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Is this the Severn Valley Railway's only colour-light signal?
Photo: J D Francis
(see article on page 14)

Front Cover: A V/Line "Sprinter" Two-car DMU passing over the Dowling Road TPWS Test site in Victoria, Australia. *(see article on page 4)* *Photo: Steve Boshier*

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NEWS VIEW 198

We still want your views and ideas!

It continues to be important that from an IRSE NEWS perspective, the editorial team continues to understand and predict what the membership will want from us in the next five years, if not longer!

One idea is to run more articles about what differing members around the world do in their day jobs, within the signalling and telecommunications industry. Whilst we have tried this idea before, we feel that it is important that the many and various roles should be highlighted and shared with the membership, to identify their individual importance to differing projects or infrastructure owners.

So what else do you want to see and read about? Whilst we already have many articles about cutting edge technology and various technical solutions from around the world, there must be further items and issues that you wish us to cover?

The editorial team are always interested and keen to hear and learn from the world-wide membership about further possible developments of this successful publication. This being the case, please send your comments and thoughts to ***irsenews@irse.org***.

Please remember that language is no barrier to our team. We can usually translate most languages. There is just one thing though. When you send an article for potential publication, please DO NOT embed your pictures within it. Please send all your pictures as individual JPEG files separate to your article, which should be in a Word file.

The editorial team look forward to receiving your feedback and comments sooner rather than later. Thanks for your support.

The Editor

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Beyond ETCS – Interoperable interfaces and more

By Dr Bernd Elsweiler, DB Netz

This article is based upon the paper given in London in November 2013

The average age of the more than 230 000 signalling units (SEU) that DB Netz has to manage in its infrastructure is about 42 years. In the next years many of these units need to be renewed in order to keep the high level of availability and performance. In order to handle that challenging situation DB Netz needs a new strategy for future signalling systems as well as a business case that justifies the investments in new electronic signalling systems.

In the past five years DB Netz has worked on a technical programme focussing on the development of a new standardised and modular signalling platform since the signalling systems available on the market do not provide an economically reasonable perspective from Deutsche Bahn's point of view. Furthermore electronic interlocking systems do not fulfil our expectations regarding usability, comparability, maintainability and obsolescence prevention.

In that respect this paper provides an overview over DB's strategy to develop a new system architecture and standardised interfaces. Furthermore the paper gives a brief overview over the business case for the renewal of the old signalling systems.

One important aspect of the approach is the usage of formal methods and in particular the development of a "Domain Specific Language (DSL)" to specify the signalling system and, most importantky, the interfaces. Using formal methods DB Netz is able to make sure that requirements are specified complete, correct and unambiguous. Furthermore, formal methods are the basis to include requirements of other European railway infrastructures.

Together with six European railway companies DB has launched a new initiative called "EuLynX – linking signalling systems". The aim of this standardisation initiative is to prove that standardisation of signalling interfaces is possible. This new initiative starts in 2014 and is open for all interested partners (***www.eulynx.eu***).

Aspects of the new signalling strategy

During the last two decades we have had almost no significant technical innovation in signalling technology. Besides ETCS we have still electronic signalling systems based on technology that has been developed in the late 1980s. The technical architecture of interlocking systems is neither modular nor flexible enough to easily implement new functional requirements. Furthermore we have failed to set standards. The consequence is that in all areas of our network we have individual solutions, in particular when it is necessary to interface products from different suppliers.

The analysis shows that sustainable management of the signalling infrastructure is only possible, if capital, as well as operational expenses can be reduced by 50% compared to the figures we had in 2008. To overcome these essential deficits, a new strategy is necessary that provides a perspective for a new generation of highly productive and convenient signalling systems.

In cooperation with universities, suppliers and consultancies DB Netz has launched an innovation programme (NeuPro) in 2008 aiming for standardisation and modularisation of future signalling systems. In the first phase the innovation programme has focussed on the definition of a new technical architecture and standardised interfaces. It became evident early on that we would have to use sophisticated methods to describe and specify systems requirements in a very detailed way. In addition to that, we have learned that structured processes are necessary to engineer highly complex and safety critical systems. Together with an engineering company we have set up a system engineering process and developed a domain-specific language to model systems requirements using formal methods. This domain specific language is based on SysML and is the basis for our specification and modelling activities.

Gradually the innovation programme has been widened to cover all aspects of the product life cycle and supporting processes. Figure 1 provides an overview over the aspects addressed in DB's signalling strategy.

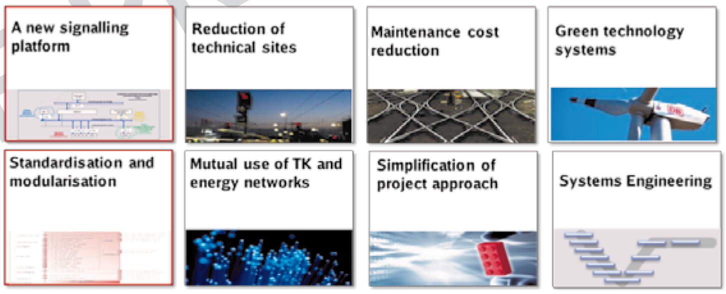


Figure 1: Aspects of a new signalling strategy at DB Netz

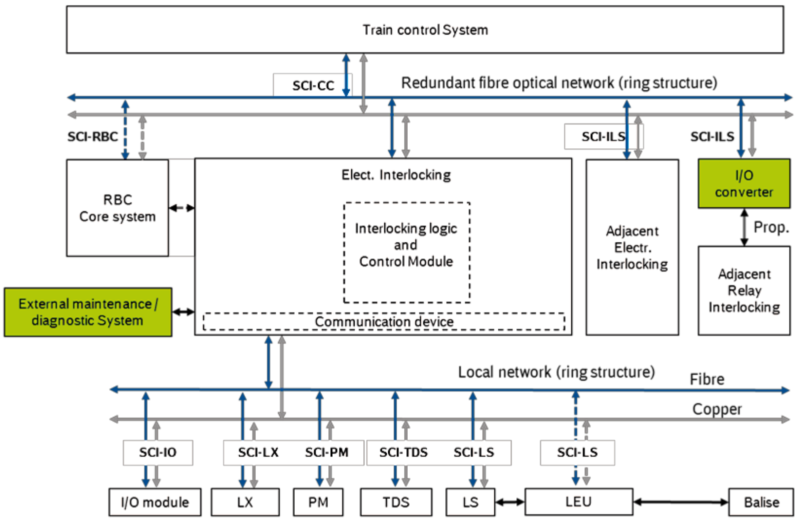
To receive more information about the strategic aspects not addressed in this article, please contact the author.

New Signalling Platform

A new signalling platform is one of the main results of DB's innovation programme. The architecture shown in figure 2 is a three-tier architecture with intelligent field components connected via standard Interntet Protocol (IP) communication interfaces. In accordance with CENELEC standards, the concept and design of the system as well as the system requirements are specified using formal methods. In addition to that, the apportionment of requirements has been defined by DB in a very detailed way.

The specification of the new signalling platform (see figure 2) is "open," which means that all specifications are available free of charge.

Standardised interfaces can only be achieved if all protocol layers are standardised. The approach taken by DB is based on international communication standards for IP communication.



SCI	Standard Communication Interface	ILS	Interlocking System
RBC	Radio Block Centre	LX	Level Crossing
LS	Light Signal	TDS	Train Detection System
PM	Point Machine	CC	Command and Control
IO	Generic Input/Output Module	LEU	Lineside Electronic Unit
I/O	Input/Output		

Figure 2: Reference architecture of signalling systems

We want to make sure that future signalling applications are based on mainstream communication technology, so that we can expect open markets and professional services to build, manage and maintain our communication network.

In cooperation with external specialists, DB has developed a so called "hub and spoke" network particularly designed to fulfil requirements for highly available applications. The network design is essential to guarantee the demanded quality parameters at each point of service.

Communication in the railway sector not just needs to be efficient and reliable but also needs to be safe and secure. In correspondence with the requirements of EN 50159 the RaSTA protocol (Rail Safe Transport Application) ensures safe communication (see Figure 3).

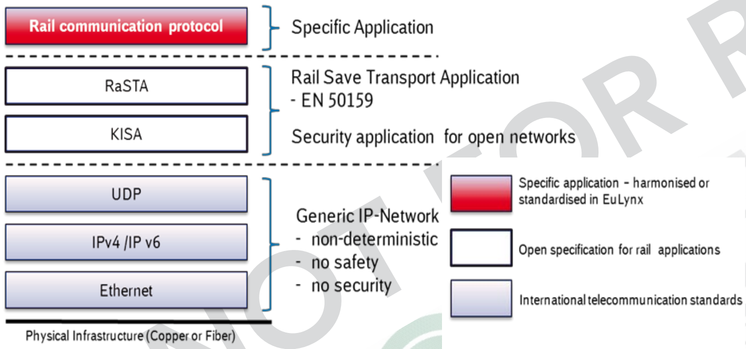


Figure 3: Protocol layer of the standard communication interface (SCI-xx)

In case we want to use open networks, we have to make sure that no external attacks can corrupt information without being detected. The experiences with cyber-attacks from other industries clearly demonstrate what we need to consider when using main stream communication technology for signalling purposes. We need to be prepared for cyber-attacks to become more sophisticated, and in response to this development we need to find intelligent strategies to prevent criminals influencing signalling systems without being recognised and identified. With our self-contained security solution called "KISA", DB has developed a security application that enables us to use open networks for signalling communication.

The two applications to ensure security and safety are strictly separated, so that we will be able to respond to new forms of cyber-attacks by upgrading the security application without influencing the interlocking software itself.

In 2011 the innovation programme reached a milestone where the first implementation projects for standardised interfaces had been launched. In November 2013 DB has taken the first project into operation, where 12 signals are controlled using an IP-based communication protocol. In 2014 DB will commission two additional projects in order to prove the concept further. Our road map shows, that we will have the entire new signalling platform approved within the next three years.

EuLynx - Linking signalling systems

Standardisation of signalling systems is not only a national issue. We have international markets, and we need signalling products that are smart enough to cover requirements from different national markets by using different configurations in order to receive economy of scale effects. Therefore DB has decided to support a strategy that provides opportunities for other railway companies by use of the same interface standards.

Although it will be challenging to develop interfaces ready to use in different national environments, the modular architecture of future signalling systems is supposed to be flexible enough that the vision of standardised interfaces ready to use with different national configurations can be achieved.

To prove this thesis, DB is promoting and preparing a new initiative called "EuLynx—Linking signalling systems," together with six other European railway companies. Within that project, we would like to demonstrate that it is possible to define standard interfaces that can be used in different national environments. This new initiative starts in 2014 and is open to all interested partners (***www.eulynx.eu***). The main parts of this initiative are the cluster projects where different railway companies implement identical interfaces and give feedback regarding additional or conflicting requirements (see figure 4).

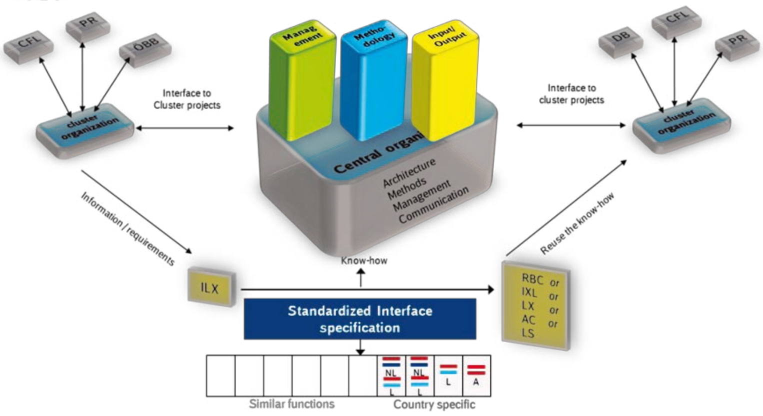


Figure 4: EuLynX – Linking signalling systems

Within the central organisation of the project we will try to solve the problems in such a way that the interface specification can still be used in different national environments.

TPWS – Some Unfinished Business

By Tony Howker

INTRODUCTION

The application of the Train Protection Warning System (TPWS) is well known amongst UK readers where TPWS has been installed throughout the UK on Network Rail Infrastructure. However in the State of Victoria, Australia, TPWS has only been installed on Regional Lines run by VLine, the rail operator servicing the country network. Although most of the country lines have been upgraded to allow for 160 km/h running and fitted with TPWS, trains entering and departing from Southern Cross, the main station in Melbourne, have to join and run on the metro network, a network really built and signalled for 1500 V electric multiple units and fitted with train stops with full braking overlaps. Needless to say, paths for VLine services as they approach Melbourne are difficult to arrange and many services end up between all station metro trains with the end result being poor timekeeping. At the same time, having run over TPWS fitted lines until the approach to Melbourne, the VLine trains now find themselves with no Train Protection System available when they probably need it most. About twenty years ago a solution was proposed to separate VLine trains from metro trains, but it was only five or so years ago that the project finally became funded. A Regional Rail Link Authority (RRLA) was formed which finalised proposals for new separate lines before letting contracts three years ago for the work. All the new signalling work would be to existing Victorian Railway Standards with speed signalling and included TPWS. Both "Train Stop" (TS) and "Overspeed" (OSS) TPWS Loops were used, with the OSS mostly installed to prove that a train was not exceeding 40 km/h at "Medium Speed" signals. This application of TPWS has been in use on the country lines now for over five years and is well understood and works well.

THE PROBLEM

As the new lines enter the central conurbation of Melbourne, restrictions of land has meant that VLine trains have to share tracks with interstate trains which use the standard gauge 4^{ft} 8½^{in}, (Victorian railways are Broad gauge 5^{ft} 3^{in} – 1600 mm). This means that VLine trains run on dual gauge track, with a common rail. This in itself is not a problem for the TPWS antenna, as it is installed on the centre line of the broad gauge track and the standard gauge rail is still more than 0.3 m away as laid down in the UK TPWS Standard *RT/E/S/10138 TPWS Transmitter Loop Requirements*. However the RRL Project required that TPWS Loops be fitted at locations where guardrails that provided derail containment are also fitted. The problem arises whether the extra guard rails would have any effect on the signal strength or shape above the track mounted antenna.

Options Considered for Solution

- ***Move TPWS loops clear of guardrail locations.*** This had been considered and undertaken where possible. Unfortunately because of very tight headway requirements, there was little scope to move signals in some areas.
- ***Gap the guardrails where there are TPWS loops.*** This could be done in some instances but was not preferred by the Civil Engineer. It was considered that a derailed train (on a curve in particular) could hit the guardrail nose and increase the risk of the train overturning and possibly falling from a bridge. Another option to be investigated was to install outside guardrails where the inside guardrail was gapped. This was not considered an ideal solution.
- ***Undertake an engineering assessment to determine whether TPWS/Guardrails could be engineered safely for a Victorian configuration.*** In the UK there is only 47.5 mm gap between the inside face of the head of the rail and the TPWS Loop, whereas for Broad Gauge track in Victoria it is 125 mm. so the problem probably did not exist with broad gauge track. However the problem could still exist with Dual Gauge Track and the TPWS must work for both types of installation. So an operational test would need to be carried out to confirm the solution.

OTHER PROBLEMS

Physical Mounting Issues

In Victoria on broad gauge tracks, the standard guard rail configuration allows for TPWS loops to be mounted between the guardrails with about 125 mm between the edge of the loop and the inside running edge of the rail, which is considered to be maintainable (Figure 1).

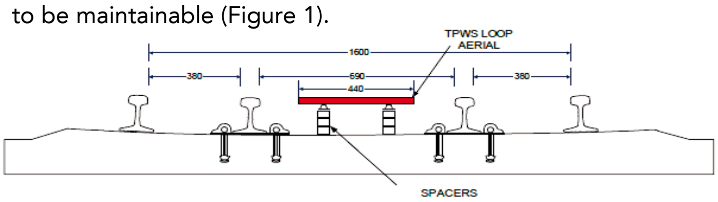


Figure 1 – TPWS Loop in centre of Broad Gauge Track

For dual gauge and standard gauge tracks where guardrails are fitted 380 mm from the standard gauge rails there would be only 47.5 mm between the edge of the TPWS loop and the inside edge of the guardrail (about the same distance between the feet of the guardrails) should a TPWS loop be fitted, which is considered less maintainable (Figure 2).

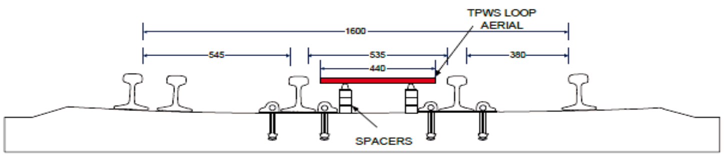


Figure 2 – TPWS Loop in centre of Dual Gauge Track

Field Strength Issues

In order to guarantee that the correct field strength is available at the onboard aerial of the train in order to reliably trip trains for all infrastructure configurations (i.e. tangent track, curves, different cant conditions) and for all rolling stock classes a minimum field strength diagram is designated under the TPWS standards (Figure 3). TPWS aerials must be fitted to rolling stock in a way that ensures that the aerials always sweep though this 'target zone'. TPWS loops on track are fitted and tested to ensure that they always achieve the minimum 90 nT (nano-Tesla) strengths at the designated frequencies within "the target zone". The combination of both onboard and lineside configuration being in specification ensures that the TPWS will operate reliably irrespective of train type and location of the TPWS OSS or TSS unit.

In Victoria the worst case rolling stock fitment is the "Vlocity" (a Bombardier DMU similar to Voyager sets used in the UK) which has a TPWS aerial fitted at 76 mm from the centre line of the track because of other fittings under the leading bogie.

When TPWS is fitted to broad gauge or standard gauge lines (both with or without guardrails), because the loops are mounted centrally then the "Vlocity" aerials will sweep through the target zone.

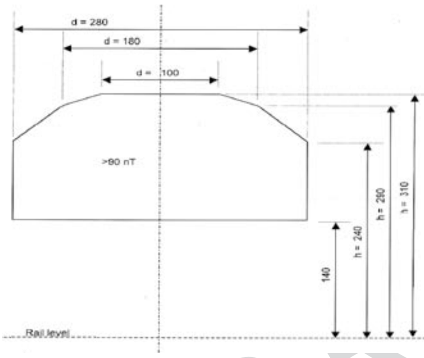


Figure 3 – Minimum Field Strength within the "Target Zone"

However for a dual gauge line with the loop mounted central to the standard gauge track, the aerial of a Broad Gauge Vlocity could sweep through the diagram at up to 158mm from track centre (i.e. 82.5mm between Broad & Standard Gauge centrelines plus 76mm offset) and thus be out of the allowable field strength diagram.

In order that the TPWS loop field strength is within specification for both Broad and Standard Gauge trains:

- On Dual gauge track the TPWS aerials must be fitted with the centrelines of the aerials being 41.5 mm between the centrelines of dual and standard gauges lines respectively;
- Future fitments of both broad and standard gauge trains must ensure that the aerial is fitted not less than 99.95 mm from the centreline of the vehicle (i.e. 140 mm minus 41.25 mm) so that TPWS on dual gauge track operates within the specification for both Broad gauge and Standard gauge TPWS fitted trains.

OTHER TECHNICAL CONSIDERATIONS

Magnetic Field Considerations

A typical magnetic field produced by a TPWS loop is shown in Figure 4. TPWS loops oscillate between 64.25 kHz and 65.75 kHz depending in the function of the loop.

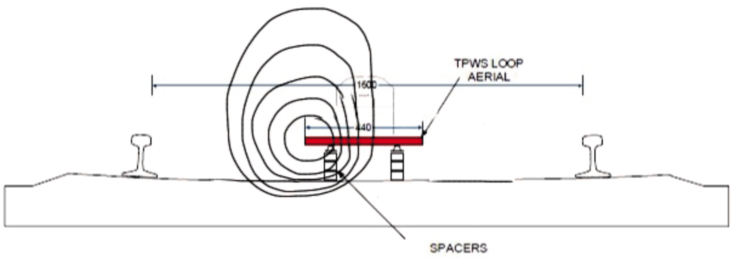


Figure 4 – Typical TPWS loop magnetic flux (LHS only)

The onboard aerial couples with the magnetic field as it sweeps through the target zone over the loop and a current of the same frequency is induced in the aerial which, if detected as being over a threshold level, will operate the onboard TPWS equipment.

The most likely effect of a guardrail (or other significant metal object) is to bend the lines of magnetic flux through the rail and hence slightly reduce the flux in the outer areas of the target zone (Figure 5). It should be noted that the field for the RHS is a mirror image of the LHS and the fluxes from both sides [and from the ends] add in the centreline of the track.

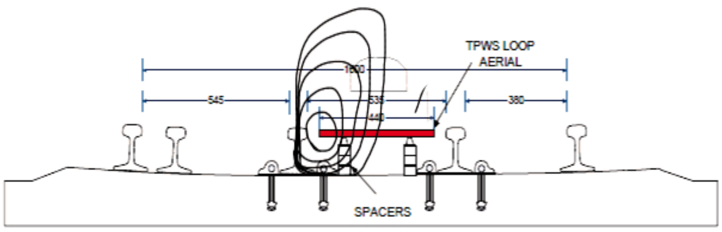


Figure 5 - Typical TPWS loop magnetic flux with adjacent guardrail (LHS only)

Because the TPWS has to be "armed" or "triggered" as the train passes over the loop, it is more likely that a weaker (or intermittently weaker) magnetic field over the loop will not activate the system at high speeds. This is because at say 160 km/h, it takes 27 ms to traverse the loop and if the signal is intermittently weak at that point there is a chance it may not register over the threshold and thus be ignored by the onboard equipment. At 40 km/h it takes 108 ms and it is likely that at some point for a wavering signal, the signal threshold will be exceeded and the onboard unit operated.

Likewise it is more likely that train classes that have the aerial most offset from the centre will be less likely to arm / trigger where there is a weaker magnetic field (i.e. Vlocity Unit).

TSS or OSS Considerations

TSS loops (trainstops) are treated differently than OSS loops (over speed) by the onboard TPWS equipment.

- When the onboard TPWS detects a TSS arming and then immediately after this detects a trigger frequency it will initiate an emergency brake application.
- When the onboard TPWS detects an OSS arming frequency it starts the onboard OSS timer. If it then detects a trigger frequency within 0.974 s it will initiate an emergency brake application, otherwise it will reset.

Because the frequencies are so close together it is unlikely that any particular frequency pair configuration (i.e. TSS Normal, TSS Reverse, OSS Normal, OSS Reverse) will be affected any worse if a guardrail was close to the loop.

However because the onboard unit needs to see an arming loop before a trigger loop it is possible if the arming loop signal strength is weak (under threshold) while the train is over the start of the arming loop (and thus be detected late), but the trigger loop is over threshold (and thus be detected early) then it may detect the loops in the wrong order and hence not trip the train as it thinks the loops are set for the opposite direction.

Thus for testing purposes it is considered a TSS is more likely to be affected by weaker field strength than an OSS.

It was concluded that:

- If they do anything, guardrails are most likely to alter the magnetic flux at the edges of the target area with a dual gauge configuration having a worse outcome (where "worse outcome" means that there is a higher probability that

TPWS doesn't work when it should compared with no guardrail). It was more likely that a worse outcome will be experienced at high speeds rather than low speeds;

- ♦ It was more likely that a worse outcome will be experienced when the onboard TPWS aerial is mounted further away from track centre. In the VLine case a Vlocity Unit on a dual gauge configuration would be the worst case;
- ♦ It was considered likely that a TSS configuration would be worse than an OSS configuration;
- ♦ TPWS performance would be unlikely to be affected by traction current or lightning surges in guardrails or vary depending on the different TPWS frequencies.

THE ACTUAL TESTS

To prove these assumptions and verify the actual data for TPWS a series of tests were undertaken over two weekends. A test site was set up on a stretch of line that carried little traffic on a weekend and was fit for 130 km/h running. This was between Ballarat and Ararat, at Dowling Road level Crossing, 129 km from Melbourne. This was chosen as an ideal site with power available and on a straight piece of track with a line limit of 130 km/h. It was also a single line that although controlled by CTC could be handed over for a complete possession by means of an occupation staff interlocked with the CTC, thus allowing the test train to move in any direction at will. The tests were carried out on weekends in November and December 2013 and utilised various types of traction units including the high speed (for Victoria) Vlocity units. A further series of deliberate SPADs (Signals Passed at Danger) were also carried out within the Melbourne metropolitan area at Spion Kop within a possession on an actual site awaiting commissioning. This site was Broad Gauge track on a right hand curve with dual Guard Rails fitted.

The Dowling Road test site comprised a number of different infrastructure configurations of TPWS loops and guardrails which had been designed to simulate the different guard rail configurations being installed through the RRL project. The tests involved enabling one of the infrastructure configurations then running a train through the test site at different speeds with the expectation of an automatic brake application by the on-board TPWS equipment. A total of 56 train runs were made through this test site over the two weekends.

A brake application occurred on every train run.

The Spion Kop test involved a deliberate SPAD of signal MYD958 at speed with the expectation of an automatic brake application by the on-board TPWS equipment. Two test runs were conducted and a brake application occurred on both occasions.

Dowling Road Test Site

The test site comprised six infrastructure configurations identified and illustrated in the following photos:

Configuration #4 has three variants where the TPWS loops are aligned to either a #4A, #4B or #4C configuration.

Figure 6 - Dowling Road Test Site – General View taken in the direction of the test train's movement showing the four TPWS Loops, #1, #2, #3 & #4

Figure 7 - #1 – Configured with no guard rail (base case and standard installation in Victoria)

Figure 8 - #2 – Configured as Broad Gauge, Double Guard rails and TPWS Loops mounted on centre line

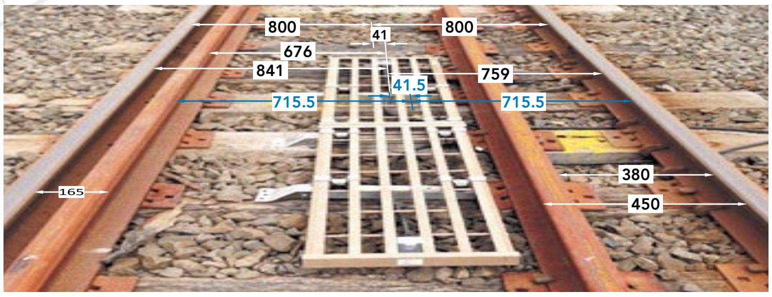


Figure 9 - #3 – Configured Dual Gauge with a single guard rail
The TPWS Loops have been mounted to the right hand side of the Broad Gauge centre line i.e. the centre line of the Standard Gauge track.

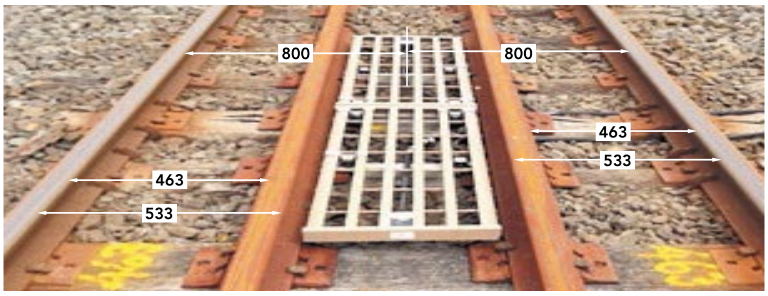


Figure 10 - #4A – Configured as a Dual Gauge Double Guard rail (Standard gauge rail not installed) with TPWS Loops mounted on the centre line of the Broad gauge and the Guard Rails fitted 533 mm from the running rails and not as Figure 9 at 450 mm

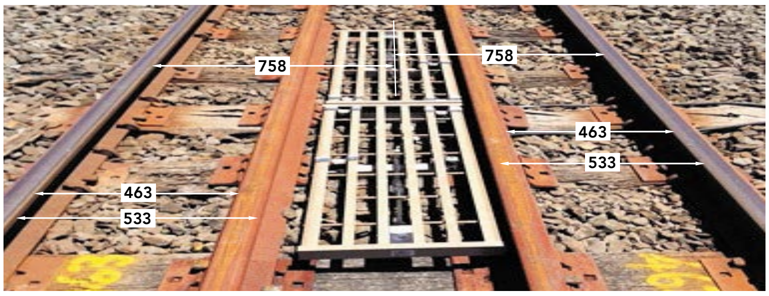


Figure 11 - #4B – Configured as Dual Gauge as above but the with the TPWS Loops mounted offset to the Broad Gauge centreline

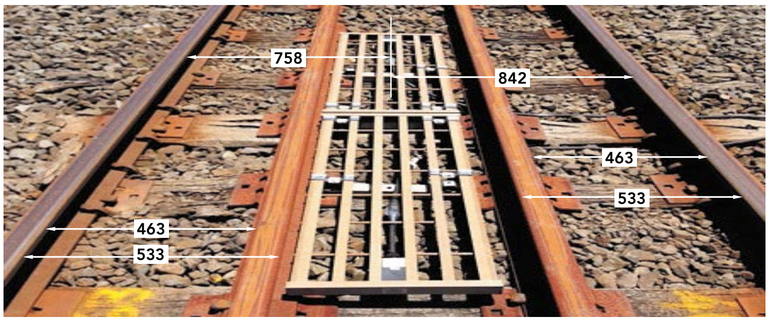


Figure 12 - #4C – Configured as Dual Gauge but this time the TPWS Loops have been offset to the left of the Broad Gauge centreline

THE RESULTS

Each of the four TPWS Loops, #1, #2, #3 & #4 was capable of being energised as a TSS independently and all four traction units traversed these loops at differing speeds. Before the testing started all loops were checked to prove that their minimum field strength was within the limits of the "target zone" as shown in figures 3 & 13 and that there was no impact to the flux caused by different guard rail positions and dual gauge rails.

All measurements exceeded 5.65 mV. These tests were taken using a Jig specially manufactured for the tests.

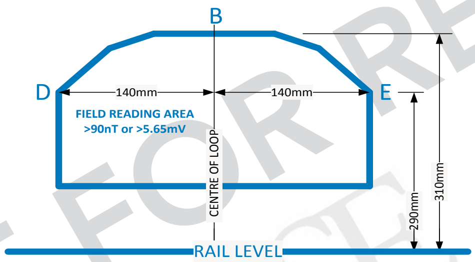


Figure 13 - Defined TPWS Loop Field Reading Area

The four different traction units (a "P" class Diesel/Electric Bo-Bo locomotive, a "N" class Diesel/Electric Co-Co locomotive, a "Vlocity" Diesel/Hydraulic 2-car DMU and a "Sprinter" 2-car DMU). All traction Units used in the tests were Broad Gauge Units. The results of any test were simple – the train or loco if tripped proved the success of the test. It was either a "Pass" or a "Fail"!

Speeds passing over the test loops ranged from 45 km/h to 130 km/h (it was noticeable that the locos took longer to reach 100 km/h than the DMUs – and took longer to stop!) All test runs ended with a TPWS brake enforcement and thus were considered to have gained a "PASS" mark.

THE CONCLUSIONS

Well what was our problem? We found out that we didn't really have a problem! It turned out that the addition of guard rails and dual gauge rails did not affect the operation of TPWS and we gained a lot of information and confidence about fitting TPWS on the network.

Configuration #4C was referenced as "dual gauge with dual guard rails". It was the same as configuration #4B except that the TPWS

Figure 14 - Class "N" Co-Co Diesel/Electric loco used in the tests

Figure 15 - Class "P" Bo-Bo Diesel/Electric Loco

Figure16 - View of the TPWS aerial under the "P" Class loco

Figure 17 - The "Vlocity" Diesel/Hydraulic Unit approaching the Test Site at 130 km/h. (Steve Boshier in the cab taking photographs of the photographer on the ground!)

Photographs by Tony Howker & Steve Boshier loops had been offset to the opposite side in order to create a large alignment difference for the Vlocity train and thus provide a worst case test scenario. This test configuration was introduced at Dowling Road test site and used during the Vlocity and Sprinter test train runs.

The key information we gained from this tests were:

- For broad gauge N Class, P Class, A Class and Sprinter vehicles the aerial is at the gauge centre point and so these vehicles will pass over the loops 41 mm (to the right) from the centre line of the loops;
- For broad gauge Vlocity vehicles the aerial is offset to the right of the gauge centre point by 76 mm and so these vehicles will pass over the loops 117 mm (to the right) from the centre line of the loops;
- For standard gauge N Class vehicles the aerial is at the gauge centre point and so these vehicles will pass over the loops 123.5 mm (to the right) from the centre line of the loops.

The testing demonstrated that there were no reading issues for any of the trains and in particular the worst case configuration for the Vlocity vehicle where the loops were misaligned by 117 mm. The 117 mm value was noted to be inside the defined TPWS field reading area though this was nearing the limit of 140 mm.

For an N Class standard gauge vehicle the misalignment could be 123.5 mm. Again this was within the defined TPWS field reading area. However this configuration would not be recommended for a dual gauge, dual guard rail installation as it is inferior to the #4B configuration which has a more uniform and lower misalignment arrangement.

So the writer trusts that the article including the results could be of possible benefit to other TPWS users (not that there appears to be any move in the future for Network Rail to install broad gauge track). It was an interesting test project and nice to carry out such a test “Down Under”. (At least it didn’t rain and the weather was perfect!)

ACKNOWLEDGEMENTS

This article would have not been possible without the input and help from the following IRSE Members (in no specific order):

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Sam Turley	*VLine Pty Ltd*
Tariq Mahmood	*VLine Pty Ltd*
Brendan Inglis	*VLine Pty Ltd*

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Authors: Robert Baird, Tony Howker and Sam Turley

Driven to Distraction

Exploring Error Producing Conditions for SPAD-risk

By Anjum Naweed BSc (Hons), MSc, PhD

In a recent issue of the Permanent Way Institution Journal, I described how train drivers view their 'relationship' with signals, and illustrated some of the psychological imperatives underlying the eponymous signal passed at danger (SPAD) failure mode. I presented some research, funded by the Australian Cooperative Research Centre (CRC) for Rail Innovation, that set out to determine certain behaviour-shaping factors that impact on SPAD-risk. The research examined this by observing how they engaged with train driving under different conditions and challenging scenarios of their design. In this follow-up article, I will draw on this research to describe some of the error producing conditions for SPAD-risk.

But before I do any of this – a little bit of scene setting is in order.

So traditionally, train drivers have always navigated railways by relying on a keen awareness of the route and 'likelihood' predictions of future train state (Fun fact, over the course of my research, drivers have referred to themselves several times as 'Crystal-ball gazers). Obviously, these predictions rely on having a good knowledge of the track. This is called *route knowledge*, and in practice, comprises both static and dynamic aspects of memory. As you would expect, this knowledge includes a variety of individual and external factors, such as an accurate understanding train handling characteristics, foundational rules, and the position of signals.

Train driving is characterised by a need to sustain attention for tremendously long periods, which increases the drivers' vulnerability to 'disturbances'. The key point here is that route knowledge become less reliable, and information such as the recollection of the previous signal aspect, can simply 'fall behind the fridge'. The error producing conditions I am refer to are those that occur when the driver is fundamentally distracted, not from things like talking on the phone or daydreaming about what they will have for tea, but from factors that are clearly task-related.

The plot thickens.

You see, few rail organisations tend to recognise things that are fundamentally task-related as being a contributor to error producing conditions for SPAD-risk, let alone a cause of distraction from the task in the first place. A good example of such a distraction is the pressure to perform. Under the grip of pressure, attention can easily be allocated to one aspect of the task and attract attention away from another task of equal or greater concern. In the industry's defence, the nature of safety and performance regulation in train driving is actually quite paradoxical - conceptually, keeping time and driving safely is conflicting, and it can be difficult for the train driver to define how they should distribute their attention to maintain these goals.

And so, our research explored the factors that contributed to SPAD-risk – but originally, we did not go out to search on the issue of distraction. We had a very generic approach that asked a number of drivers operating in organisations across Australia and New Zealand to simply 'invent' challenging scenarios in focus groups. We reasoned that their assessment of risk and SPAD likelihood would be grounded in the same sort of cognition they used when 'crystal-ball gazing' and so the rationale was reasonably compelling. Each driver created scenario with felt-pens and A3 paper using whatever drawings conventions they liked, and then shared them with the others. The real fun started when we began analysing them.

You see, even though we did not set out to look at task-related distractions, almost *all* the drivers were saying the same things - Distractions, and from task-related factors no less. The most common were ***time pressure***, which features in 60% of collected scenarios, and ***station dwells***, which were in 50% of scenarios. The consequence of distraction from these distractors increased risk likelihood, particularly when present with **sighting restrictions,** which actually featured in 80% of scenarios.

So, let us have a look at some concrete examples.

What did drivers say of time keeping? *"Well, that's your job. As a train driver your job is to get the train in on time."* Time keeping was considered a goal-directed activity, but time-keeping *pressure* was described as a distraction. The drawing in Figure 1 shows a section of P.Way with a train about to enter a caution zone. The next signal is set at danger and located on a blind corner. While this signal is restricted from view, the driver would know about its location from route knowledge. They would also know that it would be set to danger, based on the aspect of the immediate signal. In this scenario, the driver experiences what they describe as a *"loss of focus"* from a radio call as they enter the caution zone, and they have a SPAD. Aside from the train, track, and two signals, there is little infrastructure, though the duration of the conversation is marked, and you will note a meticulously drawn vignette of the driver in the act of losing focus.

On the drawing itself, the driver also notes a *'focus on quick turn around of train due to timetable running late'.* Given the propensity for acquiring and maintaining route knowledge, there is no reason why a SPAD would occur from line of sight restrictions alone. Thus, I would argue that the main risk factor for a SPAD outcome in this scenario is time pressure, which drives the decision error to answer a call under unsafe conditions, and as a consequence, renders route knowledge far less dependable.

Half of all SPAD-scenarios collected were blind-corner type scenarios, indicating the importance of route knowledge for overcoming sighting restrictions, but also how brittle it was

SPAD RISK CONDITIONS

NB: The drawings shown below are actual excerpts from driver focus groups, annotated to assist legibility

Figure 1

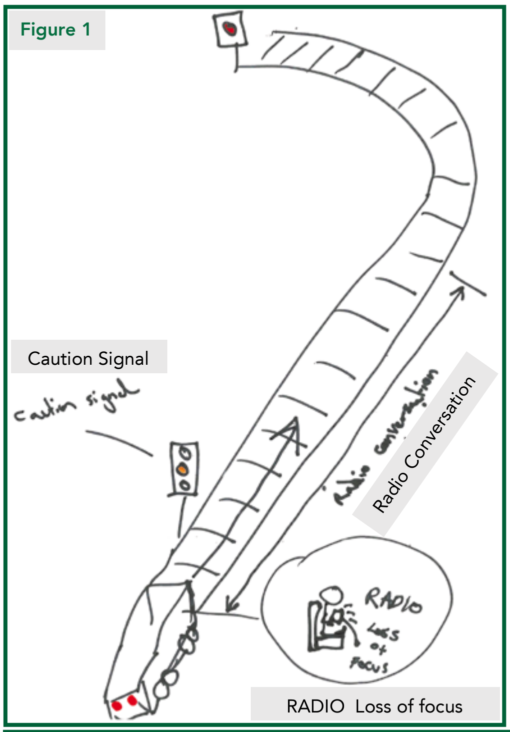
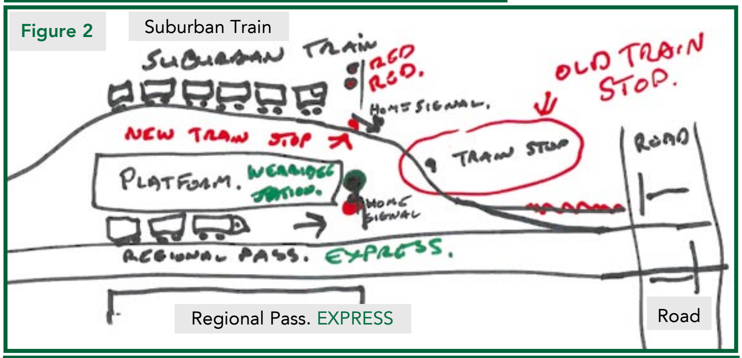


Figure 2



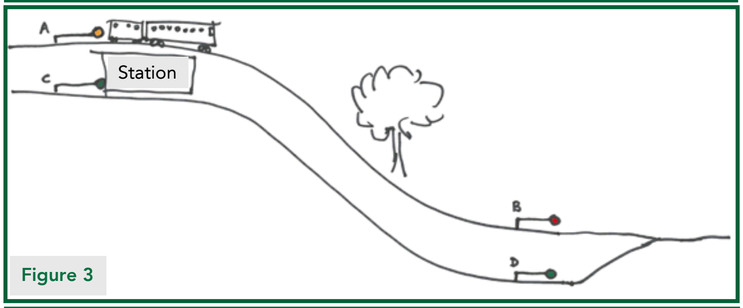


Figure 3

Figure 4

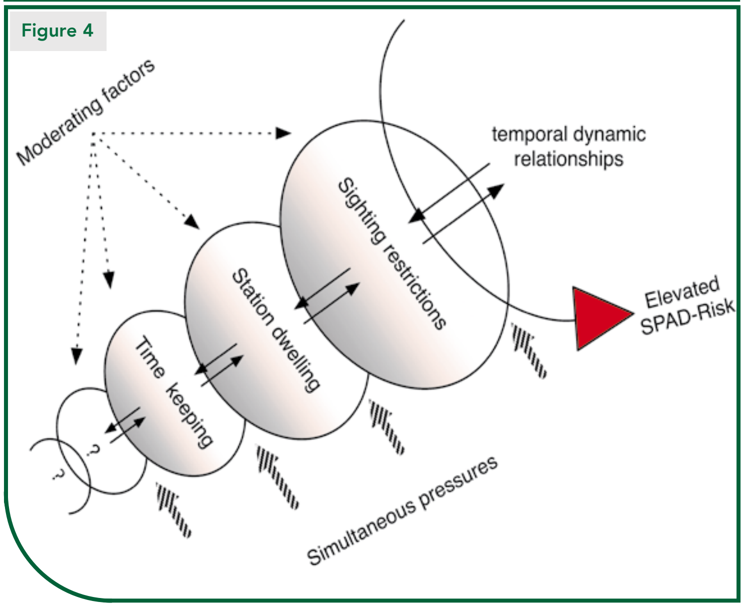


Figure 1.
An error-producing condition involving a combination of time pressure and sighting restrictions. The driver notes the following on the drawing: "Not reacted to caution signal due to conversation with train control. Focus on quick turn around of train due to timetable running late. Loss of focus left no time to react to red signal."

Figure 2.
An error-producing condition involving a combination of station dwelling and time pressure. The driver notes the following on the drawing: "Suburban train sitting at back platform waiting to depart. Regional train approaching to run express through station. Station staff announces train ready to depart and 'spark' driver closes doors and departs not looking at red signal and almost sideswipes express pass. Train stop was in advance of signal, allowing spark to reach a higher speed before stopping just short of side-on collision."
Note: "Spark" is a colloquial term for a driver of an EMU.

Figure 3.
A SPAD scenario involving distraction from station dwelling, time pressure, and sighting restrictions. The driver notes the following on the drawing: "After passing signal A, & stopping at station, signal B is obstructed & driver sees signal D and thinks it is for him and powers up the train. Key problem here is the tree (cut it down!)."
Note: the following amendment was added to the drawing: "Driver is distracted at station, then once back in the cab sees D at green and assumes he is looking at B signal which has been cleared to green."

Figure 4.
Conceptual representation of how time keeping, station swelling and sighting restrictions give rise to error-producing conditions and elevate SPAD-risk likelihood.

under certain conditions. Some train drivers were very fastidious in their time keeping: *"there are guys that really try to keep up time and…they will do anything to try and make up time. They will, you know, bend the boundaries…"*

Over half of the scenarios also featured SPAD error producing conditions on station platforms. The vast majority of these occurred on departure and also involved time pressure: *"drivers accelerate away from platforms, trying to maintain a schedule"*. The drawing in Figure 2 illustrates a train waiting to depart the platform. In this scenario, the driver closes the doors and departs when station staff announces that the train is ready to leave instead of departing at the signal's authority on a proceed aspect. The gravity of this error has been emphasised by a near-collision with an express passenger train on a parallel line, and the proximity of a rail level crossing. Additionally, the train stop mechanism, which would detect the false start and automatically trigger the brakes of the departing train, has been located near the crossover, allowing the train to attain a faster speed before it is arrested. This SPAD is also unintentional, but did more than time pressure contribute?

I would argue that a key risk factor for the SPAD in this scenario is station *dwelling* – not in the sense of the slack built into timetables, but the *experience of staying longer at a station than deemed to be necessary*. A station dwell gives rise to feelings, anxieties and perceptions of workload that transcend the confines of usual scenario pathway. Ordinarily, the driver would complete platform work (assisted by the Train Guard if present), and then depart when the signal is clear to proceed. In the scenario given, the driver misses the last step altogether, and departs without signal consultation. The inattentiveness is rooted in the disengagement from driving, and distraction from the station dwell.

Train drivers also indicate that time pressure, or alternatively, the motivation to *avoid* time pressure, plays a part in premature departure. Station dwelling is described as an anxious state – on the one hand, participants are relieved to not be driving, but also feel ill at ease from a compelling need to keep moving.

It would be remiss of me not to finish this article with something more on sighting restrictions. Many scenarios converged sighting restrictions with time pressure and station dwelling. The drawing in Figure 3 depicts the scenario of a train waiting to depart a station. In this scenario, the driver arrives on the caution signal, which means their next signal (identified in the drawing as *'B'* and located on a blind corner) is set to danger. The driver misreads signal *'D'* as their own, which is set to a proceed aspect for the other piece of line, departs, and lo and behold, has a SPAD. Originally, the driver who invented this scenario highlighted the tree as the main contributor to the SPAD, and proposed a mitigation strategy to *"cut it down"!* However, the other train drivers in the focus group suggested the tree was not the issue, and the driver should know from route knowledge that the signal visible from that side of the platform is not their own. As a consequence, the driver added the notation that they were *"distracted at station. "* The temptation to misread the signal and power away from the station instead of pulling away at caution was also attributed to time pressure.

It is important to note that errors reading across to other signals do occur in real world situations, thus the physical contribution (in this case the tree) should not be disregarded. However, the scenario given in Figure 3 exemplifies more instances where route knowledge was less reliable and attention was diverted. In this scenario, the experience of distraction projecting from both time pressure and station dwelling separates the driver from their route knowledge and the safe working requirement in the task. Thus, the dynamics of time keeping and station dwelling impacts the ability to navigate the railway, particularly, under the conditions where sighting is restricted.

In the brief error producing conditions presented, what we have learned is that distraction during train driving can happen from a number of task-related sources. I'm hoping that we have also recognised that for these error-producing conditions, SPAD-likelihood converges from a number of risk factors contemporaneously. In my preliminary work, I modelled this conceptually in three dimensional form to convey the dynamism and temporal depth between the factors. I have been good enough to show you this in Figure 4.

The point I have been trying to make with this little piece is that some SPADs escape single factor (and ostensibly judgemental) accounts of failure. There is more complexity in there than is immediately apparent, and it would behove organisations to be mindful of these issues, particularly when some of them may be of their own design.

ACKNOWLEDGEMENTS

The author is grateful to the train drives, railway and operator staff who helped with the research project. The author also acknowledges Russ Evans, the Chapter Chair for South Australia for arranging the research to be presented to the Railway Technical Society of Australia (RTSA). The author would also like to extend thanks to Phil Ransom for encouraging the work to be shared with the P.Way Institution, and to Andrew Emmerson for helping get it across to the IRSE.

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INDUSTRY NEWS

New Signalling for Sardinia

French transportation giant Alstom has won a contract to supply and install a new signalling system for the Monserrato-Senorbì and Macomer-Nuoro lines in Sardinia, Italy. The contract, awarded by the Sardinian Regional Transport Company (ARST), has an overall value of about €33m. Alstom holds a €25m share.

Work under the contract involves installing the complete railway signalling system for both the lines that are 90 km long and include 20 stations.

The work, which is expected to be completed in 2015, includes the ACC-M railway signalling system, a computerised multi-station interlocking and traffic management systems (TMS) at the control centre of each line. In addition, the installation will also include the supply of level crossings, passenger information, video surveillance and anti-intrusion systems.

The new system, which is based on Alstom's multi-station Smartlock and Iconis control centre solutions, will enable ARST to manage rail traffic in real-time on both lines in an efficient, fully automated manner. Apart from assuring timely decision-making and rapid reaction times, the system is expected to increase traffic capacity on the Monserrato-Isili line by 100%, and by 70% on the Macomer-Nuoro line.

Alstom said its railway signalling centre of excellence in Bologna, which employs 600 people, will be responsible for designing and producing the systems in partnership with the Bari railway signalling research and development centre.

New Signalling for South Africa

Siemens has won a €180m contract from the Passenger Rail Agency of South Africa (PRASA) to install new rail signalling systems and protection systems in the regions of Gauteng Province, South Africa. The upgrade work under the contract involves installation of a total of 83 Trackguard Sicas S7 type interlocking, and Clearguard ACM 200 axle counting system, a track vacancy detection system that determines whether line sections are clear or busy.

Installation of the signalling equipment is expected to be completed by 2018, when the operations control centre is scheduled to take over control of the entire Gauteng rail network.

In 2001, Siemens won a €90m contract to upgrade one-quarter of the outdated signalling systems and to build an operations control centre for the Gauteng Region. Under the latest contract, the remaining three-quarters of the trackside signalling equipment will be upgraded.

Gauteng Province covers an area of 18 000 km² and includes the cities of Johannesburg and Pretoria. It contributes about 10% GDP for South Africa, and has about 25 000 km of rail track. Siemens has already signed contracts in South Africa with Transnet Freight Rail to equip the 860 km long Orex line with 22 Trackguard Sicas S7 interlockings.

Level Crossing Technology in Poland

As part of the EU-funded partnership PROTECTRAIL, Bombardier Transportation’s EBI Gate 2000 level crossing system contributed to demonstrations of the latest state-of-the-art rail safety solutions at the test track in Zmigrod, Poland. The system is manufactured in Poland and integrated with an obstacle detector for the first time.

The successful testing was the result of the collaboration between Bombardier's site in Katowice and the global technology company Honeywell, which provided the radar scanner. The system is able to receive information about an obstacle on the level crossing, which may impact the crossing or train operations, and send data to the PROTECTRAIL system. The information can then be used to alert crossing, station or train personnel and, potentially, to inform the train driver about the need to brake.

New fibre-optic network for Brussels

Belgium's urban public transport operator STIB has selected Alcatel-Lucent to install a new fibre-optic communication network for driverless metro services in Brussels, as part of the Pulsar project to increase train frequency from 24 trains an hour to 40, in order to deal with growing passenger traffic.

Under the contract, Alcatel-Lucent will install a Wavelength Division Multiplexing (WDM) network to interconnect 70 metro stations and video surveillance with thousands of cameras.

Based on its 1830 Photonic Service Switch, the fully-redundant WDM network consists of two parallel loops and has more than 140 Reconfigurable Optical Add-Drop Multiplexer nodes. The seamless and secure broadband communication network will have the capacity to run services such as Communication-Based Train Control, and on-board Passenger Information Systems.

Santiago Metro contract

The CAF-Thales consortium has secured a $451.9m supply contract from the metro operator of Santiago, Chile, following a competitive tender process. As per the agreed terms, the consortium will supply trains, as well as a Communication-Based Train Control (CBTC) signalling solution to Metro Lines 3 and 6.

Thales's Seltrac CBTC solution, which is completely automated, will increase the frequency of train services and therefore passenger capacity. According to Thales, the Seltrac CBTC solution provides several energy savings functions including coasting, synchronised traction and braking, deferred start and restricted runs.

CAF's new energy-efficient cars will provide an increased capacity of 260 passengers per car. The CAF trains with Thales train control are expected to provide a passenger throughput capability of about 50 000 passengers per hour every day.

The scope of the contract also includes a 20-year maintenance agreement. In addition, Thales' CBTC Seltrac system has been proven on over 55 projects to date and operates on more than 1300 km of track in major urban centres across the globe, by carrying approximately three billion passengers annually.

Swindon Panel Society Update

After several months of discussion we are delighted to announce that the future home of Swindon Panel after decommissioning in 2014, will be Didcot Railway Centre, home of the Great Western Society (GWS).

The search for our future home has been necessarily lengthy and thorough, as there were many factors that we needed to consider: accommodation, available facilities, accessibility for the panel, for visitors, for members, target audience, longevity, services such as electricity, water, etc.

We had a shortlist of six heritage sites within a range of Swindon that we initially approached. From the responses we received we visited the top three and had some informal discussions with the various managers, after which Didcot came out as our preferred single option. After some very detailed discussions an agreement was reached between this organisation and the GWS on 9 November 2013.

One of the main factors that particularly attracted us to Didcot, as well as the enthusiasm of the company to accommodate us, was that its primary function is a heritage *centre*, not a heritage *railway*. We identified that when people visit a railway, whether they are enthusiasts or families, the primary purpose of their visit is to ride on the train, and any museum-type additions can be perceived as less significant secondary-objectives of the visit. With Didcot being a heritage *centre*, visitors are primarily looking to *see* things, to *learn* about things and to take some *education* away with them. We feel that the nature of Swindon Panel as a working exhibit is far more suited to this type of attraction.

Other factors that swayed our decision were accessibility for visitors and members, being well served by rail; security of the site, being 'landlocked' by railway; availability of buildings and facilities, including the accommodation for the panel as well as toilets and café; the availability of local engineering, technical and preservation skills such as fabrication, welding, etc; and finally that it is reasonably close to the panel's original home in Swindon (17 minutes on the train).

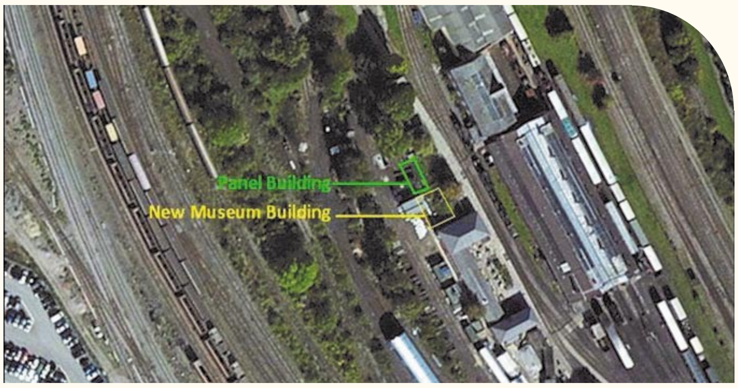
It is planned that the panel will initially be housed in a brick-built building, next to the existing museum room, opposite the locomotive shed. This is an excellent position for us, right next to the shop and café, just off the platform, really in the centre hub of the Centre.

A new archive and research room building is already being built next to the proposed position for the panel, and the GWS had plans to build the new building that the panel will go in for a different purpose in any case.

We will be required to contribute towards the construction of the new building, and we are currently working out the exact pricing and agreement on our 'tenancy'.

In the longer-term, the GWS intend to construct a large exhibition hall, and it is intended that Swindon Panel will ultimately become part of this, alongside other exhibits of mechanical, electromechanical and electronic signalling interest. Again, we are in the process of agreeing the exact expectations on each party in the course of this.

The addition of Swindon Panel to the Didcot Railway Centre site will provide visitors with an illustration of a whole new period in signalling technology development, the 1960s-2000s, a period that, as we know, is already becoming history. Our sincere thanks are due to the management of Didcot Railway Centre for the not inconsiderable amount of administration reaching this agreement has caused them, including changes to their own constitution. For further information and updates, please go to ***www.swindonpanel.org.uk***.



Chinese Track Circuit tested

China-based automation and control technologies provider Hollysys Automation Technologies announced in December 2013, that they have successfully applied its proprietary ZPW-2000s Track Circuit in Beijing's Xiaohongmen to Baiziwan trial railway line. The track circuit has also passed the review by Beijing Railway Bureau.

Hollysys Automation Technologies provides automation and control technologies and products to customers in industrial, railway, subway, nuclear power, building retrofit, and mechanical and electronic industries.

Swedish Maintenance and Diagnosis

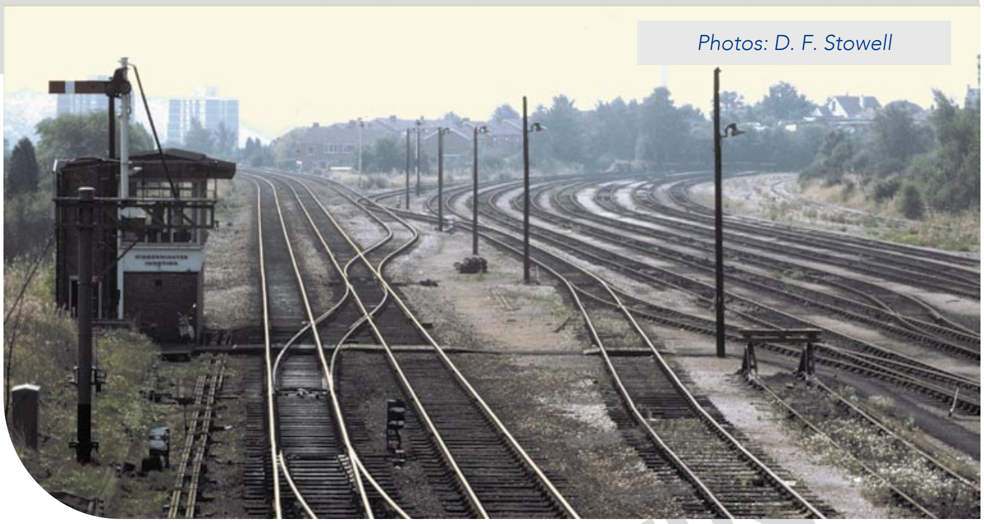
Strukton Rail has won an order from the Swedish Transport Administration (Trafikverket) to connect points in the Göteborg region with the Preventive Maintenance and Fault Diagnosis System (POSS). They will connect 10 points at Göteborg Central Station and six points at Olskroken junction with its POSS railway asset monitoring system.

POSS system continuously and remotely monitors the condition of essential assets in the railway infrastructure and rolling stock. POSS also provides trend information from measurements for further analysis on the nature of breakdowns.

Severn Valley – the Link to the National Network

By Chris K. Hall

Photos: D. F. Stowell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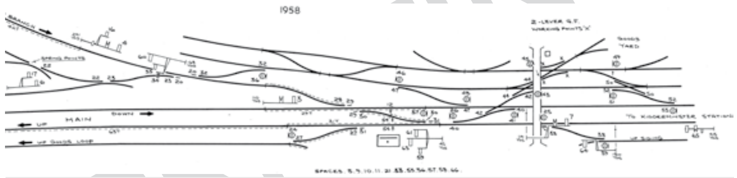
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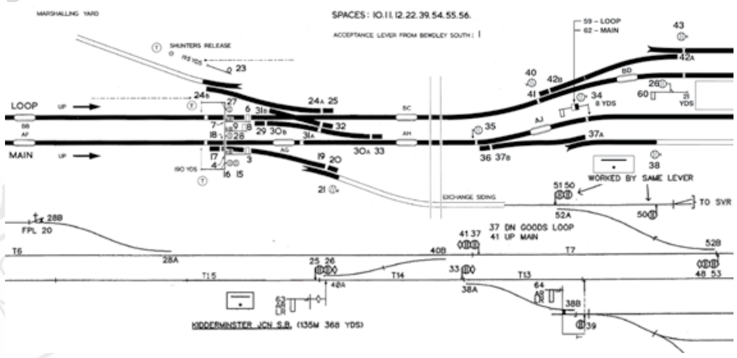
1 The connection in 1983 just before the original connection was severed

2 The position as at 1958 with an extensive goods yard and passenger traffic to and from the branch to Bewdley

3 The position at about 1990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The Severn Valley Railway is a heritage railway in Shropshire and Worcestershire, England. The 16-mile (26 km) heritage line runs along the Severn Valley from Bridgnorth to Kidderminster, crossing the Shropshire/Worcestershire border, following the course of the River Severn for much of its route. Train services are hauled predominantly by steam locomotives; however diesel traction is also sometimes used on designated days. In 2007 a resignalling scheme for the Network Rail main line from Droitwich to Stourbridge Junction (exclusive) was being developed. This article describes the recent history of the Severn Valley connection and how the scheme evolved.

From 1958 main running moves to and from the Severn Valley line at Kidderminster Junction took place via a facing single lead junction. Further connections were provided to the Down Goods Loop and Engine Shed as well as a trailing connection to the Goods Sidings.

The Engine Shed closed in 1964 but the other connections remained after passenger services to Bewdley ceased in 1970. Goods traffic from British Sugar (at Foley Park) ceased in 1980 and Kidderminster Yard closed on 16 May 1983. Access to the site by SVR was available later that year and a single connection was retained via KJ52 points. This connection later provided access to the Pickfords building (now Kidderminster Carriage Works) controlled by disc signals KJ50 and 51. Discs 50 were normally left 'off' to allow moves to and from the Carriage Works. Until the new Kidderminster Station box could be built and commissioned, a single platform was provided with 'One Engine in Steam' working from Bewdley and a ground frame to control run-round movements.

The position at about 1990 was that the Yard site had been developed into a two platform terminal station controlled by a brick-built 62 lever signalbox, which had been commissioned on 21 November 1987. Provision was made for possible electrification of the main line (by using a.c. immune relays and circuitry) as that was then a remote possibility. However the Railtrack/Network Rail infrastructure remained essentially unchanged for the next 23 years (from 1984 to 2007) until a dialogue with Network Rail's Signal Design Engineer was started in April 2007. This outlined the proposed/likely signalling arrangement expected to be commissioned at Kidderminster by about the end of 2010.

The initial proposal contained a significant change to the layout – a facing connection was to be provided on the Stourbridge side of Kidderminster station. This would serve two purposes – it would allow an Up Freight to arrive in the Down Goods Loop so that it could run-round and depart back towards Birmingham – at present these trains had to run-round at Worcester. It would also allow terminating Up passenger trains to arrive in the Down platform. However the Civil Engineer ruled that, due to curvature, the facing crossover had to be on the Worcester side of the station. The new arrangement would allow use of the Down Goods Loop as an alternative turnback siding.

At this stage the proposal showed signalling only for the existing shunt moves to and from the SVR but the purpose of the discussion was to understand the SVR's aspirations as it would be quite practicable to provide for running moves as well. The meeting also noted that the new facing crossover made direct through running possible and sought to establish the SVR's aspirations for access to and from NR: this was for a main and shunt aspect from both platforms at Kidderminster (NR) and a main aspect for exit from SVR. A subsidiary signal would be required with a route from the exit signal to the Carriage Works ('W') and a route to the Down Platform ('B').

SVR agreed to control the subsidiary signals to and from the Carriage Works (this saved Network Rail one SEU [signal equivalent unit]) and would provide the necessary track circuit indications and a release to the West Midlands Signalling Centre

(WMSC) on the cross-over connection to Network Rail. The draft scheme, after initial discussions on 25 April 2007, provided for both shunt and running moves to and from SVR. Movements to and from the Carriage Works were to be controlled by a position light ground signal. At this stage the detailed interface between Network Rail and SVR infrastructures had yet to be agreed as this was the responsibility of the designers. The scheme plan would be agreed with the Network Rail designers and Severn Valley.

The meeting identified some work that would be necessary on SVR, including trap protection from the Carriage Works to protect what would become a running line and a release to prove the line clear to the next main running signal. SVR agreed to provide input for the Signalling Scheme Plan identifying alterations to SVR infrastructure, with Network Rail providing the exit signal and point drive and SVR providing the new pointwork and the signal and derailers from the Carriage Works. Derailers proved to be the only feasible solution in this location. By November 2008 the proposals were fairly firm – the existing double disc signal 50A/51 would become DR7835 signal, 50B would be a SVR disc and DR724 points would be released by SVR.

One significant aspect of the proposed changes was that the Exchange Siding would become a running line – that would mean that a main running signal would be required on the gantry in place of the existing lower disc 16. A Calling-On arm would also be required to provide for moves to the Exchange Line when it was occupied. Although distracted in June 2007 by severe storm damage to our infrastructure, we therefore booked a possession for November 2008 to repaint the gantry and to provide the necessary fittings for an extra doll.

As the interface arrangements were firmed up – by 15 March 2009 the high-level plan for the scheme had been substantially agreed – we were able to plan in more detail. The exit signal would be controlled by WMSC but we would need three short levers to provide a release for DR724 points and 'Main' and 'Shunt' slots for DR 5834 and DR 9836 for movements onto SVR. A further lever would be required to control the trapping protection from the Carriage Works, another to control the signals reading in and out of the Works and (with the existing lever 16 becoming a Calling-On arm) to control the new main running signal on the gantry.

In all six new levers would be required in the box – there were two sets of three spaces 10, 11 and 12 and 54, 55 and 56 and there were a few levers spare – 44, 45, 46, 48 and 49. Lever 44 was to remain spare which meant that we could accommodate the work by reducing each of the three spaces to two. Some of the existing levers would need to be shuffled so that the pulling sequences were sensible and we booked a possession of the lever frame for November 2009.

The necessary changes were as follows:

Lever	Existing function	New function
10	(space)	Up Main Inner Home to Exchange
16	Disc Up Main to Exchange	Calling On
45	(spare)	Platform 2/Engine Line P'ts (ex-47)
46	(spare)	Disc at 45 (previously 50)
47	Platform 2/Engine Line Points	Disc/Shunt to/from Works (ex KJ50)
48	(spare)	Carriage Works Derailers
49	(spare)	DR724 points (Release) (ex KJ52)
50	Disc at 47	Shunt Network Rail to SVR (slot)
56	(space)	Down Main Outer Adv. Starting
57	Down Main Outer Advanced Starting	Down Loop Advanced Starting
58	Down Loop Advanced Starting	Platform 1 to Down Loop Starting
59	Platform 1 to Down Loop Starting	Platform 2 to Down Loop Starting
60	Platform 2 to Down Loop Starting	Down Main Advanced Starting
61	Down Main Advanced Starting	Down Home from NR (Slot)

This would mean quite a lot of work on the mechanical locking – a number of lock bars would need to be shortened – but at this stage we would make no attempt to provide the locking on the new levers. The run round facility on platform 2 would be booked off while levers 47 and 50 were moved to 45 and 46 – this was a lot of work as a frame support had to be moved and a new circuit controller provided in its place.

Fortunately we had a short lever (originally provided for 46 which was to be a set of motor points, never fitted) and so we just needed to make space for it – lever 48 would be the natural place for the derailer control. Moving the lever, trunnion, tappet and electric lock as a set would avoid any need to cut the tappets which simplified the work. Each locking bar was cut and remade to suit the shorter run. The lever leads were adjusted with Dymo tape and the frame tested. Services resumed with levers 57 to 61 renumbered and all associated work completed.

A further possession (in 2010) would be required to fit the new doll on the gantry and to add the new locking for the additional levers – this would require all movements to use the Loop line but would still leave both platforms in use.

4

4 Levers 57 to 61 are being moved in November 2009 to become levers 56 to 60 to make space for a new (short) lever 61

SEVERN VALLEY RAILWAY LINK

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5. Threading a short lever and trunnion into the frame in November 2009
6. May 2012; the derailers have just been delivered and there are a lot of holes to drill with a lot of equipment to be fitted into a small space
7. Signal KJ50 is being removed in August 2012 after the exchange line had been taken out of use to relay the SVR end of the crossover
8. By 21 August 2012 there's no space for anything else except some paint
9. Commissioning and testing is well in hand on Sunday 26 August 2012 *[Photo: C. K. Hall]*


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The Permanent Way Department had indicated that they would want to relay the exchange line which had not been set out for passenger moves, in particular to reduce the curvature of 18 points, which would bring the toe of these points closer to the gantry and allow a line speed from NR to the gantry of 15 mph (~25 km/h) (in place of the existing 5). They spray-painted the new position the track would adopt making it clear that our signal wire run would need to be moved. There would also not be room for mechanical detection on 17/18 so that would need to be converted to electrical detection. Our workload was increasing! Apart from moving the signal wire run, none of this affected the Network Rail resignalling and was deferred until 2013.

We moved the signal wire run, including an under track crossing, to be clear of the new track position. Just 16 signal wires to be moved and a few signal wheels to be repositioned. This seemed quite easy in comparison to everything else we had to do! The Permanent Way work (and three weeks work for us) was postponed to October 2013 and was completed by 1 November in time for a special train from Bridgnorth to the Bluebell Railway the following day.

Now the scheduled date for the Network Rail work began to slip from end 2010 to early 2012 as all schemes were reviewed against costs and savings and put on hold while this was done. The final date turned out to be August Bank Holiday 2012. This gave us a bit more breathing space for the electrical work.

Several details were still unresolved by the end of 2010: exactly what form the derailer would take; exactly which electrical controls and indications would be provided between NR and SVR; the mechanical locking design for the new levers; whether the exchange line would be realigned before or after commissioning; a functional specification for the electrical locking.

The mechanical locking functions had been decided and so we proceeded to a detailed design of the locking which was implemented in August 2011. We could do this during the running season as the work was confined to the Exchange Line which we took out of use for the work. The fringe box specification, which identified the detailed electrical interface between the two parties, was agreed in November 2011. We started running the new wiring soon afterwards – about a thousand yards of new wiring was required along with 24 new relays. Outside the signal box, two new location cupboards were provided – one to control the derailers, which were to be operated by an HB-series point machine and one for the new track circuit relays.

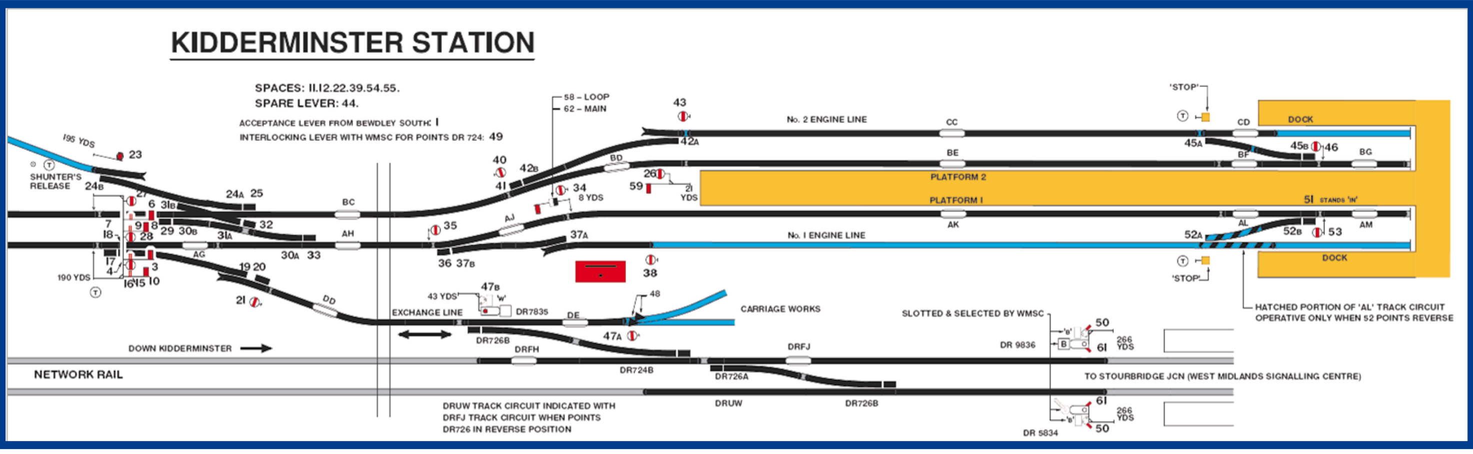
The derailers would be difficult to fit as the fouling point fell in the middle of a three-way point. Even finding the space to fit the Insulated Rail Joints (IRJ) would be tricky but we had to fit three derailers in as well. Depending on the rail, these would be left- or right-handed. Once the IRJs were fitted we were able to order the derailers – the six week lead time ended at the end of May 2012. We had to fit two large concrete bases for the cranks and another two for the point machine and another two for the disc signal, also fitting in a troughing run for the wiring.

A new box diagram was drawn to show the new arrangements with NR.

The visible results of our work from the operating floor of the box comprise the following seventeen new indications:

- Four track circuit lamp indications (DD, DE, DRFH, DRFJ);
- Two signal arm repeaters (21, 47a) showing ON/wrong/OFF;
- Three signal OFF aspects (47b, 50, 61);
- Two signal aspect lit aspect (DR7835 ON (red), PROCEED (green));
- One point NORMAL indication (DR724);
- One derailer indication (48 NORMAL/wrong/ REVERSE);
- Four lock indications (21 & 47 APP LKG, 4/-/16 APP REL, 48 FREE)

These new indications on the block shelf are to show the signalman that the new equipment is functioning correctly - those commencing 'DR' (Droitwich-Ryecroft) are indications of Network Rail equipment.



The week leading up to the August Bank Holiday weekend in 2012 had been reserved as our annual working week "just in case". The final few runs of wiring in the box had been put in and terminated and, only a few weeks before D-Day a 37-core signalling cable duly arrived from Network Rail to be terminated in our signal box on the cable frame. (Another story would be required to explain how we had moved wiring and relays to create the space for 37 new cable terminations.) As soon as we had prepared the end for terminating, they asked for it back (to relay the main line) but we got it back on the Tuesday before the Bank Holiday and we were able to complete work that day so that we could hand it over to the testing team. The new 37-core interface cable to Network Rail carries six signalling control and indication circuits from the SVR to the WMSC and eight circuits from the WMSC to the SVR. Kidderminster Station box is now a fringe box to WMSC and all classes of train can be signalled to and from the Severn Valley under Track Circuit Block Regulations between our box and WMSC with full interlocking between both boxes. WMSC, situated in Saltley in Birmingham is one of the new generation of "super" signalling centres which will eventually control the signalling in the entire West Midlands and surrounding area.

The commissioning and testing (by an independent tester not involved in the design or installation) over the Bank Holiday weekend went very successfully which is quite an achievement when you consider the complexity of the project. As well as the changes and additions to the signals and lever frame we had run about a thousand yards of wiring and installed 19 new safety relays inside the signal box (plus five relays in location cupboards) to provide the new functions and interface. The testing was signed off by Monday 27 August 2012. Each different function and route had been tested (with no trains running on the Network Rail side and a possession of the Main Line between the Advanced Starter and the Carriage Works on our side). Some extended route locking was provided during testing to prevent our signalmen operating points prematurely.

The final stage, relaying of the Exchange Line, was completed in October 2013 in time for the first through steam-hauled passenger train from Bridgnorth to Sheffield Park – a through service over two newly completed connections between two heritage railways and Network Rail.

One example of how the new facilities will work is for a train proceeding towards Network Rail - our signalman will observe that 47a signal is at Danger and that the derailer (48) is showing normal detection (to protect the running lines) before reversing 49 lever to give the WMSC a release to be able to operate DR724 points (the crossover connecting SVR to the Main Line). They can then reverse these points once they are in a position to do so.

Signal 10 (Up Main to Exchange Line Inner Home) is conditionally approach released until the new colour light signal (DR7835) has been cleared to a main proceed aspect. Otherwise it can only be cleared once the train has been checked and the lamp AFTJKE (AF track circuit timer indication lamp) lights to show when the approach releasing on this signal (and 4, 15 and 16 signals) is free. Signal 10 can only be cleared if DR7835 is correctly lit and so both the Red and Proceed (Yellow or Green) aspects are indicated by means of a red and green lamp.

Track circuits DD, DE, DRFH and DRFJ will then light up as the train proceeds onto the Down Kidderminster. DR7835 will auto-replace to Danger and DR724 points will self-normalise 10 seconds after the route is released. Most points in a modern colour-light controlled area will remain in the 'last called' position but some will normalise after the passage of a train where they provide trapping or flank protection. Our signalman will observe points DR724 showing normal and can then normalise lever 49 - this train movement has used ten of the seventeen new indications.

The new signals operated by lever 47 for shunting in and out of the Carriage Works are an interesting mixture of old and new technology. Ground Signal 47a is worked mechanically by conventional signal wire directly from the lever. Position light signal and route display 47b is actually physically part of the new Network Rail LED Colour Light Signal DR7835. In this case a contact box on lever 47 operates a circuit to the WMSC Solid State Signal Interlocking (SSI) which in turn drives the route and signal aspect. Some might argue that this makes it the SVR's only colour light signal! *(see picture inside front cover)*

I hope this illustrates the complexity of the work the SVR have achieved over the last five years.

10. A view of the exchange siding taken in April 2012

11. A view of the exchange siding taken in November 2013

IRSE MATTERS

How the IRSE works

Management Committee

In issue 197 of IRSE NEWS (February 2014), I described the role of the IRSE Council, the governing body of the IRSE. Council has the power to establish committees to help the Institution to operate effectively and to delegate tasks to those committees, although for significant items, decision powers are not delegated. This article will now cover the role and operation of one of the main committees that report to Council, the Management Committee.

Remit

To consider and make recommendations to Council on all matters affecting the policy and development of the Institution, including the delivery of the Strategic Plan, training, education, membership and examination requirements, the professional development of members, public affairs, publications policy, discipline and any other matters remitted to it by the Council. To oversee the organisation of the International Convention, conferences, seminars, technical visits, the annual dinner and the members luncheon.

Committee Members

Members of the committee comprise the two Vice-Presidents, the three Past-Presidents, the Chief Executive (who acts as secretary) and the Treasurer. Other vacancies on the committee are normally filled by senior members of the Council to give them experience in the administration of the Institution before they assume office as Vice President and others to ensure that the committee is broadly representative of the S&T industry and that the interests of Younger Members are represented. The current President is also a member of the committee as the President is a member of all the IRSE committees. Normally there are a total of between ten and twelve members on the committee and the Senior Vice-President is the chairman.

The committee members at present are Christian Sevestre, Andrew Simmons (Vice-Presidents), Paul Jenkins, Claire Porter, Francis How (Past-Presidents), Martin Fenner (past YM chairman), Peter Symons, Charles Page and Ian Mitchell, Colin Porter (secretary), Martin Govas (Treasurer) Andrew Smith (Assistant Treasurer) and David Weedon (President).

Operation

Having summarised the role and composition of the committee, I will now describe how it operates. It meets earlier on the same day as the Council meetings which are generally held six times a year in London. It is able, because it has a little more time, to consider some of the meatier items of business in greater depth than is possible at the Council meeting so when these items come to Council for discussion, they are able to come with a recommendation from the Management Committee, or if not a recommendation, a summary of the issues on which Council needs to make a decision. One of its more important activities is to monitor more closely the achievement of the Institution's strategic plan and it undertakes the groundwork for the development of the next Strategy.

It uses working groups consisting of two or three members, to work on specific initiatives between meetings where work needs to be done to establish a draft policy on a topic which will ultimately come to Council for decision. Two current activities are the development of a survey to be sent to all members and some non-members in March to provide information for developing the next IRSE Strategy, due to be finalised in 2015, and succession planning for the Chief Executive and General Secretary when I retire from the role next year. During the last year it has considered a disciplinary case raised against a member, the re-launch of the Education and Professional Development Committee and the changes to the Articles of association and Byelaws which were approved at the EGM held in November 2013. It also oversees the advance planning of the annual President's programme of events to ensure the activities are interesting and relevant to the membership and fit with the strategic direction of the Institution.

Some of the business is routine and some is not. Being smaller than the Council, it can operate in a slightly less formal way, but meetings are minuted and the minutes are distributed to Council members, local Section chairmen and Country Vice-Presidents. A summary of the discussions held during each meeting are presented by the Chairman to the Council later the same day, so Council are kept abreast of work being done. Council, from time to time, will remit specific items to the committee for them to consider and then bring back to Council with a considered view. It operates in as open a manner as it can from my perspective, although there are times when it has to discuss issues which may be sensitive.

Future articles will describe the roles of the remaining Institution committees.

Colin Porter, Chief Executive and General Secretary

Changes to Membership Grades

As a result of the adoption of the new Articles of Association in November 2013, on 1 January 2014 all existing members in the grade of Associate or Student were transferred to the new grade of Affiliate. This will not change their subscription level, nor any membership benefits.

Membership Survey

In order to inform the development of the Institution's next Strategic Plan, a survey of all members is being conducted using a web-based system. Any member requiring a hard copy of the survey should contact the IRSE HQ office and request one to be sent to them.

NORTH AMERICAN SECTION

Report by Dave Thurston

The 2013 North American Section Annual General Meeting was held at the Indianapolis, Indiana Marriott Downtown hotel at 350 West Maryland Street, Indianapolis, Indiana on October 1, 2013. This year's AGM was held in conjunction with the Railway Systems Suppliers Incorporated (RSSI) annual Exhibition, and the members enjoyed viewing the displays and informational sessions that were offered. Once again, the RSSI provided booth space at the product show for the NAS to advertise the international role of the IRSE and to attract new members.

Members enjoy opening remarks by Mike Drudy *(left)*, Executive Director of the Railway Systems Suppliers Inc., Bill Scheerer *(centre)*, North American Country Vice President and IRSE President Weedon *(right)* during the meeting.

NAS Chair Dave Thurston and IRSE President Dave Weedon are seen manning the IRSE information booth at the RSSI Exhibition.

The AGM hosted the regular business of the Section, and followed the agenda below:

- Introduction;
- Safety Moment;
- Remarks from RSSI by Mr. Mike Drudy;
- IRSE Overview – W. J. Scheerer;
- Remarks from the IRSE President;
- Call to Order/Quorum Count;
- Approval of minutes of the AGM held in 2012;
- Voting by anyone who has not voted prior to the Meeting;
- Field Tour of Amtrak Beach Grove Shops;
- Other Matters Arising;
- Election Results;
- Adjourn.

The AGM for 2013 was somewhat scaled back from previous years. Our association with the Railway Systems Suppliers Inc. (RSSI) where we coordinate our AGM with a brief conference on relevant topics of interest to the members was overshadowed by the Railway Interchange event held during the RSSI Product show. Therefore, our AGM was confined to the regular business of the Section as well as a field trip.

There were speakers that presented on topics of business interest, starting with Mr. Mike Drudy, Executive Director for RSSI. Mike reviewed the position of RSSI with the IRSE North American Chapter, and expressed a great willingness to expand the IRSE/RSSI relationship in the future with more conference based activities.

Continuing on with the agenda, North American Country Vice President, Bill Scheerer provided a discussion on the IRSE in general and how the North American Section can benefit its members.

Next on the agenda were remarks by current IRSE President, Dave Weedon. President Weedon gave the members present insight into the current activities in London, as well as providing perspectives on North American Section Growth. The Section was very grateful to President Weedon for his appearance and advice in these matters and there was follow on discussions about how the Section could have significant growth by increasing activities and offerings to the membership through additional conference and training functions. President Weedon offered to look into additional prospects in London for these activities.

The regular NAS meeting was then called to order by the Section Chair, Dave Thurston as described in the meeting agenda. Former meeting minutes were approved, NAS Officer voting was finalised and details about this year's field trip were made known. In addition, other matters arising for the meeting included those listed below.

Other matters arising:

Expanded role in the Dallas, Texas AGM (2016). There was considerable discussion on the possibility of a greatly expanded format for the 2016 AGM. That year, the RSSI Product Show will be held in Dallas, Texas and the venue is ideal for a much larger technical conference. The possibility of having an International IRSE conference at this time was also discussed and favourably reviewed by all present.

Continue with the Body of Knowledge (BOK) project. The Section is continuing with its efforts in the field of education with two projects. The first being a review with the Australasian Section to obtain and convert materials for railway engineering course work to U.S. practice. The Section has already received a favourable response from a major U.S. University to assist in either a certificate or Masters Degree program. The second is the previous book project, which has sold over 2,000 copies. "Introduction to North American Signaling" is now in multiple printings by the publisher. It has been referenced in university classes and training programs throughout North America. The Section is currently revising the book with added chapters and new versions of the existing chapters.

Next Year's AGM Plans were discussed with the traditional mini conference format to be operated at the next RSSI Exhibition which will be held in Nashville, Tennessee on 20-22 May 2014. The exact details will be forthcoming.

The NAS has always been represented on the IRSE Council, but it was noted that Rob Burkhardt recently elected and has attended meetings in London.

On December 6, the IRSE was to host a short series of presentations in Toronto at the Toronto Railway Club. This would occur just prior to the Railway Club's annual dinner at the Royal York Hotel. The web site would have listings of the speakers, and the Section thanked John Leonardo for organising this event. It is the second event in this series and we expect to continue with this format in the future. Last year's meeting was attended by over 90 visitors, and helps to increase our membership.

Election results were reviewed, with the current slate of Officers remaining unchanged.

Immediately following the AGM, the NAS held a field trip to the Amtrak Beech Grove shops. The comprehensive tour included the car rebuild facilities, paint shop and heavy locomotive overhaul area. The visit was attended by eleven members and guests and proved to be very interesting for all. Amtrak is very proud of their work at this facility, and the Section is fortunate to have had a chance to make the visit. We are indebted to Amtrak for hosting the NAS and are most appreciative of the excellent and informative tour. The craftsmanship and pride in workmanship that was on display was a testimonial to railroaders everywhere.

Members and guests enjoy the description of work being performed at the Amtrak Beach Grove shops.

Although over 100 years old, the Beach Grove Shops still perform vital duties for Amtrak equipment maintenance. Here the attendees pose for a group portrait.

The AGM and Conference meeting room was graciously provided by the Railway Systems Suppliers, Inc, who also provide the NAS with booth space at the annual RSSI Communications and Signal Exhibition. Many information packets and book orders were passed out during the two day event, and the members wish to thank the individuals that volunteered their time to man the booth. A special thanks to Vic Babin and Rob Burkhardt for setting up the booth and organizing our efforts there.

The presentations will be available on the IRSE NAS web page for download at: ***http://www.irse.org/nearyou/publicnam/namericansection.aspx.***

The North American Section (NAS) was formed on May 24, 2002 to support the goals of the Institution in North America. The NAS presently has over 50 members, and is encouraging railroad communication and signal professionals to join. While prospective NAS members must also be members of the IRSE, the NAS Local Committee would be pleased to offer assistance to anyone interested in the applying for the benefits of membership with their application. NAS membership at present is free. IRSE membership is available at several levels, from Affiliate to Fellow with appropriate membership fees. Information on IRSE and NAS membership can be found at ***www.irse.org***.

North American Section officers are:

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YORK SECTION

Report by Tony Pinkstone

The York Section December 2013 meeting, traditionally, has been more entertainment than purely technical content, and the paper by Charles Weightman on his "Half a Century of Signal Engineering" did not deviate from the usual format. Charles, a former Chairman and long-standing member of the York Section was introduced by Chairman Ian Moore. Although Charles had been retired for over a year, he was still involved in Signal Engineering, with the North Yorkshire Moors Railway (NYMR) in respect of the interface design at Grosmont between the NYMR and Network Rail. This project is to make the running of trains from the NYMR into Whitby much easier.

Charles, from a railway family, had joined BR in 1964 and left in 2012, having had 22 jobs and 33 managers. Living in the Nottingham area, his train spotting days, prior to employment, were spent in Great Central territory watching such gems as a steady stream of Annesley "Windcutter" coal trains hauled by filthy 9F locos blasting through the Nottingham area along the old GC mainline! A selection of slides in black and white from this era showed the signal boxes in the Nottingham area. A slightly more lenient attitude to trackside safety was exemplified by a picture of a Railway Correspondence and Travel Society Railtour at Leicester Belgrave Road with schoolboys, mostly in uniform, all over the track layout. Pictures of a youthful Charles showed him in the local signal boxes, confirming his interest in signalling at an early age.

His railway career started as a Student Engineer, initially in the mechanical gang at Nottingham East depot, where there was difficulty finding a pair of overalls small enough to fit him. His training in the Nottingham area gave experience on a wide range of signalling equipment. Interesting signal boxes such as Newark Crossing, Netherfield Junction and the Nottingham Victoria boxes were shown. Following his Student Engineer training and working in the Nottingham office, he was interviewed for a post in the Doncaster Divisional Design office (by a certain Tony Pinkstone!) and appointed to the post. At that time the Doncaster office did most of the design and testing on the Division on a very wide range of signalling equipment. Installations worked on included Immingham Reception Sidings, Wrawby Junction-137 levers, and many level crossing modernisation works. Following promotion to management grade his appointments included Area Signal Engineer Sheffield, Area Signal Engineer Newcastle, and Group Manager York. The latter post had responsibility for the large design and test project office at York in the period prior to privatisation. Each period was covered by a series of very interesting pictures of signalling work and signal boxes. This included the EROS project which replaced 33 signal boxes by three new ones, including the utilitarian structure at Barnsley.

During his time as Principal Signal Engineer North major works took place at Stockport, Heaton Norris and Manchester South, Stockport retaining the electro mechanical signal boxes. Charles then showed pictures of the North Notts colliery area signalling, the Lincoln Resignalling and the Cambrian ETCS Scheme. He concluded with pictures of the latest modular signalling items and of the "Green Banner" signals and advanced junction indicators. His career had included visits to 840 different signal boxes.

Taking part in the ensuing discussion were John Maw, Tony Pinkstone, Quentin Macdonald, Jim Cowan, Stuart Atkinson, and Denys Bowlby.

The vote of thanks was given by Tony Pinkstone, who congratulated Charles on a very interesting and entertaining paper, commenting how fortunate Charles and his generation (including himself) were in respect of training and wide–ranging career opportunities over the whole spectrum of the signalling profession. The 35 members and three visitors then showed their appreciation in the customary manner.

Closing the meeting, the Chairman Ian Moore reminded those present of the York Section Dinner Dance on 4 April 2014.

MINOR RAILWAYS SECTION

Report by Liesel von Metz

Biannual Technical Seminar 2013

(continued from Issue 197)

TELEPHONY OVER THE INTERNET

Following a break for tea and discussion, Mr. Ian Jolly (Tallyllyn Railway) gave an overview of an often-overlooked but very important subject – telephony on Minor Railways.

Mr. Jolly described the contrast in telephone systems used on Minor Railways, from the telephone exchange at Abergynolwyn that came from a Cheshire salt mine, to the Ffestiniog Railway system via the Boston Lodge "tandem" exchange that uses the traditional bare copper wires on poles through to the modern digital (Plessey ISDX) systems in use by the Keighley & Worth Valley Railway (KWVR) and Great Central Railway.

Another trend is the use by Minor Railways of Voice over Internet Protocol (VOIP) to provide telephone extensions. This approach is being used by the Kent & East Sussex Railway and the KWVR, and the Severn Valley Railway is also moving towards this technology in stages.

The use of VOIP has advantages of flexibility and cost, with the added advantage that it can be used to simulate the old BR identification system of circa 1950s. Thus the use of modern communications and technology can allow us to re-create the atmosphere of by-gone days whilst retaining the advantages of a modern telecommunications system.

1 Lovatt House at the Great Central Railway, Loughborough where the event took place

SOLAR POWER AT MATLOCK RIVERSIDE

Continuing with the theme of applying the latest modern technology to Minor Railways, Mr. Dominic Beglin (Peak Rail) described how renewable energy could be harnessed to power signalling equipment. When Peak Rail extended to the Riverside Signal Box, the nearest power supply from with a Grid connection could be obtained was more than 50 m away, making any mains connection very costly.

In considering the alternatives, the main options were generators with back-up batteries or solar power. The railway went with solar panel, and found that the cheapest solar panel was most suitable for their needs. A generator is used when the Signalman is in the signal box to provide power for the kettle, lighting etc, however the signalling equipment is run from batteries that are kept topped up by using solar panels.

In making the scheme work, Mr. Beglin had two key lessons to share with the audience: (1) the location of solar panels is critical but they do work adequately from behind vandal-proof polycarbonate signal box windows, and (2) most importantly of all - FROST KILLS BATTERIES!

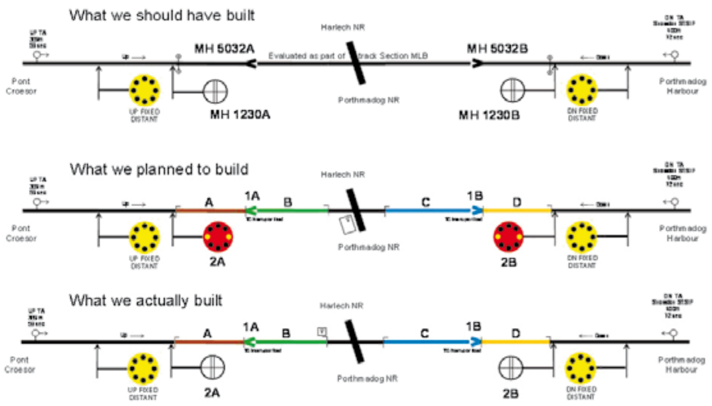
With such practical experience under his belt, Mr. Beglin confirmed that the batteries used on Peak Rail are now insulated, and that even with the levels of sunlight available in the Pennines, the off-grid power supply to Riverside signal box has proved successful.

INNOVATIONS AT CAE PAWB

The presentation schedule for the day was completed on a high note by Mr. Quentin Macdonald (Quaestus) who gave an address outlining how innovations at Cae Pawb had been brought to fruition.

The scheme at Cae Pawb involved a flat crossing between the narrow gauge Welsh Highland Railway and Network Rail - a unique and important scheme. Mr. Macdonald explained the history of the scheme, drawing out key points and lessons. The importance of getting the scheme right was linked to having a sound and technically thorough specification.

Trying to innovate brings challenges, however the importance



of basic signalling principles (e.g. flank protection) should not be forgotten - sound signalling principles should always be the foundation of the scheme.

In summing up, Mr. Macdonald drew a distinction between "safety critical" and "safety related" and the importance of understanding which parts of the scheme fell into which category.

VOLUNTEER S&T TECHNICIAN OF THE YEAR AWARD 2013

Following the presentations, Mr. Tyrell presented the Volunteer of the Year award. This is the fourth year that the Minor Railways Section has awarded the Charles Hudson Trophy to a volunteer at a heritage or minor railway regarded by an independent panel of judges as a worthy recipient of the award. The award is made to the volunteer who gives exceptional service or dedication to the provision of Signalling and or Telecommunications on a heritage or minor railway, having been nominated by their peers.

This year the award was presented to Mr. Ron Whalley of the Foxfield Railway, for his unstinting dedication to the Foxfield and other Heritage Railways in the provision of signalling systems.

The prizes associated with the award, (in addition to the trophy) are: a cheque for £250, attendance at the Section's Signalling Maintenance and Installation Workshop (or other similar IRSE Minor Railways Section event), membership for one for a year of the IRSE, an IRSE log book and a commemorative certificate and engraved shield keepsake.

The judging is by a panel led by ex-president John Francis who evaluate the nominations and from the information provided decide who the worthy winner for the year is to be.

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2 Dominic Beglin, Quentin Macdonald, Major Ian Hughes and Ian Jolly take questions from the audience
3 Charles Weightman giving the closing speech
4 Volunteer of the Year, Ron Whalley, flanked by John Francis and Mike Tyrell

Closing Address

Following a vote of thanks to the Sponsors and Organisers of the event (led by Major Ian Hughes), the closing address was given by Mr. Charles Weightman. Mr. Weightman gave a very interesting presentation in which he reflected over his near fifty years in the railway industry. A series of photos of the Great Central Railway was a fitting tribute to the achievements of the railway, and thus from the Great Northern Railway in Leicestershire.

Mr. Weightman concluded with the planned signalling works at the North Yorkshire Moors Railway and the recent plans for Grosmont and Whitby.

With that optimistic perspective of how Minor Railways have progressed and developed sound innovative signalling over a number of years, the meeting closed at 16:20. Chairman Major Ian Hughes thanked the speakers and the attendees for their excellent contributions.

MIDLAND & NORTH WESTERN SECTION

Report and photos by Peter Halliwell

Network Rail's Operating Strategy and development of the Manchester Rail Operating Centre

Over the last 18 months people in Manchester have seen a major new building being constructed on the outskirts of the city at Ashburys that is destined to become the nerve centre for rail service operations across the north west of England. The story of the development and vision for such centres across Great Britain and about the Manchester centre itself was the subject of the December technical meeting

The art gallery at the offices of ARUP in Manchester was packed out on 11 December 2013 to learn from Andy Scott about Network Rail's Operating Strategy (NOS) and specifically about the development and construction of the new Rail Operating Centre (ROC) in Manchester. Before the talk the section was delighted to welcome IRSE President Dave Weedon who reflected on the centenary year and the changes and vision for the IRSE.

Andy Scott is a Senior Commercial Sponsor for the LNW Route of Network Rail he has built a career in railway operating, freight services, train performance management and developing and sponsoring enhancement projects.

NETWORK RAIL'S OPERATING STRATEGY

The NOS is built around a vision of 12 ROCs bringing together new technology to efficiently operate train services through *traffic management* and to control the electrical traction power system for the a.c. and d.c. networks. Through these three elements the ambition is to revolutionise the way trains are operated and train performance is managed, to exploit and get maximum capacity from the network whilst drastically reducing total costs and providing a platform for future network and train service improvements.

Enabling the delivery of these facilities is founded on blending two sets of requirements. First the infrastructure investment programme which is built on the operating strategy itself including train service groups, Route geography, and enhancements to the network; the renewal requirements of the signalling assets including level crossing systems and the roll out of ETCS; and the electrification programme. The combination and adjustment of these gives a national infrastructure programme known as 'Hybrid Smoothed'. N.B. the entire national electrical control system is being renewed *en masse*. Second the means by which the new ROC systems are being designed to be 'backwards compatible' with existing signalling control systems through Route Interface (RIF) and a Layered Interface Information Exchange (LINX).

These new mechanisms will be deployed initially at Derby, Cardiff and Romford ROCs.

MANCHESTER ROC

The construction programme for the Manchester ROC remains on schedule for completion in February 2014 with a key date in July 2014 being used as the imperative to complete for the first live control which will be of the new signalling being commissioned between Huyton and Roby on Mersyside. There has been a tremendous amount of autonomy in each Route on the design and layout of the facilities and the *modus operandi* of each ROC. The LNW approach has been to concentrate on the people centred approach.

The health and safety management engagement by Morgan Sindall has been impressive and has set the tone for involvement. Much thought has gone into facilities with for example separate lower level kitchen facilities and both right handed and left handed accessible disabled toilets. A bike scheme (similar to the 'Boris Bikes' in London) to get between the NR offices at Square One by Manchester Piccadilly and the ROC has proven very effective during the development.

During the building programme there have had to be accommodations for other items. The Manchester ROC is built on the site of the former Ashbury Carriage and Wagon works. Excavation revealed much of the previous buildings and artefacts and 17 weeks was allowed for investigation and fact finding.

The proximity to the City of Manchester stadium and the associated crowds and traffic for matches and events there has also had to be taken into account in planning the works. As a result of consultation peripheral benefits have also been achieved such as improved station lighting for the security of all users at Ashburys station.

From an environmental and security perspective there are a number of benefits. To get an excellent BREEAM rating the building has a *wet roof* which means it is planted. Rainwater is collected and used as *grey water* for example for flushing toilets. Anti-hostile vehicle measures are provided in the form of earth berms that surround the building.

The traction power system electrical control equipment, principally supervisory control and data acquisition (SCADA) systems are centred nationally at Manchester and Three Bridges, but will be operated from wherever the train services on the electrified sections of the network are controlled.

Following the presentation there was a lively Q&A session during which Andy enthusiastically discussed the engagement that had driven the various decisions including the domestic facilities and the provision of a balcony overlooking the entrance hall. After the implementation of Huyton to Roby in July 2014 the next big area which will be brought into the Manchester ROC will be the first major commissioning by the Staffordshire Alliance in August 2015.

1 Lively discussions on the layout of the Manchester ROC

2 Manchester ROC nearing completion

3 Staff review a mock up workstation built in the Square One offices for consultation purposes


1


2

3


Food for Thought?

Two recent IRSE events (the seminar "25 Years On - Have We Learned the Real Lessons of Clapham" and Clive Kessell's paper "Clapham 25 Years On: Implications for Today's Rail Engineers") have raised the issue of interlocking data complexity and testability. In the context of SSI and its successors, this is a matter which has been causing me concern for a number years, and I feel it is time I made my views known, hopefully to the benefit of all.

SSI was designed in the early 1980s to replicate the functionality of signalling interlocking as it then existed in the UK, while at the same time providing the flexibility needed to make it competitive overseas. The philosophy was to embody the most commonly used interlocking functions within dedicated program modules (the 'specials') requiring a minimum of data configuration, and to provide support for non-standard functions by allowing the designer to specify them using logical data types (if… then… else etc.) and an array of memory locations ('latches') to store individual logic states. The interlocking program operates on a data structure which is effectively an internal model of the railway, which I have always regarded as a particular strength of SSI.

Since that design was conceived the number of interlocking functions falling outside the scope of the specials has increased dramatically, resulting in a large increase in data volume and complexity. One (admittedly crude) measure of data complexity is the amount of space required to explain how to write it: at the last count 84 pages for TPWS; 144 pages for axle counters and no less than 405 pages for level crossings, including 100 for 'variations'. And we have PLODs, POSAs, reminder devices, ARS latches and so on. (SSI8003 also has 136 pages for swinging overlaps, which *were* around in the 1980s and about which I have always felt uneasy.)

This situation has come about partly because SSI, by being able to handle logical complexity, has provided an apparently easy way of incorporating such functions. I believe it has also come about as a result of specification creep and gold plating of standards. That there is anecdotal evidence of data errors being found during principles testing is especially concerning. They should not be present at that stage.

One way of reducing data complexity (and therefore risk) is to provide additional dedicated program modules, and/or enhancements to the existing 'specials', such that much more of the complexity is embedded in the software (which only needs to be proved correct once). That this has not happened with SSI is due to two historical facts: one was the declaration by Railtrack that SSI was dead in the water and the consequent cessation of R&D funding; the other was the advent of IEC61508, which made it impossible for a non-diverse system such as SSI to obtain safety approval if it were significantly modified. SSI does, of course, have successors in the form of Smartlock and Westlock, and I regard it as a missed opportunity that these products have not provided the additional functionality required to make a radical impact on the data complexity problem. They have the capacity to do so and, unlike SSI, are fully compliant with IEC61508, so one might hope that current concerns about data complexity might lead to some progress on this front. If there is a move in this direction, let us hope for a coordinated approach and that there remains a single standard for SSI-based interlocking data.

The alternative approach of maintaining a library of 'standard' data constructs is, I believe, being applied to the modular signalling concept. However, it seems unlikely that the loss of design flexibility inherent in this approach will be acceptable on intensively used major routes.

On the matter of axle counters, I find it disappointing that we perpetuate the practice of making them look like track circuits and then paying the price of having to deal with failures using complex resetting and restoration logic. If the counting function and track occupation logic were performed in the interlocking there would be no need for evaluators and, in the majority of cases, failures could be handled by working double block, with automatic restoration of normal working when the fault is cleared. In critical locations axle counters could even be installed in duplicate, such that individual axle counter failures would have a negligible effect on operations. Such an approach was developed for SSI and applied successfully by SNCB. Regrettably the capacity of the SSI trackside data link was an issue and this feature was never approved for use in the UK. We are now free of such constraints.

Alan Cribbens

Re: Products of the Imagination

Roger Ford's remarks about the innovative output of BR Research are most welcome. I would add one more to his list: the inductive Track Circuit Assister - a deceptively simple device which required a considerable leap of imagination. Largely unseen and largely forgotten about, it solved what seemed to be a particularly intractable problem and has since been fitted to all British DMUs and on-track machines. We would have been in something of a pickle without it.

I would also like to correct Clive Kessel's assertion that the design philosophy for TPWS came from 'suppliers not associated with the traditional fail safe signalling approach'. In fact the design philosophy came from an inter-departmental project called SPDRAM (SPAD Reduction and Mitigation) in which BR Research played a leading role. It is, however, true to say that the favoured implementation of that design philosophy was developed in 1995 by Redifon. Initially called Enhanced AWS, TPWS was eventually rolled out nationally following the recommendations of the Davies Report in February 2000.

Alan Cribbens

Changes to Membership Grades

As a result of the adoption of the new Articles of Association in November 2013, on 1 January 2014 all existing members in the grade of Associate or Student were transferred to the new grade of Affiliate.

This will not change their subscription level, nor any membership benefits.

WING AWARD

The Wing Award for Safety 2014

The article below has been sent to a number of relevant organisations, asking for nominations for the 2014 Wing Award.

THE WING AWARD FOR SAFETY: CALL FOR NOMINATIONS 2014

The "Wing Award for Safety" was introduced in 1994 to commemorate the life and work of the late Peter Wing, a Fellow of this Institution and an employee of British Rail, who during his career made a major contribution to the cause of line side safety. Peter Wing, whose career in BR spanned 31 years, spent much of his working life dedicated to the safety his colleagues. It was his care and concern that became the driving force behind the national campaign in 1992/3 that was entitled "Dead Serious About Safety" and which had such a major impact in reducing the numbers of line side fatalities in subsequent years. The Institution of Railway Signal Engineers administers the award scheme on behalf of Members of the Railway Group, the Railway Supply Industry and the Health & Safety Executive, who amongst others supported the formation of the Wing Award for Safety.

Previous winners of the Wing Award have been:-

2004 B West	Amey Rail	2009 - M Wild	Westinghouse Rail
2005 P Broad	Network Rail	2010 - D Deeley & J Mawby	Network Rail
2006 C Wheeler	Railstaff	2011 – J Camp & S Henser	Cleshar & MPI
2007 G Bickerdike	4x3	2012 – N Pepper & A Fricker	Tube Lines & Network Rail
2008 S Cassidy	Network Rail	M Green & O Bushell	KESR

The award takes the form of a certificate and an amount of £600 to be devoted to personal development and will be made to an individual who has made an outstanding personal contribution to railway line-side track safety by, for example, coming forward with a novel idea for improving safety at the line-side, is a long term champion of improving track safety standards or has made a significant contribution to the awareness of track safety in his business.

Any employee in a railway business or an associated industry is eligible for consideration for the Award and nominations are now invited for the 2014 Award.

Nominations should be sent to me, please, by not later than 25 March 2014, together with information not exceeding 250 words in support of the nomination.

The award will be presented to the successful nominee at an industry function later in 2014.

Colin Porter
Chief Executive

ON THE MOVE ...

New Recruits and Directors at Interfleet

Interfleet's Advanced Rail Control Systems (ARCS) team is continuing to expand, with the recent appointment of two key new recruits.

Principal Consultant Carine Marin is a specialist in the European Rail Traffic Management System (ERTMS) and Automatic Train Operation (ATO).

Andrew Love, the new Head of Train Control and Signalling, is a chartered railway systems engineer with over 20 years of wide-ranging, international experience in specification, design and maintenance in the heavy metro environment.

Matt Phillips, who previously headed up the team, has recently been appointed as Interfleet's new UK Director for ARCS, alongside Iain Court as UK Director for Infrastructure, and Magnus Conn as UK Director for Rolling Stock, to give an increased focus to Interfleet's service-offer in each of these sectors. All three Directors will work closely with new UK Sales & Marketing Director Phil Hudson.

Changes at DEG

Doug Green appointed as CEO

to deliver the strategic plan, coordinate an operational plan, and look for market opportunities.

Gary Hirons appointed as Managing Director

Due to Doug's appointment as CEO, Gary Hirons is appointed as Managing Director. Gary has worked for DEG Signal since 1996 and was previously Operations Director.

Eduardo Franco Lazzarotto becomes Business Development Manager

The aim of Eduardo's role is to deliver DEG's business development plan, as well as help strengthen the company's position as the best independent signalling consultant in the market.

David Nash appointed as Project Manager

David has extensive experience of signalling, level crossing and power supply projects, and will be based in the new office in Moorgate, London.

MEMBERSHIP MATTERS (cont'd)

REMOVALS *(due to non-payment of first subscriptions)*

Britton	M A	Kumar	R *(A)*
Chinnathambi	M	Louram	L
Chintapalli	S	Lynn-Devere	M T
Chirindo	J	Muthukrishnan	S
Dhliwayo	A	Muthusamy	B
George	E	Mutyala	K P
Gondela	R	Nitchenametla	N V
Gorle	T R	Sudalaimuthu	A
Hardman	D C	Syed	A
Khan	M A	Thatipelli	B K
Klaassen	A R	Reilly	P
Kumar	R *(F)*	Sun	H P J

RESIGNATIONS

DuPlooy D J

RE-INSTATEMENTS

Chapman L P
Mayo T M

MEMBERSHIP MATTERS

ADMISSIONS

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

Companion

Bratschi	O	AlpTransit Gotthard	Switzerland
Maaris	A	PRIME	Malaysia
Phillips	M	Interfleet Technology	UK

Member

Bate	L	Transport for NSW	Australia
Han	M K	Ansaldo STS	Australia
Leopold	L	Thales Rail Signalling	Switzerland
Milligan	D B	Interfleet Technology	UK
Russo	A	CERTIFER	France

Associate Member

Adhikary	S K	WS Atkins	India
Bansal	D	WS Atkins	India
Che Jaafar	D	Global Rail	Malaysia
Dsilva	F J	Railway Project M'gement	Saudi Arabia
Erra	M K J	VR Track	Finland
Goel	R	WS Atkins	India
Harikisun	N K	Parsons Brinckerhoff	Australia
Kakinada	V	Atkins Rail	India
Karade	R	Railway Project M'gement	Saudi Arabia
Kaushik	K	WS Atkins	India
Kulshrestha	G	WS Atkins	India
Lismana	Y	ALKMAAR ASIA PACIFIC	Indonesia
Louie	V	Metro Trains Melbourne	Australia
Mariappan	S K	Atkins Rail	UK
Mendiratta	P	WS Atkins	India
Moode	V N	Atkins Rail	India
Nasar	M T	EtoE Transportation	India
Sekanderzada	M Q	Network Rail	UK
Sharma	P K	WS Atkins	India
Standaart	M	Arcadis Nederland	Netherlands

Affiliate

A Hamid	R	SPAD	Malaysia
Abdul Rahman	H A	CMC Engineering	Malaysia
Abdul Rahman	M N	SPAD	Malaysia
Abdul Wahid	R	SPAD	Malaysia
Agrawal	P	WS Atkins (India)	India
Bairagi	P	Siemens Rail Automation	Australia
Baporia	M H	Network Rail	UK
Bint	M D	The LED Studio	UK
Cheah	W K	CMC Engineering	Malaysia
Chen	C-C	Siemens Rail Automation	Australia

Engineering Council Registrations

Isireddy	R P R	Final CEng registration

The report in Issue 196 of Mr V Prakash registered as Final IEng was an error

Affiliate *(continued)*

Edmonds	M W	SIMS	UK
Fletcher	G	SIMS	UK
Golby	A B	DeltaRail Group	UK
Gupta	R	KEC International	India
Hamid	A H	SPAD	Malaysia
Johal	K	Metrotrains Melbourne	Australia
Laroya	S S	Interfleet Technology	UK
Law	K-C	MTR	Hong Kong
Mangsor	N E	SPAD	Malaysia
Mann	Z	Signalling Solutions	UK
Mohd Ismail	M S	SPAD	Malaysia
Mulugeta	T	Atkins	UK
Musa	S Z	SPAD	Malaysia
Ni	S	Land Transport Authority	Singapore
Pathak	H	KEC International	India
Pathak	M	KEC International	India
Raihan	A	JMD Railtech	India
Ramakrishnan	P A	JMD Railtech	India
Rao	X	Systransis	Switzerland
Razali	ANAB	SPAD	Malaysia
Salleh	A S	SPAD	Malaysia
Schrempp	M	Eversheds	Switzerland
Shaikh	N	JMD Railtech	India
Sharma	S	JMD Railtech	India
Singh	A	Dedicated Freight Corridor	India
Singh	V	Dedicated Freight Corridor	India
Sohil	S	KEC International	India
Suliman	M	SPAD	Malaysia
Tombs	D J	Queensland Rail	Australia
Tran	P	Thales UK	UK
Wilcox	D	Green Dragon Rail Solutions	UK

TRANSFERS

Associate Member to Member

Coomer	S D R	London Underground	UK
Philbin	L T	Signalling Solutions	UK
Sivaprasam	U S	Siemens Rail Automation	Singapore
van Meeteren	A F	ALSTOM Transport	Netherlands

Accredited Technician to Member

Penfold	G	Mott MacDonald	Australia

Associate to Member

Fawkes	A	VolkerRail	UK
Sarvepalli	M	WS Atkins	India

Associate to Associate Member

Hoogenraad	J	Spoorgloren	Netherlands
Jackson	P	Siemens Mobility C&I	UK
Jayaraman	E	Atkins Rail	India

Current Membership: 4897