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

Track Maintenance Machines

Often venturing out under the cover of darkness after the last passenger services have finished in the metropolitan areas, track maintenance vehicles can be an odd sight – a complex web of systems and workheads which have the specific purpose of ensuring that the below-rail assets are kept in an acceptable condition. Mechanisation of, previously, very manual tasks makes this operation more productive, safer, and produces a higher quality track condition for rail operations.

Broadly, “track” maintenance machines fall into the following categories:

- Track structure maintenance, or resurfacing – realignment of the rails and sleepers and re-profiling of ballast
- Track structure replacement – re-sleepering or rail replacement, including green field operations for new corridors
- Ballast replacement – undercutting or ballast cleaning
- Railhead maintenance – rail grinding or milling
- Overhead electrical equipment maintenance – quite often undertaken using Elevated Work Platforms (EWPs) but can include re-wiring trains
- Structures inspections vehicles
- Specialised vehicles such as switch transport vehicles
- Track geometry recording vehicles.

There are three key performance metrics to measure the success of a track maintenance vehicle (or, indeed, a fleet):

1. Safe operation, including the personal safety of people working in & around the machines (machine operators and maintainers, track surveyors, inspectors and the like)
2. High (within means) production, to ensure that track closures and occupations are as short, or infrequent, as possible and to avoid cumulative “maintenance debt” across the network
3. High reliability (and maintainability), to ensure that the likelihood and consequences of a machine failure are reduced as low as possible, and in the event of such a failure, restoration of the operation can be achieved with minimal disruption.

Added technical complexity associated with these machines comes about as:

- Unlike “traditional” rolling stock, track maintenance machines interact with below-rail infrastructure in extraordinary ways. These external loads must be considered during the design, construction, and maintenance of such vehicles.
- There is often a significant personnel presence around network maintenance operations, and so the separation of people and plant in such operations is critical. It is of utmost importance that machine designers and engineers understand the operational aspects for the intended use of any given machine so that associated risks can be managed safely (So Far As Is Reasonably Practicable).

Trackless Tram System

With the current population boom in Australia, more and more major cities such as Sydney and Gold Coast are adopting to build new traditional light rail systems within the CBD area. These systems have been proven to alleviate traffic congestion that ultimately drives better economic outcomes to state / country. However, due to the complexities constructing in and around major road intersections and whilst the main arterial roads in the CBD are being dug up during construction period to lay tracks, businesses in the area were severely affected. Coupled with the unknown issues such as dealing with underground services (e.g.; electrical, gas mains, etc.), it could result in a final cost outcome that is not desirable to both contractors and the client that would ultimately lead to a negative memory to the community.

With the recent technological advancement that can be seen in some countries, trackless tram system also known as Autonomous Rail Transit (ART) has anticipated to eliminate or at least reduce the aforementioned issues and disruptions to the community.

This trackless system has the ability to provide the following benefits:

1. Significant reduction in the overall construction costs;
2. Project delivery timeline can reduce drastically due to the elimination of complex civil and track interfacing works;
3. Major reduction in overall lifecycle asset costs;
4. Expansion of the ART can be seamless and can move to undeveloped areas to attract development for value capturing purposes.

More information can be found at:

https://www.createdigital.org.au/trackless-trams-solve-light-rail-problems/

Interoperability – Never Guaranteed

Interoperability – the ability of rolling stock to operate on a variety of networks. It's often the key design constraint on new and modified rolling stock and a topic of much discussion between the rail infrastructure manager (RIM) and the rolling stock operator (RSO).

Interoperability is often achieved as an exported requirement on the rolling stock in the specification phase and validated in network testing, rather than a modification required on the infrastructure itself. However, in some cases the network is physically modified to accept new rolling stock, (e.g. structure gauge, power supply, platform lengths).

However, with the advent of brownfield, next generation signalling systems such as European Train Control System (ETCS), the track-train interface is becoming increasingly complex.

The general interoperability of ETCS is defined in the appropriate Specification Baseline by the European Union Agency for Railways (ERA). However, building an ETCS does not simply guarantee interoperability between trackside and on-board systems.

The interoperability between ETCS onboard and trackside must be proven for that specific network and those specific ETCS systems. There are various baselines and system versions for onboard and trackside, RIMs must ask themselves if and how they will enforce the appropriate baseline onto the rolling stock, or conversely, is the trackside an appropriate baseline that enables the RSO to operate with all desired features of ETCS?

Additionally, ETCS enables a certain degree of configuration, both from an onboard and a trackside perspective. RIMs and RSOs across adjoining networks must also evaluate the features and configuration of other ETCS systems on which the rolling stock may eventually operate. As seen in the traditional sense, network modifications to enable interoperability may have lasting effects!

3D Printing the Future of Rail

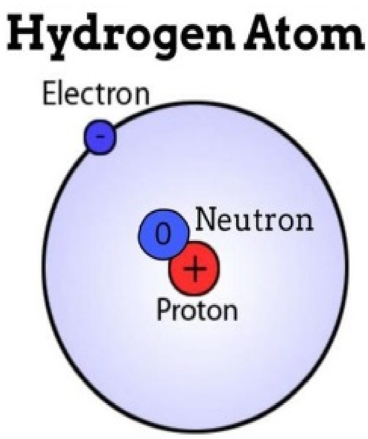
The recent improvements in 3D printing means that it has become a viable industrial production technology, often referred to as a*dditive manufacturing*. Additive manufacturing is used across multiple industries including:

- Medical (prosthetics, surgical instruments, etc.)
- Aviation, cars (spare parts, engines, bodywork, etc.)
- Education (rapid prototyping, scientific equipment, etc.)

Recently, additive manufacturing has become more prevalent in the rail industry. In the rail business, additive manufacturing can be used to replace obsolete parts, print prototypes, and manufacture and customize replacement parts. This means that replacement parts can be produced on request, in smaller quantities, both efficiently and cost effectively with high grade materials. Typical replacement parts are generally ordered in bulk and often have an extended lead time of weeks or months due to the typical manufacturing process (e.g. casting). By using Additive Manufacturing, replacement parts can be created on-demand within days. Due to the reduced lead time for spare parts using Additive Manufacturing, there are less delays on rollingstock and the overall railway. Additive manufacturing, or 3D printing, is a new technology in the railway industry that is expected to expand into business as usual in the near future.

3D Printed Grab Handle Produced by Angel Trains, DB ESG, and Stratasys (Source: GlobalRailwayReview.com)

To Bond or Not?



Innovation and the ability to be a step ahead of the market are key for all organisations' future growth. This is especially true for the energy markets. The demand of society on organisations to not only be more efficient but to also be sustainable is forever growing.

In November 2017, KiwiRail published a report called 'The Value of Rail to Aotearoa', which looked at the benefits of rail from environmental, safety, social and economic perspectives. This paper clearly showed that rail is an inherently sustainable form of transport with 66 per cent fewer carbon emissions than heavy road freight, and without continuous innovation this advantage will erode.

Ports of Auckland have announced their intention to build a hydrogen production and refueling facility. Recent advances in technology are rapidly improving the cost, viability and availability of clean hydrogen across the globe. This is an opportunity for organisations to stay ahead of the curve, to collaborate and invest in hydrogen fuel cell vehicles. Freight trains powered by hydrogen produced in a clean and sustainable way could dramatically reduce carbon emissions from the rail transport sector and enhance its competitive advantage.

Hydrogen, atomically speaking is number one: it is first in the periodic table, it is the lightest of elements and the most abundant element in the universe. And for the rail industry, in the opinion of this author, it is a *bond* worthy of making.

References:

- Deloitte, Exploring Strategic Risk
- Jamie Gray, 4th Dec 2018, NZ Herald: Ports of Auckland plans hydrogen plant to cut carbon emissions.
- Fatih Birol, 4th June 2019, US Financial Times: How hydrogen can offer a clean energy future

Thanks for reading

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