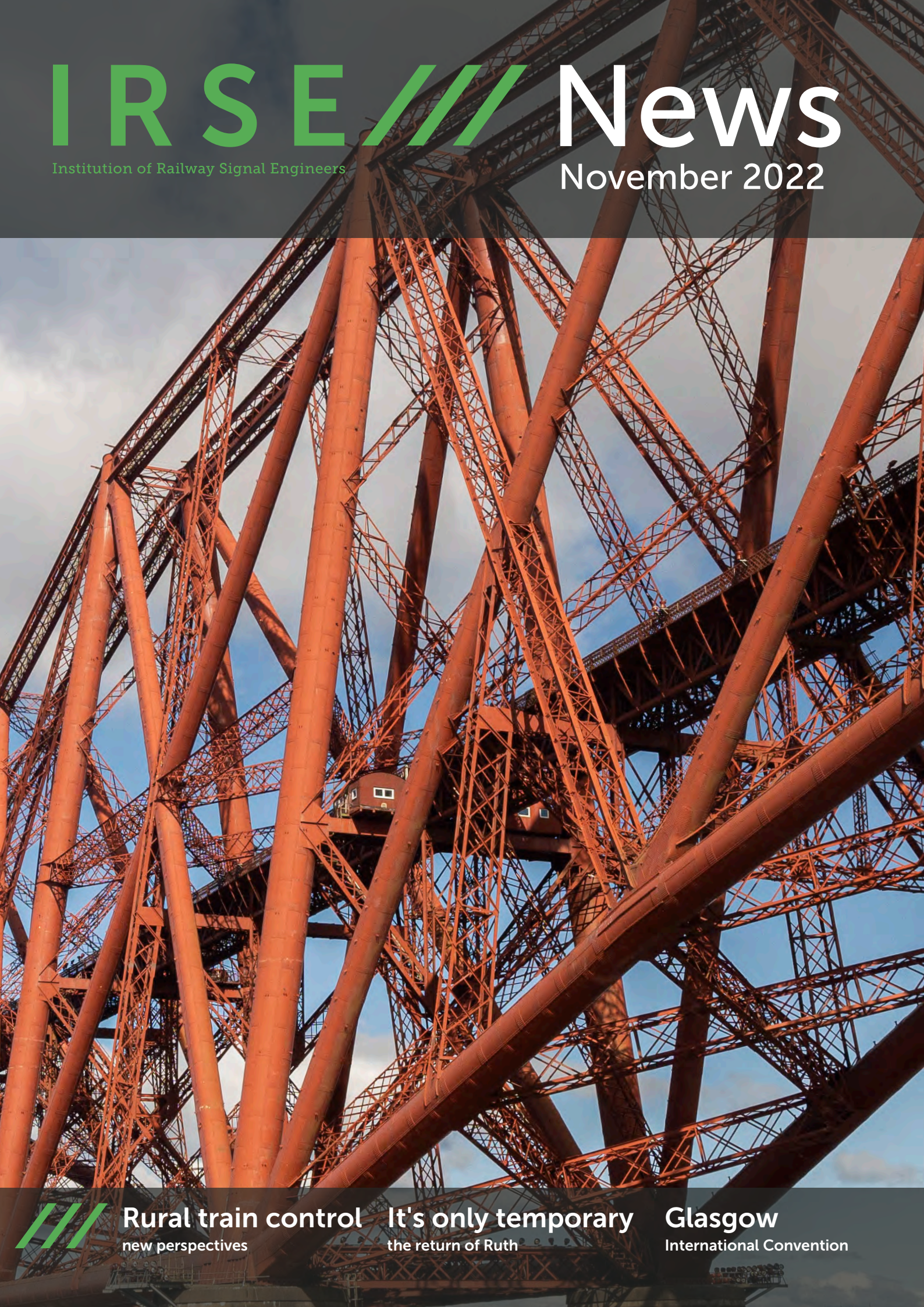
IRSE News

Institution of Railway Signal Engineers

November 2022



Rural train control
new perspectives

It's only temporary
the return of Ruth

Glasgow
International Convention

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IRSE
Institution of Railway Signal Engineers

Issue 293
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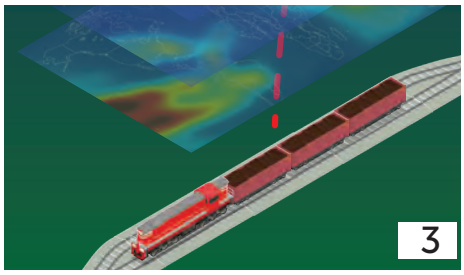
This month



New perspectives on rural signalling and train control

PDJ Clark

The third presidential paper for this year, looking at some options for the use of digital comms to enhance rural services.

"It's only temporary"

Stephen Dapré

Hard working, but fictional, S&T engineer Ruth grapples with issues that aren't supposed to last for long.

IRSE International Convention 2022 – Glasgow

Paul Darlington, David Fenner and Ian Mitchell

Reporting from this year's major event in Scotland's central belt.

Presidential programme 2022-2023

Next events are

1 December 2022
Canadian CBTC
Boyd McKillican, Systra

12 January 2023
Autonomous vehicles and level crossings
Hugh Rochford

2 March 2023
Testing and changes for digital signalling systems
International Technical Committee

visit **irse.info/events** for more information

News view: Presidential experiences and challenges

As I write this News view, we have just completed our first International Convention in four years and launched our first IRSE10/// video to support all our exam participants. I hope they all had a good exam.

The IRSE president has some wonderful experiences and challenges, and this Convention was no exception as we found ourselves coming out of the Covid-19 pandemic, and in the latter stages of the Convention planning we suffered the loss of our beloved Queen Elizabeth.

However, this showed the true spirit of our Institution and the quality of our membership as we pushed ahead with our planning whilst remaining respectful during the period of mourning. Many people were involved in the planning and delivery of this event, and you will see more details in this issue of IRSE News.

The event is a key part of our offering for our membership and allows people to meet and share their experience and knowledge, attend paper sessions

and technical visits which offer unprecedented opportunities for people to develop their understanding of signalling and communications. These events can sometimes be seen as something for a certain audience, maybe from an age perspective, so I was very happy to see engineers both young and old sharing and developing together.

I am also thrilled to have launched the IRSE10/// video series (please check out our Vimeo channel (**irse.info/irse10**). This is an exciting offering for all the membership, and it realises the need to support our other offerings by providing short and sharp presentations by professionals on key issues of the day. This content will build over the coming year and offer a wide range of subjects to support members' development.

All this work has been delivered with support from the HQ team but most importantly by the wide range of members who support these projects by attending meetings and committees in their own time. I am always impressed by these people as they really see the value of the Institution and what opportunities we can offer and how we can help you develop into the professional you can become.

Andy Knight, President

Cover story

This month's cover was taken during the 2022 International Convention which is reported on page 18. The Forth Bridge is a cantilever railway bridge built across the Firth of Forth at Queensferry, 14km west of Edinburgh in Scotland.

The bridge became operational in 1890 as the world's first major steel structure. The Forth Bridge represents a key milestone in the history of modern railway civil engineering and still holds the record as the world's longest cantilever bridge.

A full-scale restoration project to return the bridge to its original construction condition was completed in 2012 and in July 2015, UNESCO named the Forth Bridge as the sixth World Heritage site in Scotland. It continues to remain a significant and admirable railway engineering structure of the Victorian era.

The 8094ft-long (2467m) railway bridge acts as a significant thoroughfare connecting the north-east and south-east of Scotland. The bridge primarily connects the city of Edinburgh and council area Fife and further leads to Dundee and Aberdeen. It is located adjacent to the newly constructed Forth Road Bridge and the 1964 road bridge that is now only used for pedestrians, cycles and buses.

Photo Paul Darlington

IRSE
Institution of Railway Signal Engineers

New perspectives on rural signalling and train control

P D J Clark

"The case for in-cab rail signalling is, I believe, now almost universally accepted"

This, the third presidential paper of 2022-2023 was presented on 26 October, draws primarily on Paul's experiences with Comms Design Limited (CDL) and many years of involvement in the Radio Electronic Token Block (RETB) digital in-cab signalling system deployed on UK rural routes in Scotland.

As technologists, we have been at the heart of a revival and evolution in the capability of the RETB system and see a bright international future for in-cab signalling solutions that are scaled specifically for the rural rail market. The case for in-cab rail signalling is, I believe, now almost universally accepted as the direction of travel for the whole industry; infrastructure-dense track side signalling has served rail well in its first 180 years, but better and more effective solutions now exist and a global transition is underway.

The market for high-capacity, high-speed, low-headway rail operations now has a number of premium in-cab signalling solutions and providers to choose from, but I believe that the market for medium capacity, medium speed rural routes has space for offerings specific to those markets.

Following on from Andy Stringer's excellent call-to-arms for ETCS adoption in the last presidential paper; here we imagine a future where an advanced fit-for-purpose derivative of RETB or similar systems claim their place as rural rail train control solutions; including for use in developing nations where affordability drivers are a dominant concern. Andy discussed the many challenges of introducing a state-of-the-art high-capacity signalling system to major European main line service, using his extensive UK experience as an example and I will discuss how these implementation challenges contrast for rural solutions, drawing on both UK experience and that gained by talking to international rail administrations in developing nations.

Right-sizing signalling and train control solutions for rural routes will always present a trade-off between matching capability with available capital and operational budgets. Emerging and maturing technologies from markets beyond rail are making new approaches possible and the paper discusses current trends and opportunities from a technology and communications perspective, rather than focusing purely on signalling technology alone.

The opinions expressed are entirely my own and come from the perspective of a comms system technologist with no formal signalling system training. To quote Niels Bohr, "Prediction is very difficult, especially if it's about the future", so whilst we may well not be accurate in all our predictions, I am hoping that an outsider's view of where technology could take us in the rural rail space will prompt at least interest and debate.

The fundamentals

The basics of in-cab signalling rely on movement authority messages being distributed from a control centre to rail vehicles over a comms network. (Here, IRSE News issue 259 offers a good back to basics guide for the fundamental requirements for a train control system). In the case of RETB controlled routes, voice messages and digital movement authority tokens are passed over a distributed VHF radio network directly to in-cab equipment. The interlocking issues tokens provided the desired route is available together with the signaller's verbal authority in forming the final authorisation to move.

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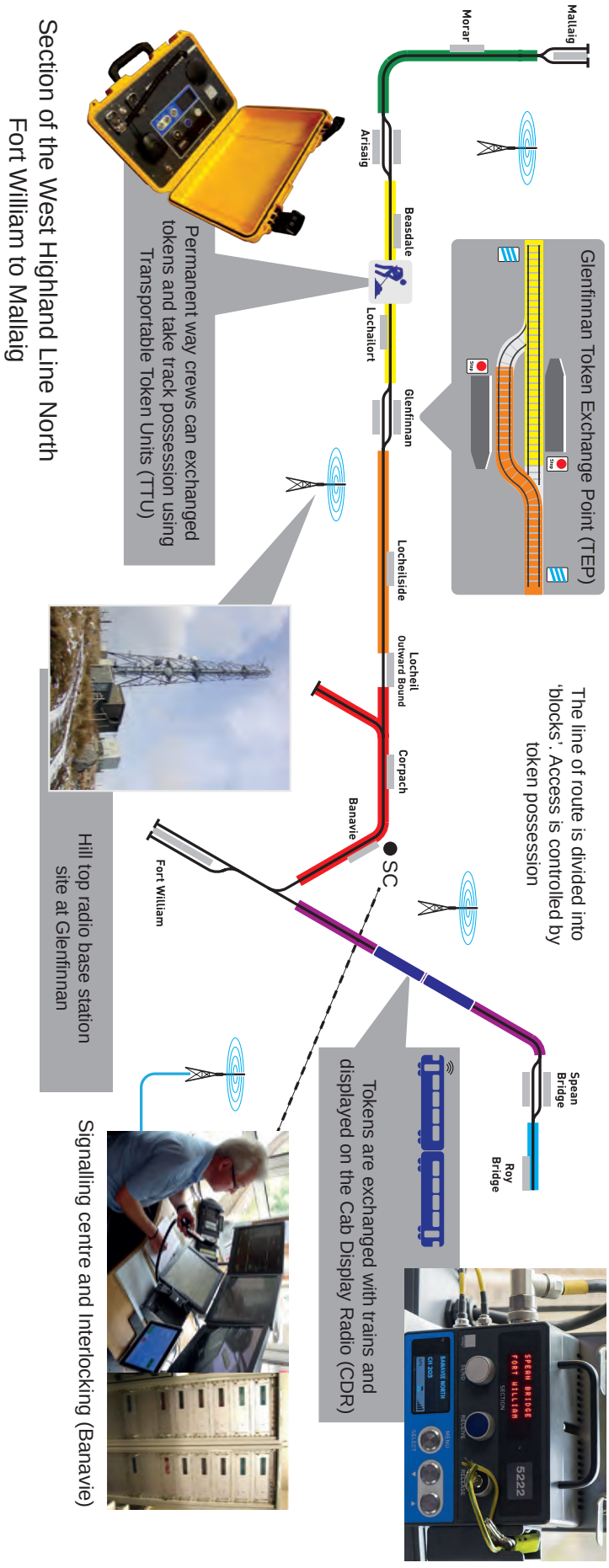
RETB sections detail. In-cab movement authority tokens and voice authorisations are issued to trains from a single control centre over a radio network.



Route setting

Currently in the UK, RETB route setting largely relies on train-operated self-restoring points that default to the appropriate loop routing, with route proving done by local points set indicators. Token controlled points for junctions are in live trial at the moment and are coming soon to critical junctions on the route.

Building on this basic platform, our approach to rural in-cab train control is founded on two principles: 'know where the trains are at all times' and 'be able to communicate this at all times'. Rail operations need safe route-setting, train protection and route control plus a host of other services, but these can all be provided if these two positioning and communication principles can be achieved with high integrity and resilience.

Resilient positioning for rural rail

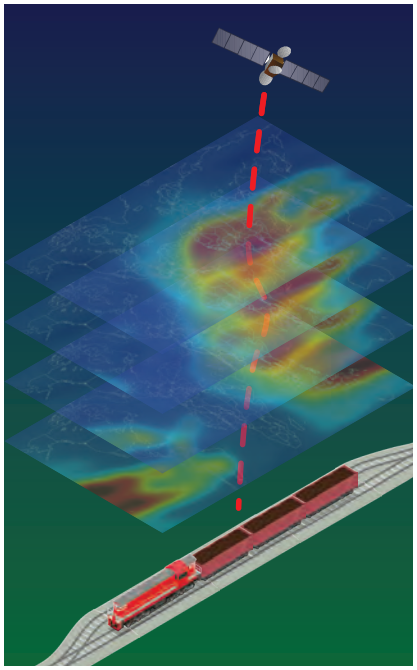
Conventional signalling schemes typically detect the presence & position of rail vehicles via a combination of track circuits, axle counters and treadles. This approach has a rich heritage and is well proven but requires a very high density of track side equipment and cable runs. There are many rural routes, especially in the developing world, where these systems will never be viable so what can new technology do to eliminate this track side equipment? Perhaps the answer is GNSS? Let's take a look.

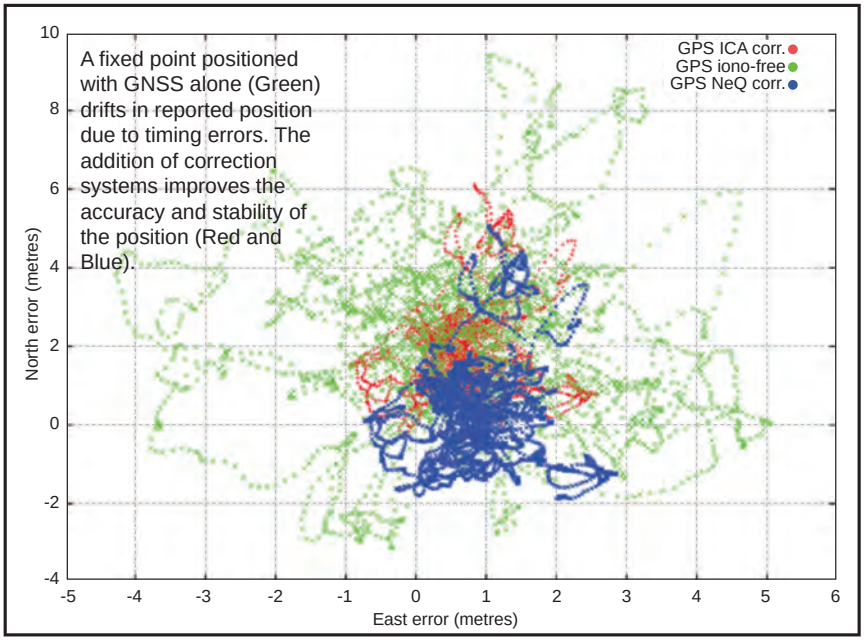
The promise (and myths) of Global Navigation Satellite Systems, GNSS

When considering satellite navigation options, for many years there was only one game in town for civilian users, namely the US Dept of Defense Global Positioning System, GPS. The satellite constellation was started with a first launch in 1978 and this system was soon joined in 1982 by the soviet era military GLONASS system, but this system remained unavailable to civilian users for many years.

Things have moved on considerably from these early days and the technology behind modern GNSS is pretty astonishing and would fill a whole paper by itself but suffice to say that today there are four global coverage GNSS satellite constellations to choose from (namely; GPS, GLONASS, Galileo & BeiDou) and modern state-of-the-art receivers can tune to up to 184 satellites across all four systems simultaneously, offering redundancy and giving the best possible satellite geometries for a given view of the sky.

If one were to read the data sheets for GNSS positioning engines one would find a bewildering array of position accuracies quoted under different circumstances. One's eye is naturally drawn to the most exciting number and one might believe that it is possible to get centimetric positioning accuracy from GNSS for rail. In fact, under the right circumstances, it is possible to achieve centimetric accuracy if one is using static GNSS receivers with high grade antennas and a good view of the sky. This is ideal for tasks such as civil engineering site surveys; the challenge comes as soon as the ground receiver becomes mobile.





GNSS Ionospheric Distortion & GNSS random walk
GNSS signals pass through the earth's ionosphere on the way to the surface. These layers of charged particles randomly bend the path of the timing signals on their way from the satellite constellations to the ground receiver. The increased random path lengths translate to random-walk positional navigation errors for the mobile unit on the ground.

"The fundamental challenge remains that if you can't see the sky then you can't see the sky"

If we start with the premise that a train-mounted GNSS antenna has a good view of the sky, then GNSS can be 'the' navigation solution for most of the route in single track zones, provided that a sensible accuracy tolerance is specified.

The dominant remaining navigation error mechanism left for a modern GPS receiver is ionospheric distortion of the signal path. Solar activity each day forms a number of charged layers in our upper atmosphere that extend from around 50km to as high as 400km in altitude. These layers exhibit constantly changing charge densities and altitudes that cause distortion to any radio signals passing through them, including signals from orbiting GNSS satellites to receivers on the ground. If this effect is left uncorrected, it leads to a generally usable accuracy limit of approximately 3m at most times but the error can suffer from large excursions of several tens of metres on occasions, (we have observed up to 50m in our own lab testing).

Real Time Kinematics (RTK) is the technique of using networks of fixed GNSS ground receivers to gather the latest real time ionospherically-induced position errors. This is straightforward to gather at known fixed positions; one simply records the 'movement' data and reverses its direction and magnitude to provide corrections to a mobile GNSS receiver unit in the area. RTK then uses a variety of additional comms techniques to get this correction data to the mobile receiver in sufficient time to give a useful corrected position. Other techniques are emerging, for example GPS is about to go dual-band where navigation signals are broadcast in two different radio bands that are sufficiently separated in frequency so that the ionospheric distortion is slightly different in each band and complex mathematical models can be applied directly at the receiver to somewhat remove the ionospheric distortion error without the need for an RTK comms link or static ground station network.

So, many augmentations to basic GNSS are either available or coming soon that will give it a high level of performance but the fundamental challenge remains that if you can't see the sky, then you can't see the sky, and augmentation can't help you and all else is moot.

Here, the challenge is that trains don't like hills so people who build railways go to great lengths and expense to keep the inclines manageable. This means that a train is often either on an embankment (actually very good for GNSS), in a cutting (bad for GNSS) or in a tunnel (really bad for GNSS!) and other positioning approaches must be used when GNSS coverage is poor.

Another wrinkle of system complexity in GNSS for rail is the fact that all really safety-related positioning decisions in rail actually relate to route mileage. Whereas, GNSS systems don't care about trains or route mileage and only report Latitude & Longitude. This means that there is an intermediate 'track atlas' step needed between the raw GNSS positions and usable track mileages. In this case, the accuracy and correctness of the track atlas itself becomes part of the safety system and must be validated if such a system is to be used to make rail safety decisions.

My personal view is that GNSS is going to be a very big part of the rural train positioning solution but will always require augmentation to achieve the resilience and integrity necessary for safe train control.

So, what can be done about this fundamental availability challenge of even the best GNSS systems? One approach is to augment GNSS navigation with ancillary positioning solutions and to use data fusion to 'bake a high-integrity positional cake from lower integrity ingredients'. Here the key is to make sure that the different positional systems are not co-dependent on each other and we will now examine some of the other positioning options available. >>>

Trackside beacons

At CDL we are developing a trackside beacon system specifically for the rural rail environment that avoids many of the drawbacks of conventional track side infrastructure and can complement GNSS-based position systems. Equipment mounted in the track bed on ballasted track can be subject to ballast strikes and disruption by tamping operations, as well as the risk of damage by dragging equipment. So, taking the beacon out of the track bed removes a host of maintenance challenges and risks; the beacons are sealed for life with a target operational lifetime of 10 years, they are pole-mountable to existing trackside signage poles and have no requirements for foundations, cable runs, power supplies or trackside cabinets.

The beacons are intended primarily for use on single-track sections, a disadvantage of pole-mounting versus track bed mounting in multi-track sections is that one loses the certainty of which track the train is on. We are developing technology that addresses this issue too but are not yet comfortable that we can have the level of integrity required for such an important safety critical positional determination.

Within single track sections, this approach can offer track side performance similar to track bed RF tag technologies, such as Eurobalise, that use energisation and detection algorithms based on RF signal strength and ID detection only. These techniques can only really be relied upon for very short RF links, such as between a track bed tag and an under-train reader, and cannot be easily extended to provide reliable longer links to track side positions. Longer range RF signal strength-based beacon systems would be prone to 'passing epoch detection' problems when used in complex RF scattering environments; a common occurrence on rail routes filled with gantries, poles and other metallic equipment.

Our approach avoids these risks by using on-train equipment that detects the beacons with modern IoT hardware and new direction-finding algorithms. These systems give confidence and accuracy in providing high integrity beacon-passing events.

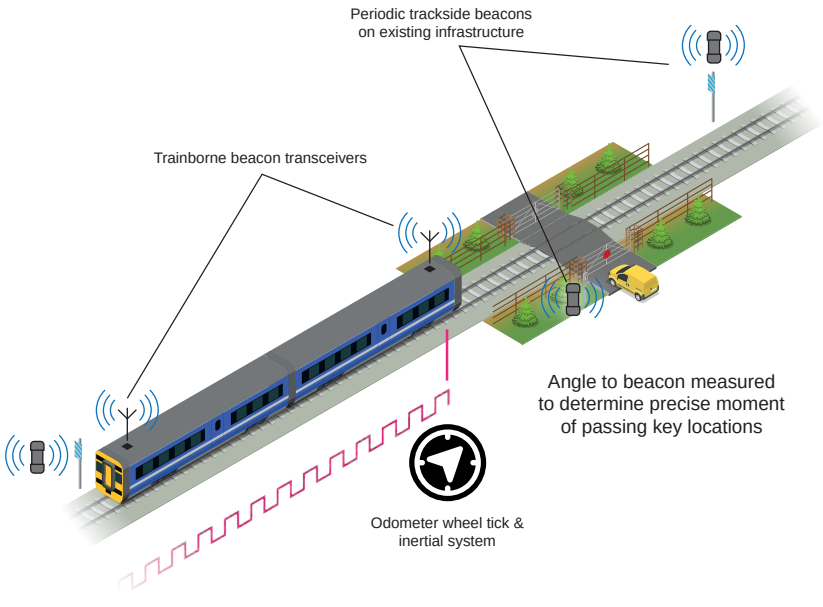
Pairs of beacons at known distances can be used in the normal way to determine calibrated speed and to give a high integrity estimation of direction of travel. The density of track side beacons will be a compromise between economics and functionality. However, we envisage as a minimum that beacons can be used at all safety critical points in a network such as level crossings and their approaches, station limits and junctions and their fouling zones. A limitation of beacons is that they can't be fitted everywhere so we need additional systems to offer positioning support between beacons.

Tethered Dead Reckoning, TDR

Wheel-tick systems are part of a class of navigation aids known as 'Tethered Dead-Reckoning (TDR)' where wheel rotation sensors essentially continuously report the number of revolutions of the wheels. A limitation of these systems is that wheel-tick sensors are subject to a number of error mechanisms when used standalone for route mileage estimation. Traction and braking events can cause slip and slide and wheel wear presents a continuous systematic error if not correctly calibrated out.

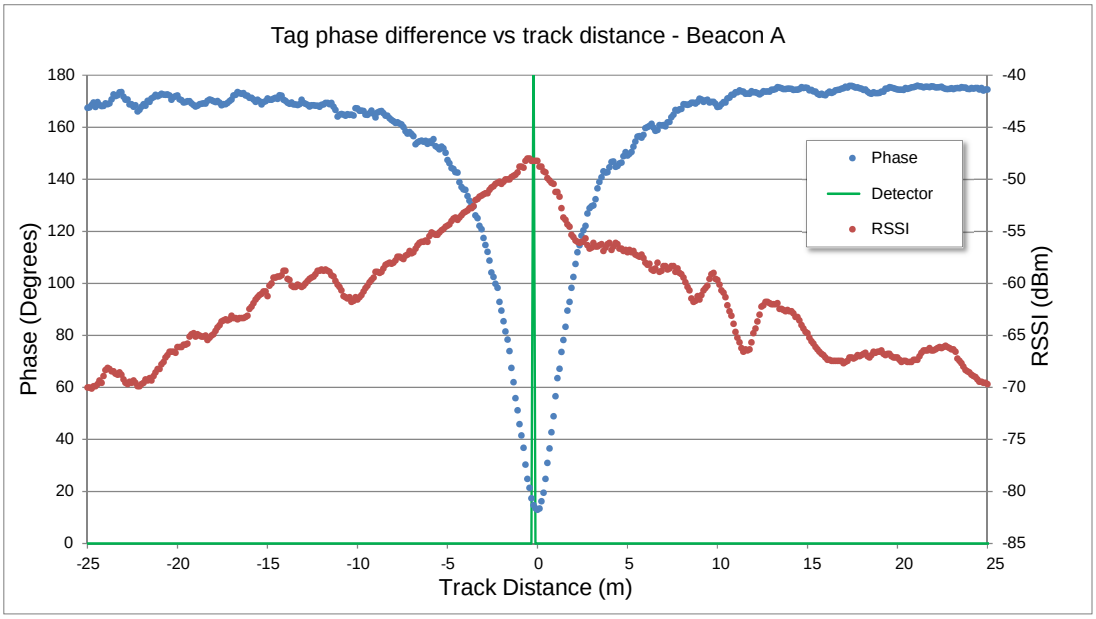
In reality, wheel tick systems have no idea of where they actually are, they are just counting ticks which accurately provide speed and progress but not actual position. The big advantage of wheel-tick systems is that they produce a continuous signal that covers the whole route.

"In reality, wheel tick systems have no idea where they actually are, they are just counting ticks which accurately provide speed and progress but not actual position"



Output = track mileage + key logic (has/has not passed a key location)

Trackside beacons can offer an effective route mile positioning system to complement GNSS positioning, especially when combined with other systems such as inertial navigation or 'wheel ticks'.



Modern IoT techniques allow trackside beacons to offer positional accuracy similar to track bed beacons for single track sections, without the installation and maintenance challenges of track bed equipment. RSSI is Received Signal Strength Indicator.

"So, wheel ticks, beacons and GNSS can use data fusion to complement each other to provide resilient positioning and extract valuable condition monitoring data at the same time, but ..."

This is where beacons can be combined with wheel-ticks to provide a potent alternative positioning system to GNSS. Beacons can provide the route mileage datums needed to calibrate the wheel-tick system. Passing a beacon gives an actual route mileage datum to high accuracy, and the known distance between beacons provides the calibration factor for wheel circumference, (incidentally, this factor gives a handy wheel wear condition indication 'for free').

So, wheel-ticks, beacons and GNSS can use data fusion to complement each other to provide resilient positioning and extract valuable additional condition monitoring data at the same time, but recall that we still have the challenge of detecting and compensating for slip and slide errors. This could be done by detecting discrepancies using the GNSS system but part of the point of our approach is that, to remain resilient, the separate sources of positioning data should not be co-dependent, using GNSS data to 'fix' the TDR data would violate this premise. Here we can turn to Untethered Dead Reckoning (UDR) for help.

Untethered Dead Reckoning, UDR

UDR relies on Inertial Navigation Systems (INS) to determine vehicle motion using accelerometers and gyroscopes to 'feel' where the vehicle is moving independently of any external inputs. Over short distances, the INS data can be used to independently detect and compensate for wheel-tick signal drop-out due traction slips and braking slides by estimating the vehicle's motion whilst reliable wheel-ticks are absent.

Tick-rate analysis combined with knowledge of vehicle dynamics can be used to detect severe slip or slide events and may be useful in making real-time integrity determinations such as 'you can't trust the wheel ticks until we get to the next beacon'. However, INS is actually measuring vehicle dynamics and can quantify the slip or slide event so that wheel ticks continue to be useful, even between beacons.

Wheel-tick systems can come with vehicle installation challenges, especially if retrofitted to existing vehicle fleets, so a lower performance approach can be adopted to augment GNSS by using UDR and beacons without the wheel-tick input of TDR. This is practical if the UDR-only distances are manageable, typically less than 1km of route mileage.

Here the problem is that INS systems need calibration by vehicle movement and we have encountered challenges in finding INS systems with suitable calibration regimes for rail use. Often UDR-GNSS combination systems are intended for the road vehicle market and need drivers to 'take the car round a few roundabouts' before they truly get in sync and can contribute properly to a navigation solution. I am not a rail expert, but I believe that a lack of roundabouts is a common feature of most routes. No doubt in time, UDR offerings aimed at rail will emerge and this augmentation can become part of the positioning solution in a useful standalone mode, especially for the fleet retrofit market where wheel tick sensor fitting is problematic.

Pulling it all together, rural rail resilient positioning, what could good look like?

So, if we have great GNSS positioning that cannot be relied upon over the whole route and beacons that are accurate but sparse combined with wheel tick systems that suffer offsets and calibration errors and INS assistance that can only be relied upon for short track runs, how do we pull these parts together?

A wheel-tick system uses data-fusion with beacons and INS to provide continuous, calibrated route mileage that is able to independently detect and compensate for wheel-tick signal drop-out due traction slips and braking slides. This system then forms one input to a high integrity comparator. The comparator is also being fed a route mileage position estimation from a GNSS-based track-atlas system.

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The high integrity comparator continuously checks that the route mileage position estimates of the two independent systems agree within a defined accuracy tolerance where the accuracy tolerance is selected to be appropriate for medium speed rural rail. This approach can provide dependable resilient positioning estimates that can be relied upon for safety-related position decisions.

An example application – train protection

An example of the utility of such a system would be the provision of the train protection function. As an example of current practice, on the RETB routes in the UK, train protection is provided by the well-known and proven Train Protection and Warning System (TPWS). This solution involves a significant amount of track side and track bed infrastructure but makes sense in this application, as all UK rail vehicles and rail routes are fitted for TPWS. However, imagine a dependable train protection system with no track side infrastructure based on a resilient positioning system that can give accurate high integrity positioning. Imagine now that the track atlas has a list of all the valid tokens that cover each particular single track section. If the on-board equipment can verify the position of the train and the current movement authority token held, it is now a simple matter to confirm that the train is authorised to be at that track mileage.

Such a system also provides high integrity train speed so if the track atlas also contains permanent and temporary speed restriction data, it is possible to provide train overspeed protection along the entire route using the same equipment. The system can provide a watchful overlay to complement the driver's route awareness and intervene if a dangerous situation occurs.

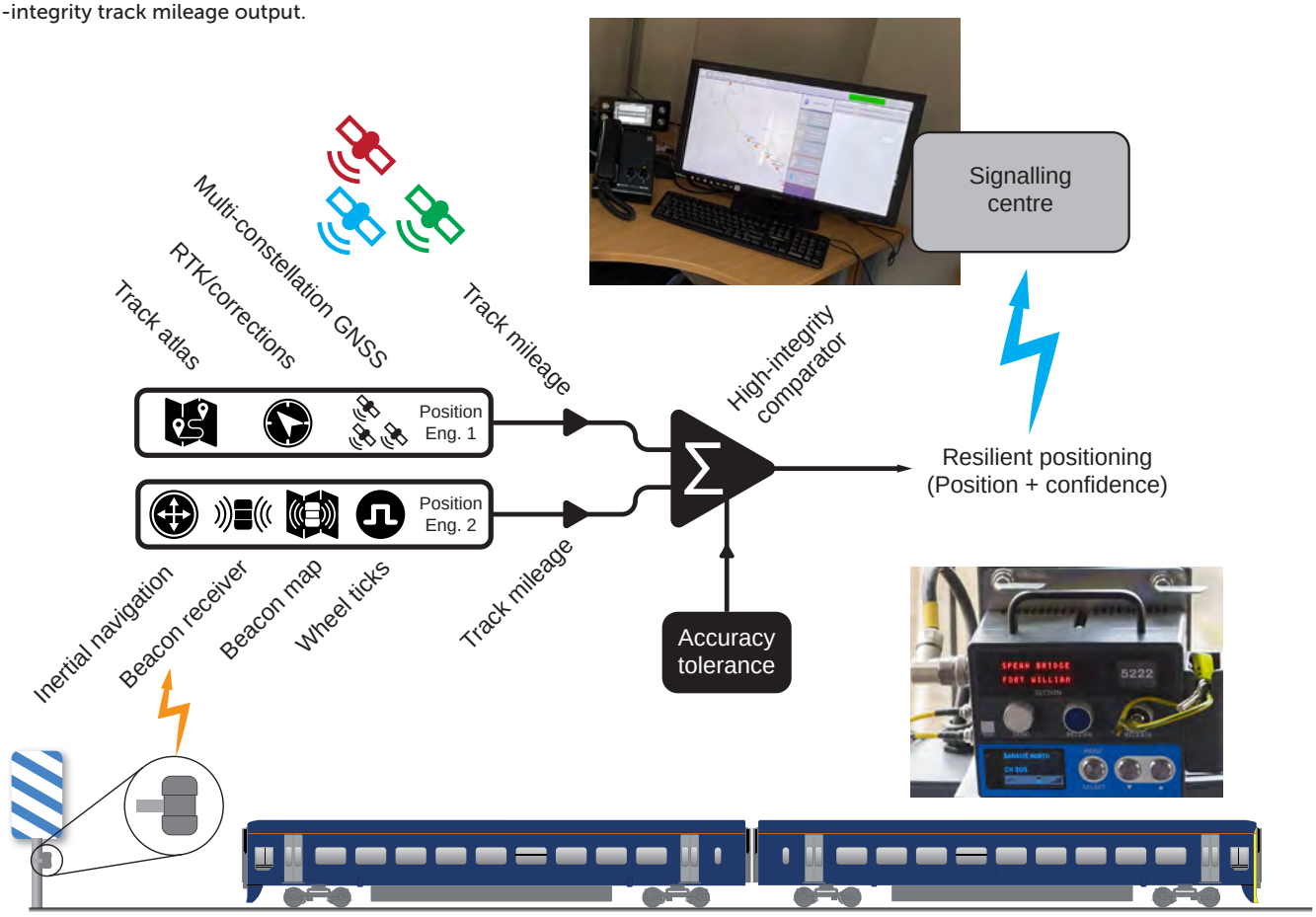
Resilient communications for rural rail

Knowing the position of every rail vehicle on the route with high integrity and resilience on a continuous basis is a critical part of the train control solution. However, this will not afford us centralised route control if we cannot communicate that information to a control centre with equally high resilience.

The basic functioning of RETB relies upon a distributed custom VHF radio network for communications. Since 2016, the latest incarnation of this equipment has used modern RF hardware using digital radio and digital signal processing techniques to offer very high voice and data quality over a cascaded network. The proven FM modulation method has been retained from previous generations of RETB and has the advantage that the resilience of the voice and data comms functions are well matched so that they tend to degrade in step in areas of challenging coverage.

"This will not afford us centralised route control if we cannot communicate that information to a control centre with equally high resilience"

Data fusion combines independent track mileage-based positioning systems to provide a dependable high-integrity track mileage output.



Providing high quality full-route communications coverage is achieved for RETB with a custom VHF radio network.

The challenge for basic RETB is that the only comms channel available is reserved primarily for voice and data messaging between drivers and signallers. Beyond the transmission of infrequent alarm conditions, this system has very limited capacity for general telemetry data transfers. Here we have turned to a new generation of long-range Internet-of-Things (IoT) based communications protocols to provide a dedicated data overlay network sharing the same radio sites to provide continuous low-rate telemetry feeds from all vehicles on the route.

Many IoT protocols are designed to provide very low data rates to very large networks of long-range fixed sensor networks, (e.g., think about water meters with a data payload requirement of a few hundred bits per day). However, they feature the rate adaptation mechanisms that are suitable for use for much higher data rates to a smaller number of widely dispersed moving vehicles, making them ideal for rural rail. One notable example is the LoRa system that offers a robust spread-spectrum modulation method with variable error control coding rates, data rates and modulation types. Here we are using the LoRa silicon to scale the comms data rates to the low kilobit per second regime per vehicle, which is all that is needed for the core functions of rural rail train control.

Variable coverage of one form or another is a feature of all communication networks to mobile vehicles. In well-designed communications systems it is possible to maintain communication connections in poor coverage zones by trading data transfer speed for link resilience in a number of ways; bit rates can be adapted along with modulation modes, error-correcting rates and choice of spreading rates in spread-spectrum systems. With good protocol and system design, the data payload can be scaled down selectively as the comms channel degrades; if necessary, down to a bare minimum of critical vehicle

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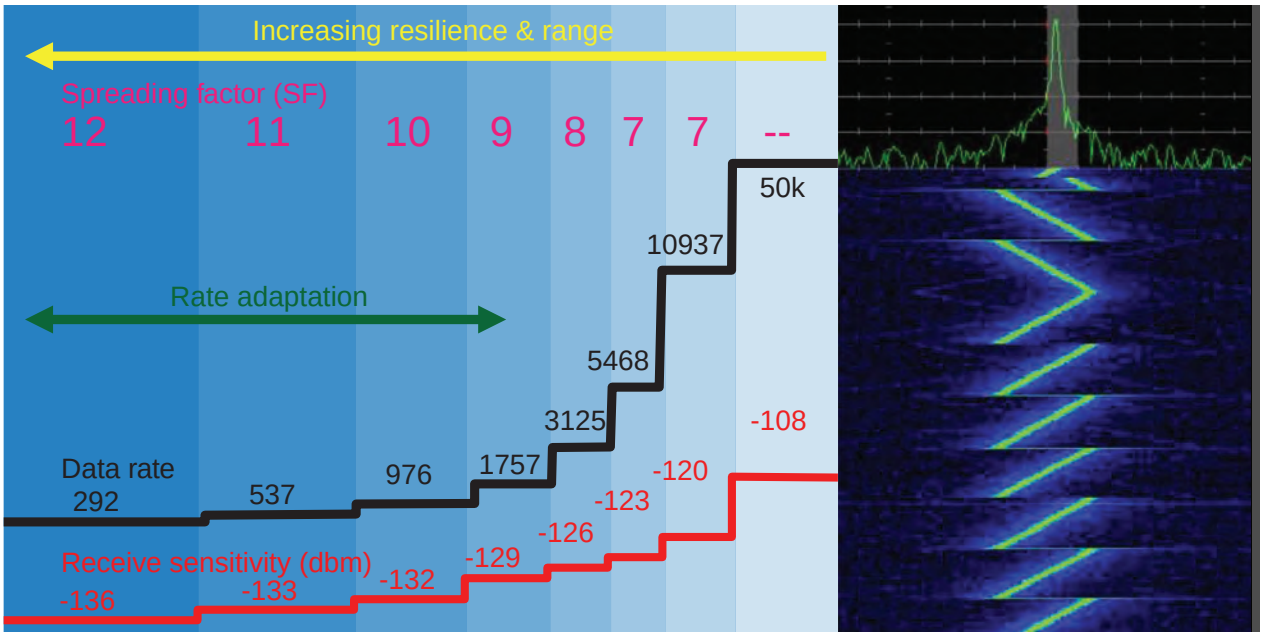
Modern long-range IoT comms bearers feature the interference resistance, rate adaptation and security features suitable to support high resilience communications, even in challenging terrain.



position, direction and speed data. Data rates can then be adaptively increased again as the vehicle passes through challenging zones and into better coverage areas.

Some IoT systems enjoy globally harmonised frequency bands that are intended to act somewhat like quasi-public networks, with network providers essentially offering subscription access. This model will work very well for many users, such as utility companies and other large scale sensor network owners. However, this is not what is wanted for rail as the cohabitation rules for these networks severely limit the amount of access one group of users has to the network. Rather, we advocate the establishment of separate networks using small amounts of segregated rail-specific radio spectrum that will allow the full exploitation of these new protocols in novel ways, without the access restrictions of the more public bands. Resilient comms would be greatly improved with segregated spectrum, allowing higher transmit powers and more link resilience at higher data rates. Spectrum availability should be plentiful, especially in developing nations, it is a matter of appropriate rail industry advocacy to prise a piece of this national spectrum resource from the steely grip of the local comms regulator.

In summary, new long-range IoT-based communications silicon and protocols offer great promise for rural rail telemetry and control, especially when combined with rail-only radio spectrum.

Satellite communications for rural rail

There are actually two comms systems needed to run a railway; vehicle-to-track comms (from maritime roots, this is sometimes referred to as 'ship-to-shore') and fixed site comms to distributed fixed installations such as stations and control centres. If we initially consider the fixed site communications requirement, newly emerging dense-constellation satellite IP providers such as OneWeb and Starlink have much to offer here if the capital expenditure is not available to build and operate a railway dedicated comms network.

Providing low-latency high speed IP connectivity to fixed rural subscribers is the core of satellite IP providers business offering and should remain well aligned to fixed site rail users, as long as those satellite services persist. It is also worth mentioning that some higher frequency satellite bands are subject to precipitation fading which can be a factor in areas subject to occasional heavy rain.

Turning to the ship-to-shore requirement, unfortunately, neither Starlink or OneWeb can help rail as these services require relatively large steerable ground antennas and neither service is yet offering antennas with ruggedness and size suitable for rail vehicle roof mounting at the moment. However, many satellite providers do offer mobile ground stations suitable for rail vehicle fitment. These have small rugged antenna solutions and can provide relatively rapid (but not instant) data packet transmission services that are suitable for rural rail vehicle telemetry. Such services are usually allied with a voice call capability analogous to terrestrial phone calls.

Our experience with RETB has shown the value of instant Push-To-Talk (PTT) communications between signallers and drivers. In the case of RETB, this is well catered for by a custom distributed VHF radio network, but this feature is not yet commonplace for satellite comms providers. Here, recent new offerings in the satcomms market are of great interest; in 2015 Iridium announced the introduction of a satellite-based PTT service allowing widely distributed pools of subscribers to participate in PTT networks in a manner similar to instant terrestrial PTT radio comms. This could offer valuable realtime comms features for drivers to signallers in rural rail system deployments.

In summary, I believe that emerging satellite comms capabilities can offer resilient communications solutions for rural rail, with advantages of rapid deployment and greatly reduced capital expenditure, also potentially at an ongoing subscriber price point that is sustainable. However, in the next section we discuss the issues surrounding reliance on third-party comms providers for mission critical rail operational communications over the multi-decade life cycle of rail train control systems.

"New long-range IoT-based communications silicon and protocols offer great promise for rural rail telemetry and control, especially when combined with rail-only radio spectrum"

The allure of third-party comms for rail – or "you are not 'the' customer"

Here I offer some personal opinion and food for thought as a comms engineer but also as a business founder with an eye on how businesses and markets work.

Put crudely, all railways are 'long and thin' and have always needed good comms to provide a 'nervous system' for smooth operation. Rural routes are no exception to this and it is very tempting to rely on third-party comms providers to fulfil this comms need. Someone else has already built the hard bit and we can just be subscribers/users, but perhaps slightly special users, because we are rail.

It is a sad truism that nobody is building satellite constellations, or mobile phone networks for that matter, for the exclusive use of the rail industry. Mighty as rail is, other markets are huge in comparison and the user-base for operational rail will always be dwarfed by the user-base that the third-party comms system owner actually intended when they put up the capital funding for their comms system. Rail will only ever be a peripheral user, reliant on the main business case for the comms company to persist. This approach has hidden risks as the rail industry has very long-term horizons when it comes to asset life cycles but sometimes comms providers do not. When that original comms company business case changes, rail can be left stranded.

"It is a sad truism that nobody is building satellite constellations, or mobile phone networks for that matter, for the exclusive use of the rail industry"

A good example of this phenomenon from the Great Britain (GB) is offered by comparing the great success of the Network Rail owned Fixed

"The moral of these stories is that, wherever possible, a rail administration should aim to own and operate its own comms"

Left, rural cell tower and compound in Tanzania - Third-party owned radio sites in developing nations usually offer plenty of mast and shelter space for site sharing. *Photo Timothy D Baird.*

Right, Shared RETB radio site at Invershin on the Far North Line. Radio site sharing has proved cost effective in Scotland.

Telecoms Network (FTN) fibre network versus Network Rail use of BT landlines. Considering FTN, here the GB infrastructure manager has provided itself with its own fibre network, giving essentially unlimited comms capacity for rail uses wherever the FTN network reaches, with GSM-R radio base station backhaul provision being a major 'internal customer'. This is in contrast to the challenges that the UK rail infrastructure provider is facing today due to the phase-out of legacy BT (GB public telecoms operator) leased and dial-up landline networks. Whilst the rail industry relied heavily on this network for many years for a number of mission critical purposes, Network Rail was never 'the' real customer for BT. Rather, this was the UK population and business community as a whole. As the introduction of broadband made the wider business case for landlines go away, BT began withdrawing the provision from everyone, including UK rail.

We have other examples of a West African rail administration which rented comms capacity from their local regional mobile phone service provider. The rail administration used this service for a simple but critical station master to station master phone service. They suffered regular outages due to backbone equipment failures from the mobile phone provider which were exacerbated by the fact that the mobile phone provider did not prioritise repairs due to the low number of rural subscribers serviced by the mobile phone network in that region. Again, the rail administration is not 'the' customer, the local population is, so rail has to tolerate the level of service that it gets rather than what it might need or want.

The moral of these stories is that, wherever possible, a rail administration should aim to own and operate its own comms. There is a saying in railway telecoms that "you can't control what you don't own". I also believe that, as the operators of nationally strategic infrastructure, rail administrations worldwide should proactively lobby for segregated access to appropriate radio spectrum exclusively for rail operational use. This is more challenging today as radio spectrum allocation has been monetised by many national treasuries as a simple means to levy stealthy taxes on mobile phone users via the mobile phone system providers. To quote the author Terry Pratchett "the art of taxation is extracting the maximum amount of milk with the minimum amount of moo" and national radio spectrum auctions have yielded much milk over the years.

Going another way – share comms sites, not comms systems

Ignoring land, the economic drivers for any given radio site from highest cost to lowest cost are usually; the road to the radio site, the power line to the site, the comms tower itself, the equipment shelter buildings and site fence (or wall) and finally the specialist electronic comms equipment itself.

Looking at the international picture, why build new radio sites when you can share them? In a number of potential rural signalling project opportunities that we have been involved with in West Africa, we have always found that the local mobile phone provider has 'got there first' and that a good network of comms towers and radio sites already exists.

Whilst surveying potential new projects, we have also always found plenty of equipment shelter and tower space for additional antennas, feeder systems and shelter comms equipment with little to no impact on the site owners comms services. If site-sharing arrangements can be agreed at reasonable cost, this can offer a win-win for both the radio site owner (who gets some help with the cost of maintaining their radio site) and the rail administration who get all the benefits of a radio site without having to pay the upfront cost of building it. In our experience, radio sites in rural developing regions are invariably protected by a high boundary fence or wall and often have live-in security staff within the compound when placed in populated areas.

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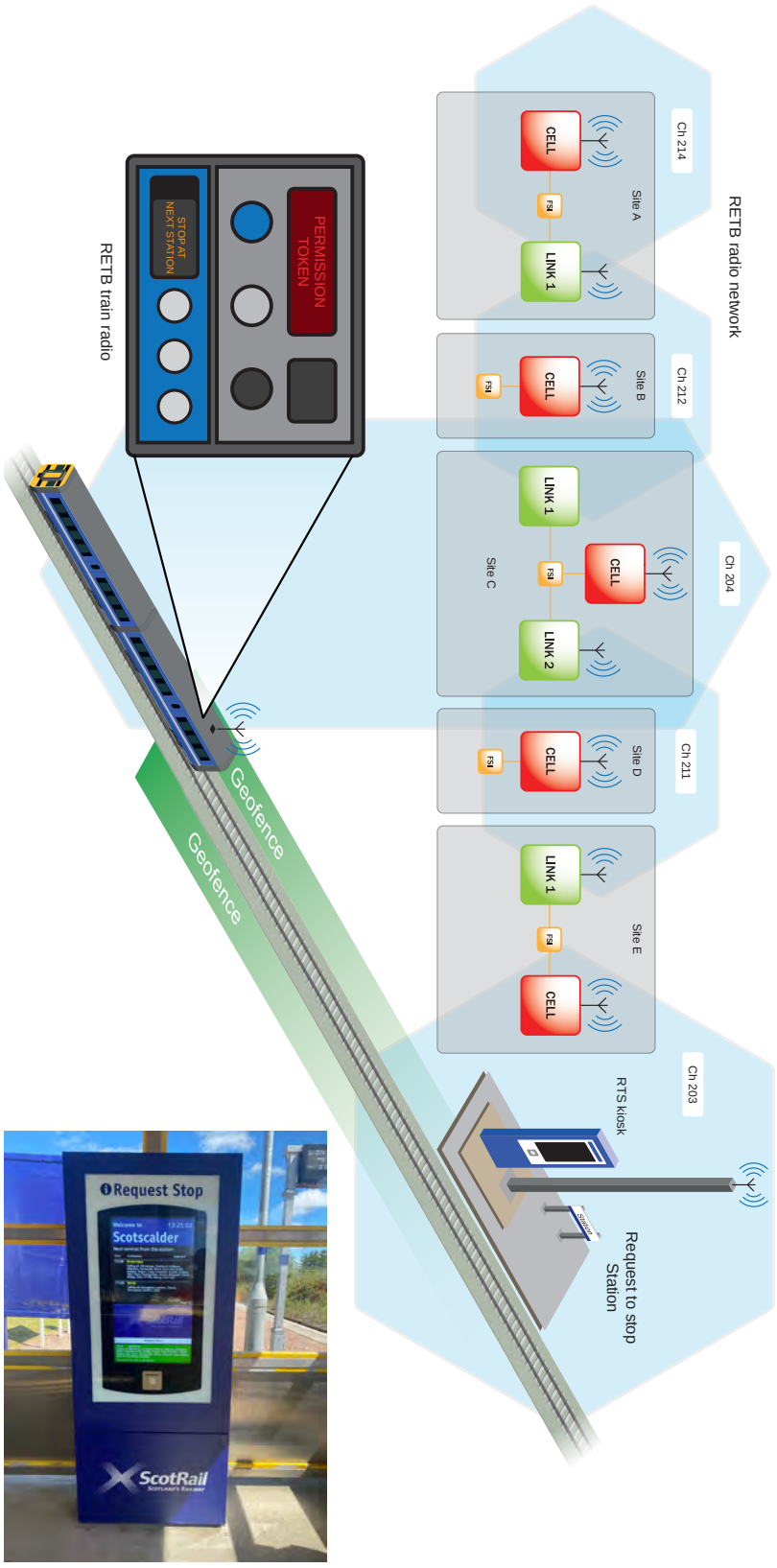


The complete request to stop system features signalling centre, in-cab system and radio network updates to support live geo-fenced driver notifications, allowing in-cab pass through or slow to stop indications. The train uses its position to interrogate the kiosk over the radio network just prior to the normal deceleration point for that station. If the kiosk responds that no passengers are waiting, the service may pass through the station at line speed, (assuming no disembarkations are required). *Photo of kiosk Network Rail.*

Equipment shelters are often climate-controlled, so assets placed at radio sites are in a relatively protected benign environment.

The site-sharing approach can work equally well in developed countries with mature rail networks, for example; the RETB radio network in Scotland makes extensive use of shared radio sites. In this case, the BBC 'got there first' in the 1930's and left some great radio sites for us to use today.

New technology in action

I now offer some practical examples of where recent innovation in positioning and communications are having a positive impact on rural routes in the UK.

A new passenger 'request to stop system' is currently under trial on the Far North Line in Scotland. Currently, trains must coast through all request stop stations at 20mph (32km/h) instead of full line speed in case there are waiting passengers wishing to board, who will literally wave down the train. The new system allows passengers to directly request a service to stop at the station by means of a platform kiosk that also shows live service information, offering a much-improved travel experience.

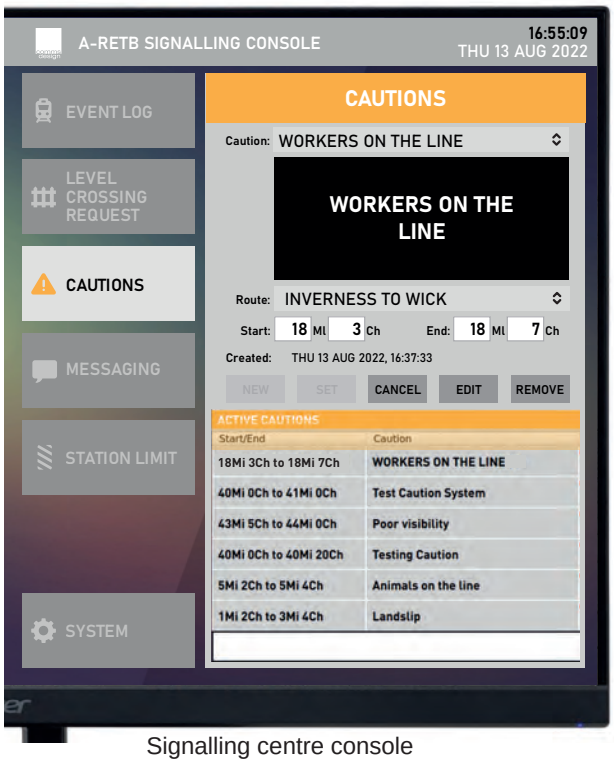
If no passengers are waiting to board at the request stop station, this is indicated directly in the cab and the driver is able to maintain line speed and pass through. These request stop stations are by definition lightly used so no passengers waiting is a frequent occurrence. The ability to exploit drive through opportunities without the risk of stranding passengers offers the route operator timetable resilience, as well as fuel and brake wear savings.

A new digital cautions system is now leaving the lab and is scheduled to roll-out on the live railway over the next 12-18 months. This system will use train positioning technology to greatly increase the situational awareness of drivers to caution hazards and conditions.

In summary

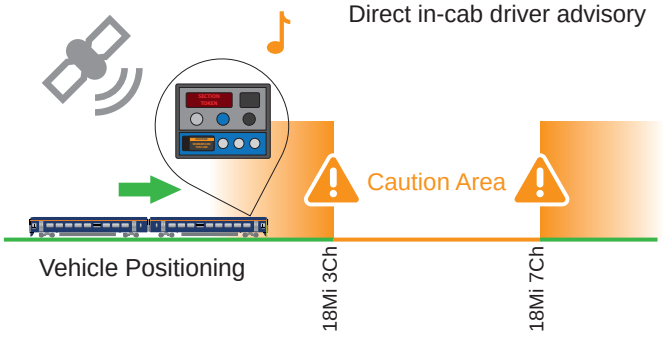
Compelling and proven in-cab signalling solutions exist today to meet the high-speed, high-capacity challenge but these have yet to achieve the necessary real-world project cost profile that would lead to widespread adoption beyond mainline or prestige routes.

At the risk of being burned at the stake by all the rail safety professionals out there, is it always the right solution to require SIL4 safety certification for all rail signalling systems regardless of train speeds and traffic density? Could it be that this approach makes the introduction of new systems essentially unaffordable for system developers due to the reduced market value of train control for lower speed rural routes? Is there a risk that the industry is forcing some sectors of the market to be underserved by such an approach? I'm just asking, please don't bring your pitchforks.



Signalling centre console

Direct in-cab driver advisory



A new digital cautions reminder system allows temporary speed restrictions or other cautionary warnings to be sent directly to in-cab equipment and triggered by train position to give drivers timely caution reminders

The introduction of new positioning and communications technologies in other arenas has the potential to have a transformative impact on signalling and train control for rural rail. In order to realise this transformation all elements of the rail industry are going to need to be prepared to embrace the new systems that will become possible, with appropriate regulatory and implementation frameworks that match the needs of low to medium density, low to medium speed routes.

Other teams around the world are investigating these approaches and I have no doubt that solid high integrity on-train positioning based on augmented GNSS is on the near-term horizon for rail, the challenge will be creating an acceptance and certification regime that allows these systems to be appropriately deployed.

I hope that this paper signposts some of what might be possible and prompts debate on where we might go next. ///

Authors recommended further reading and references

- IRSE News October 2019 "Fundamental requirements for a train control system". **irse.info/irsenews259**
- IRSE News September 2022 "ETCS – The impact on the signal engineer" by Andy Stringer. **irse.info/irsenews291**
- "Study on the feasibility of SATCOM for railway communications – final report" European Union Agency for Railways–2017. **irse.info/cr9tj**
- "Certifiable Localisation Unit with GNSS in the railway environment" **irse.info/ela5h**
- Iridium Satellite-based PTT services **irse.info/q2u0p**
- "GPS and GNSS for Geospatial Professionals" **irse.info/6v20z**

About the author

Dr Paul Clark has spent a 33-year technical career creating novel radio communications systems using digital signal processing techniques, doing early work in airborne over-the-horizon HF radio systems that led to an MoD-sponsored PhD.

As task leader for communications, Paul led the team that built a 3000km^2 custom digital radio network for a major international science observatory project in Argentina before leaving academia and heading into business, creating CDL in 2005.

Today, as founder and managing director of CDL, Paul is in the 17th year of a love affair with the RETB in-cab signalling system and is helping to drive a stream of innovation to create a world-class rural signalling solution. As a member of the Unipart Technologies Group of companies, CDL work closely with our colleagues at Park Signalling Limited on all things RETB.

Paul is passionate about solving real-world engineering problems using technology and is a strong advocate of the transformative potential of rural rail, especially for developing nations.

"It's only temporary"

Stephen Dapré

We first met Ruth in IRSE News issue 250, with various encounters since then. For newer readers, Ruth is a fictional engineer who works for a fictional railway arranged into geographical Communities, and both her grandfather Harold and uncle Bob previously worked in the industry.

"Ruth, we've been told by our Community Control Committee that our Community has far too many items classified as 'temporary' and we need to get the numbers down, so we need a signalling engineer to work with the other disciplines to eliminate them."

"Interesting – do you know why they are all there in the first place?"

"Aha, that's where you come in."

Ruth was confident that she had learnt how to spell the word "temporary" at a younger age than the national average (although this important educational statistic was one of the few not measured and reported). Her achievement was not because Ruth felt particularly gifted with languages; instead, she felt the full credit should go to her primary school teacher. As with most schools (and hospitals), the school site was formed of an ad-hoc collection of buildings of varying ages, quality, architectural styles, and heating systems, and one year her form group used a classroom known as "T1". Each new academic year the teacher valiantly ensured that the class knew that T was for Temporary, and that they swiftly learnt how to spell temporary correctly. In hindsight the teacher probably felt victimised for always being allocated one of these prefab huts the far side of the playground away from the main block – the extra distance and remoteness magnified the drama of any child-related mishap or foul weather. Nobody could remember when the huts first arrived, and recently when Ruth was casually looking at aerial maps of the area on her phone, she noted they were still there – albeit with a new path and trees outside.

The railway industry was little different: temporary was a term that defied definition, it simply meant not quite so permanent. In fairness some standards did try to define it, notably in the world of civil engineering (where 'temporary works calcs' required particular attention), plus the Track (permanent way) discipline – hence many of the items on the Community list were related to track. Ruth therefore made a start by finding who would be the best contact within Track, but it was far from easy. A fading organisation chart on the wall in the main Community office looked promising, until Ruth discovered that the person shown in that job had left over a year ago. After numerous emails, she was eventually given the name of someone with a plausible job title, so she gave them a call.

"Hi, I'm a signalling engineer and I've been asked to work with the Track department to help deal with some Temporary Speed Restrictions (TSRs). Are you the right person?"

"I suppose so, although it's not really my substantive post."

"Oh, I was told it should be you, what is your role then?"

"Well, I am a p-way engineer – my normal job is in a different Community, however I am meant to be on secondment into this Community, although HR haven't set it up properly yet."

A forest of TSR signs, some with interesting modifications, seen near Darlington station in 2016.
Photo Thomas Nugent, CC BY-SA 2.0 licence.

"Good, so are you managing the TSR removals?"

"Hmm, another person in this team is off work and they normally deal with removing TSRs, so I probably ought to be doing that as well at the moment."

Ruth was finding this painful. She had recently attended some people skills training that encouraged playing back a conversation in your own words to the other person to ensure both parties were clear about its outcome.

"OK, may I clarify that I've understood: you are the Permanent-Way engineer temporarily responsible for making temporary speed restrictions permanent?" The resulting silence left Ruth wondering whether this had really helped her case.

Meeting of minds

Ruth contacted various other disciplines and found they had also been told by their managers to give this suddenly important topic their full attention and to form a project team. The consensus view amongst the others was that they should invoke the standard industry response applicable to almost any challenge: a big meeting at the Community head office. At least some good dialogue with other engineers and operators should help get some quick answers and decisions.

Before the meeting she tried to use the toilets nearest to that meeting room, only to find a sign saying they were still temporarily out of order, just like the last three times she had visited head office. She walked the length of the building to use the other ones, wondering if she had time to compose and print a sign for them saying: "temporarily in full working order".

When she eventually arrived in the room, she saw various friendly faces from other departments. There was also someone at the front dressed in unnecessarily vibrant clothing who she quickly guessed was a hired-in facilitator/coach/consultant, presumably because the engineers couldn't be trusted to work it out for themselves. As soon as the facilitatory person opened their mouth, she was proved correct. "It's so inspiring to see such a knowledge-rich room ready to peel back the onion layers of the challenge before us and help get this project team stood up."

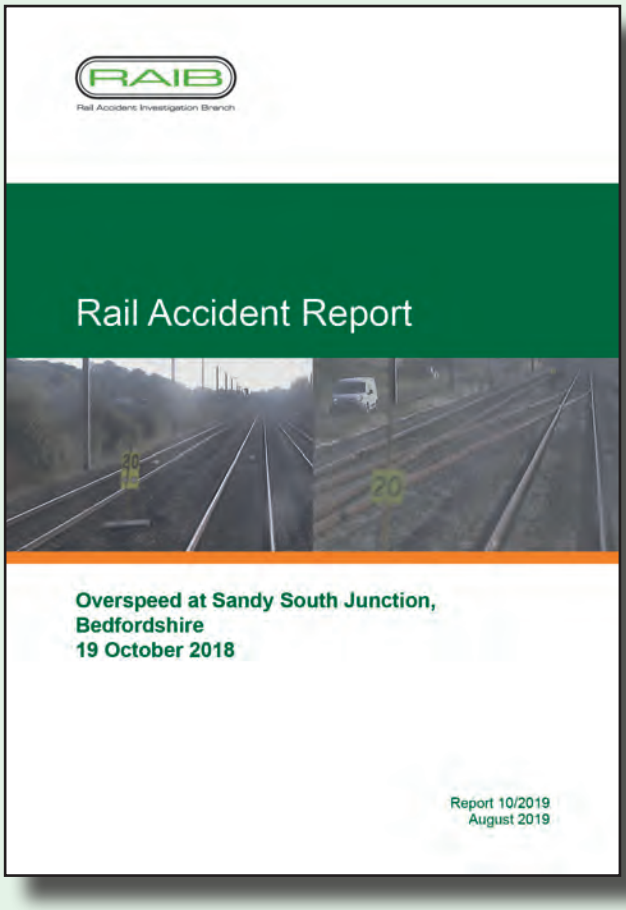
Ruth discreetly glanced around the room to see if she had entered the wrong meeting, but she was convinced most of the room were normal railway engineers. "We need to achieve a paradigm shift in our Community so that zero tolerance of temporary scenarios is baked in to our rules of engagement, and so that we reach out to others who may have synergies with our mission..."

Her mind wandered to a science fiction novel where the heroes had inadvertently landed on a planet and had been captured by the resident creatures, who then subjected their visitors to gradual torture by reading aloud their planet's traditional poetry.

".....and we will be leveraging the benefits that we have unpacked..."

When Ruth was much younger, Grandpa Harold had explained to her how mechanical signalling worked with levers to operate heavy equipment some distance from the box. She was pretty sure that Harold would argue that a lever was an object, levering is an action, and leverage is what you get when it all works smoothly; however, leveraging would not be a proper engineering word in Harold's eyes and must have been invented by non-technical people.

After a few more minutes Ruth was relieved to find that someone different (who had not apparently swallowed a business school thesaurus) would be leading the discussions about each case. She listened as the conversation evolved. "Right, let's start with an easy one: this TSR needs to become a PSR because the existing track cannot be maintained for the current line speed."



TSRs can introduce yet another element of complication to train drivers and bring with them risk. In 2019 the UK Rail Accident Investigation Branch reported into an incident which saw a passenger train pass through a speed restriction at 100mph (160km/h) over the posted limit.

"Don't worry, we are doing a full renewal which is only three months away" said someone from track renewals.

"So surely it should stay as a TSR until then?"

"No, it can't, our Community benchmarking rules state that TSRs cannot exist for more than 199 days, it's already at 167 days so it needs to become a PSR temporarily until the track renewal is complete, after which we can raise the PSR to what it was previously."

"In which case we would need to follow the national standard for raising the line speed, which needs technical approval from every discipline and train company."

"But that will take ages – even if we started now, it won't be ready in time to raise the line speed once the relaying has happened!"

Ruth observed quietly from the side-lines until an outbreak of common sense concluded that the TSR could be signed as a PSR but was still effectively a TSR until the relaying work, after which the pre-existing PSR would resume. There was some debate about whether the current PSR signage was fit for reuse and where to store it safely for its brief holiday, until the person now running the meeting neatly closed that discussion and moved on.

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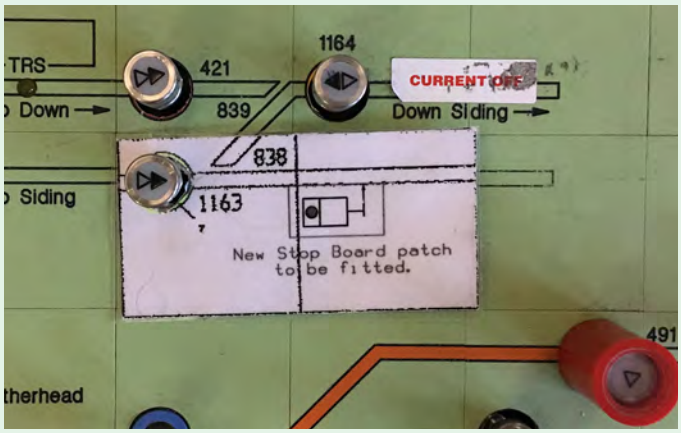

Chessington is a terminus for suburban services in SW London, unexciting until recent months when regular freight traffic resumed after a gap of several decades. The line has been controlled from Wimbledon signalling centre since c1990, although Chessington relay interlocking is somewhat older having previously been controlled from Motspur Park SB. The freight sidings had never been formally closed or removed from the network, so in theory it should just have been a case of refettling and reopening; however it became apparent that there were several discrepancies such as the panel not reflecting the yellow shunt signal (rare nowadays), and a Stop board necessary to protect the exit from one siding. It is debatable whether the panel controls and indications for the sidings were temporarily out of use, or were only ever temporarily in use. To allow freight services to commence as planned, temporary paper patches were provided at Wimbledon until more permanent panel alterations could be achieved.

"Next: this TSR is in place because there is inadequate sighting distance at an open footpath level crossing."

"Yep, know about that one, we are installing miniature stop light and audible warning equipment later this year, don't need to convert that one to a PSR do we?"

"I refer you to my previous answer."

"Seriously? If we make the TSR a PSR, we then have to go back and raise the PSR again when the new crossing equipment is brought into use."

"Can't you do that sometime later once you've followed the PSR raising process?"

"No, otherwise the strike-in points for the full speed would temporarily give excessive warning times."

"Why not adjust the warning times for the slower speeds then?"

"Because then we'd have to go back and alter the strike-ins again if you want to get the line speed back up!"

As with the previous one, once everyone understood all the wider constraints it became obvious why the TSR could not simply be removed.

"OK got another TSR here: this facing turnout is no longer fit for it's designed diverging speed so it now has a TSR applying purely to the divergence. We just need to provide new PSR signage and take away the TSR."

Having been silent for most of the meeting, Ruth felt obliged to intervene on this one:

"It's not quite as easy as that, the junction signalling controls rely on the speed differential from the straight route . [In Ruth's world, junction signalling principles are similar to UK practice, hence signals inform the driver about their destination rather than the permitted speed.] With the diverging speed now being much lower than intended, we would have to impose approach release from red."

"So? I know that's been done elsewhere, I thought you had special disconnection links to apply temporary approach control?"

"True" said Ruth, "however that only works in relay interlocking areas where there is a separate disconnection link for each route. This area uses our Standard Computer Interlocking (SCI), so we can only apply temporary approach control to the entire signal."

"And?"

"Would you like every train continuing along the main line to approach this signal at red before it clears?"

Ruth could see the operations staff in the room ready to interject, so she felt she had made the point sufficiently. The meeting continued until the TSRs were thankfully complete and they could cover some more diverse topics.

"Right, what about this one? This siding was recovered years ago by the track engineers, but the signalling engineers still have it logged as temporary, why is that?"

Ruth already knew about this site. "It's because the points still exist in the interlocking data, so the lineside equipment has been altered, but the locking cannot be removed until we do the next data change in the area."

"But it says here that the signal box panel still shows it as temporarily disconnected and there is still a turn switch for those points. Why do the signallers need to know if it is not there on the ground?"

"Unfortunately, we need to keep the point key for failure situations, again it is just the way SCIs work. If we have to reboot the interlocking after a shutdown, the signaller may have to re stroke the points on the point key to get the detection back into correspondence, otherwise they won't be able to set the mainline routes past where the siding is – or isn't. At least it's a panel, so we've been able to put a temporary patch over the track layout until the data is updated, you couldn't do that on a VDU system." Nobody seemed able to challenge Ruth on that, so it was noted no action was required.

"Here's an interesting one: Temporary Block Working, who knows what that is?"

"It is a method of degraded working we introduce when the normal signalling fails" said one of the operators.

"So how long should it take to remove it again?"

"That depends upon why it was imposed: it might only be in place for a few hours if it was a simple track circuit failure,

In some places 'temporary' is a necessity and has almost become an art form. The much-needed resignalling of Birmingham New Street station in the UK was a case in point.

The final part of the £600m (€691m ,$692m) investment to upgrade signalling systems in the West Midlands, this project involved installing computer-based signalling to ensure the safe movement of some 140,000 passengers per day.

The national importance of this through-station was such that a decision was made early in the project to maintain a full timetable throughout the period that the works were being undertaken. The result was a sixteen-month rolling programme of works and immense flexibility and imagination for engineering teams and operators alike.

The temporary signal on Platform 10 was just one example of the ingenuity displayed to upgrade the railway.

However, unlike some other 'temporary' solutions, this signal really was replaced with the final infrastructure.

Photo Siemens Mobility.

longer if a multicore cable has been damaged, could be days or even weeks if something major happens such as a fire or flooding."

"And is that acceptable?"

"Again, it depends. It relies on people, phone calls and written forms so it is prone to human error, however it works well to keep a basic service moving in the absence of anything better."

Ruth felt it was time to probe this one: "Surely if it was anything that significant, we would have heard about it anyway, where is it please?"

"Here", said someone pointing to the huge Community map on the wall.

"But I travelled through there this morning and it seemed fine. When was this list compiled?"

"Er, let me see....according to the footer on this report: last Friday."

At this point another of the operations attendees chipped in.

"Ah, yes we did have TBW there last Friday now you mention it! It was a failure, can't remember what caused it but it was all repaired that same night."

"Oh, in that case we call that VTBW then", someone helpfully called out, causing some blank looks. "Very Temporary..."

The rest of their sentence was drowned out by a mixture of laughs and groans. Ruth could just imagine her primary school teacher's reaction to all this overuse of the sacred word.

Harold

Ruth had been busy with her temporary project and was conscious she had promised to visit Grandpa Harold at his care home. Having finally found some spare time to visit, she was walking across the car park and saw her Uncle Bob emerging – he must have just visited his father as well.

"Alright Ruthie, what are you up to these days?"

Ruth explained her recent efforts to eradicate temporary measures from her Community, especially the various TSRs.

"Ho ho, TSRs eh? When I was still working, the p-way had to keep on top of them for their own good."

"Really, why's that?"

"Ah well, before the days of trains with decent headlamps so bright yellow reflectorised boards would work, they had to use illuminated numerals with battery packs. The batteries would only last a few weeks, which were a right chore to go and keep changing. It wasn't unusual for the batteries to expire first, after which some of the more observant train drivers would ring up to complain. The on-call p-way manager would thus get a phone call and try to contact someone to send out to change the batteries. The faults would only get reported in darkness; hence the phone calls were typically at anti-social hours. Good incentive to get rid of the TSRs, eh?"

With that, Bob winked at Ruth and continued walking, and Ruth went to find her grandpa.

Harold always enjoyed hearing about how the railway world was evolving, and Ruth's ongoing exploits. They chatted at length, comparing the different approaches in both technology and processes over the decades, with Harold relishing every opportunity to gently challenge Ruth about the detail. He also told Ruth about examples from his era, such as a resignalling scheme that ran out of money before the new panel was built, so the temporary panels installed in local signal boxes about to close had to be retained longer-term.

When they'd almost finished talking railways Harold asked:

"Do you still enjoy it though?"

"Oh, absolutely grandpa – the more I know, the more I realise there is even more to learn. I love finding solutions in the end and making a difference somehow." Ruth cringed slightly, thinking how her choice of words sounded more like a CV or interview answer, but Harold knew she was being modest and genuine.

"That's good Ruthie, that's good. While you're young it's important to always have a go, try to do something useful whenever and wherever you can. When you get to my age..."

Harold's voice dried up and he looked out of the window into the distance. Ruth gave him time to gather his thoughts.

"Yes, make the most of everything Ruth – at my age, you become increasingly aware that we are all only temporary."

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IRSE///
Institution of Railway Signal Engineers

IRSE International Convention 2022 Glasgow

Paul Darlington, David Fenner and Ian Mitchell

From the 12 to 16 September, IRSE president Andy Knight and the Scottish Section hosted this year's International Technical Convention, which was the first to be held since 2018. The Convention is a week-long programme of presentations, technical visits and networking opportunities for mainline and metro professionals. The organising committee had organised an excellent set of technical presentations and site visits.

The IRSE was deeply saddened by the death of Her Majesty Queen Elizabeth II the week before the 2022 International Convention and after careful consideration by the organising committee it was agreed to continue with the Convention based at the Marriot Hotel in Glasgow. There were some respectful changes to the programme and a minute's silence was also held.

Monday 12 September

The president of the Institution, Andy Knight and his wife Isobel, warmly welcomed 145 IRSE members/guests to Scotland and to light refreshments consisting of drinks and a finger buffet. Many old friends were reunited and new friends made, and it was wonderful to see so many members (including younger members) from around the world looking forward to the week ahead.

Andy said how good it was for so many IRSE members to once again to be able to meet face to face after over two years. He also announced the launch of the new IRSE10/// series of ten-minute short form video talks. The content of the talks will be a mix of talking heads from a studio set, stock footage and existing IRSE content. The content of IRSE10/// will be aimed at using expert knowledge, be railway focused, and to showcase IRSE members' expertise.

An evening meal was then hosted by Andy for all the recent IRSE bursary winners.

Tuesday 13 September

Throughout Tuesday groups of members took turns to visit Highland Spring Group's new rail freight facility in Blackford, and Network Rail's Larbert Training Centre, while other groups received four interesting technical papers in the hotel.

Site visits

Highland Spring Group's new rail freight facility is Scotland's first dedicated rail freight facility in over a decade and was officially opened on 31 August 2022 by The First Minister of Scotland, Rt Hon Nicola Sturgeon. The site did originally have a rail siding before the current bottling plant was constructed, but this required a nearby crossing to be closed when a train entered the siding. The new siding uses a turn in from the other direction, enabling trains to enter and leave the freight facility with the crossing open to road traffic.

The development is a major milestone for the company producing natural source waters, enabling them to transport goods sustainably and supporting their ambition to reach net zero by 2040. The new facility, adjacent to Highland Spring Group's main bottling plant, has been planned in partnership with Transport Scotland, Network Rail, and the Scottish Government. It will offer long-term environmental benefits through the removal of 8000 lorry movements from the road, saving 3200 tonnes of CO_2 every year.

The project has been ten years in development and received £4.47m through a Freight Facilities Grant. It is part of the company's long-term strategy to invest in and develop innovative solutions to provide healthy hydration in an environmentally sustainable way. The size of each daily train is equivalent to 22 heavy goods vehicles. The facility will deliver containers of water to their external warehouse in Daventry daily and 40 per cent of the water supplied by the plant will now be transported by train.

The second site visit was to Network Rail's impressive £4m purpose-built Larbert Training Centre, opened in 2008 and built on former railway sidings next to the station. The centre provides Network Rail's Scottish engineering, operations and maintenance staff with a dedicated base to learn new techniques and update existing skills. The centre can train up to 100 at a time and its facilities include an indoor, full-size 60m replica track layout with signals, as well as a 150m outdoor track, classrooms and dedicated teaching staff.

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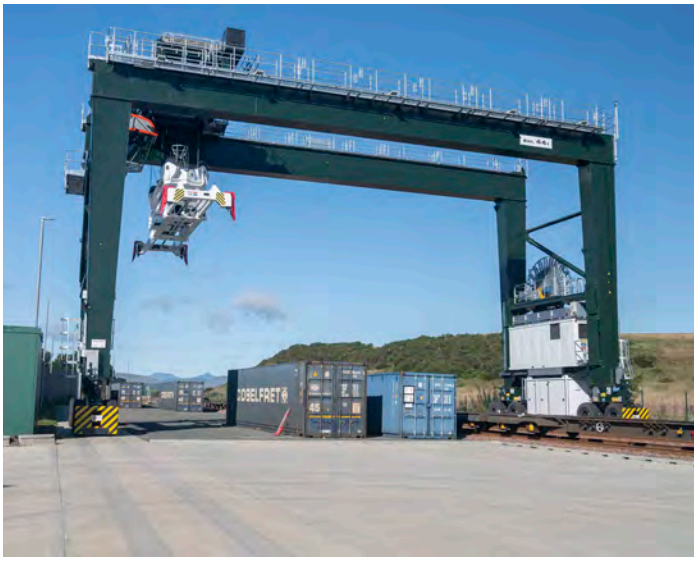

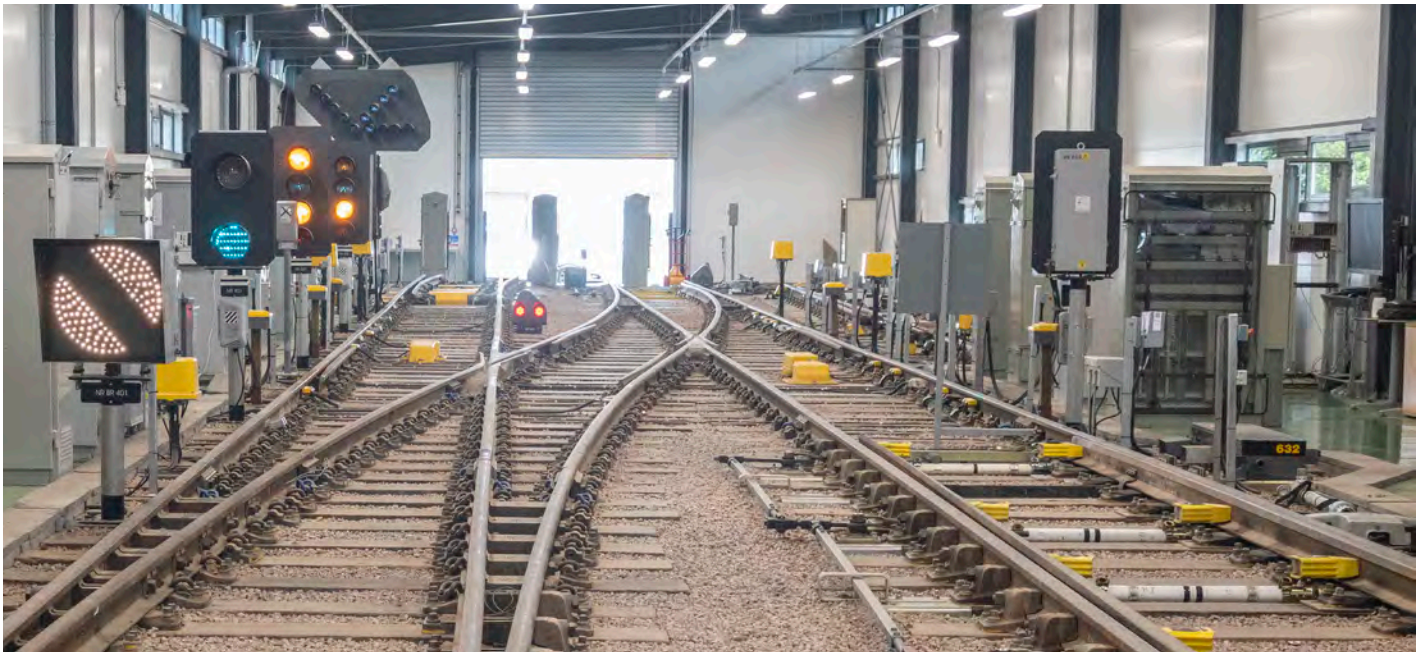

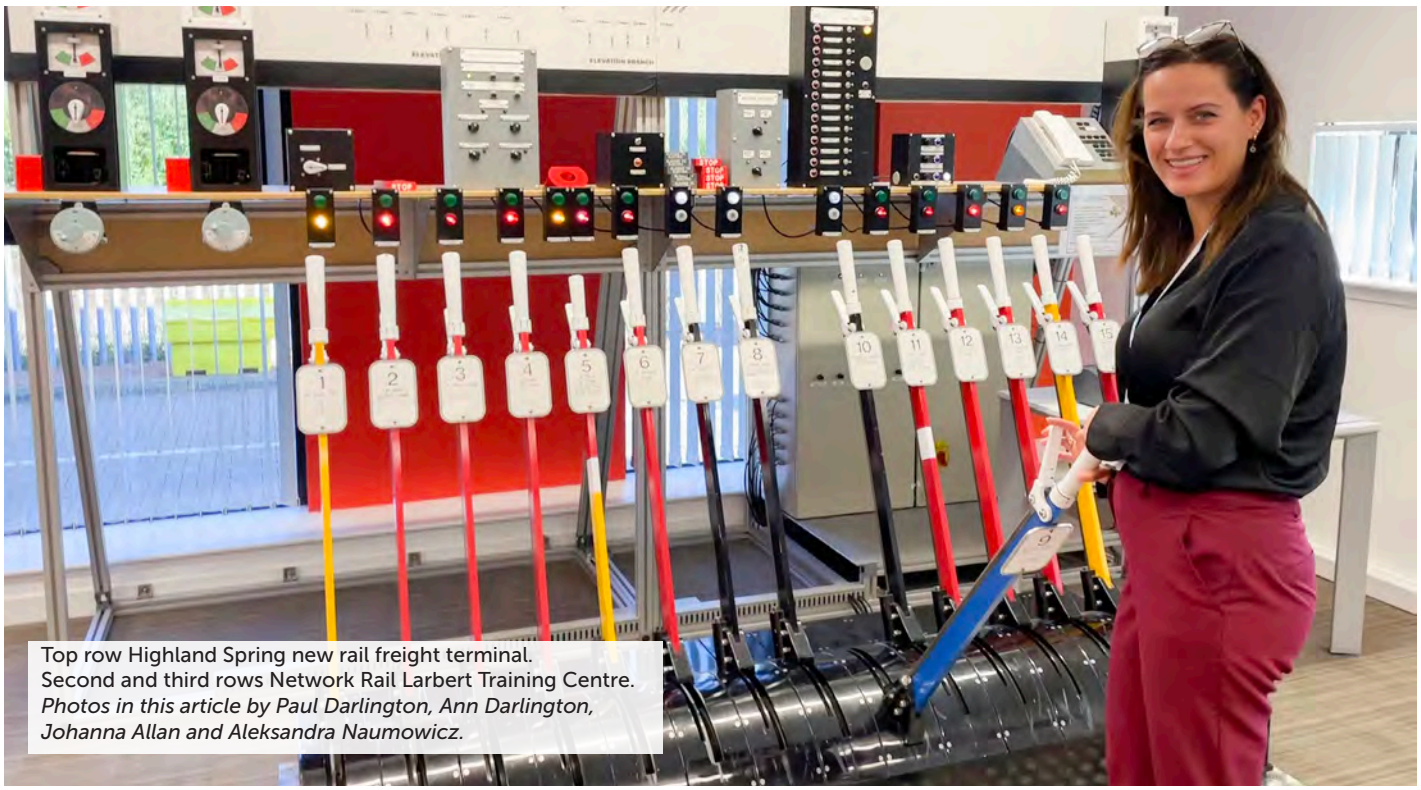

Top row Highland Spring new rail freight terminal.
Second and third rows Network Rail Larbert Training Centre.
Photos in this article by Paul Darlington, Ann Darlington, Johanna Allan and Aleksandra Naumowicz.

During the tour of the training centre, we were treated to a demonstration of the ZKL 3000 RC preinstalled, remotely operated Track Circuit Operating Device. The system (see photo right) enables rail workers to perform track work efficiently and safely, and has been designed to be both simple to install and cost effective. The system can remain installed and be switched on remotely as required by an app on a smartphone or tablet, removing the need for anyone to enter the 'four foot' to place or remove protection once installed. When switched on, the system simulates a train in section, causing the track circuit to show 'occupied' and holding the protecting signals at danger.

The visit also included a demonstration of operating a signalling lever frame and how new operators learn block working, and the importance of communicating safely with members of the public operating User Worked Crossings to cross the railway safely.

Presentations

Introduction to the Carstairs site

Jim McLeary and Carole Markou of Network Rail, and Philip Carachi from Siemens Mobility.

Carstairs Junction is a major junction station on the West Coast Main Line (WCML), situated close to the point at which the lines from London Euston and Edinburgh to Glasgow Central merge. The north-westerly route goes via Motherwell to Glasgow and the north-easterly route goes towards Edinburgh. The southbound route goes towards Carlisle and on to London Euston. Carstairs is also a freight marshalling point.

Northbound (Down) WCML services usually pass the station on the Down Main avoiding line, but northbound services coming off the chord from Edinburgh usually pass Platform 1. The Up Main and Down Platform lines are both signalled for bi-directional working, and used as passing loops for passenger and freight services. There is also the Down Passenger Loop and Up Passenger Loop for holding freight services while faster passenger services pass.

The junction is used by 200 trains a day and is 'life-expired' infrastructure in need of renewal and enhancement. Short toe to toe points constrain the use of the WCML and a new more efficient layout is therefore required.

The project will improve reliability, operational resilience and flexibility. A loop will be moved further north, ten miles of track will be renewed and 35-point ends removed. 100 Signalling Equivalent Units (SEUs) will be renewed, along with new power systems and line speed improvements. The Siemens Mobility signalling contract will deliver the first Trackguard WTS digital signalling technology in Scotland. This uses an IP-based network to connect objects to the interlockings and control centres, and will enable line speed to be increased through the junction. It will also enable the removal of a temporary speed restriction on the WCML. The project will also introduce a station bypass line to increase line speed and space to hold longer freight trains of up to 775 metres in length will also be added. Work is underway on the detailed scheme design and stage works, and final commissioning is due to take place with a three-stage blockade between April and 2 June 2023.

Trackguard Westrace Trackside System (WTS)

Ben Pugh, Siemens Mobility.

Ben explained that the WTS is a tool box of signalling products to 'get the job done'. The system consists of a collection of Trackguard Westrace units operating at 110V AC, 50V DC and 24V DC including, for example; enclosures, location cases, equipment rooms (where necessary), racks, power supplies, and remote condition monitoring and management. The concept of WTS is a deployment method with templated designs (to enable faster design), pre-wired components (for rapid build), and factory testing.

WTS uses SIL 4 Westlock interlocking with IP and Ethernet communications with Remote Serial Adaptors and Media Adaptor Units to convert Ethernet to Serial Module Bus (SMB) for dedicated fibre communications. Where Removable Equipment Buildings (REB) are used the REB is divided into 'slices' with a 7.2m REB consisting of five slices. Each slice can drive up to 12 signals and up to 24 point ends, along with peripheral racks to support point batteries and remote condition monitoring. The location case design is evolving and is currently capable of using 110V AC and 120V DC power driving up to four signals including TPWS and up to eight point-ends.

The design of WTS is continually evolving to provide more capability with more equipment in the same space with increased standardisation to save waste. Interface boards are replacing wiring looms and power supply arrangements are being reviewed to ensure they are not over engineered. Longer tail cables will allow fewer location cases with more convenient siting and better remote monitoring including earth leakage detection will result in fewer maintenance visits.

WTS is currently installed at London Bridge, Derby, Weaver to Wavertree, Liverpool Lime Street, Huddersfield to Bradford, Sutton to Wimbledon (Wimbledon interfaced), Hither Green (part interfaced), Kings Cross, Werrington, Durham Coast, Trafford Park, Miles-Platting and Macclesfield. In progress of installation (in addition

to Carstairs) are Birmingham New Street (December 22), Victoria Phase 3 (December 22), Wood Green to New Barnet (interfaced) and Welwyn to Hitchin (ETCS overlay).

Lower cost signalling solutions

John Richmond, Park Signalling.

John presented Park's lower cost signalling systems. DiBloc has featured in IRSE News a number of times (see IRSE News January 2022). It is a digital block controller that communicates with other block instruments using IP communication which could be provided by public broadband and not require lineside railway cabling. The first application of the system has been on the Romney Hythe and Dymchurch narrow gauge railway in Kent and it will soon be installed on the Whitland to Tenby line in west Wales. There are still a few single lines in the country that are operated by token machines, both on the main network and heritage railways, and there may also be a need internationally for the system.

Radio Electronic Token Block (RETB) is used on lines in very remote areas where often there are no passengers at stations to join a train. To avoid the driver having to slow down in case a passenger is waiting, Request Stop Units have been developed by Park Signalling, linked into the RETB network. These allow more recovery time for trains and there is a marginal fuel saving in not always having to stop and start a train at every stations. A display unit is provided on the platform that indicates the time of the next train services and a push button is provided to request the train to stop. The stop request is then displayed on the driver's RETB token screen. The system is currently being trialled at Scotscalder.

Hydraulically controlled loop points are a limitation of RETB operation as they are trailed through in the wrong direction, requiring a speed restriction. Park Signalling are investigating the motorising of points with control via the RETB commands, improving the speed profile and enabling more recovery time savings. Park Signalling is also looking into GPS positioning information from trains to link into RETB to provide signallers with more accurate train location information.

Network Rail innovations

Robert Gardner, Network Rail.

Robert opened his presentation by saying 'new-age' satellite communications will be a game-changer for rail, providing infrastructure-less or infrastructure-lite connectivity for remote and rural lineside voice communications, remote asset condition monitoring and other sensor/IoT devices, and broadband-on-the-move from Low Earth Orbit (LEO) satellites. This is a fast evolving technology and there have been dramatic improvements in a relatively short period of time.

The Public Switched Telephone Network (PSTN) is progressively being switched off across Britain and in rural and remote locations Network Rail uses PSTN lines for some uses of operational telephones; such as RETB Token Exchange Point (TEP) telephones and User-Worked Crossings (UWC). With power available there are several telephony options, such as Fibre To The Premises (FTTP) and where there is no power, GSM/GSM-R phones can be used. But where there is no power and no useable GSM/GSM-R coverage, (typically on RETB routes) there is currently no viable option for providing lineside telephony, hence the requirement to investigate satellite communications.

DAC and Gai-Tronics are the current suppliers of Network Rail approved trackside telephones and Network Rail are working with them and a new third party (USA Blue Sky Network) to incorporate satellite connectivity for trackside telephones. Blue Sky Network are developing a unit that uses the Iridium satellite constellation (66 LEO satellites) to deliver voice communications, and trials undertaken by Network Rail are so far very encouraging.

Two types of tests have been completed to assess the quality and integrity of the satellite phone, together with a spectrum analysis of the locations. The Network Rail Telecom (NRT) engineering team have modelled and simulated the Iridium Satellite constellation to provide coverage availability predictions over time. The initial results indicate that this type of operational telephone will be suitable in areas of reasonably open sky throughout the rail network.

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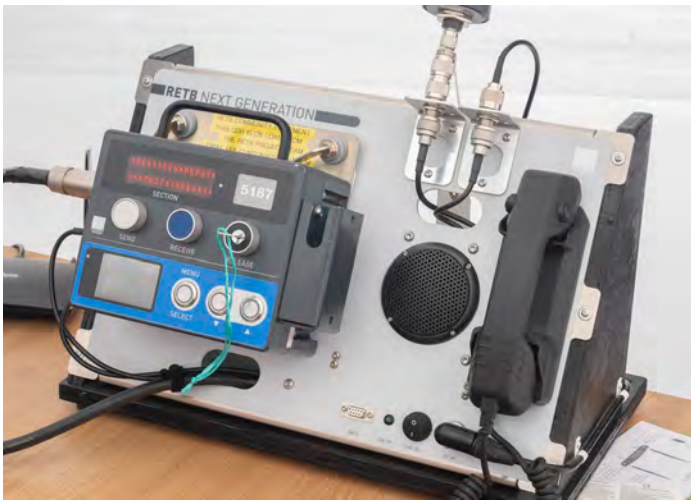
RETB NEXT GENERATION


SIEMENS


Comms Design Ltd
ScotRail


telent
talent with technology
Improving the Highland Railways - RETB
Radio Test Vehicle
telent

NRT has also been involved with remote condition monitoring via satellite for track flooding and bridge scour monitoring along with Radio Data Networks Ltd and Iridium Satellite Communications. The system trial could be quickly expanded to more vulnerable areas in relation to flooding/scouring.

Along with Tactical Wireless Ltd (TWL) and LNER, NRT are also testing StarLink on-the-move, to deliver high data rate satellite broadband to a moving train, more cost effectively and with better service than using the current 4G Mobile Network Operators. A Starlink residential broadband terminal will be tested first, followed by an enterprise unit and a specialised high throughput mobile unit is to be mounted on an IC225 LNER train and data rate downloads of 190 Mbps are said to be possible. We were able to see the trials in action on Wednesday at Carstairs.

Wednesday 14 September

Consisted of four technical presentations and a visit to various exhibits at Carstairs.

Ways S&T can support the decarbonisation of the railway.

Stephen Wright, Siemens Mobility.

Railways are a low carbon means of transport and thus modal transfer is a important opportunity, but this requires an affordable and reliable railway. The big savings within rail will be made by reducing the carbon emissions of moving trains, making solutions such as traffic management and driver advisory systems important. However, we must not lose sight of the embedded carbon in our projects. This requires thought on the materials used and the methods used to install them. Can we reduce the volume of equipment and install it more efficiently? Efficiency also applies to good use of labour and minimising travel to and from worksites preferably in zero emission vehicles.

Hydrogen train project

Iain Rae, Brodie Engineering.

This project was organised to demonstrate the concept of a hydrogen powered train at COP26 back in October/November 2021. More details are given in the section reporting on Thursday's activities where we were able to inspect the train.

Rebuild of the Glasgow Subway

Usman Ali of The Strathclyde Partnership for Transport (SPT). Colloquially known as The Clockwork Orange, Usman gave an overview of the history of the Glasgow Subway, which is essentially a two-track circular railway with trains running clockwise and anti-clockwise. It was one of the earliest subways in the world, opening in 1896, and is now on its third major renovation. This upgrade will see major improvements to the stations, much of which has been done, with new trains delivered and the upgrade of the signalling and control system to enable the railway to operate under Grade of Automation level 4 conditions, i.e. with no on board staff required. The presentation provided some interesting insights into the management of such projects and how schedules and project sequences often need to be amended to cope with challenges not foreseen at the beginning, or as a result of circumstance arising during the project life.

Signalling in Scotland and in particular the importance and challenges of signalling asset management

Lynsey Hunter, Regional Asset Manager (RAM) signalling.

In her enthusiastically and expertly presented talk Lynsey explained that she was the owner of every signalling asset in Scotland and was responsible for assessing their asset condition throughout their life, specifying the maintenance requirements and any mid-life interventions, and deciding and sponsoring the assets renewal.

She explained the many challenges including liaising with the many stakeholders, including government, other asset owners, train operators, enhancements, and maintainers – who all had different and sometimes conflicting requirements. Obsolescence of equipment was one of Lynsey's biggest challenges, together with spending her limited budget to ensure all the signalling assets in Scotland delivered a safe and efficient railway for everyone. Lynsey also explained how she valued having easy access to her framework renewals contractor, Siemens Mobility, allowing her to informally discuss renewal options before producing a renewal specification. She also explained a case study of a level crossing with many conflicting stakeholder requirements and the challenge of providing an affordable way forward to the satisfaction of everyone. Many attendees at the Convention commented this was an excellent and a very interesting subject and presentation.

Visit to Carstairs

The visit to Carstairs provided the opportunity to visit a number of demonstrations of equipment and systems many of which had been the focus of papers presented to the convention. There were nine different marquees to visit. Highlights included upgrades to the RETB system in the north of Scotland and in particular a new system that facilitates request stop operation using radio messages to the drivers cab rather than a hand signal.

There were demonstrations of the infrastructure monitoring systems that communicate via satellite in locations where terrestrial radio systems have poor coverage, along with voice communications and broadband data communications to trains via satellite.

Thursday 15 September

On Thursday members and guests visited sites together, with the first stop being the Bo'ness and Kinneil Railway. As you would expect on an IRSE visit to a heritage railway, there was a visit to a mechanical signal box, and a ride on a steam train (with the 'S&T Engineer' headboard on loan from the Midland and North Western Section). The elegant Caledonian Railway lattice steel signal posts and a traditional overhead pole route were particularly appreciated. The Scottish Railway Preservation Society are fortunate in having a large site where they have been able to erect several buildings for storage and restoration of rolling stock, an impressive 'Museum of Scottish Railways', and miniature railway with working signals.

Alongside the historical interest, our visit provided a chance to see one of the future possibilities for de-carbonising rail traction. A redundant Class 314 electric multiple unit train has been converted to demonstrate the potential for hydrogen fuel cell technology, which is seen as an attractive option to replace diesel trains on longer regional routes where electrification is uneconomic, such as those in the Highlands of Scotland.

The project is led by Ballard Motive Solutions, who have adapted a hydrogen fuel cell power train used on buses and refuse collection vehicles, with the fuel cells and high-pressure hydrogen storage cylinders integrated onto a 'raft' under each of the two driving vehicles of the three-car set. Another raft under the centre car contains traction batteries that even out demand so that the fuel cells can operate continuously at their optimum load while the train accelerates and brakes. One bogie on each end car is powered, with compact permanent magnet AC motors replacing the original DC motors on the 40-year-old train. One of the challenges faced by the designers was cooling the fuel cells;

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while they are more efficient than a diesel engine, they operate at a lower temperature and so a large radiator is still needed to dissipate the waste heat.

The setup at Bo'ness includes a refuelling facility which stores hydrogen produced by electrolysis using electricity from 'green' sources at a pressure of 500 bar, so that it can be rapidly delivered to the tanks on the train at 350 bar through an impressively small diameter pipe.

The project is funded largely by the Scottish Government, and the train that we saw represents Phase 2 'Technical Proofing' of a five-stage project. It is not intended to run on the main line, but to prepare the way for acquisition of a small fleet of trains for operational proofing on the national network, pilot operations and eventual deployment.

Leaving Bo'ness we continued onto Queensferry for a boat trip on the Firth of Forth, cruising underneath the three impressive bridges that connect Edinburgh with Fife. The famous 1890 Forth rail bridge (see cover photo) is a steel cantilever structure that still forms the main railway route from Edinburgh up the East coast of Scotland, and has been inscribed by UNESCO as a World Heritage Site. On the other hand, the 1964 road suspension bridge now has structural problems and has been downgraded to carrying only cycles, pedestrians and buses, with other road traffic diverted onto the cable-stayed Queensferry Crossing which opened in 2017. An informative commentary on the boat described the history of the bridges and the train ferries that preceded them, and also where to look out for seals around the rocky islands in the Firth.

Friday 16 September

Friday was technical visits day. Due to the mourning of the passing of Queen Elizabeth the visit to the catacombs of Glasgow Central could not be held so the one available visit was to the West of Scotland Signalling Centre. This had three parts: The first was a visit to the equipment room where we saw a wide range of signalling and telecommunications equipment often of more than one generation and supplier essentially performing similar tasks. The second was a visit to the operating floor where again there was more than one generation of equipment. An interesting observation was the significant level of automation being used by the signallers for a substantial part of the routine route setting. Finally, there was a visit to the training facilities provided to ensure both operations and technical staff were able to practice skills that may otherwise be lost, and to provide experience of new systems prior to their application on the operating floor.

Guest programme

On Tuesday 13 September guests toured the Falkirk Wheel and The Kelpies and on Wednesday 14 September visited the New Lanark UNESCO World Heritage Site. Evening activities with members included a civic reception held at the Riverside Museum on Tuesday, courtesy of The Rt Hon the Lord Provost of Glasgow Councillor Jacqueline McLaren. On Wednesday there was an optional Ceilidh night for those wishing to immerse themselves further into Scottish music and dance.

Forth road bridges left and rail bridge right.

The Kelpies.

Gala dinner attendees suitable attired for Scotland (left to right Ricky Scarff, Peter Allan, Peter Cuffe, Andy Knight and Ian Bridges).

Andy Knight handing over the ASPECT/ Convention token to Steve Boshier.

Thursday evening was a free evening and the Convention ended on Friday evening with the traditional gala dinner at the Marriott Hotel in Glasgow and both the current and past president wearing their kilts.

Gala farewell dinner

After a busy week of site visits, technical presentations and networking, the gala dinner provided a chance to relax and to thank all those who had contributed to the Convention's success.

President Andy Knight thanked the organising committee for all their hard work in organising the week's events and visits, in particular Paul Booth and Peter Allan, and the sponsors for their generous contributions. Past presidents Daniel Woodland and Ian Bridges were thanked for their difficult Covid-19 years and next years president, Steve Boshier introduced ASPECT 2023 which will be held in Melbourne, Australia from 21–24 November 2023.

The 2022 Technical Convention was a great success with excellent technical presentations and site visits, and all superbly organised. There were many young engineers present and who were all eager to learn from those towards the end of their careers. Even the weather was sunny and with blue sky. The Australian members and guests did say they had bought their weather with them, but the Scottish Section said the weather was always like this in Scotland!

The successful Convention was made possible by the generous support and co-operation of the City of Glasgow and the following sponsors, to whom the Institution is extremely grateful:

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Gold Patron: Kilburn Consulting.

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Industry news

For more news visit **irse.info/news**.

Main line and freight

Return to rail in GB

UK: In August, the Department for Transport national rail passenger numbers reached 95 per cent of pre-Covid 19 levels. Darren Caplan, chief executive of the Railway Industry Association (RIA), said:

"Given all the industrial action of recent weeks, and that the month of August is the traditional summer season when many go on holiday, it is astonishing that we are now getting 95 per cent of pre-Covid passenger levels on the national rail network, and in a week where over 93 per cent was recorded every single day of the week. This welcome milestone has been hit less than six months since pandemic restrictions started being relaxed, and is a clear vote of confidence in UK rail.

"One must assume it is only a matter of time before we are back to 100 per cent of pre-Covid 19 levels. Given this, RIA and our members once again urge the Treasury and policy-makers and influencers not to base 30-year programmes and forecasts for the future of rail on the abnormal period of the pandemic, but instead to plan increased investment for the growth in capacity we are going to need in the years ahead."

Macclesfield resignalling

UK: Over the August bank holiday weekend Network Rail and Siemens Mobility completed the resignalling of the route south of Stockport – between Prestbury, Macclesfield and Congleton. The final switch over from the manually operated Macclesfield signal box saw the last lever pulled and train signalled through on Friday evening 26 August.

The 72-hour possession, from 00:10 on Saturday 27 August to 05:35 Tuesday 30 August, saw over 600 staff and suppliers complete the scheme. The £45m (€52m, $51.8m) project, which started in July 2021 has involved the installation of 53 signals and bases (over 700 piles), 23 location suites, under track crossings, four power supply compounds, nine clamp lock conversions, with control transferred to the Manchester Rail Operating Centre. The work also involved two structures carrying the 25kV overhead lines to improve signal sighting.

Macclesfield signal box was a British Railways (London Midland Region) standard design type 15 installed in 1965 with a 55-lever LMR standard tappet locking frame. Its abolition was originally in the 2004 Ansaldo SWIM scheme (Stockport Wilmslow Including Macclesfield), but was removed from the scope and received life extension works.

ProRail awards ERTMS engineering design contracts

Netherlands: Infrastructure manager ProRail has awarded contracts for engineering design services on three of its ERTMS corridors to five firms. The contracts cover the whole engineering design process from concept designs to testing and commissioning.

ProRail will form a "Knowledge Alliance" with Arcadis, Movares, Nexus Rail, Royal HaskoningDHV and Sweco to implement ERTMS on three ERTMS corridors: the Northern lines (ENL): Hanzelijn–Lelystad (EHL); and Schipol–Amsterdam–Almere–Lelystad (ESAAL).

The Knowledge Alliance method, which has been used for the project to install ERTMS to the Kijfhoek to Belgian border section, will enable the contractors to exchange knowledge and experience, and will also be used in the contractors' interactions with ProRail and as a platform for the transfer of knowledge from the ERTMS systems supplier, Thales.

Arcadis will carry out engineering design for the Harlingen Haven–Leeuwarden sub-corridor, for Leeuwarden yard, and on the Amsterdam Muiderpoort–Weesp–Hilversum sub-corridor. Movares will work on the Almere Oostvaarders–Lelystad stabling yard sub-corridor, on the stabling yard itself, and on the Hoofddorp–Schiphol–Diemen sub-corridor. Nexus Rail will be responsible for the Leeuwarden–Stavoren sub-corridor and Leeuwarden–Groningen sub-corridor. Royal HaskoningDHV will carry out engineering design for the Lelystad staging area–Hattemerbroek connection sub-corridor, and the Weesp–Almere Oostvaarders sub-corridor, and Sweco will work on the Groningen–Roodeschool/Delfzijl sub-corridor, the Groningen–Nieuwschans/Veendam sub-corridor, and on the Groningen rail yard.

TGV M unveiled

France: The new TGV M train has been unveiled at La Rochelle. The train will operate on France's national network from 2024 following SNCF Voyageurs's order for 100 units in 2018 and an additional 15 units in 2022. There will be a 20 per cent increase in on-board space, with a possibility for up to 740 seats compared to the current train's maximum of 634.

Alstom says that the carbon footprint per passenger will be the lowest on the market and each train will continuously transmit data to enable the train to be examined in real time, thus optimising maintenance and availability.

The units will undergo dynamic testing at 200km/h in Velim, Czech Republic. A detailed analysis is also underway on the compatibility of the TGV M with the network. For example, surveys of nearly 70 stations have identified the need to move signals to ensure driver sighting. This is because the nose of the new TGV is longer to make it more aerodynamic.

New generation axle counters

France: Frauscher Sensor Technology has been awarded with a contract for the development, deployment and maintenance of a new generation of axle counters by SNCF Réseau. The contract started in autumn 2022 for a period of 10 years, renewable for a further 5 years, as well as a maintenance period of up to 30 years.

East Coast Digital Programme Class 43 ETCS testing

UK: Another milestone has been achieved in the East Coast Digital Programme (ECDP) with the successful completion of testing with digital signalling for Class 43 power cars forming part of Network Rail's New Measurement Train.

The successful testing programme at Network Rail's recently upgraded Rail Innovation and Development Centre (RIDC) now enables commissioning of the relevant Class 43 power cars into ETCS Level-NTC (National Train Control). Using the RIDC facilities, recently upgraded for ETCS testing, enables progression to Level-NTC without the need for any passenger disruption through track possessions.

Porterbrook, the lead Rolling Stock Company (ROSCO) for the Class 43 under the National Joint ROSCO Programme (NJRP), managed the project on behalf of the rail industry under instruction from Network Rail. Thales was awarded the contract to carry out the First in Class design and fitment project, and the completion of testing at RIDC marks the first time that the Thales On-Board System has been successfully fitted in the UK.

The train testing process at RIDC for the Class 43 involved several days of running and builds on an initial phase of lab testing to integrate and prove the technology. The physical testing at RIDC then proves that the component parts of the ETCS technology (train, trackside, radio block centre) and the train itself all work together in real life conditions.

With around 700 vehicles needing to be prepared for the East Coast Digital Programme, the First in Class (FiC) testing programme at RIDC over the next two years will involve around 20-25 classes of passenger and freight trains.

City and urban railways

Dublin metro project

Ireland: The Irish government has given the green light for a €9.5bn (€8.3bn, $96bn) rail project that will provide over a billion carbon-neutral, fully electrified passenger journeys by 2050. The MetroLink service is set to be 19.4km in length, operating mostly underground across 16 stations to connect the north and south of Dublin.

Trains will run every three minutes during peak periods, which can be increased to every 90 seconds by 2060, and will be capable of carrying 20 000 passengers per hour. The project is expected to receive 75 per cent of its financing from the government, with the rest from public-private partnerships. Under current plans, construction will begin in early 2025, with services starting in the early 2030s.

Panama Metro signalling

Panama: A consortium led by Alstom has secured a signalling contract for the expansion of Panama Metro Line 1, a rapid transit system in Panama City. The consortium, which also includes Thales and Sofratesa , will engage in engineering, installation, testing and commissioning of a CBTC Solution.

The contract will also include the update of the ATS and SCADA system. Alstom will deploy its Urbalis 400 bi-directional track-to-train wireless communication solution on around 2.2km extension of Line 1. This section will link the San Isidro Station with the new Villa Zaíta terminal station.

The Line 1, which is currently being accessed by an average of 230 000 users on a daily basis, will be expanded upon the completion of the new extension. The extension of Line 1 to Villa Zaíta will include the construction of a terminal station at the northern end with a capacity to support over 10 000 passengers during peak periods.

Currently, Panama's Line 1 has around 16km of extension and 14 stations including eight underground stations. Launched in 2014, the line uses Alstom Metropolis trains and Urbalis 400 train control system.

Government and funding

USA rail funding

USA: The Department of Transportation has announced the availability of over $1.4bn USD (£1.2bn, €1.4bn) grant funding, which is more than triple the funding from previous years.

The Consolidated Rail Infrastructure and Safety Improvement (CRISI) programme will be overseen by the US Federal Railroad Administration and supports projects that focus on the modernisation of freight and passenger rail infrastructure. The projects will include the creation of new intercity passenger rail corridors, lessening rail congestion and enhancing multimodal connections, and more than a quarter of the total funds will go towards projects in rural areas.

Grants will be provided to support safety projects, such as level crossing enhancements and line relocations and improvements. The grants can also be used for workforce development and training, regional rail and corridor planning, environmental analyses, and research and deployment of rail safety technology.

Safety and standards

Recommendations following derailment investigation

Canada: The Transportation Safety Board of Canada (TSB) has issued two recommendations following its investigation of a train collision and derailment in 2019 near Portage la Prairie, Manitoba. TSB is calling for Transport Canada and the Canadian rail industry to expedite the implementation of automated train control systems and to develop and implement formal crew resource management training.

On 3 January 2019, trains 318 and 315 were operating on the Rivers Subdivision, one of CN's busiest routes, which frequently transports dangerous goods, according to the TSB report. "while proceeding on the south track using Trip Optimizer ..., train 318 passed a signal at Mile 52.2 indicating to the crew that they should be preparing to stop at the next signal, located at Mile 50.4 at Nattress," TSB reported. "The conductor called out the signal as required, but did not hear the locomotive engineer (LE) verbally respond and the train continued at track speed.

"Soon after, the head ends on train 318 and train 315 passed each other, and train 318's conductor reminded the LE of the previous signal. The LE then applied the train brakes. However, as the Stop signal indication at Nattress came into view, the crew recognized that they would not be able to stop in time and applied the brakes in emergency. Shortly after train 318 collided with the side of train 315 at 23 mph (37km/h), the crew jumped from the train, sustaining minor injuries. The two head-end locomotives on train 318 and eight cars on train 315 derailed as a result of the collision."

As a result of its investigation, TSB has issued to Transport Canada two recommendations:

1. All major Canadian railroads to speed implementation of "physical fail-safe train controls on Canada's

high-speed rail corridors and on all key routes." TSB Chair Kathy Fox said: "The United States has fully implemented a positive train control system on all high-hazard track required by its federal legislation. This includes the US operations of both CN and Canadian Pacific, which have invested significantly in their locomotive fleets and infrastructure. The railway industry must act more quickly to implement a similar form of automated or enhanced train control system on Canada's key routes to improve rail safety and avoid future rail disasters."

2. Canadian railways to develop and implement formal crew resource management (CRM) training as part of qualification training for railway operating employees. "The aviation and marine industries experienced significant safety benefits with the introduction of CRM," Fox said. "This type of training could provide additional tools and strategies to train crews to mitigate inevitable human errors, providing significant safety benefits in the rail industry.

CEN/TR 17833:2022 simulation as alternative to physical tests

Europe: CEN and CENELEC have published CEN/TR 17833:2022 "Railways applications". Developed by CEN/TC 256 in close collaboration with CENELEC rail experts (CENELEC/TC 9X), the report covers the deployment of simulation as alternative to physical tests in railways.

Guidance is provided for the use of simulations to demonstrate compliance with technical and regulatory requirements, as well as the introduction and development of simulation requirements into standards.

The aim is to help CEN and CENELEC Working Group convenors and experts to develop simulations in their standards as an alternative to physical tests for proving conformity. It can also provide useful guidance to assessors in the railway sector in approving simulations where they are not yet specifically defined or where physical tests on the real system are not defined in standards. CEN/TR 17833:2022 is also relevant to companies developing and applying simulations with the intention to achieve system validation.

Topics covered include: numerical simulation; using complex methods or using simple spreadsheets methods; hardware and software in the loop; and mathematical models solved using numerical methods or iteration.

EN 50388-1:2022: Railway Applications–Fixed installations and rolling stock

Europe: CENELEC has published EN 50388-1:2022 'Railway Applications–Fixed installations and rolling stock–Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability–Part 1: General'.

This has been developed by the experts CLC/TC 9X 'Electrical and electronic applications for railways' in support of Directive (EU) 2016/797 on the interoperability of the rail system within the European Union. The Standard establishes requirements for the electrical aspects to achieve technical compatibility between rolling stock and electric traction systems.

EN 50388-1:2022 covers several electric traction systems in its scope: railways; guided mass transport systems integrated with railways; and material transport systems integrated with railways. Basic considerations have also been included concerning the use of accumulator trains.

This new standard is the first part of the new EN 50388 series for which CLC/TC 9X is currently working on the development of Part 2 on stability and harmonics.

Big data and monitoring

Finnish point monitoring

Finland: VR FleetCare and the Finnish Transport Infrastructure Agency (FTIA), have signed an agreement on extensive remote condition monitoring of points. The agreement covers the condition monitoring of up to 300 points, aiming to monitor the operation of the points at several busy traffic points. Condition monitoring of railway locations has not been carried out to a similar extent in Finland before.

Resilience and climate change

Three-months of ultra-cheap trains a success

Germany: A survey has showed that a super-cheap rail and bus ticket programme in Germany this brought 1.8 million tonnes–the equivalent of the annual CO_2 output from almost 388 000 vehicles, savings in carbon emissions. The ticket, valid nationwide by metro, bus, and train (except for high-speed trains), for €9 a month was introduced in June for three months.

One in ten users of the ticket said it prompted them to use public transport instead of cars for a least one journey a week. In total, 52 million tickets were sold, in a country with a population of 83 million. This is the equivalent to powering about 350 000 homes for a year. Ten million people who already have regular monthly public transport tickets also benefited from the cheap fares, together with tourists.

According to data published by the Statistisches Bundesamt, Destatis, train trips almost doubled in rural tourist regions, and increased by more than 50 per cent in urban, non-tourist regions. Sources and further reading can be found at **irse.info/37pm1** and **irse.info/bhxdi**

In September the German government announced they will be introducing a successor to 'nine euros a month travel ticket', as part of their €65bn (£56bn, $65bn) package of measures to ease the cost-of-living.

Exhibitions

Railtex 2023 in the UK

UK: Taking place from 9-11 May 2023 at the NEC, in Birmingham, Railtex 2023 offers an opportunity to experience state-of-the-art equipment and innovative systems and solutions. The show will include live demonstrations, as well as an extensive seminar programme focusing on topics for the industry, such as sustainability, digitalisation, maintenance and passenger experience, alongside the well-established On-Track Display area.

With exhibitors and visitors from the UK, across Europe and the wider world, the exhibition serves as a forum for attendees to discuss all aspects of infrastructure, technological innovations, digitalisation, safety, and sustainability across the entire rail supply chain.

Covering all aspects of railway technology and with more than 180 categories of products and services including rolling stock technology, track and infrastructure, signalling and communications, passenger information systems, vehicle maintenance, fare collection systems, cable technology and many other rail-related sectors.

The conference and seminar programme will bring together key players in the rail industry and focus on passenger experience, sustainability, net-zero, digitalisation, infrastructure, maintenance and women in rail. More information on the seminar programme will be published in due course and companies interested in showcasing their products and services can request the new exhibitor brochure or reserve their stand space via the show website.

Companies

Satellite messages for Network Rail RCM

UK: Radio Data Networks has announced that they believe they are the first supplier to be given direct access to Network Rail's intelligent infrastructure system for the delivery of Remote Condition Monitoring (RCM) data using the Iridium satellite network.

Iridium consists of a fully meshed network of 66 low-earth orbiting cross-linked satellites, and nine in-orbit spares ready to replace any unserviceable satellite. Every region on the globe is covered by at least one satellite at all times. The satellites orbit at an altitude of 485 miles (780km), circling the earth once every 100 minutes. Each satellite is cross-linked to four other satellites; two satellites in the same orbital plane and two in an adjacent plane; creating a secure and reliable connection.

Radio Data Networks say this is a significant step towards the widespread adoption of their Iridium based remote condition monitoring and flood monitoring solutions, since the original successful trials conducted by Network Rail's Melton Rail Innovation & Development Centre over the winter of 2018.

In the trials the Iridium based RCM systems were tested under live running track conditions alongside other technologies and demonstrated the combination of Iridium and smart sensor technologies could deliver connectivity suitable for RCM in remote locations, where cellular and other types of communications are not available.

ACTIA long-distance portable radio warning device

France: ACTIA's new long-distance portable radio warning device (DAPR) is being deployed on several large-scale railway renovation worksites by FVF and SAGES-RAIL, which provides trackside safety for the SNCF railway network.

ACTIA's SAFeasy 200 DAPR system is one of the first on the market to cover very long distances: over 1km. The most common worksites where the ACTIA solution is being used are designated as 'industrial' by SNCF Réseau. These are sites where rails are renewed on an industrial scale using their track renewal train. This 'factory' train unloads rails 80m to 120m in length, welds them electrically on the track, substitutes them for the old rails and reloads the replaced rails.

On the Venarey-les-Laumes (Côte-d'Or) Paris-Lyon high-speed line the ACTIA system has been extensively deployed. The system consists of 28 audible alarms and visual warnings, in addition to the central warning unit and the warning boxes, covering more than 1800 linear metres. The warning point is located 890m away and the warning covers an area of 1760m.

Onboard Wi-Fi usage greater than pre-pandemic levels

UK: A report by connectivity company Icomera, says they are seeing 134 per cent more passengers connecting to its onboard Wi-Fi services compared to pre-Covid-19 pandemic levels. Travel patterns are also changing, with weekend travel Wi-Fi sessions (25 per cent) than during the same period in 2019 (20 per cent). The data is available through a new 48-page industry report – 'The Connected Journey Through Transport's Transformative Decade'. The report also looks at factors that will influence travel over the next decade. See **irse.info/grxf3**

Supported by data and information gathered from transport authorities, operators, and technology companies around the world, the report says that the transport industry needs to simultaneously pursue three objectives to attract passengers in a post-pandemic world:

- Catering for the evolving needs of business and leisure commuters, regardless of age or disability.
- Offering a safe environment that minimises the spread of disease, and guards against physical and cyber threats to individuals and to wider infrastructure.
- Achieving this in a cost-effective and resilient way that also allows the industry to adapt to rapidly changing environmental, societal, and economic needs in the future.

Gee Ltd rebranding

UK. One of the successes of railway privatisation in Britain has been the establishment of Small and Medium sized Enterprise (SME) companies, such as Gee Ltd based in Cardiff to support rail. In the UK the usual definition of an SME is a company with less than 250 employees. SMEs are typically highly adaptive, creative and innovative, and are often owned and run by people who have learned their trade from the bottom and risen to the top. Network Rail says it works directly with over 3000 SMEs and that their indirect spend with SMEs is continuing to rise.

Originally formed by brothers Terry and Chris Gee in September 2009, Gee Communications have grown from undertaking maintenance of station telecoms systems, to a company offering a wide range of services involving telecoms, electrical, alarm systems, IP CCTV, access control, fire detection, cyber security, and civils and ground works. The company now maintains all of the Station Information and Security System (SISS) for the whole of Wales, along with delivering many new telecoms works schemes throughout the UK. This has included for example installation of Infotec RGB displays at London Victoria and London Waterloo stations. The growth in the company has resulted in Gee Ltd adopting a new logo and company branding, which was launched in Cardiff at the end of August. This includes the words "Securing future generations" to emphasise the company's strategy of investing and looking after the next generation, and sustainable engineering.

GEE
SECURING FUTURE GENERATIONS

The event was hosted by Phil Steele, BBC radio rugby broadcaster and one of Wales' most popular after dinner speakers. His rich fund of humour provided a very entertaining and informative presentation to the guests, who also included Mike Gillard from Industry Wales. With a combined membership of approaching 400 leading Welsh companies, Industry Wales provide a range of services to help grow Welsh technology and businesses such as Gee Ltd.

Do you have good news about a rail SME company in your part of the world to share? If so we would love to hear from you at **editor@irsenews.co.uk**

News from the IRSE

Blane Judd, Chief Executive

Council Strategy meeting

Members of the IRSE Council met in Glasgow on 12 September at a special strategy event to discuss the future direction of the Institution. Some members who could not be at the Glasgow Convention in person joined via a video link. The topics ranged from the current vision and mission to the development of the Country and Regional Vice President role and the contribution train control makes to global railway operations.

In the picture (left front to back) Rod Muttram, Peter Allan, Andy Stringer, Paul McSharry, Charles Page, Ian Bridges, Bogdan Godziejewski. (Right front to back) Pete Gracey, Rob Burkhardt, Andy Knight, Steve Boshier, Jane Power, Daniel Woodland. (On screen) Rob Cooke, Yuji Hirao and Jane Copperthwaite.

Also in attendance Ian Allison (just out of shot) and Harvinder Bhatia. Photo by Blane Judd.

October Professional Examination breaks records – again!

For the first time in the history of the IRSE Professional Examination, there were more candidates from outside the UK sitting both the Certificate and Advanced Diploma modules than from the UK.

Over 290 engineers from 28 different countries sat the examinations online, 177 of which were Certificate candidates and the remainder taking Advanced Diploma modules B–D.

We wish all candidates every success and would like to express sincere thanks to all IRSE HQ staff and volunteers who give their time so generously to help make our Professional Examination the envy of other professional institutions.

IRSE 2022 International Convention Glasgow

Thank you to all members and guests who attended the recent IRSE Convention. I would also like to thank everyone on behalf of the Glasgow Section organising committee for all the kind messages of thanks received – it was a great event.

Attention now turns to ASPECT 2023 in Melbourne, Australia which will be held from 21–24 November 2023. More details will be on the IRSE website soon, but in the meantime it's never too early to start planning your trip.

Professional Registration

Aligned to our aims, particularly that of 'Assure', we are pleased to report a substantial increase in the number of people achieving professional registration. An additional 63 IRSE members have been added to the Engineering Council's register of professional engineers this year so far, this represents a 20 per cent increase in the number that were registered at the end of 2021.

Professional registration as an Engineering Technician (EngTech), and Incorporated Engineer (IEng) or a Chartered Engineer (CEng) can be one of the greatest things you add to your CV as it provides a benchmark through which the public, employers and clients can have confidence and trust that you have met globally recognised professional standards in engineering knowledge, understanding and competence. If you are interested in finding out more please visit the IRSE website **irse.info/professionalregistration** or email the team at **registration@irse.org**

Council representation and election process

You may recall that the IRSE council undertook a full review of the Memorandum and Articles (M&As) of the Institution in 2020/21, and the changes were approved at the AGM in 2021. The first part of that revision was the introduction of three-year terms of office rather than two years. This was felt to be better in that only one third of Council would be up for re-election at any one time. This change helps to maintain a consistent level of expertise.

The second part of the revision was to offer greater opportunity for candidates from less well represented sections to gain a place on Council. The Council elections in 2023 is first time we will be inviting candidates from smaller constituencies to stand in the knowledge they have as much chance of getting elected as those from areas with more representation.

We will be looking for candidates from the UK as one constituency, Australasia, Hong Kong, India, and Netherlands (AHIN), as the second constituency with candidates from the rest of the world (RoW) forming the third constituency.

This is a great opportunity for you to get involved in the strategic direction of the IRSE through Council representation, no matter where in the world you are from. Council agreed all future Council meetings would be held online, and the times of meetings would rotate to allow all members a fair share of late night and early morning meetings. This has been the practice this year and has worked well in sharing the load.

It is important to understand that being a Council member is not about representing your particular country or region but bringing your knowledge and experience as a member of the IRSE to help shape the future of your Institution.

IRSE members will be asked to cast votes for their preferred candidates from each of the three constituencies and in all three grades of membership: Fellow, Member, Associate Member. Once the votes are counted seats will be allocated to the candidates who polled the most votes in each of the constituencies. Through this process we will obtain a more representative council based on the spread of our membership across the 53 countries of the world where IRSE members operate.

Nominations for Council open on 10 October and close on 25 November. Voting will open on 6 February 2023; details will be sent nearer the time, please let us know if you have changed your email address. You can only nominate someone, stand for election, and vote if you are a paid-up Associate Member, Member or Fellow of the IRSE (these grades are sometimes referred to as corporate members). Taking part in Council elections is important to ensure the membership is properly represented. Please ensure your nomination reaches us by the deadline. Once again, this year the nomination and voting process will be held online, administered by Mi-Voice but those who would like a copy of the nomination form or paper ballot to complete offline can contact **membership@irse.org** for information.

Your letters

The impact of ETCS on the Signal Engineer

Andy Stringer should not be too hard on the signal engineering profession over the slow progress in developing and implementing ETCS (IRSE News September). It is not a signalling system specified by the railway to meet a railway operating requirement but a political construct.

The European Rail Traffic Management System (ERTMS), of which ETCS is the command-and-control component, was initiated by the European Commission to prevent different national railway signalling systems from frustrating cross border traffic. Signal engineers and the equipment manufacturers have had to make this aspiration work, which, as we now know, has not proved straightforward.

And, while the cost savings of removing lineside equipment benefit the infrastructure engineer's budget, they reappear in the capital and maintenance costs of tractions and rolling stock. There is still some way to go in the ETCS saga.

Roger Ford

HM Queen Elizabeth II

Dear IRSE-Friends,

After a few days of speechlessness, I would like to send my deepest condolences on the passing of the Queen.

As a native of Lower Saxony, I grew up in the British-dominated part of Germany in the 1960s and the first television pictures in black and white that I can remember showed the Queen. My grandmother, who was responsible for my upbringing during this time, taught me that Elizabeth II was not only the Queen of the English, but also of the British and all good Lower Saxons. So, I already became a good subject of the Queen as a child. Today I have tears in my eyes when I think of the past, immense historical era with many highlights in the British-German friendship.

My first ship-model kit, which I eagerly took on in 1971 (as a seven-year-old boy, Daddy helped a little) was the impressive 1:600 scale model of the Cunard liner "Queen Elizabeth 2" by the company "Airfix". What a ship, what shipbuilding ingenuity – that was very understandable even for the little boy I was at that time.

So British engineering fascinated me from an early age, not only in shipbuilding but also in railway construction, I admired my father's model of a Prussian locomotive (1:87), the original of which was a standard design in Northern-Germany at the turn of the last century but one and was equipped with an Allan valve gear.

As I stand today (from afar and in my heart) by the Queen's coffin, I would wish above all from the bottom of my soul for a revival of the once so good German-British and especially Lower Saxon-English relations. After all, it was Bismarck and the Prussians who drove our last good Hanoverian King (George V) into exile in Paris (among other things because he refused to allow the construction of a railway line to Wilhelmshaven on his territory).

So, it is also of some comfort to me that the Queen of us all will soon find her final resting place, in the burial place that also provides final refuge for a humble family member from Lower Saxony.

I remain in the highest esteem, in hope for a good future, your most humble member and your most humble subject.

Martin Bimmermann

Ed: There must be quite a few pictures taken of Her Majesty at railway locations in the UK and elsewhere during official visits over the years. Do you have memories and photos of the late Queen to share in IRSE News? If so please let us know at **editor@irsenews.co.uk**

Membership changes

Elections

We have great pleasure in welcoming the following members newly elected to the Institution:

Fellow

Stephen Allday, TSA Management, Australia

Member

Bashir Anarwala, Transport for NSW, Australia
Rajashekar Pokkuluri, Mosaic Rail, India

Associate Member

Samuel Cowlard, Siemens Mobility, UK
Kar Hao (Derrick) Ee, Land Transport Authority, Singapore
Linden Johnson, Colas Rail, UK
Guru Bhaskar Pula, Mosaic Rail, India
Anil Kumar Raparthi, Mosaic Rail, India
Rakesh Raparthi, Mosaic Rail, India
Nageswaramma Sana, Integrated Rail Engineering Services, Australia
Ethan Williams, Arup, Australia

Accredited Technician

Shivangi, Dubai Metro Project, United Arab Emirates

Promotions

Member to Fellow

Michael Ewart, Amaro Signalling, UK
Gordon McGadie, Siemens Mobility, UK

Associate Member to Member

Huw Bates, Translink, UK
David Grant, S&T Cover, UK
Pavan Kumar Kokkonda, Metro Trains, Australia

Affiliate to Member

Malcolm D'Cruz, Calibre Global, Australia

Affiliate to Associate Member

Zhenwei Zeng, Airport Authority, Hong Kong

Accredited Technician to Associate Member

Scott Buchanan, Network Rail, UK
Mfundisi Moyo, Calibre Global, Australia

Professional registrations

Congratulations to the members listed below who have achieved final stage registration at the following levels:

EngTech

Philip Brown, Northern Ireland Railways, UK
Samuel Loveless, Aecom, UK
Kevin Tanser, Babcock Rail, UK

IEng

Huw Bates, Translink, UK
Matthew McDonald, Alstom, UK
Daniel Oakes, Omada Rail Systems, Australia

CEng

Santosh Hanumanthappa, Hitachi, Australia

Reinstatements

We're delighted to confirm that the following members have been reinstated to the list of members following resolution of payment issues.

Hui Qi Evonne Chng (Singapore), Simon Eastmond (UK) and Jerin Kuriakose Tharamuttam (UK).

New Affiliate Members

Mohammed Fahim Ahmed, Alstom, UK
Tulasi Naidu Bammidi, Mosaic Rail, India
Madhava Bandlamudi, Mosaic Rail, India
Sophie Beckingham, Siemens Mobility, UK
Reltje Jan Bloem, Royal HaskoningDHV, Netherlands
John Carter, Cleshar Contract Services, UK
Veeravenkata Sai Satya Praneeth Chaganti, Mosaic Rail, India
Mamatha Chakali, Mosaic Rail, India
Chun Hang Eric Chu, Amey, UK
Patrick Chung, Hitachi Rail, Australia
Brett Clarke, London Underground, UK
Thomas Coney, Siemens Mobility, UK
Sai Sujatha Dandibhotla, Mosaic Rail, India
Divyasree Goduguchintala, Mosaic Rail, India
Mohammed Karim, Amey, UK
Anil Kuma Kurva, Mosaic Rail, India
Yin Cheung Lam, MTR, Hong Kong
Naga Raju Marri, Mosaic Rail, India
Ram Kumar Mathivanan, Mosaic Rail, India
Nibin Melicorajan, Mosaic Rail, India
Bhanuchandra Naidu Mulagapaka, Mosaic Rail, India
Prem Kumar Murahari, Mosaic Rail, India
João Paulo Nogueira Santos, Irish rail, Ireland
Joseph Nowicki, Network Rail, UK
Sriganth Pappannan, Mosaic Rail, India
Ashwini Pendker, Mosaic Rail, India
Bala Murali Krishna Pentakota, Mosaic Rail, India
Venkata Sai Kiran Ponnada, Mosaic Rail, India
Sandeep Kumar Pujari, Mosaic Rail, India
Ranjith Prabhakaran Rajendran, Mosaic Rail, India
Arivazhagan Ramalingam, Mosaic Rail, India
Renato Rodrigues, DB Netz, Portugal
Alistair Rutter, Northern Trains, UK
Naga Durga Sangam, Mosaic Rail, India
Prema Raju Upputholla, Mosaic Rail, India
Ramanjaneyulu Vadde, Mosaic Rail, India
Alexander Warmelink, Royal HaskoningDHV, Netherlands
Derek Whittle, Linbrooke, UK
Matthew Wright, Siemens Mobility, UK
Dharani Srikanth Reddy Yarramuddu, Mosaic Rail, India
Yousif Yohana, Aurecon group, Australia

Resignations: Adrian Copley, Michael Hellyer, Conor O'Flaherty, Craig Reynolds and Ka Kam Tso.

Past lives

It is with great regret that we have to report that the following member has passed away: Tom Greaves.

IRSE
Institution of Railway Signal Engineers

ASPECT 2023

International Conference

Melbourne, Australia

21 to 24 November 2023

3 days of technical papers
1 optional day of site visits

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Do we hold the correct email address for you? If you have just joined the digital community or recently changed your email address you will not be receiving important membership information or IRSE e-communications.

Don't miss out. Please email your new contact details to membership@irse.org to enable us to update our database.

IRSE News is published monthly by the Institution of Railway Signal Engineers (IRSE).

Website

For latest information about IRSE events, news and how to become a member, visit our website at www.irse.org. We welcome all those who are interested or involved in the fields of railway control systems, communications, data management or systems engineering.

Contributions

Articles of a newsworthy or technical nature are always welcome for IRSE News. Members should forward their contributions to one of the editors listed.

If you have a view about something you've read in IRSE News, or any aspect of railway signalling, telecommunications or related disciplines, please write to the editor at editor@irsenews.co.uk.

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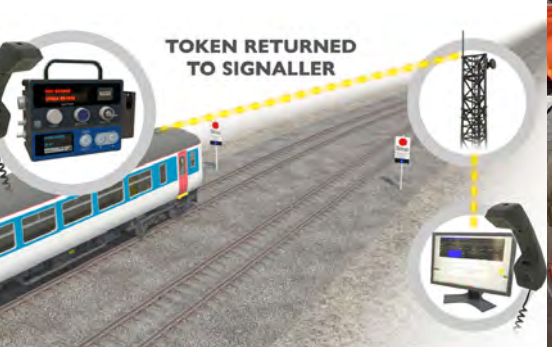

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