



Transforming rail network safety through  
equipment safety & compliance management  
on a modern SaaS platform

Presented by  
**Mark Barrett**  
Chief Operating Officer, aquipa, Australia

## Abstract

Australian rail is experiencing unprecedented growth, a boon for the rail sector and supporting industries. However, expansion also introduces new risk into a system that's already strained. There are more suppliers in the network, more equipment on work sites, and more people in the field than ever before. Because of that volume, making sound decisions relative to risk and safety is more challenging than ever.

Australian Rail Track Corporation (ARTC) manages and maintains an 8,500km rail network that spans five states. They're also a key driver in Australia's rail expansion with projects like the 1,700km Inland Rail. ARTC are motivated toward leading the way in practices showing commitment to the safety of their people, protection of the environment, and the sustainability of the communities they serve. A key component of ARTC's commitment is the company's approach to managing safety and compliance specific to high-risk construction and maintenance equipment working in its rail corridor.

Under Australia's Rail Safety National Law (RSNL), ARTC must eliminate or minimise risks to safety so far as is reasonably practicable. Aligning to the RSNL mandate, ARTC is implementing a new technology designed to deliver a quantum leap forward in the effort to mitigate risk associated with equipment on the company's construction sites and in its rail corridor. The solution implemented by ARTC is mobile-enabled, SaaS-based platform that provides ARTC personnel and the company's supply chain with the critical processes and insights required to make sound safety decisions about equipment, both in the office and in the field.

All equipment in the ARTC network, the company's and its suppliers', is registered in and managed on the platform. Real-time views into equipment compliance status, specifications, certifications, maintenance records, operating restrictions, and more are available to users anywhere and at any time, and restricted by user access permissions. Now equipment operators, site managers, network

controllers, inspectors, supply chain managers, engineers, and procurement professionals have at their fingertips the information they need to make critical safety decisions.

Equipment owners and inspectors complete pre-delivery processes configured in the platform to ensure only quality, fit-for-purpose equipment arrives on site. Equipment operators are guided through equipment and site specific pre-start safety checks. Audit processes are configured in the platform for site managers and network control. Site level data feeds back, enabling network visibility for equipment managers, HSE managers and supply-chain managers to analyse and deliver change where needed.

Dynamic communication threads enable engagement between various stakeholders to resolve equipment issues. Tasks and corrective actions can be assigned to individuals and discussed between multiple parties to ensure completion and issue resolution. The platform also empowers ARTC to broadcast bulletins and updates to the entire network or specific groups. This capability drives true multi-disciplinary management of equipment and the associated risks.

All activity is logged enabling users to run reports filtered to their individual requirements. The history record produced from this logged activity means producing evidence for regulatory compliance and audit purposes is always available and just a few clicks away.

Leveraging the platform, ARTC transforms traditional equipment and supplier management processes to enable next level collaboration across the entire rail network and supply chain. Better collaboration and informed decision making using more accessible processes ultimately results in improved safety for all involved. ARTC are at the forefront of this new way of thinking and behaving relative to driving risk out of the Australia rail system and the aquipa is key to their innovative approach.



## Acknowledgements

We extend a heartfelt thanks to both Carolyn Southern and Richard Potts of ARTC. Your incredible partnership, expertise, engagement, and continual feedback are inspirational and invaluable to this project. And to the ICP Assessors, the ORNSR and RISSB teams, and the suppliers/contractors that all provided tremendous feedback on this system, we say we couldn't have got to this point without you. The aquipa team has been overwhelmed by the energy this group has applied to improving safety, health and quality across the rail sector and we're proud to be part of such a committed ecosystem.

## Introduction

Australia's unprecedented rail expansion means more suppliers in the network, more equipment on work sites and more people in the field than ever before. Because of that volume, making sound, data-driven decisions relative to risk and safety is more challenging than ever.

Australian Rail Track Corporation (ARTC), a key driver in Australia's rail expansion with projects like the 1,700km Inland Rail, are motivated toward leading the way in practices showing commitment to the safety of their people, protection of the environment, and the sustainability of the communities they serve. A key component of ARTC's commitment is the company's approach to managing safety and compliance specific to high-risk construction and maintenance equipment working in its rail corridor.

Under Australia's Rail Safety National Law (RSNL), ARTC must eliminate or minimise risks to safety so far as is reasonably practicable. ARTC must maintain a documented Safety Management System which must include equipment management practices. While ARTC can outsource rail corridor construction and maintenance work, from a compliance, legal and reputational perspective, ARTC cannot outsource its safety responsibility. While critical to network safety, ensuring equipment safety and managing compliance is complicated and time consuming, and in the context of a high risk, multi-stakeholder environment presents challenges for supplier businesses, operators, projects and ARTC alike.

# Desired Outcomes

## Information Availability

Better availability and accuracy of equipment information and insights.

## Consistency & Transparency

Greater consistency and transparency around network-wide operational processes.

## Communication Channels

Superior communication channels across functional areas and stakeholder groups

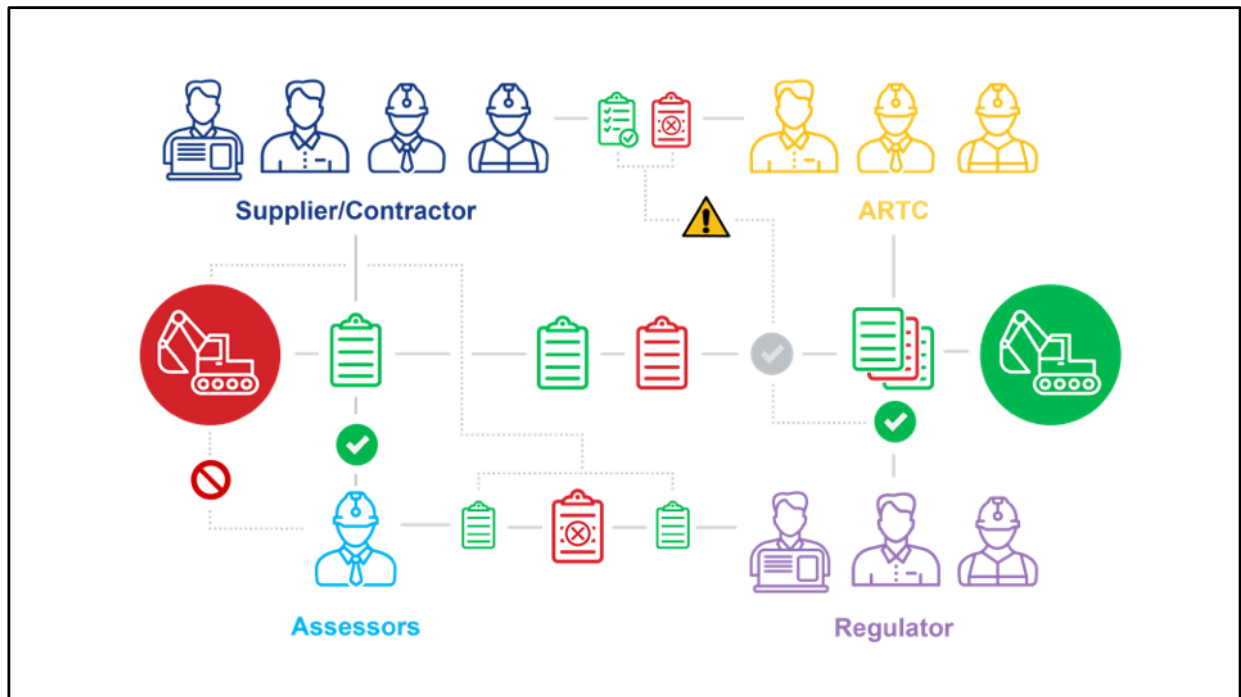
## Reduced Paperwork

Reduced paperwork and administrative burden with better safety outcomes

ARTC is “constantly seeking to strengthen their compliance and safety culture and ethical business practices through the adoption of best practice”. As part of the initiative, ARTC identified key outcomes it sought to deliver:

- Better availability and accuracy of equipment information and insights
- Superior communication channels across functional areas and stakeholder groups
- Greater consistency and transparency around network-wide operational processes
- Reduced paperwork and administrative burden with better safety outcomes

The vision is to implement a new technology designed to deliver a quantum leap forward in the effort to mitigate risk associated with equipment on the company’s construction sites and in its rail corridor. A process of continual improvement, we explore ways that ARTC can leverage technological advances to ensure network wide alignment to the equipment management practices outlined in its Safety Management System.



A “quantum leap” does not imply a fundamental change to the processes and best practices already in place. Rather, it means transformational improvements across the gamut of those processes and expanding the possibilities their execution was meant to provide.

Let’s consider Road Rail Vehicles (RRVs) for example. The Office of the National Rail Safety Regulator (ONRSR) lists RRV safety as a national priority and state in their Rail Safety Report:

*In order to allow RRVs onto their networks, operators (like ARTC) are required to put into place processes to manage the safety of RRV operations. They are strongly encouraged to:*

- *Ensure RRV certification, registration and compliance to appropriate standards, such as Australian standard AS/RISSB:7502 Road Rail Vehicles*
- *Engage an independent competent person (ICP) to undertake engineering assessment of the RRV*
- *Review, assess and accept the ICP’s report and impose limitations or restrictions on the RRV operations specific to network conditions*
- *Regularly audit the competencies of any ICPs used to certify RRVs*
- *Manage RRV recertification at regular intervals and also in response to any configuration change or substantial modification*
- *Manage compliance to scheduled maintenance plans and defect tracking*
- *Manage the process control on the traceability of rail guidance systems*
- *Ensure contractual arrangements adequately cover certification, auditing and maintenance requirements for network access*
- *Audit contractor-provided RRVs to check for evidence of network certification, including field inspections and checks on functioning of safety systems*
- *Assess RRV-specific project risks*
- *Undertake corrective actions including the ongoing review of risks and risk controls, taking into account internal and external audits and RRV-related safety occurrences.*

Collaboration with people from a range of disciplines across multiple organisations is required to ensure ongoing equipment safety and compliance. It’s a complex series of processes dependent on information coming from multiple sources, typically documented on paper or electronic equivalent and shared across the network via email and spreadsheets, limiting access to those that need it when they need it.

While some technology has been applied to resolve some elements of these gaps there has been no solution that accommodates the dynamic nature of these processes and the people who depend upon them.

ARTC undertook to establish system requirements for a fully integrated electronic solution to manage the life-cycle of “both their own and contractor’s rail maintenance vehicles that operate on the ARTC Network”. Functional requirements were developed, with the objective being a portal with network wide access through which ARTC could collaborate with equipment owners and ICP assessors.

While network wide improvements are the goal, it is still important to focus users on what is relevant to their role and the equipment they are managing. For example:

Site managers looking at a “Road Rail Vehicles” (to which the standard AS/RISRB:7502 applies) need to have visibility that

- The vehicle is registered meaning prior verification that it has been designed, constructed and tested to be fit for purpose, and that maintenance procedures have been defined
- The vehicle has been maintained in accordance with the defined procedures
- Relevant operating restrictions apply for that equipment
- Relevant documentation is available to the operator and other site personnel
- Pre-operation safety inspection has been performed and passed

An equipment operator may need to access equipment manuals and safety documents, operating restrictions, and pre-operation safety forms that include site specific risk controls

A rolling stock engineer, standards manager or auditor may need to have a deeper look into maintenance history, assessment reports or other aspects of equipment lifecycle history.

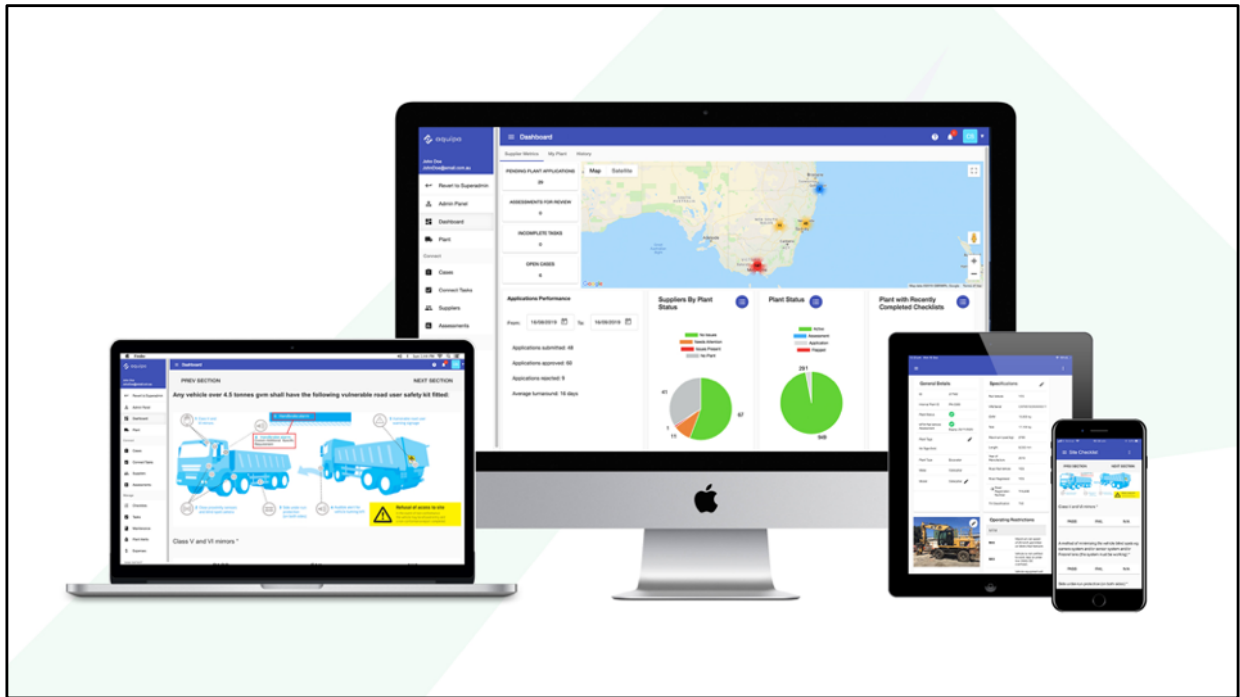
Initially the project deliverables were summarised as:

- *Develop a central location for all registration vehicles and status: TMV details and operating parameters, accreditation and registration status, ownership details (including transfer history, incident history).*
- *Ability to apply and manage operating restrictions of the TMV and corridors on which each TMV can operate.*
- *Secure, access-controlled portal for users allowing them to self-manage their information.*
- *Ability for project managers/regulator to log in and see status of the equipment on site without having to access TOC waivers or other registration folders.*
- *Automated notification process for TMV when registration is coming due, overdue and no longer registered.*
- *Ability to upload supporting documentation for each TMV related to accreditation, operation and registration for central storage, including spare fields for additional capacity for the administrator.*
- *Create a unique identification number for each TMV so as duplication cannot occur and*

*potential incorrect assignment of registration of each TMV.*

- *The system would have various reporting functions, and import and export of data.*
- *ARTC would act as the administrator for the approvals of track maintenance vehicles on the ARTC Network.*

These evolved as the project progressed and continue to evolve as the objective is continual improvement. However the above deliverables provide a good summary of the starting point.



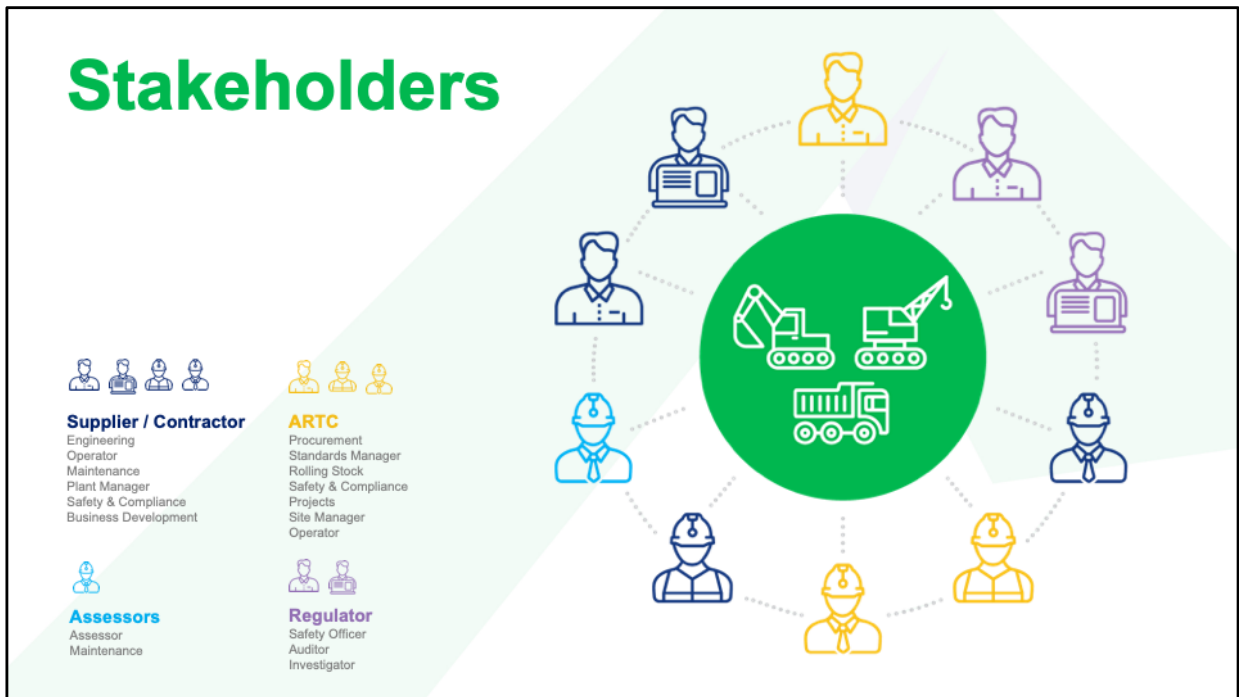
## Solution

ARTC adopted a mobile-enabled, SaaS-based platform that provides ARTC personnel and the company's supply chain with the critical processes and insights required to make sound safety decisions about equipment, both in the office and in the field. Initial purpose was for rolling stock to ensure only safe machines were on track, but the platform has since been adopted by key Principal Contractors on the Inland Rail project to cover all high-risk equipment used in the project.

A number of characteristics of the platform are key to achieving ARTC's objectives

1. A mobile enabled web application in which data is updated instantly and available to every person in the network, wherever they are
2. Multi-tenant architecture connecting equipment to users from multiple organisations
3. User access governed by granular permissions to ensure each person sees what is appropriate for their role and qualification, and are restricted from actions that are beyond their permission level
4. Configurable workflows and checklists with advanced conditional form logic to enable:
  - Equipment registration and inspection processes that perform calculations, flag non-conformances and apply operating restrictions
  - Inspection workflows that focus users on key operating risks
  - Audits of contractor equipment
  - Collaborative corrective action management
  - Management of compliance to scheduled maintenance plans
  - Equipment modification, change of ownership and decommissioning processes
5. Reporting and data export capability for network wide analysis



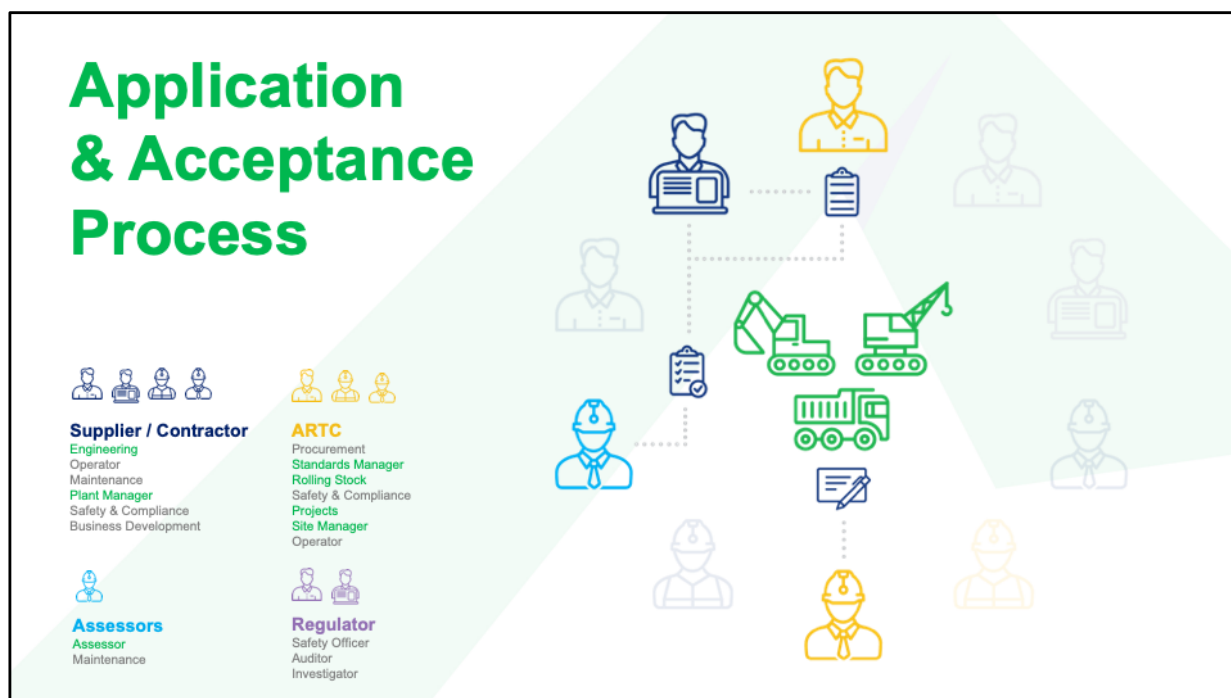


## Bringing plant, people and processes together

The piece of equipment forms the focal point of a web connecting anyone at any level who engages with that plant. Procurement, safety, project managers, site managers, rolling stock engineers, maintenance, auditors, assessors, and operators.

Workflows are configured to enable users to focus on the information and processes applicable to them while facilitating a multi-disciplinary team approach and network transparency.

While equipment is the focal point here, recognition of human factors principals is critical to network safety. ARTC is an expanding rail network with a large supply chain, mistakes, errors of judgement and unethical practices are inevitable. Early detection, management and prevention of these is where the real opportunity lies in implementing a fully integrated system that leverages modern technology.

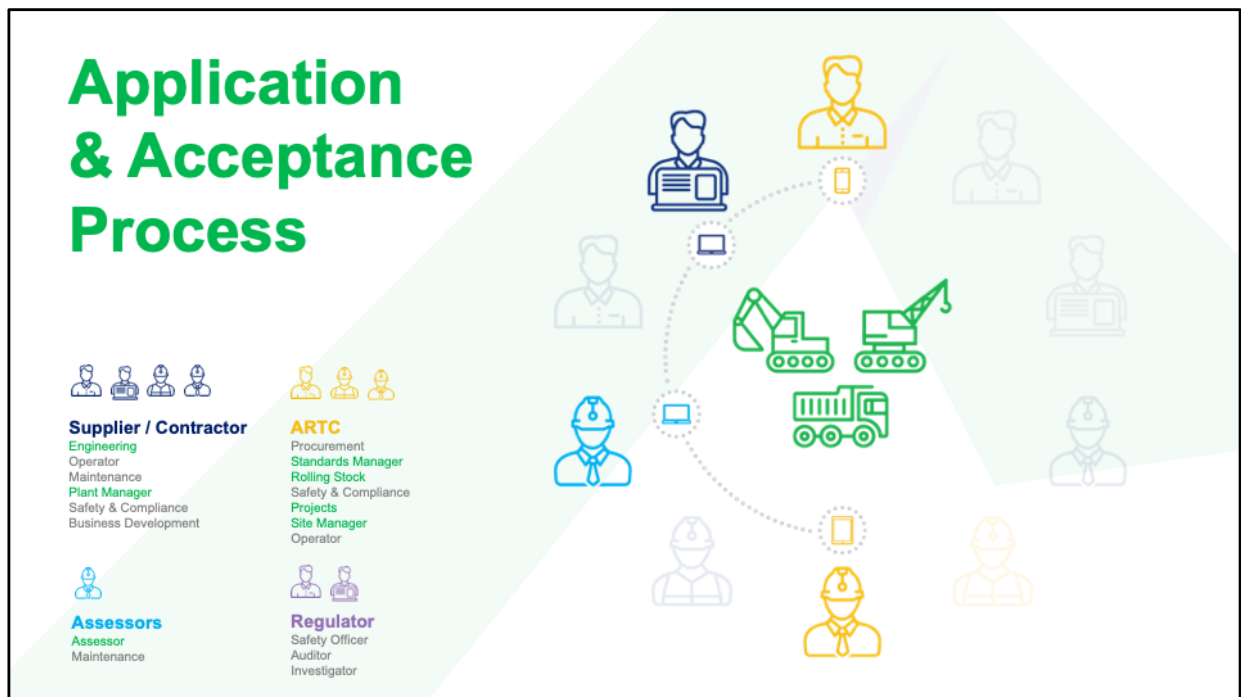


## What happens to register equipment on the network?

Track vehicle registration for the network requires interaction between ARTC personnel, the contractor and a third-party “Independent Competent Person” (ICP) who assesses the equipment.

- Contractor applies to ARTC for equipment access to network
- Acceptance is dependent on assessment by a third-party ICP to certify compliance against applicable standards including the AS 7500 series of Australian Standards
- Applications and assessments are reviewed and accepted or rejected by ARTC standards managers and rolling stock engineers, and operating restrictions are applied
- Principal contractors may have additional project/site specific requirements
- Projects and site management require knowledge about whether equipment has or has not been pre-approved and the operating restrictions of that equipment

These processes have traditionally used paper forms, email, phone and/or document upload tools which risks information loss, creates bottle necks and contains multiple points with potential for human error. Certification and registration involves a large amount of data, having that data stored in static files is inefficient and doesn't reflect the dynamic nature of equipment compliance.



Now the entire application and acceptance process comprising checklists, document upload, declarations and verification, is contained within the platform.

Contractors complete applications and ICPs complete assessments using forms that leverage conditional behaviour to focus users on providing the required information for that equipment type and managing key operational risks. Users can only proceed to submit when all required questions are answered, and documentation uploaded. Non-conformances and operating restrictions are logically applied based on information submitted and equipment specifications, so that ARTC and ICP verification is supported by system analysis of data.

ARTC verifies equipment information, documentation, ICP assessments and that the maintenance plan submitted by the contractor aligns with relevant standards and their Safety Management System. Decisions are made about non-conformances, operational restrictions can be modified, and the equipment ultimately accepted or rejected.

Where issues do arise in the registration process, discussion threads open a communication channel between ARTC, contractor and ICP to enable an efficient and transparent resolution process.

The result is a thorough but efficient process that assures quality of equipment on the network, availability of equipment information, and is automatically documented for later review.

Civil (non-rail) equipment undergoes a similar registration process between contractor and project principal contractor.

Once accepted the equipment assumes its own profile for ongoing collaborative management by individuals who have their own profile.



## What happens out on site?

On-site personnel have had to rely on registration stickers and certificates as evidence of compliance and for information about operating restrictions. However compliance status of equipment varies, dependent on factors like maintenance, modifications and pre-operation safety checks. Similarly, operating restrictions can vary depending on modifications, minimum standard changes and site specific risks. So, information stored in static documents can lead to dangerous assumptions at site level where fast, easy access to up-to-date information is critical to decision making.

For safe operation, equipment operators also need fast access to current compliance status and operating restrictions. Operators play a key role in ongoing safety assurance by performing pre-operation safety checks which are still most commonly paper-based, or rudimentary digital checklists at best.

Safety inspectors from all stakeholder groups audit equipment out on site to check for compliance status as well as compliance with operations maintenance and defect management, and safety checks. Access to information is essential for audits, so improving access and information quality helps reduce disruption of work on site and improve effectiveness of audit processes.



These daily safety checks and audits double as an extremely valuable data capture opportunity, the benefit of which can only be realised in an integrated system with standardised processes. All site personnel are required to have the app on their mobile devices, so they have access to equipment information and processes when needed.

Equipment operators check equipment profiles daily to confirm compliance status and operating restrictions, and access operational information. Checklists are configured to guide operators through pre-operation safety checks which may include site specific risk controls.

Site managers and supervisors access equipment information and perform site acceptance and site attendance log processes to ensure only fit-for-purpose equipment is used on site.

- Issues identified in pre-operation safety checks and site manager checks are automatically logged and communicated to all relevant users.
- Issues can be documented as resolved at the time
- For other non-critical issues, “Tasks” can be set with due dates for contractors
- Safety critical issues logged trigger equipment to be flagged as non-compliant, automatically setting up a “Case” and network wide alert.

Inspectors and other personnel also access equipment information using the app, and have workflows configured depending on their role.



## How are issues managed?

As an accredited rail transport operator, corrective action processes are integral to ARTC's Safety Management System (SMS). SMS corrective action requirements under the Rail Safety National Law Regulations include:

- 1) *Procedures to ensure, so far as is reasonably practicable, that corrective action is taken in response to any safety deficiencies identified following inspections, testing, audits, investigations or notifiable occurrences.*
- 2) *Procedures for—*
  - a) *registering any corrective actions taken; and*
  - b) *the review of those corrective actions; and*
  - c) *the implementation of corrective action if it is determined that corrective action is required; and*
  - d) *the assigning of responsibilities for corrective action.*
- a) *Procedures for giving priority, when undertaking corrective action, to those matters representing the greatest safety risk.*

Equipment related issues present a significant safety risk so it is critical they are promptly communicated to the entire network and corrective actions established. Implementation of corrective actions requires a multi stakeholder approach and must be documented for review and regulatory purposes, all of which is difficult to do effectively with traditional unintegrated processes.

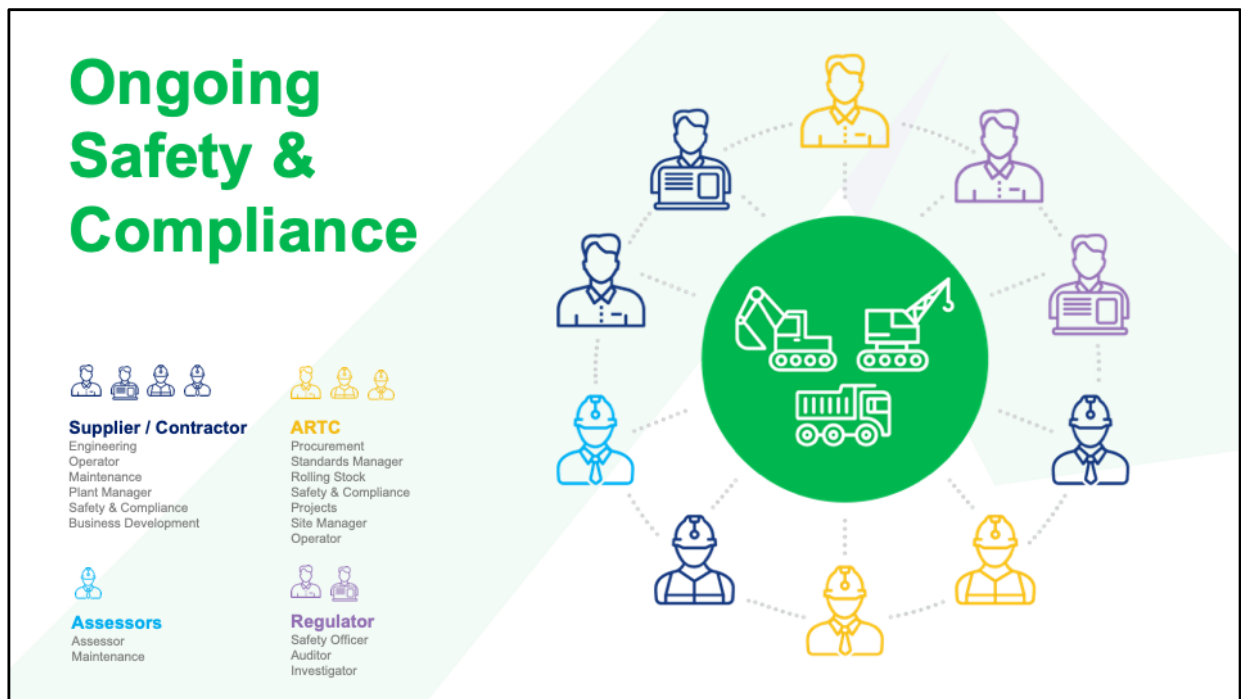


When safety-critical issues occur, a corrective action is initiated and the equipment is tagged as non-compliant in the system showing that it is not permitted on the network. A “Case” is created which pulls relevant ARTC, contractor, assessor and principal contractor users into a portal to log communication and collaborate to resolve the issue.

The case management portal comprises a message thread for transparent and chronologically logged communication, as well as the ability to upload documents, add photos, assign users and set tasks and deadlines.

ARTC has the ultimate power to close the case and enable the equipment as compliant for work immediately or pending outcome of assessment.

When non-critical issues occur ARTC sets “Tasks” for the contractor which also leverages a collaborative portal for discussion, sub-task setting, issue assigning and due date setting.



## How does ARTC ensure ongoing safety and compliance?

### Maintenance Compliance:

Contractors must demonstrate that equipment is being maintained in accordance with the maintenance plan submitted during registration. Contractors achieve this by either utilising the maintenance scheduling and logging features in the application, or by completing a maintenance self-assessment processes every 6 months that include declarations and upload of maintenance reports. Contractors are alerted prior to deadlines and when deadlines lapse ARTC is alerted and visible compliance status changes in the system to alert users network wide.

### Checklist Monitoring:

Now ARTC and their principal contractors have visibility to:

- See each day where checklists have/have not been completed
- Be alerted when checklists have not been submitted
- Be alerted when checklist items are failed
- Analyse checklist activity network wide, by site, by contractor, by checklist, by user
- Identify equipment that is not utilised

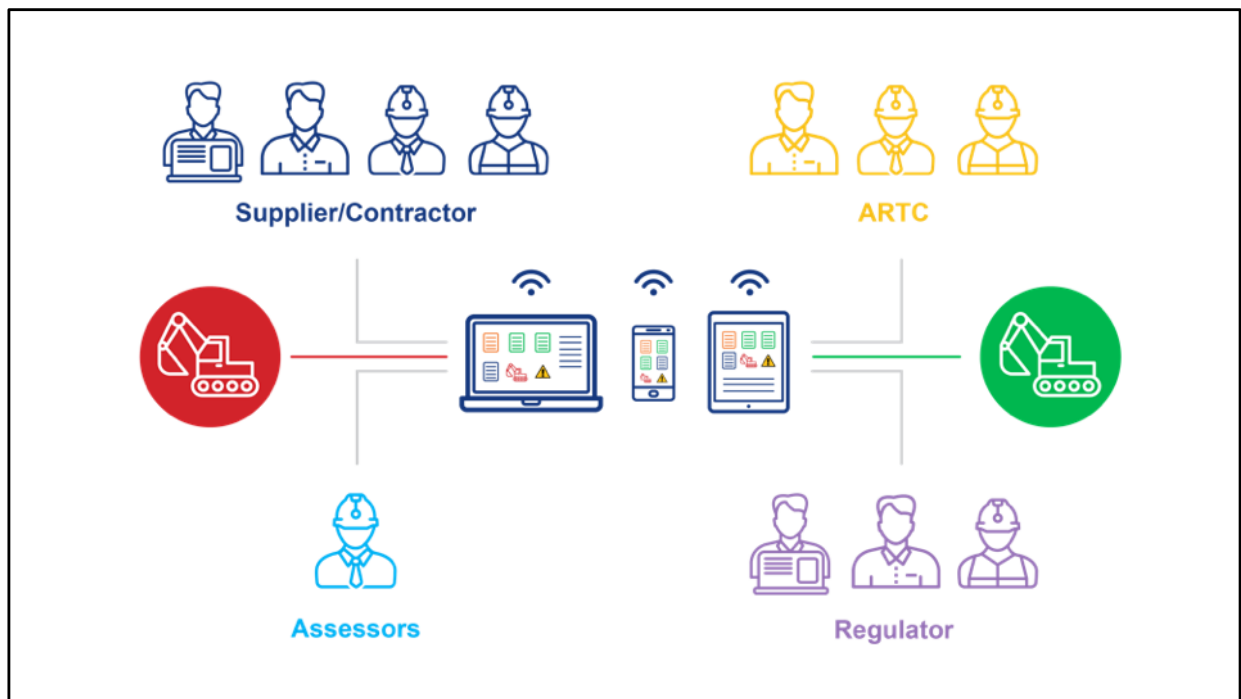
### Inspections, Desktop Audits and Self-Assessments:

Processes are configured to enable qualified third-party and ARTC users to inspect contractor equipment and review contractor equipment profiles for maintenance practices and adequate documentation. Self-assessments are configured that lead contractors through assessment processes which are reviewed by ARTC upon submission.

### Other Equipment Life-Cycle Activities:

- Contractors are required to report equipment modifications, some which may trigger changes to operating restrictions or compliance status pending assessment
- Change of ownership processes enable transparency for ARTC and ensure the information and life-cycle history for that equipment remain complete
- Decommissioning process enable identification of previously decommissioned equipment





## Outcomes

ARTC has configured a platform on which to develop a national register for track maintenance equipment which will enable them to stand down the preceding “TOC Manual” and “TOC Waiver” processes. Key principal contractors on the Inland Rail project have adopted the platform for all high-risk equipment, ensuring network-wide consistency in equipment safety and compliance processes.

Safety hinges on the decisions people make on an ongoing basis, and good decisions hinge on accuracy and availability of information. An outcome of this implementation is a new level of information availability for everyone at ARTC and in their supply chain.

The early stages of implementation have already seen multiple compliance issues ranging from basic human error to questionable ethical practices, that have been detected and addressed earlier than would have previously been the case.

The results in the context of the desired outcomes:

- Availability and accuracy of equipment information is achieved by configuring robust equipment registration and management processes on a mobile-enabled, cloud-based platform
- Communication channels open as information updates instantly in an environment that connects users in online discussion portals
- Network-wide operational processes are more consistent and transparent as a product of the structured workflows that are configured in a collaborative environment
- Reduced paperwork and administrative burden are achieved through streamlined processes and automated reporting.

Better safety outcomes are the result of all the above factors as well as a more connected network with enhanced visibility, greater ability to detect problems, increased engagement in processes.

Greater transparency in a connected, network is expected to strengthen safety culture and foster industry-wide collaboration for continuous improvement.



## Future Direction

While the initiative has transformed equipment safety and compliance processes network-wide, it is important to look at where further safety gains can be achieved.

### **Continuous Improvement:**

Now that processes are cloud based, they can be measured and analysed for insights to further system and operational improvements. An integrated, cloud-based platform enables data driven reviews of equipment safety and compliance processes as well as the development of meaningful safety performance measures.

### **Campaign Delivery:**

A platform that people access on a regular basis has great potential to promote safe behaviours, support ARTC safety fundamentals and support organisational health and safety initiatives. High rates of mental illness exist among operators in the field, yet these people can be hard to reach with health and safety campaigns. Piggybacking off platform processes is an effective way to deliver campaigns around:

- Safety culture
- Safety and compliance responsibilities
- Training and education
- Health and fitness
- Drugs and alcohol
- Fatigue risk management
- Mental health signposts

### **Leading Indicators:**

Analysing process data may reveal leading indicators for safety issues. For example, changes in checklist activity or maintenance activity may identify sites or contractors that need closer monitoring and health and safety education updates.

# Looking Forward

- Continuous Improvement
- H&S Campaign Delivery
- Predictive Analytics
- Human Factors
- Intelligent Checklists



## Human Factors

The bigger opportunity in implementing a cloud-based, multi-tenant platform is the potential for next level integration of human factors principals into equipment safety and compliance systems.

Transitioning checklist processes from paper based to cloud based enables a multitude of improvements beyond the obvious cost and environmental advantages. A range of constraints with paper checklists inevitably result in sub-optimal safety processes that:

- Are difficult to manage and change
- May lack completion
- Produce poor quality data that is difficult to manage and resource heavy to analyse
- Lack user engagement and risk becoming tick-and-flick exercises prone to critical misses
- Subject to unethical behaviour

Some of these issues can be solved by converting paper forms into digital forms, but that does little compared to the full potential of checklists to improve safety and wider business operations. The criticality of safety checks is well understood, yet audits and incident investigations repeatedly cite safety check processes as failure points. So, we really need reimagine the role of checklists because in the context of a mobile enabled, cloud-based system they become infinitely more powerful.

For example, consider ARTC managing pre-operation safety check processes across 8,500km of rail. To ensure network safety, the basic questions:

- are pre-operation safety checks are being done on time and fully completed?
- are pre-operation checklists adequately configured and performed?
- are issues identified in pre-operation checks being appropriately communicated and escalated?

Relying on traditional checklists takes significant ongoing resources just to manage a sample of the network. In an intelligently configured checklist environment, the entire network can be monitored automatically, alerts set, and data analysed in minutes. Resources can then be diverted away from getting the data in, and toward more impactful health and safety activities like education and mentoring.

### **Improve Safety Behaviour:**

Behavioural science researchers have demonstrated that “ethical people make unethical choices” and when they have done it once they are more likely to do it again. But strategically placed reminders about the importance of and commitment to ethical codes improve behaviour.

It’s virtually impossible to predict when an individual may develop poor safety check habits, like completing the process whilst sitting in the cab of a vehicle instead walking around the vehicle to complete the checks properly. Intelligent checklists can randomly display safety culture messages during checklist activity to keep operators aligned to ethical codes.

By leveraging mobile technology, intelligent checklists can detect whether a user is still when they should be moving around a vehicle, or answering questions faster than is realistic, and serve safety culture messages at time of detection to “auto-correct” the behaviour and prevent problems occurring.

Repeated or broader detection of checklist behaviour issues may indicate a need for safety culture education activities for individuals, contractor businesses, sites, or entire network.

### **Engage Users in Meaningful Process:**

When users and groups see clearly the effects of their activities, those activities become more meaningful. Intelligent checklists enable organisations to better leverage the expertise of people in the field, but we should also explore how processes can be configured so those people receive feedback about the impact they are having.

Humans are easily distracted when involved in repetitive activities but we now have many more possibilities to minimise the impact of this. How do we optimally configure workflows and checklists to simplify processes and avoid reliance on memory, while focusing users on what is important?

### **Big Data:**

Network and industry adoption create opportunities to analyse large amounts checklist process data help drive improvements in these safety critical processes

- Do checklist attributes like, number and structure of questions, affect performance?
- What are ideal lengths for specific checklists?
- How to best serve checklist instructions?
- Does checklist performance and reliability decline if checklists are too long?
- Which languages do we need to serve checklists in to ensure optimal performance?
- Do changes in checklist behaviour provide warning signs about time-pressure, fatigue, mental health



Mark Barrett  
B.AppSc  
aquipa  
Chief Operations Officer

## Glossary

Safety Management System (SMS) - It is a regulatory requirement that ARTC maintain a documented Safety Management System. Equipment management and maintenance practices are included and ARTC must ensure that contractors' practices align to the ARTC SMS

Contractor - contractor or supplier

Equipment - equipment, plant and asset are interchangeable terms

Assessment - assessment and inspection are interchangeable terms

Assessor - assessor and inspector are interchangeable terms