RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

FASTTRACK

THE NEWSLETTER OF THE HORIZONS PROGRAM I MARCH 2019

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

Metro Automation

As the railway evolves to a metro system to address the increasing demand and traffic capacity, rail operators around the globe are seeing the potential in metro automation to optimise service and maximise line capacity, whilst reducing capital and operation cost.

According to *Union Internationale des Transports Publics* (UITP), there are 55 fully automated metro lines in 37 cities around the world, operating in total 803 km – that is nearly a quarter of the world's 157 metro cities have at least one line operating in full automated mode. The projection is that by 2025 there will be over 2,300 km of automated metro lines in operation and CBTC is showing to be the preferred signalling technology. It was also reported that 68% of the world's km of automated metro lines are operated using CBTC signalling systems as of July 2016. Moreover, a significant figure of close to three quarters of the new fully automated metro infrastructure built in the last decade was equipped with CBTC. This modern signalling system has lesser line side signals infrastructure requirement; it utilises the exact position of the train to accurately define the safe sections for each train, thereby maximising line capacity and enabling efficient operation of the rail network.

Conversion of metro lines from conventional to fully automated operation can be complex and challenging in both scope and scale. It requires signalling upgrade, significant modification or the renewal of the rolling stock fleet and the retrofitting of platform-track protection systems at stations. However, leveraging these emerging technologies can also provide opportunities to operators in bringing a more sustainable and better service to commuters. *(photo by Oliver Yuen)*

Digital Asset Management

In the digital world we live in it is important for businesses to be current in the most efficient and productive technologies. At Genesee & Wyoming Pty Ltd. (GWA), we will soon be implementing a new digital asset system to keep track of our assets, materials and time spent on jobs. This will greatly reduce the use of paper and eliminate the risk of losing documents. It will also provide the business with instant information on all of its assets and create future cost efficiencies.

This database will be implemented for all GWA departments in Australia and the UK after an initial rollout with the Australian Infrastructure Group. It will allow track inspectors, track maintainers, and signal maintainers to access their work orders and log faults. The system will track the history of faults on an individual asset for future references. It is cloud based and the devices automatically synchronize every few minutes giving employees an up to date account of their work schedules.

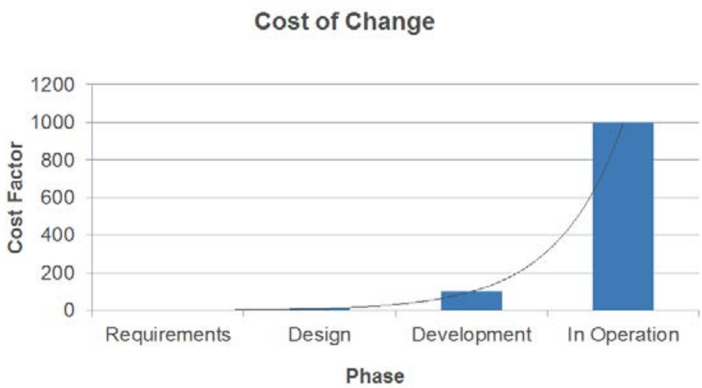
The program includes a GIS system that allows employees to locate an asset through GPS coordinates and display on a map. This will allow inspectors to be more precise when logging faults, and this is especially helpful with GWA's Northgate to Darwin section of track where reference points are quite remote.

The Importance of Good Requirements

Requirements are contractually binding technical agreements between the customer and contractor about how a system is supposed to work. They are one of the most vital aspects of any project. Unfortunately, they are also the aspect that is most likely to be overlooked, due to how time consuming and monotonous they can be.

Poorly defined requirements can cause all sorts of issues, including quality, performance, cost blow outs and the breakdown of stakeholder relationships.

It is estimated that 85% of all errors in a complex system are introduced in the requirements phase of a project. Additionally, the cost of fixing an error dramatically increases as in each phase of the project.



By writing requirements well, and doing proper requirements analysis, we can help mitigate these errors early on, reducing cost and improving quality.

Well written requirements are:

- Unique
- Consistent
- Complete
    - Requirements should be able to be read out of context of other requirements.
- Verifiable
    - Don't write subjective requirements. Define terms like "fast", "easily" and "comfortable".
- Clear and concise
    - Each requirement should be unambiguous and only address a single concept.
- Achievable
    - Ensure that the requirements you write don't break the laws of physics.

Real-Time Passenger Counting to Improve Safety and Service Scheduling

The era of traditional passenger counting at railway stations using hand-held counters or via manual customer surveys is coming to an end due to their costly and time-consuming nature as well as their limited capability in providing useful information surrounding how passengers use the network. Wi-Fi based technologies can now be used to count the number and compute the flow of passengers with enabled Wi-Fi devices (A survey showed that 71% of those who had a Wi-Fi capable device had Wi-Fi enabled) and hence by inference people, through the transport system.

Wi-Fi capable devices search for Wi-Fi networks by sending probe requests. By using sensors that listen for these probe requests, it is possible to count the number of devices in its immediate vicinity. Further expansion of the system to include more of these sensors it is possible to measure how people move between them.

This technology has numerous short-term and long-term benefits, some of which are listed below:

- Efficient allocation of station staff based on platform crowding;
- Efficient handling of platform overcrowding by station staff;
- Efficient diversion of passengers to less crowded carriages on a train and reduction of station dwell;
- Strategic infrastructure renewals and business revival;
- Optimum timetable adjustments; and
- Providing valuable input into the design of infrastructure (platforms, rolling stock, etc.)

A pilot project was conducted as part of a joint initiative (among Monash Institute of Railway Technology, YPB Group and MTM) to achieve real-time passenger counts at Richmond Station in Melbourne and on-board three carriages on one train set. Using the data from the Wi-Fi sensors it was possible to determine morning and evening peaks, public holiday/Saturday/Sunday trends and impacts of unplanned service disruptions on passenger dwellings.

It has been shown that such data can be utilised to improve safety and the passenger experience by improving:

- Boarding and alighting time;
- Train scheduling;
- Understanding of passenger movements within stations; and
- Planning and design of multi-modal integrated transport networks.

Once enough data is collected throughout the transportation network, other tools such as Artificial intelligence (AI) can be used to predict network congestion, passenger behaviour and planning for special events.[1]

[1] P. Reichl, B. Oh, and R. Ravitharan, "Using Wifi Technologies to Count Passengers in Real-time around Rail Infrastructure", 2018 IEEE International Conference on Intelligent Rail Transportation, 12 – 14 December 2018, Singapore.

Braking Points

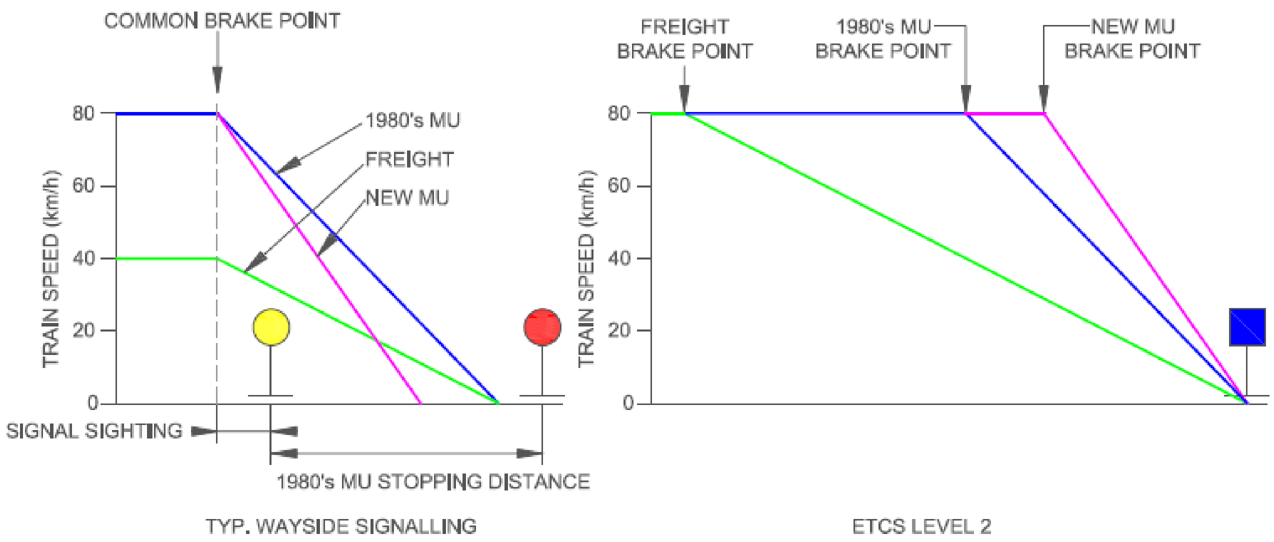
All rail signaling systems fundamentally aim to ensure a safe separation of rail traffic at all times. The rail corridor is typically split in to track sections known as blocks; under normal operation only one train is permitted in a single block at any time. With traditional wayside signaling, each block is defined by signals which are spaced according to the maximum allowed stopping distance for that corridor.

Using wayside signaling, all trains brake at the same point for a red signal. The allowed braking distance is usually based on the brake performance of the most common type of rail traffic operating in the rail corridor when the signals were installed. For example, in the suburban corridors, the signal spacing may be based on the stopping performance of a 1980's vintage multiple unit rolling stock.

Where a train cannot achieve the required stopping distances of the signaling system, for example a freight train, the train must operate through the corridor with a speed restriction. Even when the route is set to all green aspects, the train must travel at reduced speeds through the section, increasing the section run time. Similarly, newer rolling stock which may have superior braking performance generally results in minimal improvement in section run time due to the common brake point defined by the wayside signal position.

In cab signaling, ETCS level 2 for this article, provides an alternative means of managing varied rail traffic through the same section. ETCS Level 2 still operates on the same principle of fixed blocks, however the red signal is replaced with a supervised point board and all other signals are removed. Balises are added to the track to provide a reference location to the train's on-board equipment which then based on the trains speed determines the trains position relative to the next supervised point. Proceeding authority for a train is provided via a digital radio-based signal interlocking protocol.

Each train's stopping performance is defined within the on-board equipment. Based on this, the system is able to provide an in-cab signal to the driver to brake. With this system, all trains running through the section can operate at line speed due to the system varying the braking point to suit each train type. By increasing the time that a train is allowed to run at road speed, there is a clear reduction in each train's section run time allowing. Where a driver fails to brake, the system automatically applies the Emergency brake stopping the train prior to the supervised point.



While the benefits are clear, implementing in-cab signaling poses some new challenges. Under all circumstances, the trains stopping performance must be equal to or better than the stopping performance assumed by the ETCS system at that location. In practice, the system must account for all variations in the trains stopping performance repeatability, error in the train's location, error in the track gradient and environmental factors which may impact the rail adhesion. Depending on the type of rolling stock in question, the cumulative impact of all of the above may result in the train needing to brake earlier with the ETCS system than what was required by the conventional signaling system. Variations in rail adhesion in particular have a very significant impact to a train's stopping distance; consequently to optimise the benefits of the ETCS system operators need to consider controls to minimize the impact of low adhesion on the train stopping performance. This typically includes fitment of systems which are able to increase the available adhesion.

Thanks for reading

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