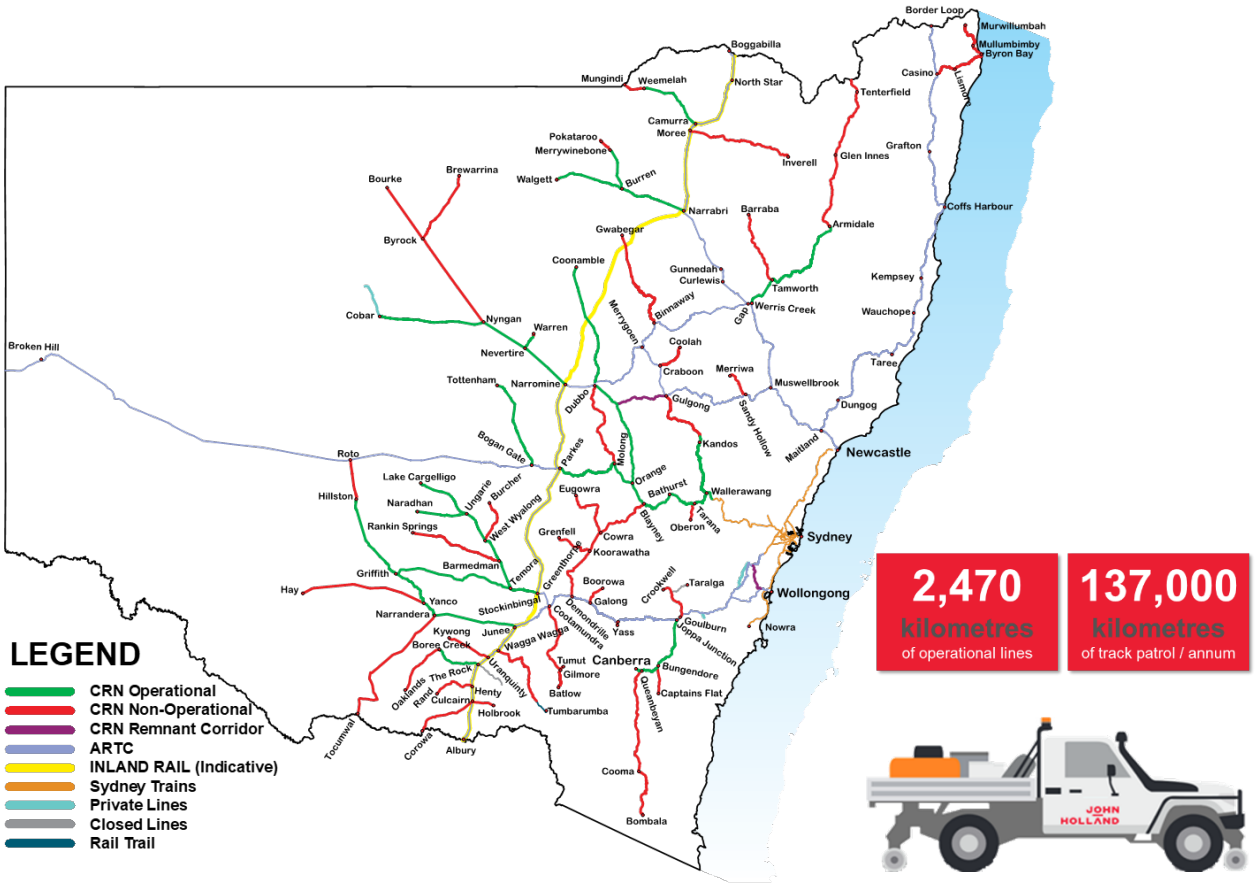

Figure 1 - NSW Network Map with annual track patrol statistics.

Track occupancies allow maintainers and their equipment onto a defined portion of the track for an agreed period of time. The defined portion of track is always between two nominated fixed points such as signals or yard limit boards. These are known as limits of authority. Trains are excluded from a track occupancy via blocking arrangements put in place at the Network Management Centre (NMC).

Prior to ETW-V being implemented there was always a potential for track vehicles to travel beyond the limits of authority into live sections of track, exposing maintainers to risk of collision and / or derailment. There had also been no visibility of track vehicle position at the NMC.

ETW-V provides the following functions (see Figure 2)

- an electronic interface for maintainers to be able to obtain a track occupancy for a defined portion of track;
- visible positioning of track vehicles for the NMC.
- a visible and audible warning when within 500m of the occupancy limits; and
- a visible and audible alarm when a limit of authority has been passed as well as an alert received at the NMC.

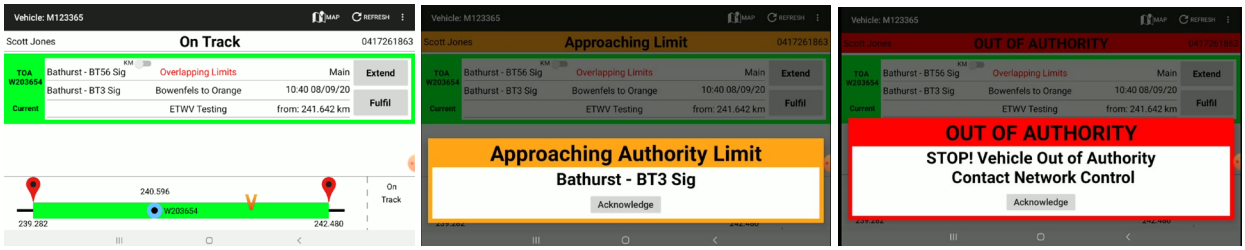

Figure 2 - ETW-V Screens (L-R) – typical state / warning within 500m of limit / alarm when limit passed

The ETW-V app is operated via a tablet mounted to the dash of the current fleet of forty (40) rail vehicles and is connected back to the control centre via the vehicles on board GPS system. See Figure 3.

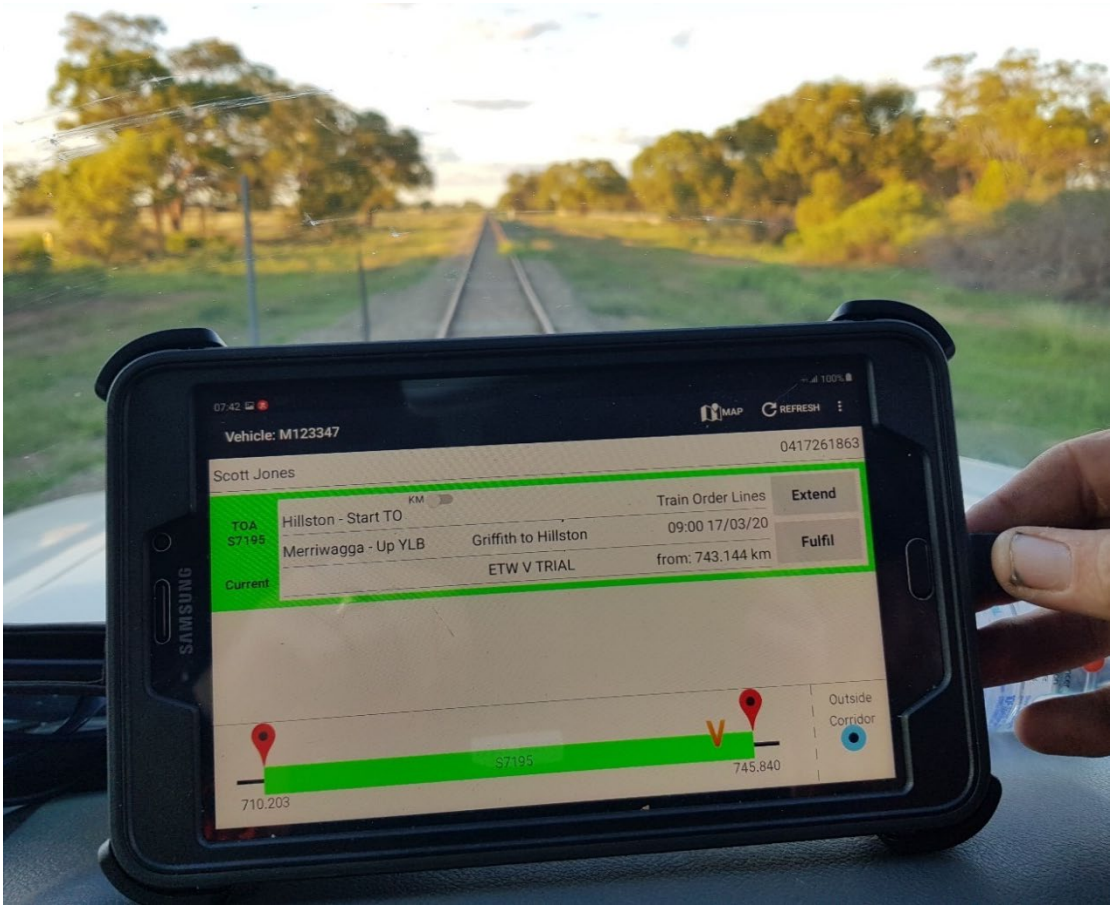

Figure 3 - ETW-V tablet mounted on dashboard of Hi-Rail Landcruiser

2 Submission Criteria

2.1 Difficulties overcome

There were numerous difficulties to overcome in the development of ETW-V, some of these are as follows

- Train operations – two operational systems of Rail Vehicle Detection (RVD) and Train Order (TO) make up about 7% and 93% respectively on the network. Where these two operating systems interface ETW-V had to be modified to account for the differing systems.
- Network connectivity (mobile) – parts of regional NSW has poor mobile network coverage. ETW has been designed to account for this issue while operational. The system requires network coverage to accept a track occupancy and hand back but not necessarily while undertaking the rail journey.
- Interfaces with ARTC / Sydney Trains – both ETW-V and the operators have been briefed on how the system treats these interface points. Warnings will still be received but not alarms (by design).
- Rail kilometrage and GPS – the accuracy of these two measurement systems was initially a concern. During field testing any sites with adjustment issues were modified.
- Existing GPS hardware in vehicles – a cost saving was made by the system being able to interface with existing GPS equipment on the vehicles. Tablets are tethered to individual vehicle asset numbers.
- Training and adoption of a new system – work teams were already utilising the existing ETW app. Less initial training was required for ETW-V due to the existing familiarity, allowing the innovative features of the 'V' version to be adopted.
- Road / Rail vehicles – binding position of vehicles to tracks. Initial development was focussed on requiring the vehicle position be tied to the track at all times. Due to the nature of the type of works, vehicles are required to routinely go from road to rail and back to road. An alternative solution was developed in the final product.
- Junction locations – there are a handful of junction locations on the CRN that branch off to other rail corridors. At these points the TVO's have been briefed on how ETW-V treats these unique locations.

2.2 Contribution / Impact to Rail

ETW-V's main contribution is to safety which is discussed in detail in section 2.5 below.

For the wider rail industry the contribution has already seen the following

- Interest from other Rail Maintainers with the same issue looking to implement similar solutions, the result is improvements on other networks
- Puts a spotlight on newer systems and solutions for potential investment
- Potentially provides cheaper solutions than traditional systems

2.3 Technical Input

Multiple stakeholders were involved in the development and roll out of ETW-V with required various forms of technical input required including:

- 4 Tel Pty Ltd – developed the app and linkage back into existing network control systems.
- JH Network Operations Team – project managed the roll out, undertook field testing and briefing of maintenance teams. Carried out human factors review and provided network rules input.
- JH Maintenance teams – end users who provided initial input, participated in the in-field testing process and implemented the process change as part of the ETW-V roll out.
- JH Risk and Assurance team – undertook change management and risk reviews as well as liaison with the rail regulator (ONRSR).

- JH Plant team – ensured vehicle GPS systems were fully functional, rewired electrical systems as part of initialisation process and installed mounts for tablets on dash.

2.4 Degree of innovation in Rail aspects

The degree of innovation is high and quite unique in some respects across Australian rail organisations. While the principle is similar to train proximity reminders implemented on the CRN in 2018 it's the first time that track vehicles have been considered as part of the same risk profile. Similar technology is currently being considered on the networks managed by John Holland in WA as a result.

It is also worthy to note that ETW-V is an enhanced version of the ETW app originally developed in 2017 to replace the issuing of paper-based track occupancies on the CRN. The 'V' or vehicle aspect of this app is mostly focussed on providing a contingency to the situational awareness an operator should already have. Visibility of the track vehicle position on operational systems is a secondary benefit. This app-based technology easily interfaces with existing control systems.

ETW-V is another continuation of John Holland's objective to utilise more smart app-based technology solutions for delivering and receiving safety critical communications by adding and improving features that benefit the users in the field.

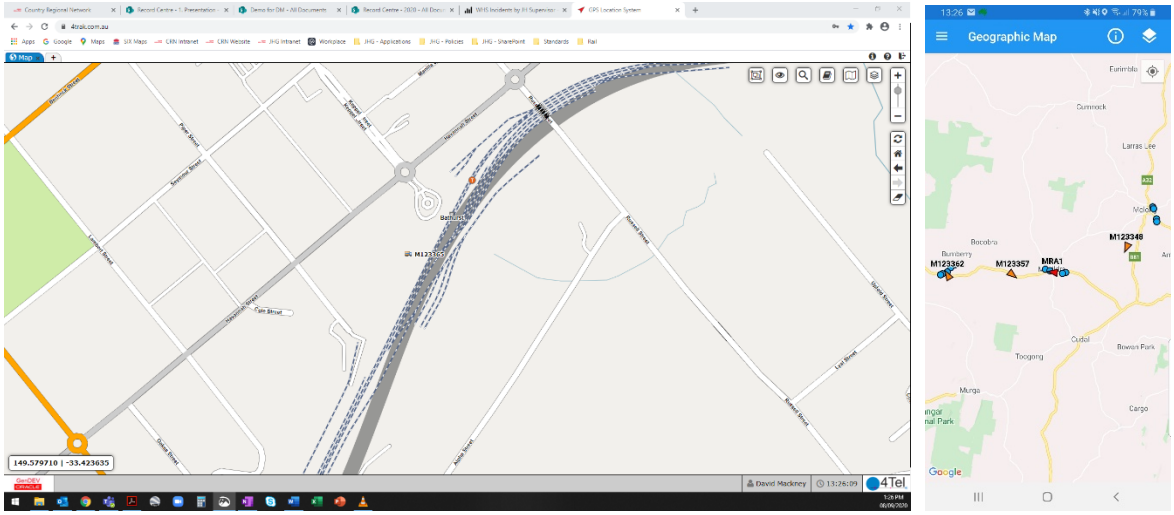

Figure 4 - Visible GPS Positioning on Desktop and Mobile Phone apps of track vehicles.

2.5 Contribution to Safety

Between 2012 and 2020 and before the introduction of ETW-V, the CRN has witnessed several safety incidents where rail vehicles have travelled beyond the limits of their authorities. In most cases these have been considered minor in nature with vehicles passing limits by only tens of metres. A handful of more serious events have also occurred where track vehicles have been able to travel hundreds of metres for significant periods of time beyond the limits. Fortunately, these events have not resulted in any injuries or damage.

Where ETW-V is utilised, it significantly reduces the potential for this type of event to reoccur. ETW-V is considered a support tool and cannot prevent an intentional overrun of a limit by a wayward TVO, but it will alert the NMC if this was to occur.

The contribution to safety is considered significant for the CRN. Considered in the context of the 'accident triangle' (Figure 5), this solution has effectively removed the opportunity for a number of events (considered near misses, unsafe acts and unsafe conditions) to reoccur.

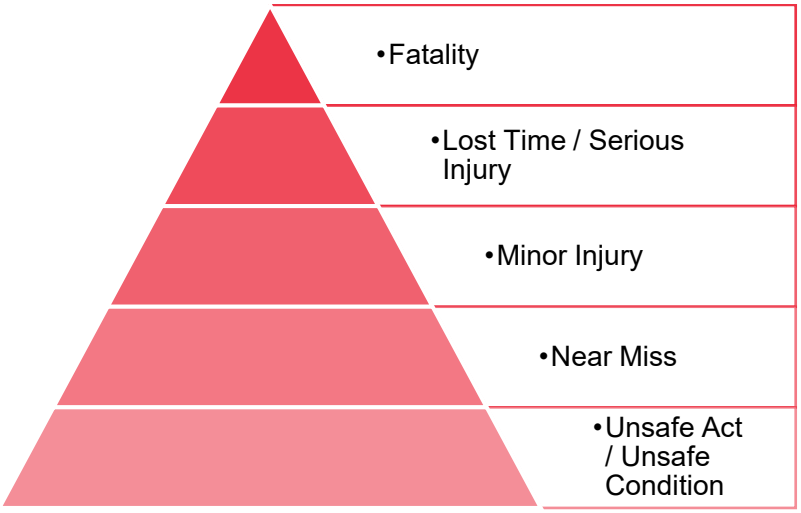

Figure 5 - Depiction of the accident triangle

2.6 Systems Assurance

Due to the complexity of ETW-V and the related systems and infrastructure, a rigorous systems assurance process was followed to ensure the system functioned as intended during its life cycle. This included:

- change management process review
- risk assessment review
- systems testing stages
- field testing in controlled and live environments
- human factors review
- independent assessment and verification
- demonstration to the rail regulator (ONRSR).

Post implementation assurance and verification activities also form part of the ongoing review of the system to ensure it retains its integrity over time.

2.7 Commercial benefits

ETW-V has the following commercial benefits:

- demonstrates a commitment to the safety and moral of our employees first and foremost
- provides a significant improvement to safety on the CRN that demonstrates leadership in innovation in the rail industry
- fosters business relationships and trust in what we do with our stakeholders, customers, suppliers and other parties
- provides potential savings on time lost as a result of incidents and investigations.
- is a relatively inexpensive solution to implement and maintain in comparison to installing equivalent train-based systems
- is easily adaptable to new technology
- interfaces with existing control systems technology
- provides faster and safer communication transactions between operators and network controllers.

3 Acknowledgements

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