

FASTTRACK

THE NEWSLETTER OF THE HORIZONS PROGRAM | JULY 2022

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Smart Train Toilet System

Ashley Gorfine

Rail operators and governments alike are always looking at new and innovative ways to make their networks more sustainable. In 2020 the Innovate UK's First of a Kind (FOAK) Funding Programme announced a grant for Chiltern Railways to trial and develop the Cleartrak toilet system on their network with the goal of making it commercially available to all operators by the end 2023.

Cleartrak recycles wastewater that is reused in hand wash basins and toilet flushing. Solid waste is processed into an inert biochar, solid material produced by thermochemical conversion in an oxygen-limited environment. This biochar only needs to be emptied once every 6 weeks without the need for specialist equipment.

Current Controlled Emission Toilet Systems (CET's) discharge approximately 80 tonnes of waste into the sewage network every year. The Cleartrak system has the potential to reduce this to 0.25 tonnes per year of biochar which can easily be safely disposed of.

An added advantage of the system is that it eliminates the need for capital and operational investment in waste emptying equipment, removing an unpleasant and time consuming task for the trains regular maintenance schedule. It also reduces the burden the network places on traditional land based sewage treatment facilities.

The Cleartrak system will only require servicing a maximum of 4 times per year. The system will also reduce the volume and weight of tanked water and waste resulting in lower fuel usage and emissions.

This is an innovative solution to a problem that is not regularly talked about and has the potential to change the way toilet systems on trains operate into the future.

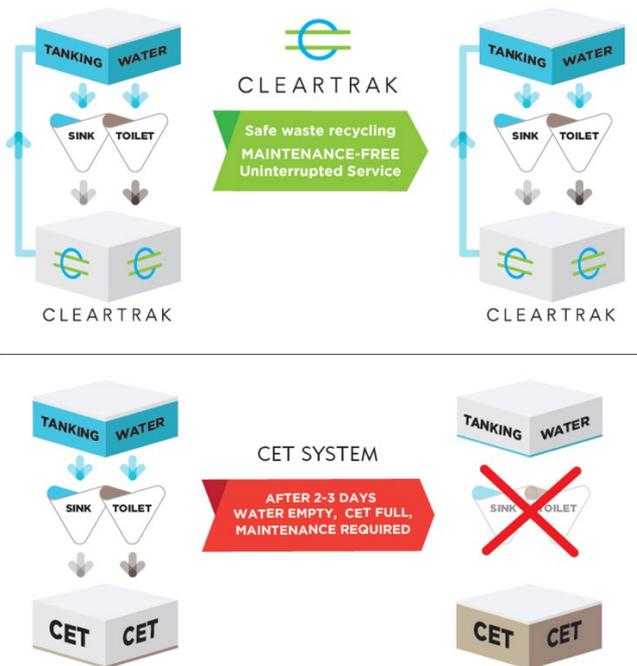


Sources and additional information:

<https://www.gbr-rail.com/cleartrak.html>

<https://www.railpage.com.au/news/s/garrandale-s-cleartrak-toilet-system-to-begin-trials-on-chiltern-railways>

<https://news.railbusinessdaily.com/cleartrak-the-train-toilet-waste-processing-system-that-does-it-all-on-board-tested-on-chiltern-railways/>



The system is predicted to reduce the whole of life servicing costs by half, with the potential for water wastage reduced by 95% and greenhouse gases by 35%.

Emerging technology in the railway industry – Digital Interlocking System

Matthias Heigl

In today's world, where sustainable travel and mobility is becoming more and more attractive and important both nationally and internationally, it is crucial to sustain an up to date and well-maintained network to meet the growing demand of our commuters.

The railway industry is currently going through technological change and upgrading a variety of obsolete and faulty rail systems built throughout the great history of railroad mobility.

Germany has recently introduced the first digital interlocking system to meet the growing demand of transporting double the current amount of passengers by 2030¹. This emerging technology may also be the answer to Australia's growing public transport demand in the future.

What is a digital interlocking and what are the benefits of this new technology?

Digital interlockings are an advanced electronic interlocking system that offers standardised component interfaces and transmits its control demands digitally via fibre-optic cable to points and signals¹.

Due to this new IP-based technology, signals and points can be controlled at much greater distances. It enables increased capacity and processing speed, fewer cable usage and data analysis-driven maintenance².

Digital interlocking systems in Germany entail the following technologies:

*Digital Interlockings*¹:

- IP-based technology to control points and signals.
- Standardised interfaces to remove manufacturer related system dependencies.
- Enhanced ETCS compatibility across the network.

European Train Control System (ETCS):

- a communication-based train control system, which continuously calculates a safe maximum speed for each train, including cab signalling and on-board systems that takes control if the allowed speed is exceeded³.

- involves continuous supervision of train movements and offers 3 levels and operation modes⁴.

Integrated command and control system:

- combines all required applications and standardised operations.
- functions as interface to electric and/or digital interlockings and ensures that all interlockings behave the same way regardless of manufacturer¹.

The railway industry in Victoria is currently going through a construction boom as the public transport demand is expected to almost double from 17 million to almost 30 million trips by 2050⁵. With its CBTC (Communication Based Train Control System) Victoria is making a step in the right direction, however, Germany's digital interlocking systems may be another well-defined alternative to support Victoria's digital transformation in the future.

Sources and additional information:

Deutsche Bahn, Digitale Schiene:

<https://digitale-schiene-deutschland.de/en/Digital-signalling-system>.

European Commission ETCS levels and modes:

https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes_en.

International Rail Journal:

<https://www.railjournal.com/signalling/db-inaugurates-first-digital-interlocking/>.

Global Railway Review:

<https://www.globalrailwayreview.com/news/67227/germany-interlocking-technology/>.

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- (1) <https://digitale-schiene-deutschland.de/en/Digital-signalling-system> (viewed 29.06.2022)
 - (2) <https://www.alstom.com/solutions/signalling/interlocking-40-safe-rail-operations-increased-capacity-and-reliability> (viewed 29.06.2022)
 - (3) <https://www.thalesgroup.com/en/markets/transport/signalling/signalling-solutions-main-line-rail/european-train-control-system-etcs> (viewed 29.06.2022)
 - (4) https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes_en (viewed 29.06.2022)
 - (5) Department of Transport – Our transport future: <https://transport.vic.gov.au/our-transport-future> (viewed 29.06.2022)

System Safety Assurance planning and implementation

Luke Jabarian

Background:

The delivery of rail, infrastructure and their operation and maintenance require to meet two legal obligations:

- safe so far as is reasonably practical (SFAIRP) and
- fit for purpose.

To achieve these two requirements, the product and service should apply system assurance philosophy and processes. Systems assurance includes system safety, systems engineering and human factors. The focus of this newsletter is system safety assurance planning and implementations.

Current area of improvements:

It cost more for the delivery agents and the government to achieve “safe SFARIP” and “fit for purpose” products. Because they should follow system safety assurance processes at every stage of delivery and O&M lifecycle. As a result, they cannot use obsolete and off the shelf products all the time. Meeting these two requirements leads often to adjustment on off the shelf products, consolation and tailoring the solutions to meet “safe SFARIP” and “fit for purpose” requirements.

The delivery of products and services often overrun by cost increase from what was estimated because:

- System safety assurance processes are not tailored to meet the scope requirements.
- The program managers and project managers pick and choose to implement system safety processes as it was planned.

Solutions:

- The system safety assurance should be tailored based on the program scope. Tailoring requires to focus on meeting “safe SFAIRP” and “fit for purpose” outcome rather than following each safety assurance activity by the book. Having an outcome focus leads to innovative ideas and only implementing safety assurance activities that meets the legal obligations rather than implementing every activity that may not add value.
- The safety assurance manager should be located independently from the program delivery team, so all the safety related issue can be escalated. Being located independently means the Program manager cannot have impact on their income. Otherwise, safety related issue may not be raised.
- The program managers and project managers tend to be communicated on what safety assurance activities needs to be done. However, why comes first. If why to implement safety assurance activities is communicated clearly and constantly, then the project managers will have inner drive to follow the process as they know the consequence of not following it.

Technology in Inspections

Lara Knight

Inspections of rail infrastructure has always been a hands-on and time-consuming process requiring visual siting of each nook and cranny. Growing improvements in safety requirements within the construction and rail industry have restricted the ability for personnel to undertake these inspections utilising historic methods which has made inspections a resource heavy and costly exercise.

Drones are a fast-growing technology, and their commercial availability has increased significantly over the last decade. Being an unmanned vehicle that's able to access hard to reach locations, drones have begun to play an important role in the asset inspections, increasing our accessible whilst alleviating safety risks involved with physical inspections.

The inspections utilising drones are not just restricted to scheduled maintenance, drones have been found to be useful in inspections following significant weather events where vehicle access is not yet possible. Drones with Lidar capabilities have also been used to measure washouts with improved accuracy in calculating repair materials.

Some limitations with the use of drones for inspections are their ability to access or view all locations due to their size or restrictions in camera rotation. Although drones can capture high-resolution images, physical inspections are still required once defects are identified for defect measurement, recording and confirmation.

However, at the rate the drone technology has been growing and our confidence in utilising drones increases, these obstacles may soon be overcome and more reliance on drones and unmanned inspections is likely to become more prevalent in managing rail infrastructure.

LeadMind

Joshua Penman



seen an increase in fleet availability and reliability. Increased reliability means better service and greater comfort for passengers. Through real-time fleet health status, it is possible to detect faults in advance and track deficiencies proactively so that problems can be identified and rectified without impacting service.



What is LeadMind and how does CAF use LeadMind in Canberra?

By providing real time operational data to operators and maintainers, LeadMind can increase the efficiency of operations, availability, and depot performance. A bit like your car warning lights, LeadMind shares real time information to the maintainers to resolve issues before impacting service. The LeadMind platform offers many benefits such as real-time fleet management, improved diagnosis, and condition-based and predictive maintenance. All of which contribute to minimizing service breakdowns, life cycle costs, and energy consumption while maximizing passenger comfort and safety. LeadMind has the backing of CAF's 50 years of manufacturing and maintaining light rail vehicles which provide analytical data to form the basis of LeadMind.

Since implementing LeadMind on the Canberra light rail network in October last year, the maintenance team has

Where else in the world is LeadMind used?

LeadMind is used in 58 fleet projects across more than 20 countries. CMET joins a diverse group from high-speed and regional trains to other light rail networks. More than 1500 train units and 5300 cars are currently monitored, and this number continues to grow. Across the group, there is real evidence of saving maintenance costs and improving reliability, availability, maintainability, and safety.

Whilst Canberra uses LeadMind to help with predictive maintenance other networks utilise LeadMind to help with the testing and commissioning phase of a new network¹ including coming up with new scenarios to be tested by LeadMind so when they occur during operations there is a data lake of data to quickly manage and resolve any issues.

¹ <https://www.cafdigitalservices.com/success-stories>

Asset Maintenance Tool

FLUKE ii900 SONIC INDUSTRIAL IMAGER

Reshma Ramesh

The Fluke ii900 Sonic Industrial Imager is a handheld device that enables maintenance teams to locate air leaks; quickly and accurately in pneumatic pipelines, especially in noisy environments.

It has a 7-inch touch screen that produces a visual image for quick identification of the leak location.

- Ensures correct air supply pressure to pneumatic equipment
- Improves reliability in maintenance process and inspections

Application

Pacific National successfully trialled this tool, and it is now embedded in maintenance practices; UTM (Unit Train Maintenance)

The tool proved reliable especially in lower temperatures, when train air systems are performing poorly due to leakage from the air-brake system.



The interface allows technicians to isolate the sound frequency of the leak, to filter out loud background noise.

Images can be saved and exported for reporting purposes.

Benefits

- Maintenance team can quickly identify leaks that are not easily audible
- Reduce Leak Detection time



Duratrack® Plastic-Composite Sleeper

Poppy Sun

Railway sleepers made from recycled plastics by Integrated Recycling was type approved in 2019 by ARTC for trial on a section of main line in Tottenham, Victoria. With the success and recent extension trial period of the composite sleepers, it is potentially an innovative solution to the future of sustainable rail infrastructure.

The sleepers are manufactured from 85% recycled material, a mix of polystyrene and agricultural plastic waste, including cotton bale wrap, vineyard covers and pipe from the mining industry. A kilometre of track laid with Duratrack® sleepers uses approximately 64 tonnes of recycled plastic. The materials are also fully recyclable at the end of the sleeper's life, which demonstrates a great practice of circular economy.

In 2016 Sustainability Victoria gave a research grant to Monash University which enabled an analysis of flexible plastics in a railway sleeper environment. As a partner of Sustainability Victoria, Integrated Recycling was supported by the grant towards to the development of the Duratrack® sleeper. ARTC takes on the future thinking of rail infrastructure sustainability and works with the Institute of Railway Technology (IRT), Monash University by providing field data for R&D exercise.

In a railway application the sleepers are exposed to harsh climate, chemicals, vibration, and applied load.

The properties of a plastic-composite sleeper can vary significantly depending on its geometry, manufacturing method and material composition. To ensure adequate performance on the field, A series of laboratory-based tests were proposed to comprehensively assess the plastic-composite sleeper and rail fastening system. The following main components were considered:

1. Electrical insulation
2. Fastener pull-out test
3. Bending moment capacity
4. Fastener repeated load
5. Rail seat durability
6. Sleeper lateral stability

25 sleepers are trialling on ARTC's network. The sleepers are supporting standard gauge with an arrangement of 1 in 6 used with timber sleepers (i.e. 5 plastic-composite and 1 timber). To this day, IRT is continuously monitoring the stresses of the sleeper in the field using instrumentation. Being a similar weight and characteristics to timber sleepers, Duratrack® sleepers provide an alternative to traditional timber sleepers, only with 3.5 times longer design life (50 years). The sleepers utilise existing railway equipment and fasteners like timber sleepers and can be drilled to adapt to different track gauges. Based on the data collected, it is suggesting the sleeper is performing stable at the trial site (under specific operation conditions and sleeper arrangement at trial site).

BuiltView - Photo and Video Management System

Tyler Martin

Construction Engineering, Environmental and safety teams take a lot of photos and videos across numerous worksites and can spend many hours each week uploading, sorting, and sending files to other members of their teams as well as clients.

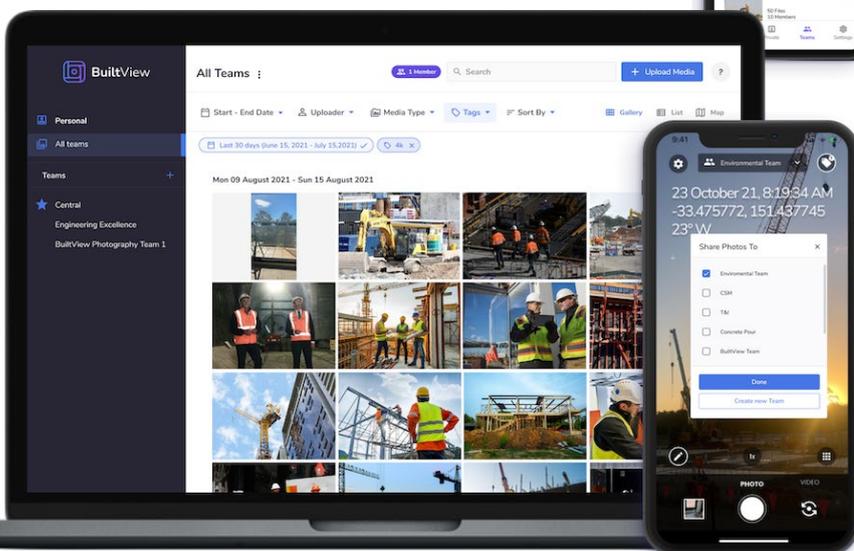
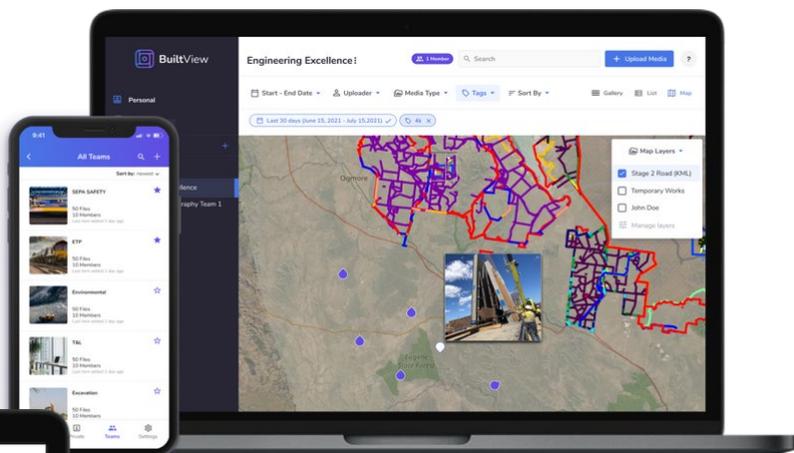
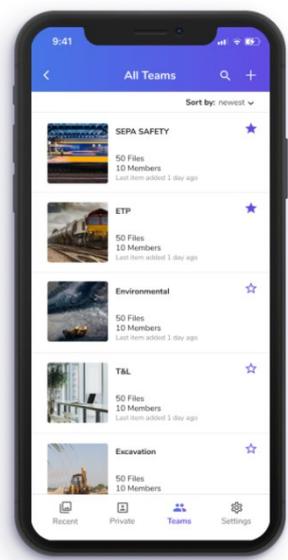
The BuiltView App, developed by Laing O'Rourke Australia's Technology and Innovation Group, allows users to easily take, store, label and share photos and videos on their smartphones and automatically share with their teams and clients. As the system is internet connected, it saves and shares files in real time between phone and computers as well as team members, meaning files are always backed up and stored ready for use.

With railways being a high-risk environment requiring numerous inductions, protection officers and sites generally covering a long distance, reducing the number of workers on inspections and site walks is beneficial for both labour efficiency and safety and can be achieved through the BuiltView app. Along

with photos, both standard and 360o videos can be uploaded through the app and are extremely useful for regular environmental inspections, planning construction works and recording as built conditions for quality assurance.

Photos and videos can be automatically time, date and GPS location stamped, providing reliable records for quality evidence, which when combined with tags and descriptions, are efficiently sorted to save time in processing back in the office. With the ability for anyone in the team to search for specific locations, tags or date ranges, exporting bulk files is simplified and expedited and allows for easy management between site and office teams.

A recent addition to the system is the ability to overlay KML files to a map view of sites, allowing for design layouts and underground services plans to be overlaid on high definition map images. As all files in the app have GPS coordinates, each photo and video can be plotted on this map overlay to clearly show exact locations on site where images were taken.



Thanks for reading

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