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Thank you for all the feedback regarding the new image and look of the NEWS. We are pleased with the support and positive responses we have received to date. We encourage you to provide comment where appropriate and to continue to supply us with articles, technical papers, letters, emails and pictures, so that we may continue our efforts to improve this publication. After all, it’s all about you and your industry!

The Institution held a very successful Convention in Madrid at the end of May. Those members who were fortunate to attend had a very enjoyable time travelling extensively around Spain to view new railways and projects. Indeed most of the time it was also at a very high speed and there was never any shortage of food, refreshments and entertainment! It was also encouraging to see differing and new faces attending. We intend to run the Convention report in the September issue of the NEWS. This being the case, it gives those who attended time to send in your pictures and comments about the event, in order to encourage even more members and guests to attend next year!

The Members Luncheon was also well attended this year in London during June. It was good to see many old faces and to have the opportunity to listen and learn from such a wealth of experience and knowledge at the event.

Section technical meetings and events continue to be popular amongst the membership during the middle of the year. The Midland & North Western and Australasian Sections have articles within this very issue, demonstrating how popular and well attended their events are. It is also pleasing to note the amount of younger members with their partners and families that are beginning to get involved and attend these types of events. You are also reminded that the Minor Railways Section are holding their first technical meeting and visit to Devon in September this year. Your support and attendance at this event would be very much appreciated. Further details are included within this issue and we are sure that the event will be very successful.

Please do not forget that this issue of the NEWS covers two months, so we shall return again in September, having had a well deserved rest and prepared ourselves to provide another eleven issues of this ever developing and popular publication.

Happy Holidays!

The IRSE NEWS Team
Recent developments in audio-frequency track circuit techniques
By John Rose  BSc., C.Eng., MIET, FIRSE

ABSTRACT
The paper briefly reviews firstly the history and nature of the long established audio-frequency track-circuit type TI21 and TI21M and then goes on to describe the very latest design enhancements which have been tailored to more effectively match modern demands of the market place.

Considerable development work has been done over the past three years culminating recently in the announcement of new versions of TI21 (now branded EBI Track 200) and TI21M (now branded EBI Track 300). A new advanced coded version has also been added to the range branded EBI Track 400.

The EBI Track range embodies several significant design enhancements over its predecessors, principally:

♦ A unique, exceptionally safe, coding system and communication technique - a particular feature of EBI Track 400;
♦ Extremely high immunity against traction current interference - a particular feature of EBI Track 400;
♦ Superior frequency stability;
♦ Simplified installation and commissioning techniques;
♦ A high quality in-built condition-monitoring system;
♦ An extension to its range of application usage, particularly in station areas and when operating in single-rail mode (e.g. through points and crossings).

THE FUTURE DEMAND FOR TRACK CIRCUITS.

Despite further technological advances in traffic control systems, particularly those based on radio communications which are capable of detecting the precise position of vehicles on the track, there is still likely to be a continuing general need for an independent means of train detection such as the track circuit.

Track circuits still form the basis of railway signalling systems on the majority of lines throughout the United Kingdom and worldwide. Communication based traffic control systems, when and where they are eventually introduced, may well still demand an independent means of train detection for emergency back-up purposes.

It is likely that situations such as Stations and Depot areas will continue to demand the use of an independent reliable means of train detection such as the track circuit because of the many short track circuit lengths and usual proliferation of points and crossings. Track circuits need to have a safe and proven electromagnetic compatibility with all types of current and future train born electronically controlled traction units.

THE EBI TRACK 200

The well known EBI Track 200 Track Circuit has been in service in its original form since its approval by British Rail in 1980. Around 7000 EBI Track 200 Track Circuits are currently in service in the UK and a total of some 25 000 worldwide in main line usage. The following notes will serve to remind readers of the basic circuit configuration of the EBI Track 200 Track Circuit.

EBI Track 200 audio frequency track circuits are designed to be capable of operating in jointed rail, joint-less rail, in both a.c. and d.c. traction territory and through points and crossing areas. They are immune from the effects of high levels of harmonic interference present on traction supplies. This immunity is largely due to the use of selected carrier frequencies and the adoption of a low frequency modulation technique known as frequency selective keying (FSK).

Track circuits of lengths up to 1100 m can be achieved in end-fed mode and up to 2000 m when configured in centre-fed mode.

EBI Track 200 track circuits employ eight audio carrier frequencies (generally referred to as channels A, B, C, D, E, F, G and H) in the range 1500 Hz to 2600 Hz. Two such carrier frequencies are allocated to each line and are used alternately to ensure that consecutive track circuits on that line use frequencies spaced about 600 Hz apart. By providing eight channels in this way it is possible to equip up to four parallel lines fitted with cross-bonding without risk of frequencies from one line wrongly operating a track circuit on another.

Each track circuit operates on a frequency shift keying (FSK) principle whereby each audio frequency carrier is modulated between a pair of frequencies 34 Hz apart at a shift rate of 4.8Hz. See Fig 1.

![Figure 1: EBI Track 200 transmitter output signal](image_url)

The electrical separation of the ends of track circuits is accomplished on joint-less track by electrically tuning a short length of track using two series-resonant tuning units connected across the rails and mounted adjacent to them. The tuned zone length is 20 m for standard gauge (1435 mm) and 22 m long where steel sleepers are fitted. A block diagram of a basic arrangement identifying the various modules is shown in Figure 2.
THE EBI TRACK 300

The EBI Track 300 is a variation of EBI Track 200 designed particularly for Metro applications and was originally introduced to the market in its original form about 1995.

EBI Track 300 meets the functional requirements for metropolitan railway applications by providing sharp definition of track circuit boundaries, i.e. no dead zone and minimum overlap of train detection at separation joints. Individual track circuits may be between 50 m and 500 m in length, with their associated transmitter and receiver located up to 2.0 km from centralised equipment rooms. The only equipment modules which need to be located alongside the track are those passive items associated with coupling to the track itself.

As well as providing safe train detection, EBI Track 300 can also be used to transmit data to the train in an occupied section. This data is fed to the transmitter via a serial link from an Object Controller that provides ATP encoded data. To accommodate both requirements, the track circuit operates in the frequency range 5 kHz to 9 kHz, and is able to modulate the carrier at rates up to 100 Hz (corresponding to a 197.6 Baud data rate), this is the rate at which train data is supplied to the transmitter from the Object Controller.

When a transmitter identifies the absence of track-to-train (ATC) data from the interlocking, it generates modulation for train detection purposes at a frequency modulation of 20 Hz. Absence of data is assumed after a minimum duration of 200 ms without level transitions, thus data from the interlocking must have bit transitions within a maximum of 40 bits (at 197.6 Baud).

Since successful track to train data transmission relies on the train travelling towards the transmitter of a track circuit, and trains may need to travel in either direction over any particular track, the capability of switching the transmit function to the receive end of a track circuit is also catered for.

A basic EBI Track 300 track circuit layout is shown in Fig.3. The heavy duty bonding cables at each end of the track circuit provide a very effective means of balancing traction current in the rails and considerably reduce the need for other forms of Impedance bond.

Figure 2: EBI Track 200 basic track circuit (1435mm gauge)

Figure 3: EBI Track 300 basic track circuit
|| Train detection category | d.c. Traction territory | a.c. Traction territory | a.c. Traction Units with electronic speed control | Jointless Rail | Broken-rail Detection capability |
|--------------------------|------------------------|------------------------|-----------------------------------------------|--------------|----------------------------------|
| 1. d.c. track circuits    | X                      | C                      | A                                             | X            | L                               |
| 2. a.c. track circuits low frequency | C                      | X                      | X                                             | X            | Cc                              |
| 3. Audio Frequency track circuits with simple FSK modulation | C                      | C                      | A                                             | C            | C                               |
| 4. Coded Audio frequency track circuits with more complex modulation | C                      | C                      | C                                             | C            | C                               |
| 5. Axle-counters          | C                      | C                      | C                                             | C            | X                               |
| 6. HVI track circuits     | C                      | C                      | A                                             | X            | C                               |

Key: C = compatible, X = incompatible, A = compatibility assessment necessary, L = limited compatibility

**THE CASE FOR FURTHER UPGRADECING OF EBI TRACK 200**

Table 1 provides an overview of the principal types of train detection systems currently in general service and compares their compatibility with:

- Various types of traction systems;
- Modern traction units (e.g. those incorporating asynchronous and three phase and inverter drives);
- Joint-less track;
- Broken-rail detection capability.

It is apparent from table 1 that only coded AF track circuits (category 4) fully cover the complete range of situations demanding compatibility.

Note that EBI Track 200 falls into category 3 of the table which demands that a separate capability assessment is necessary for each type of a.c. traction unit used on the same track. Consequently it was decided that a principal objective of development work was to upgrade EBI Track 200 to the category 4 level by producing a suitably coded version.

By suitably heavily bit-coding an audio frequency track circuit it can be shown mathematically that an enhanced version of EBI Track 200, branded EBI Track 400, can easily achieve the highest possible edible safety grading required by SIL 4 level and consequently avoid wrong-side failures.

Increasing globalisation has brought into being the concept of the interoperable railway meaning that trains can run seamlessly across national borders while maintaining compatibility with different national signalling systems and track infrastructure. In the train detection context this means that train detection systems must be compatible with all possible train types that may run over them. This requirement for track circuits to be compatible with all train types and traction supplies carries the implication that it must be possible to prove quantitatively that it is impossible for a train to produce an electrical signal which can duplicate the track circuit signal in such a way that detection of a train in a given section is lost. Such a type of fault is commonly known as a wrong-side failure.

Axle counters can readily avoid such wrong-side failures by the application of straightforward immunising techniques to combat the effect of traction current flowing in the running rails.

However, axle counters do suffer with three prime disadvantages when compared with audio frequency track circuits:

- They cannot detect a broken-rail;
- They cannot be used for continuous transfer of data to a train for purposes of Automatic Train Control etc;
- They cannot “self-recover” and detect a train in section in the event of a power failure.

**KEY REQUIREMENTS FOR INTEROPERABLE TRACK CIRCUITS.**

The interoperable track circuit has two main requirements:

- A safety requirement that wrong-side failures (WSF) due to traction current interference are classed at the SIL 4 level;
- A functional requirement that the availability of the track circuit is not degraded by traction current interfering with the coded signal reception so that the track circuit fails “Occupied when clear”, also known as a right-side failure (RSF).

A suitably complex coded track circuit signal can provide the ability to meet the WSF criterion but, if a simple demodulation technique were used, this very complexity can make the RSF condition much more likely to occur because of the basic necessity to receive an intact signal code.

Thus the functional requirement for acceptable right-side failure performance becomes a key factor in the design of a high performance coded track circuit and furthermore that it should aim to equate to that of an axle-counter in this respect.

**THE EBI TRACK 400 AFTC.**

The challenge to produce a truly interoperable track circuit in line with the key requirements outlined above have resulted in the recently launched coded audio-frequency EBI Track 400 AFTC.

With over 30 years experience of producing the EBI Track 200 AFTC, Bombardier decided that this well-proven product family would be the ideal platform from which to develop the new range. This decision has enabled the new EBI Track 400 AFTC to use the same track circuit interface components and tuned area layout as the original EBI Track 200 and also provide the following additional benefits:

- Allow development to concentrate on the key areas of perfecting modulation and demodulation techniques;
Make maximum use of the safety evidence for the EBI Track 200 track interface equipment amassed over the past 30 years;

- Upgrade the track circuit design of the EBI Track 200 FSK system to the new coded system achieved by changing only the transmitter and receiver modules.

The basic track circuit layout of EBI Track 400 is shown in Figure 4.

A prime development exercise related to the size of the code word so that wrong-side failure integrity could be mathematically proven. The choice of a 256 bit telegram in turn dictated a bit rate of 128 bits per second which the communication channel would have to support given that code recognition was required within two seconds to stay close to the tried and tested performance parameters of the previous TI21 track circuit. The 256 bit code word has meant that by optimising the hamming distance between code words to cover both wrong-side and right-side failure conditions at least 16 000 exceptionally safe unique codes per carrier frequency can be generated.

Basic performance characteristics are:
- Wrong-side failure probability
  $< 4.8 \times 10^{-9}$;
- In-band traction, or other, interference up to the level of the track circuit signal threshold itself can be tolerated without right-side failure;
- Out-of-band noise with amplitude up to 100 times greater than the track circuit signal threshold can be tolerated;
- 16 000 unique codes per carrier frequency are available so that every track circuit can be allocated its own unique code.

Typical signal waveforms at the transmitter output, the receiver input and the output of the demodulator are shown in Figures 5, 6 & 7 and illustrate the high noise rejection capability of the system.

Considerable development activity was focussed on the adaptation of satellite communication correlation techniques to produce a novel demodulation and track occupancy evaluation solution. The coding system uses a form of phase shift keying (PSK) of a sine wave carrier rather than the frequency shift keying (FSK) technique of all earlier versions of EBI Track 200 and EBI Track 300. This arrangement has been proved to deliver excellent performance in a noisy track environment.

The EBI Track 400 transmitter.

A block diagram of the transmitter is shown in Figure 8. The carrier is generated from constants held on the frequency and code key. The carrier is then modulated by the output of the codeword buffer to produce a phase shift keyed (PSK) representation of the codeword.

Basic Features;
- A transmitter is assigned to one of eight carrier frequencies by means of the frequency and code key;
- The unique transmission code is also held on the frequency and code key.
- The code is transferred to the transmitter at power up so that the key can be used to transfer the code to companion receiver keys;
- Condition monitoring and diagnostic information is available via a four character display and as isolated serial data on a nine-way ‘D-type’ connector;
- A high power transmitter output drive allows feed lengths of up to 7.5 km for main-line applications.

The EBI Track 400 receiver.

A block diagram of the receiver is shown in Figure 9. The signal from the track tuning unit is fed to the Front-End block which incorporates an input transformer to isolate the receiver circuit from the tuning unit. The signal is converted to digital format (ADC block), filtered by the DSP stage and demodulated to recover the signal amplitude and code correlation review the Continued...
factor. Finally, level comparison is carried out to ensure that the signal amplitude and code correlation factor are above the detection threshold (supplied by the Auto-Set block). If the evaluation is true continuously for more than two seconds, the track clear indication output is set to TRUE.

Principal Features
- A common Receiver unit is assigned to one of the eight EBI Track 400 frequencies and one unique code by means of the frequency and code key;
- The Auto-Set feature simplifies the track set-up procedure and front end circuit by eliminating the requirement for sensitivity-setting straps;
- Condition monitoring and diagnostic information is available via a four character display and as isolated serial data on a nine-way ‘D-type’ connector;
- The Track Clear output is an isolated relay drive signal.

**CONDITION MONITORING**

The operation of an audio frequency track circuit is strongly affected by the trackside environment and the following factors can have a detrimental effect on reliability.
- Ballast impedance;
- Track to sleeper insulation integrity;
- Integrity of track connections;
- Track contamination, e.g. leaf mould or rust.

The first three directly affect the amplitude of the track circuit signal which finds its way to the receiver, this quantity normally being referred to as the ‘Clear track current’. Track circuits with stable clear track currents, i.e. those that do not vary by more than a few %, can be seen to have good quality ballast conditions (i.e. high impedance), good quality sleeper insulation and good quality track connections. Conversely, unstable conditions indicate that degradation of one or all three parameters is taking place, and a maintenance visit is required to prevent a worsening situation leading to a nuisance, right-side failure.

The fourth condition, track contamination, affects the ability of the train wheels to shunt the track circuit, thus leading to an increase in the shunted track current at the receiver. Thus, increasing shunted current in a track circuit indicates that the track is becoming contaminated, and track cleaning needs to be activated before the track circuit shows clear when occupied.

Clearly, remote monitoring enables both types of condition to be detected, and corrective action taken before traffic is disrupted. All EBI Track Receivers simplify the implementation of remote monitoring by providing clear track current, shunted current and the train detection threshold as serial data via a standard nine-way D-type connector. This means that no additional trackside transducing equipment is required, also deleting the need for transducer set-up and calibration. Further, the monitoring process is completely isolated from the train detection function.

A final benefit from remote monitoring is the ability to pinpoint which track circuit has failed within a long cascaded section. In the EBI Track designs, condition monitoring is provided as an integral part of the transmitter and receiver. The monitored data is available in three ways:
- Via a nine-way dedicated condition monitoring connector, providing (via a link selection) RS232 or RS485 protocols. This method is ideal for connection to centralised monitoring systems;
- Via the configuration key. Monitored data is stored on the Frequency & Code Key using a technique that captures event sequences most likely to be of value in understanding unexpected behaviour of the track circuit (e.g. nuisance dropping). This method allows examination and analysis of fault data back at the technical centre even if there is no monitoring infrastructure;
- Real time track circuit data can also be read off the condition monitoring digital displays mounted on the front face of each transmitter and receiver module.

Monitoring is an important tool in improving availability as technical staff can readily monitor actual track circuit conditions and detect problems such as ballast degradation or loosening connections before complete failure occurs. Figure 10 shows such a typical monitoring system in action at the site of one of Bombardier’s customers. The blue trace shows the receiver current over a seven day period and the gradual decrease can be clearly seen. Receiver current behaviour like this gives a straightforward warning of progressive loss of signal and enables preventative action to be taken before train delays begin, clearly a very useful benefit to the user.

This display shows receiver input currents for four receivers recorded over a seven day period and has identified a potential future failure of one track circuit.
SUMMARY

In summary, the EBI Track 400 coded track circuit offers a significant improvement in track circuit performance since:

- Dangerous failures caused by traction current interference are practically impossible;
- The incidence of nuisance failures is significantly reduced because of improved ability to tolerate excessive traction current interference;
- In-built health monitoring enables diagnosis of problems before track circuit fails. This feature is available on a local and remote basis.

Further benefits to the user now also include:

- Long line feed capability, up to 7.5 km between transmitter/receiver and trackside equipment as a result of a higher powered transmitter output;
- Smaller footprint in the equipment cabinet;
- Simplified spares holding requirements since the transmitter, matching unit and receiver are not frequency or code specific. Operating code and carrier frequency are determined by the use of a removable key (see Figures 11 & 12);
- Uses track mounted equipment identical to previous TI21 installations;
- Transmitter and receiver modules are directly interchangeable with all previous versions of EBI Track 200 and EBI Track 300 units.

ACKNOWLEDGEMENTS

I would like to extend my thanks to Bombardier Transportation UK Ltd for permission to publish this paper and particularly to C. Mackie and his Plymouth based Development team for their considerable assistance in providing information and comments.

n.b. EBI Track is a trademark of Bombardier Inc. or its subsidiaries.
Validation of a semi-quantitative approach for railway risk assessments

An opinion by Sonja-Lara Bepperling

ABSTRACT
Performing a risk assessment for a new railway system is required by law and to meet industrial standards. However, currently there are no specified methods or tools that must be used to carry out a risk assessment. Nor are there any ‘requirement specifications’ that would describe the required properties of an acceptable risk assessment method. Thus, many existing risk assessment methods have substantial weaknesses in their design and application.

The Best Practice Risk (BP-Risk) methodology for risk assessment in the railway industry was developed in 2005 to remedy the lack of a standard approach for risk assessment. The method is based on the generic specifications for European standards (CENELEC) and the European law regarding rail system risk assessment (European Union Railway Safety Directive and European Commission Regulation for Common Safety Methods).

The original BP-Risk method did not include a comprehensive approach to functional system definition and had not been validated. This article describes research completed to develop a method for formulating an adequate system definition and results of calibrating and validating the entire BP-Risk method. The article is based on the author’s PhD dissertation.

ABOUT THE AUTHOR
Sonja-Lara Bepperling was born in 1980. She studied civil engineering at the Technical University of Braunschweig, Germany, specialising in Transportation Engineering. In 2008, she received her PhD with a dissertation on railway risk assessment. Since 2009, she has worked as a Post Doc at the Swiss Federal Institute of Technology in Zurich.

INTRODUCTION
In May 2007, the British HSE (Health and Safety Executive) stated one of the great health and safety myths: “risk assessment must always be long and complex”. [1]

This myth is probably common not only in Great Britain, but throughout the entire European Union (EU) and the world. In addition, it communicates the commonly held belief that risk assessments can only be valid and accepted if enough paperwork has been produced.

Unfortunately European standards and regulations do not specify particular methods or tools for performing risk assessments of new railway systems. Nor are there any ‘requirement specifications’ for risk assessment methods that would describe the required properties of an acceptable risk assessment method. Thus, many risk assessment methods currently in use have substantial weaknesses in their design and application (refer to [3], [4]).

“The European railway system is one of the safest transport systems in the world. However, one of the obstacles for the full opening of the railway market is the absence of a common approach for demonstrating the safety levels of the railway system,” says Thierry Breyne, European Railway Agency (ERA) Project Officer. “Without this, the assessment will have to be done in each Member State according to their national rules in order to accept systems, or parts of systems, that have already been proven safe in another Member State” [11].

To overcome the weaknesses in current risk assessment methods and to help address the great health and safety myth, Braband developed a method called Best Practice Risk (BP-Risk) to assess risk in railway systems [5]. The BP-Risk method combines the generic specifications of European railway standards [6], [7] with the European law on Common Safety Methods [9], [10] to create an improved and consistent methodology for risk assessment in the railway industry. The BP-Risk approach has been acknowledged by the German Federal Railway Authority and Siemens Corporate Technology.

The original BP-Risk method did not include an adequate functional system definition and had not been calibrated and validated. As part of her PhD research [2], the author completed these tasks. This article describes the main results. It introduces the formulation of an adequate system definition, which is the basis for applying the BP-Risk method. Calibration of the BP-Risk method was carried out using the new European risk acceptance criterion [10], which is part of the European Regulation (EC) No 352/2009. Validation of BP-Risk consisted of verifying the risk assessment method based on the European criteria for risk assessment methods. Finally, the BP-Risk method was used in a case study to evaluate a new railway application to demonstrate its ability to derive valid safety requirements.
BP-RISK – A SEMI-QUANTITATIVE APPROACH

BP-Risk is a semi-quantitative approach for railway risk assessment. But, what does semi-quantitative actually mean? Quantitative risk assessments use numerical values to describe the frequency of undesired events and/or potential damage (e.g. “10 fatalities”). Those values can be derived from simulations or statistical extrapolations. The quality of the analysis is highly dependent on the accuracy and integrity of the numerical values, as well as on the validity of the applied method. Examples of quantitative risk assessment methods include the risk formula or methods such as ASCAP that use a Monte Carlo Simulation.

In contrast, qualitative risk assessment methods do not use numerical values, but rather use a verbal description to characterise the hazard frequency and/or potential damage (e.g. “many fatalities”). These verbal descriptions are usually categorised in classes e.g. in the risk graph or risk matrix [6].

Semi-quantitative methods combine the two methods. Milius [13] defines them as “qualitative, model-based” risk assessment methods. In other words, in a semi-quantitative risk assessment method numerical (quantitative) values are assigned to qualitative scales (e.g. “10 fatalities = many fatalities”). Examples for semi-quantitative risk methods can be found in the automobile industry and in the IEC 62061 standard “Safety of machinery” [12].

The BP-Risk method provides risk analysts with front-end tables that they can use to assess qualitative risk parameters. These tables are generated using a risk model which is based on numerical (quantitative) input values.

BP-Risk uses the following risk model:

\[ R = f \times g \times s \]

Where \( R \) is the hazard frequency - expressed as Tolerable Hazard Rate (THR), \( g \) is the probability that the hazard being considered leads to an accident, and \( s \) represents the potential damage caused by the accident. The two risk parameters \( g \) and \( s \) are evaluated using sub-parameters. The possibility of accident prevention parameter \( g \) is evaluated using two sub-parameters: \( b \) (operating density) and \( m \) (potential for human prevention), illustrated in Figure 4. The potential damage parameter \( s \) is evaluated using three sub-parameters: train category \( t \), decisive speed \( v \), and number of affected persons \( a \), shown in Figure 5.

FUNCTIONAL SYSTEM DEFINITION

One of the indispensable requirements for every risk assessment process is a precise method for system definition. This section describes the approach used to develop the BP-Risk functional system definition.

System definition lists the system components and explicit functional interfaces that describe component interactions with the environment. In general, risk assessment methods should not be based on a project-specific or equipment-specific system definition, so that the methods can be used in a broader area of applications.

The European draft Standard for Rail Vehicle Functions EN 15380-4 [8] was used as a basis for BP-Risk’s system definition. The EN 15380-4 states that it “covers the requirements of the TSIs (Technical Specifications for Interoperability of Rolling stock) described in chapter 2.1 and the requirements of TR 50126-3 and completes these documents”. As shown in Figure 2, there are nine First Level functions included in EN 15380-4.

The rail vehicle functions are grouped in five levels with code letters used to designate function groups from the 1st to the 3rd level, whereas the 4th and 5th level are informative.

<table>
<thead>
<tr>
<th>level</th>
<th>function</th>
<th>example / explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K, E</td>
<td>provide automatic train protection &amp; control</td>
</tr>
<tr>
<td>1</td>
<td>K, E, B</td>
<td>provide interface with ATC</td>
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</table>
CALIBRATION OF BP-RISK

The first published version of BP-Risk was calibrated using the results of several previously approved German risk assessments. The main goal of this research was to find a calibration that corresponds to the risk acceptance criterion introduced in EC Regulation for Common Safety Methods [10].

The BP-Risk method was calibrated using the European risk acceptance criterion (RAC-TS) which states “For technical systems where a functional failure has a credible, direct potential for a catastrophic consequence, the associated risk does not have to be reduced further if the rate of failure is \( \leq 10^{-9} \) per operating hour” [10]. In other words the tolerable failure rate is \( \leq 10^{-9} \) per operating hour.

The hazard scenario chosen for the calibration was failure of the vehicle functions from Figure 3: “automatic train protection fails and is unrecognised” (e.g. for an ETCS-equipped high speed rail vehicle). To assess this hazard scenario, the BP-Risk tables illustrated in Figure 4 and Figure 5 are used. Figure 4 presents information on the potential for the accident occurring and Figure 5 presents information on the severity of an accident if it occurs.

The formulas used to assess the possible accident prevention \( G \) and the potential damage \( S \) result from the design of the BP-Risk method, which is based on a mathematical transformation of the risk model presented in Formula A. The formulas, including the basic mathematical model, are described in detail in [3] and [5].

The hazard scenario used in the calibration was a high speed rail line with a high operating density. In this case there is only a very small possibility that an accident can be prevented should a hazard be identified. This is consistent with RAC-TS, since RAC-TS only considers a credible, direct potential for an accident.

Automatic train protection is generally used on high speed rail lines with frequent service carrying large numbers of passengers. This is consistent with RAC-TS, since RAC-TS is used to consider catastrophic consequences and many people would be affected by a potential accident resulting from a failed vehicle-side automatic train protection system.

Following this simplified consequence analysis, the resulting tolerable failure rate \( F \) for the considered hazard can be derived from the BP-Risk table, shown in Figure 6. For the calibration, the resulting value for parameter \( F \) was set to match the tolerable failure rate from RAC-TS.

![Figure 6: tolerable failure rate \( F = G + S \)](image)

It is very important to note that the derived Tolerable Hazard Rate (THR) in general applies to a man-machine system, because that is the scope of BP-Risk. However, the presented calibration is a special case, where a system without human impact is considered, because the preferred risk acceptance criterion is only valid for technical systems.

VALIDATION OF THE BP-RISK METHOD

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<td>calibration with RAC-TS</td>
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<td>implicit residual risk</td>
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<td>man and machine model</td>
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<tr>
<td>A07</td>
<td>accuracy within one order of magnitude</td>
<td>theoretically + practically fulfilled</td>
</tr>
<tr>
<td>A08</td>
<td>rigorous justification of the method</td>
<td>documentation with dissertation</td>
</tr>
<tr>
<td>A09</td>
<td>results: same unit as safety objective</td>
<td>design (RAC-TS)</td>
</tr>
<tr>
<td>A10</td>
<td>ability to do (parameter) trade-offs</td>
<td>risk model ( R = f \times g \times s )</td>
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EN 50126 [6] defines validation as the “confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled”. Validating BP-Risk means therefore to check the method against given requirements for risk assessment methods. Those requirements were taken from the European documents, e.g. from [10] and from practical experience stated in [5]. Figure 7 illustrates the considered requirements and BP-Risk’s satisfaction of those requirements.

**CONCLUSIONS**

The research describes a method for setting the functional system definition for the BP-Risk railway system risk assessment method. Using this functional system definition, the research calibrated and validated the BP-Risk method.

The research shows that the BP-Risk method’s semi-quantitative approach is appropriately constructed and that it derives valid results. Furthermore, the BP-Risk method features traceable properties, allowing a systematic verification of the process, since the method is comprehensibly and transparently constructed.

The full dissertation presents all the assumptions, models and design criteria in detail, and also presents results of a case study in which BP-Risk was applied. One of the case study’s main findings was that BP-Risk is a user-friendly and accurate method for assessing railway system risk.

As a semi-quantitative approach, BP-Risk is one of the first justified and feasible methods shown to fulfil the European requirements for explicit risk analysis. Since the BP-Risk method can be adjusted to specific application areas, it has the potential to become a common safety method for the entire field of railway technology.

**ACKNOWLEDGEMENT**

The PhD thesis was sponsored by SIEMENS Industry Mobility Braunschweig, Germany within the Rail Automation Graduate School.

**REFERENCES**

1) [http://www.hse.gov.uk/myth/may.htm](http://www.hse.gov.uk/myth/may.htm) (updated 02/03/09).


(International) Barriers to Level Crossing Safety
An opinion by Tom Craig of a previous ITC paper (Part 2)

…… continued from Issue 146

TECHNICAL DEVELOPMENTS

It is easy to say ‘cheap bridges’ but I suspect that very few civil engineers would want to be responsible for a cheap bridge - bridge engineers like signal engineers have to account for their works. In much the same way as I mentioned earlier in matters of highway standards, there are minimum requirements for bridges in the UK - and I am sure in other countries as well. New bridges must have minimum widths and load bearing capabilities, as well as requirements for reasonable approach gradients which generally require land acquisition - never cheap, even in the most rural of situations. Referring again to the 1978 Level Crossing Working Party, we were interested and quite surprised in some of our discussions with SNCF officers to find that each week there were several incidents of vehicles getting on to the railway due to crashing off bridges. It must also be remembered that there was a very serious accident in the UK where a driver fell asleep at the wheel, crashed down the embankment on to the railway and collided with two trains.

I cannot resist a comment about ‘cheap’ bridges because, although I discount the realism of the idea, I did actually make it once. There was a crossing in Northern Ireland where the railway ran through a shallow cutting until we passed it through a monster ‘Armco’ tube and put the road on top. One of the cheapest level crossing abolitions ever but only once was I able to achieve it in all those years I was looking for crossing solutions.

I would hope not to be thought of as reactionary but must say that I find it almost impossible to imagine a new idea at this stage in the development of road and rail transport. ‘Tinkering’ is a term with which I don’t feel very comfortable as it suggests a crude system of crashing around hoping to stumble upon a solution which no-one has yet thought of. Signal engineers are generally very thoughtful and resourceful and have always built upon and developed what they have inherited by application of thoughtfulness, observation and careful progress to improve on the extremely high safety standards for which our profession is known within the railway industry - an industry itself very conservative and careful. No amount of tinkering with systems by railwaymen is going to solve the level crossing problem as it is not a signal engineering problem.

THE NEED FOR CHANGE

I think it is not realistic to wait for a ‘need for change’ to burst upon anyone as, however unpalatable and almost unbelievable to railwaymen such a thought may be, level crossing accidents are just not frequent enough or important enough to have an impact on public finance sufficient to cause a major change of direction in national transport policy.

WHAT COULD WE DO DIFFERENTLY / WHAT WILL TRIGGER CHANGE

I believe it was one of the Chief Inspecting Officers of Railways who used the term ‘a minimum acceptance level of safety for any particular mode of transport as determined by public opinion’. I have no definitions to offer as to these acceptance levels and I don’t really think he had either, but it is clear when taking note of the numbers of people killed and injured on the roads of any developed country, that these acceptance levels must be dismayingly low, as compared with rail, sea or air accidents.

Road accidents, by their sheer volume and regularity, have become a part of every day life and the daily toll of human misery caused by large numbers of deaths and enormous numbers of casualties seem hardly to be noticed by the public, except perhaps when they touch people personally. On the other hand, rail, air and sea accidents command high levels of public concern, protest and even outrage that such accidents are ‘allowed’ to happen - with the implied criticism that the operator of the relevant system is somehow careless of safety. Although, after a while even these accidents are largely forgotten.

But, whilst in light of the statistics, it seems surprising to railwaymen that the general public could perceive the railway and trains as more dangerous than the roads, they surely seem to and, worse, often tend to perceive the prospect of changes in level crossing protection systems as undesirable because such changes may, in their uninformed opinions make the situation even more dangerous. Problems arising from this perception are not especially confined to the UK and I am aware that in many countries, level crossing modernisation is not a popular subject. It is not so easy at the usual local level of negotiation to deal with the public aspect of the level crossing interface as it is to deal with the railway aspect because there is not really any corporate public body to come to terms with and make agreements. To agree with the people of one town does not help dealings with the people of the next!

It must be accepted that all the while there are railways, there will be level crossings and the crossing problem will not go away. Rather, as road traffic grows, it will become more serious, thus bring me to my main thesis, which is that it must be both possible and practicable to reduce the interface problem and to enhance the safety and efficiency of both road and rail elements of transport by coordinating the interest and understanding of those at official level who could and probably should be involved. All the problems must be dealt with together because it is futile for railway and road engineers to try to solve them separately and independently. To achieve this requires ‘Government’ - and here I remind you of my use of this word to mean National and Local Authority - to recognise the apparent ambivalence of the present position, in which it might be thought there is an appearance of government being responsible to the public for ensuring that railways are properly managed and safely run and yet sometimes seeming to be inhibiting them from doing that whilst at the same time making what must seem like a pretence to the very same public that it is safeguarding their interests against the railway.

Thus there should be an up-to-date coming to terms with railway and government authorities to develop a
National Level Crossing Policy and, when this has been done, a modern approach can be agreed to replace the old not very effective one and the establishment of a National Level Crossing Programme can be put in place. This must be managed by an independent agency able to resolve crisis points between road and rail interests, because the interests can never be coincident, so neither railway engineer nor highway engineer can be in control.

A simple aim, but one which has so many facets and complications that it demands careful study to identify affordable and realistic criteria for identifying crossings for abolition as well as the right protection systems for those that must remain, producing and resolving the technical requirements and directives that road and rail authorities will follow, devising an approval procedure with appropriate public and official inputs and ensuring that the work is carried out in a coordinated manner, making funds available to both road and rail participants so that both can carry out their part without unreasonable claims on the other.

I mention above that a National Level Crossing Programme would, of necessity have to be managed at a level independent of both railway and government parties. This is because of the sheer complexity of creating a machinery capable of managing such a project, involving so many user interfaces coupled with the impossibility of getting either railway or highway authority to manage it objectively.

The idea that there should be a National Level Crossing Programme is not new as it was one of the recommendations of the 1978 Working Party. It came to nothing however as, like many things, it was very easy to say but proved impossible to achieve.

The idea fell on stony ground at BRHQ which, understandably, took the view in the relevant departments that their purpose was to manage policy etc., rather than become involved in site work - even at arms length. As a result of the Hixon Accident however, some sort of a system had had to be developed in order to cope with the massive alterations required by that occurrence and its aftermath. So for a number of years BRHQ and the Regions managed quite well, albeit rather unwillingly, to cooperate with each other to effect the alterations demanded first by the Hixon Recommendations and then the ‘Surplus Capacity’ Level Crossing programme. The actual work was achieved in a different way in each of the Regions, managed by different departments ‘singing (more or less) from the same hymn sheet with BRHQ choosing the hymns and holding the hymn sheet’.

This was not popular, either at BRHQ or in the Regions and it was inevitable that the recommendation would come to nothing because the railway couldn’t even agree with itself about building on the foundation it had already established, let alone develop a working arrangement with a multitude of highway and local authorities, police and national government to develop such a programme. I thought this was a bit sad but rejoiced in the other important recommendation which did come to fruition, the 1981 Level Crossing Act.

I have provided a copy of an extract from a paper I gave a number of years ago in Budapest called ‘Road Safety at Level Crossings’ - the extract relates to a project in Northern Ireland where I was fortunate enough to have been able to set up on behalf of NIR a fairly effective Level Crossing Group to tackle some of the problems.

Clearly, it is in the mutual and best interests of all concerned that level crossing interfaces, if they must exist, should be improved but, wherever possible, crossings should be abolished and in any consideration of a level crossing programme this should be the first aim. It is seldom capable of realisation in a really worthwhile measure because of the cost and lack of practical solution. It is not necessary to dwell too long on the attitudes of railwaymen, which may reasonably be described as conservative but, briefly, the railway is not in the ‘accident business’ and the railway operator requires nothing more than to operate trains safely, efficiently and with confidence. To these aims we must nowadays add ‘economically’ because labour is no longer cheap. The railway attitude to the modernisation process therefore is that it must reach and maintain extremely high standards of safety and reliability at level crossings before it is acceptable to run trains, particularly in the case of automatic crossings where the safety of the railway depends upon the good behaviour of the road user. It is just not acceptable to submit passengers, staff and trains to risks beyond the absolute minimum that can be identified and supported. There is a point however in the process of evaluating these matters when it must be appreciated that additional protective features add cost but little value or effectiveness to the systems and this point must be identified, in spite of the natural tendency to safeguard against every conceivable accident. This is a particularly difficult area to resolve in discussion between road and railways interests, particularly when costs are under discussion.

Out of all these things comes Road Safety at the Level Crossing Interface. Rail Safety follows as a natural consequence all of these will fall short of the target however unless they are related to a system which has as its target, education and advice to all classes of road users, from pedestrians to operators of abnormal vehicles. Most important of all is some sort of legislative code to bind all of them together.

**POTENTIAL IMPACT OF ERTMS AT AUTOMATIC CROSSINGS**

I have no comment on this heading or the next three as they concern developments of which I have no knowledge.

**AFTER THOUGHTS**

When I thought I would like to make my own commentary on the (International) Barriers to Level Crossing Safety paper I had no idea that I should find myself looking afresh at some things, nor yet realising some things that just dawned on me as I wrote. I had intended to include a section on the very considerable differences in outlook between railway signal and highway signal engineering and, in comparing these, hoped to shed light on some of the matters that the railway should not, must not, overlook if it is really to try to do something about level crossings.

I had also intended to talk about ‘people and level crossings’ - in particular the difference between the behaviour to be expected of road users at signalled and other interfaces but no room for that either, beyond two examples of extremes in ‘people behaviour’ which you might find interesting: The first person killed at a UK AHB (Star Lane, Wokingham, SR) soon after commissioning in 1964 was a Mr Lawless; I was on the footplate of a locomotive crossing the desert in Saudi Arabia - nothing but sand and a car on a road in the distance that was clearly going to cross the railway. The driver gradually slowed his.
train and I could see he was grappling with the thought ‘who will get there first? - he gave way to the solitary car.

If anyone is interested, and no doubt your Editor will tell me, I would be pleased to submit a paper about roads, people and level crossings, i.e., a look from outside the fence!

CONCLUSIONS

As I write these words, being blessed as I am at my age with hindsight in 20/20 vision, I realise that the Hixon Accident was not so much an accident as an event that was inevitably going to happen sometime - not necessarily in the scale of the major disaster that it was but in circumstance. I say inevitable because of the way in which the 1964 introduction of AHBs through the six regions of BR was devised. I do not mean or imply carelessness by anyone in the past but simple naivety in that not enough thought and preparation had been put into the great urge to get started somehow with AHB which had been a desire for some years. Most important, in my belief, and this is one of the things that only came to me as I thought about what I was writing so I’m no better than everyone else and I’m not saying ‘I told you so! Nobody in the country beyond a select few knew what was going on about the plans to install the ‘new continental barriers’, only a few were involved in the development and design of the systems. Highway and local authorities and police had little knowledge and, I would guess, no part in the design of the system. This state of affairs must have had a great deal to do with the constitution of and the results from the Enquiry Tribunal.

It was many years before it dawned on me that we on the SR must have been very lucky to have not had an accident of the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale). We came to hear of a ‘near miss’ between a train and a tank from the same type as Hixon (although perhaps not on the same scale).

An extract from ‘Road Safety at Level Crossings - first given in Budapest in 1986

“I do not offer the following as a model but an example of what can be achieved if Government and Railway agree to work together on the level crossing problem. This is part of an Appendix to a paper I prepared some time ago and illustrates a project in Northern Ireland.

At an early stage there were round-table conferences at Headquarters level between officers of the Provincial Government, the Government’s Railway Inspectorate (on secondment from GB), Road Services and Road Safety Departments and the Royal Ulster Constabulary on the one hand and Northern Ireland Railways (NIR) and their advisers on the other. The discussions resolved fundamental policy matters, systems to be installed and the legislative and other procedures which were to be adopted.

NIR and Road Services works were coordinated so that opportunities for both level crossing modernisation and highway improvements, which might otherwise not have been possible, were dealt with together. The works have progressed well. Further discussions to settle problems take place as, required but, generally the mechanisms having been established, continue successfully at local level.

A considerable effort has been made throughout the project to ensure that all concerned, especially local people know what is planned. To this end NIR have addressed very many meetings, including those of local councils etc showing films and answering questions etc. Sometimes these meetings are difficult, but the results have made them worthwhile in most cases.

In conjunction with Road Safety Officers an agreed system of public information dissemination is applied. When a crossing is being modernised this ensures circulation of special information leaflets by mail to every home within a large radius of the crossing, a press release to local news media, local meetings and film shows if required and, most importantly, visits by Road Safety and Police Officers to schools in the area of the crossing to show films and talk about railway safety.

A ‘week’ of the ‘schools calendar’ has been allocated to railway safety in some years, thus teachers are reminded to keep children aware of railway matters.

The ‘Highway Code’ for the Province has been brought up to date with the latest level crossing advice. The Police are also kept informed so that everyone knows what is going on.

NIR have conducted a ‘Teach In’ for a number of years at which Road Service/ Police/Road Safety Officers at local level can discuss details of the project and the systems with those responsible for policy and works. Again, these meetings are often not easy meetings, but are greatly valued by all concerned.

NIR have provided sufficient information to the Police to facilitate the issue of a ‘Force Order’ (a document addressed to all officers). This ensures that traffic offences involving level crossings are properly understood and prosecuted by the Police. NIR are called as expert witnesses in some cases, or to give evidence of tests carried out when offenders allege the equipment did not work properly.

Guidance notes for NIR trainmen have been issued. These are explanations, in much less formal terms than rulebook instruction, of how the system works with respect to the progress of the train, what happens if all is not well and what the train driver must do in the event of failure.

The keynote of the whole operation is to promote both public and railway awareness about level crossings, so that all appreciate that the systems are simple: safe and reliable, independent of power supply problems and, if they do fail, will fail safe. Thus, if road users obey the simple safety rules “Stop at the Red Light - Keep behind the White Line” there will be no accidents.
Introduction

As a young engineer one respects one’s elders (or at least one did in my day) and accepted their statements at face value. A similar approach was adopted to standards, which were the perceived wisdom of the industry and one followed automatically. It is only with experience (plus the modern pressures of the project manager) that one begins to look at the requirements and see whether one can avoid them!

In challenging a standard one has to first understand what it is saying and then discern the reasons for the rules – this is the same message I gave to the Younger Members at the recent Exam Review, professional engineers need to know what to do and how to do it, but it is understanding the ‘why’ which sets them apart. With many of our standards the ‘why’ is lost in the mists of time and (if truth be known) may only have been the opinion of the best engineers of the day.

To challenge a standard nowadays, one has to redevelop the arguments for the requirements and then argue that one’s proposal is at least as good. As someone who reviews applications for deviations on behalf of Network Rail and drafts new standards, I spend a lot of time trying to understand the reasons for the clauses and discern the core safety and performance requirements.

Double Cutting, Insulation Monitoring and Earth Free Supplies

After the Exam Review, we started talking about the current requirements for circuit design and what they were trying to achieve. It became obvious that many of our younger members are, like I was some years ago, taking the standards at face value without understanding the reasons.

In trying to explain some of our current principles for circuit and power supply design, I realised that perhaps an exposition of the reasons might aid all of us and, even, facilitate a simplification of the requirements.

Starting with our primary objective as signal engineers which is to provide a safe signalling system to only authorise train movements into protected, clear sections of line, it is obvious that a failure mode which causes a signal to be displayed erroneously, a wrong-side failure, must be avoided. In terms of traditional circuitry, this is achieved by only allowing a relay or function to operate when required and safe and designing the circuits so that credible failure modes will not cause false operation. (It should be noted that most signalling safety circuits are designed to fail to the safest situation if the circuit is broken or the control signal is masked by interference).

Our secondary objective is to provide reliable signalling since a failure leads to the requirement to use verbal communication to authorise train movements, a situation which we know to be less safe than a signalling system. (There is an argument that even a system which is suspected of failing wrong-side may be safer than no signalling system at all – perhaps that is the subject of another article).

History

When the earliest line circuits were introduced earth return was the norm. Typically a battery fed over a proving contact on a signal back along overhead line wires to an indicator in the signalbox. The return was via the earth – a great saving in line wires – and the indicator was designed to be very sensitive.

Whilst line wires could touch (in strong wind), it was unusual for a circuit to be false fed since there were so few circuits in use and hence little opportunity for contact. However, the indicators or relays on the ends of the circuit required minimal energy to operate and any leakage into the circuit could maintain the relay energised.

Moving on circuits started to share a common metallic return which replaced the earth connection. Circuits remained with a single control contact, mainly because the equipment often only had one contact available. Shelf type relays were a very efficient and successful design, particularly when power supplies consisted of wet or dry cells and demanded considerable maintenance unless minimal power was used.

With the move to the 930 series plug in relays, multiple contacts became less of an issue, cables became the norm allowing individual returns for each circuit and power supplies were readily available. In parallel, electrification was being introduced and engineers became concerned that the reliance on the signalling could be compromised through rising numbers of wrong-side failure.

The response was to introduce policies of double cutting critical circuits, to ensure power supplies were not earth referenced (i.e. floating) and add insulation monitors (or earth leakage detectors) on vital circuits. Whether these remain appropriate with modern materials, better cables, good circuit design and the ability to analyse potential interference using computer models, is the subject of this article.
Getting energy into the circuit

In order for a wrong-side failure to occur, energy needs to enter the circuit on the load side of any control contacts. By energy, I mean electrical energy and it has to be of the correct type (alternating or direct current, polarity) and with a low enough impedance to enable power to be transferred to the load. An induced voltage is not a problem if its source impedance is so high that it cannot drive a significant current through the load device. Therefore, it is not only important to think about the mechanisms for energy transfer but also whether that energy can actually influence the load. Note, for certain types of load it is simply a matter as to whether enough energy can cause it to partially operate, whereas for relays there are two levels of energy, that to energise the relay and the lower amount required to maintain a relay energised.

When considering the form of the energy, a transient pulse is generally not an issue since to operate a relay, illuminate a signal or move some points, energy is required for a duration. It may, therefore, be more appropriate to use the power which can be transferred rather than the energy. Before looking at real risks, it is probably appropriate to state what the test will be.

For a typical 50 V, 931 series relay, it will remain energised with a voltage of 7.5 V (using the guaranteed release value in the specification) into a load impedance of 1000 Ohms – this equates to about 50 mW of power. However most real relays will drop away at a higher voltage and typically require about 400 mW to remain energised. To pick the same relay requires a voltage of at least 40 V equating to 1.6 W. For an a.c. fed signal, a voltage in the order of 80 V a.c. or more is required capable of delivering about 4 W for an LED type signal.

Having identified the power required, the next question is how suitable power can actually enter a circuit. The obvious means is through direct contact where one conductor touches another. A more likely variant is a resistive connection between the conductors, possibly through deterioration or damage to the insulation. Whilst there is some history of crushed cables leading to partial contact, the real risks should be considered with modern cables and installation techniques.

Unless of course, the case becomes connected to one phase, due a fault, and the other phase has an earth fault, in which case anyone touching the case may receive a shock. The circuit includes two contacts with earth and if the person is wearing normal footwear then the loop resistance will be reasonably high.

Signal Head Control Circuits

Having considered the risks to people, it is time to turn to the risk of a signal being falsely illuminated. In this instance, the simplest arrangement is a supply is fed from the control point with a switched phase and a common return from all the aspects. So what are the potential failure modes and how can they be eliminated or mitigated?

With an 110 V a.c. feed, via a common fuse, over a single control contact before leaving the control point, the tail cable then feeds the signal head before the circuit returns in the same cable back to the power source. Any interference needs to enter the circuit beyond the control contact and be of sufficient energy to cause a partial illumination of the signal. One obvious route is for two cores in the control cable to be crushed together so that the energy intended for one aspect reaches another and in this case either both aspects will show or (in the worst case) the wrong aspect will show if the correct aspect light unit has failed. The risks of a cable crush causing two cores to come into contact is relatively low and there is a chance that one of the cores will be the return (hence blowing a fuse). A corrupted aspect is unlikely to be unsafe and the chances of the correct light unit failing at the same time is very small (or even lower with LED technology).

The other potential source requires energy to enter the circuit and this requires two faults to create a circuit. There needs to be a connection with both the control core (beyond the control contacts) and the return leg.

The most likely form of contact is a resistive contact to earth which, in itself, does not cause a problem. If both the connections are to earth, then there is a
risk that the intended energy will pass through earth rather than through the light unit leading to a dim or black signal whilst still achieving enough current to “prove” the signal lit.

Alternatively, the two earth connections have to provide the energy source which requires both sufficient voltage and low enough source impedance to drive a current around the circuit. The question is where does the energy come from? A difference in ground potential due to other circumstances will be a d.c. voltage which will have little effect on a standard a.c. signal head. The other suggestion is induced voltage from the a.c. overheads where the coupling needs to be sufficient to power the light unit. Since 2km of cable is the limit to protect staff from induced voltage risk, and it takes a lot less energy to hurt you and me, it does seem incredible that a false indication could be generated.

However, it may be prudent to double cut all the aspect circuits (except the most restrictive) since that minimises the potential affects of an earth fault on another circuit fed from the same supply, plus it makes the chances of crushed cores causing a false aspect incredulous.

**Point Detection Circuit**

Obviously a set of points being detected in the wrong position leading to a derailment has to be at the top of the hazards from energy getting into any circuit. The question is how one minimises the risk whilst still delivering an economic means of detecting points.

Circuits in the UK have been a variety of two, three and four wire circuits which included elements of separation and polarity/phase swap. The actual detection elements have normally cut both legs of the circuit, but some designs have incorporated changeover devices (such as the clamp lock detector) which effectively means that the normal and reverse detection circuits are connected together. Traditionally all the detection elements for an end of points, and sometimes all ends with the same number, were daisy chained so that interference mid way through the circuit could bypass earlier detection elements.

The current practices are moving towards a four wire arrangement where each position of the points is detected by a double cut, independent circuit. Additionally, the trend is to have an independent circuit for each detection element – this makes fault finding and testing simpler although it does require more relays/inputs to the monitoring equipment.

The advantage, from an interference point of view, of this trend is that the only area of risk is energy entering the circuit between the detection contacts in the point mechanism and the relay/monitoring device. By ensuring that the detection is double cut and that the return circuits are in a different cable to the feed to the detection, the risks of false energisation are very small whether the circuit is d.c. or a.c.

However, many traditional circuits included contacts which could mask potential false energisation of the wrong detection circuit by cross proving the detection relays – removal of this and proving that the required detection is made and all the non-required detection is not made later in the circuitry means that a false energisation is likely to be seen as a loss of detection.

An extra measure being considered is an arrangement where if both positions are energised together (one being correct and the other falsely energised) then contacts of the two detection relays can blow the fuse feeding that detection element.

Based on the circuits shown, the risks of energy entering the circuits are adequately controlled allowing d.c. detection circuits to be used in all areas (even with d.c. traction present).

**Conclusion**

It is healthy that signal engineers review the perceived wisdom of the fore-fathers from time to time and challenge the assumptions. One may find, as I believe I have found through this analysis, that we have generated more than one potential solution to the problem and then applied them all.

Double cutting can eliminate many of the risks of insulation faults and energy getting into circuits. Earth leakage (or insulation) monitoring only shows significant benefits (from a system point of view) where single cut circuits are used, although it does help to protect staff from risk where they may rely on the circuits being earth free for live working.

Separation of supplies does not seem to have much benefit except where some circuits are single cut and others are double cut (and where those circuits extend for a distance outside the apparatus housing before reaching any control contacts) – however segregating supplies does aid availability and reduce common mode failures.

The exercise which led to this paper started by looking at point detection where the ability to detect points with multiple detection elements in areas of dual electrification was becoming impossible. It has ended with a view that d.c. detection is perfectly safe in all situations with good products and good circuit design.

Your comments and views are invited!
IRSE International Convention 2009

To whet your appetite for the Convention Report, which will be in the next issue of the NEWS, here is a selection of pictures taken by your Editor.

Spain has some spectacular countryside, some no less spectacular trains, and a degree of sophistication in on-board and automatic train control systems that make most other countries seem primitive. This all starts at the airport with the Metro de Madrid network, one of the largest of any city in the world and virtually all equipped with ATO and ATP, and extends throughout the country with the high-speed AVE lines and modern RENFE network, much of it already fitted with ETCS.

Please send your pictures of the event, for possible inclusion in the next issue, to irsenews@btinternet.com. Pictures of the guest and social activities are especially welcomed.
1. Two Ian’s lunch together in Zaragoza - without the beer!
2. A local RENFE train arrives at Madrid Chamartín during the convention visit.
3. An AVE S-102 High Speed Train awaits departure from Madrid Chamartín station.
4. An Alstom CITADIS TGA 302 Tram on display during the visit to the Madrid Metro.
5. Arrival of the AVE S-103 special convention train at Zaragoza on Thursday 28 May.
6. Members board the AVANT S-121 special convention train on Tuesday 26 May at Madrid Chamartín station for Segovia via Valladolid.
7. Members view the Dimetronic CBTC equipment called SIRIUS fitted to a stabled train during the convention visit to the Metro de Madrid.
8. A view of the station platforms at Segovia.
9. A view of the train controls of the AVE S-103 special convention train at Zaragoza.
10. A view of the driver of the S-104 special convention train to Toledo.
11. A view of the driver of the AVE S-103 special convention train at Zaragoza.
12. Bob Woodhead operates the Tram Simulator at Metro de Madrid on Friday 29 May.
Network Rail’s £104m upgrade of the line from Colchester to Clacton and Walton-on-the-Naze moved a step closer to completion over the May Bank Holiday weekend with the installation of new signals, track circuits and upgraded level crossings.

With stage one of the project successfully completed in March, stage two was carried out during a 72-hour closure of the railway this May Day bank holiday. This involved the resignalling of the railway from east of Alresford village through to Walton-on-the-Naze and to the outskirts of Clacton-on-Sea, replacing obsolete semaphore signals with 41 new LED signals and upgrading five level crossings, including the crossing at Frinton-on-Sea. Control of this section of railway has now been transferred from Thorpe-le-Soken signal box to the newly extended and modernised signalling control centre at Colchester, where Network Rail signallers will control the railway using state-of-the-art visual display units.

Garry England, Network Rail senior project manager, said: “The signalling infrastructure on this part of the railway was like a classic car – unique, but becoming unreliable and expensive to maintain. Thanks to our £104m investment, passengers in this part of Essex will be among the first to benefit from Network Rail’s nationwide programme to upgrade signalling equipment and make the railway safer and more reliable.”

The new, modern system will be more reliable for passengers, reducing the likelihood of train delays. Once the project is completed in the summer, control of all signals and level crossings on the line will be transferred to the newly refurbished, state-of-the-art signal box at Colchester. In addition, new bi-directional signalling is being installed on the main line between Colchester and Marks Tey. This allows trains to travel in either direction on all four tracks, vastly improving flexibility and helping to reduce delays.

Editor’s Note: Frinton-on-Sea is a very old-fashioned sea-side resort, and the residents desperately try and keep it that way. The first fish and chip shop was only approved a few years ago. The only access to the town is over the level crossing mentioned, which was fully gated until replaced by barriers. There was a concerted campaign for several months to have the gates retained, which the locals considered would protect their genteel town from the general public rather better than these new-fangled barriers!
**IRIS Certification for Signalling Scope**

Bombardier’s Plymouth site has become the first signalling company in the UK to achieve certification to the new global rail quality management system, IRIS.

Announced in early June 2009, Bombardier Transportation’s Plymouth site, part of the UK operation and global Rail Control Solutions (RCS) Division, has become the first signalling company in the UK to achieve certification to the new International Railway Industry Standard (IRIS). IRIS is a global quality standard to ensure that rail company management systems are fully aligned to the needs of the market sector, thereby recognising a high level of product and service quality within the Plymouth site.

IRIS has been developed by Europe’s main railway system integrators and is run through UNIFE, the Association of the European Rail Industry. It is based on the international ISO 9001 standard but with specific requirements related to the railway industry. IRIS is expected to become the main supplier certification scheme for all suppliers and rolling stock manufacturers and will become the main certification to be used by Bombardier Transportation.

As part of the global strategy for IRIS certification, Plymouth joins a growing list of accredited sites within the RCS Division, including the Headquarters in Stockholm (Sweden), Braunschweig (Germany), Katowice (Poland – a joint venture) and Rome (Italy). The UK company’s achievement also makes them the first Bombardier Transportation site in the UK to achieve the IRIS certification.

**Westinghouse secures $14m Sydney turnkey signalling project**

21 May 09/Sydney -- Invensys Rail Group, today announced that its subsidiary Westinghouse Rail Systems Australia (WRSA) has won a A$14m turnkey signalling contract from the Australian Rail Track Corporation Ltd (ARTC).

The contract is central to an ARTC project to improve the efficiency and cost-effectiveness of rail freight services along the North-South Rail Corridor between Melbourne, Sydney and Brisbane.

A major bottleneck in the rail freight network currently exists in southern Sydney, where freight trains share existing rail lines with the Sydney metropolitan passenger services operated by RailCorp. During morning and afternoon peak periods, freight services are not permitted to run due to passenger priority. As a result, freight services cannot arrive or depart Sydney at the optimum times.

To alleviate this bottleneck, the ARTC began work on the Southern Sydney Freight Line (SSFL), which will provide a dedicated freight line for a distance of 36 km between Macarthur and Sefton in southern Sydney. The SSFL will provide a third track in the rail corridor specifically for freight services, allowing passenger and freight services to operate independently.

Under the contract, WRSA is to supply a turnkey signalling system, including design, supply, installation, testing and commissioning.

One of the main reasons for WRSA’s contract win was the ability to reduce the requirement for signalling technology on the project. Managing Director Phil Ellingworth explains “ARTC’s tender specified delivery of a conventional interlocking solution using track circuits. WRSA proposed an alternative solution using service-proven signalling elements in an innovative architecture delivering optimal value to meet ARTC’s key operational needs. It was this innovative engineering solution that won WRSA the tender in the end.”

The ARTC has been a major client of WRSA for many years and this latest project is one in a series won in recent times. These include: the relocation of the train control system in Victoria to Mile End in Adelaide; North Coast New South Wales level crossing upgrades; the Newport to West Footscray signalling upgrade; and upgrading the crossing loops on the Trans-Australian Railway between Port Augusta and Kalgoorlie.

**Westinghouse lands $4.5m Laverton contract**

19 May 09/Melbourne -- Invensys Rail Group today announced that its subsidiary Westinghouse Rail Systems Australia (WRSA) has been selected by Connex Mainco Joint Venture (CMJV) to provide A$4.5m worth of signalling equipment and services for the Laverton rail upgrade project in the State of Victoria, Australia. The project is part of the A$38b Victorian Transport Plan which aims to deliver extra trains and services to the busy Werribee corridor by the end of 2011.

Under the contract, WRSA will replace the existing life expired relay interlocking at Laverton with a Hot Standby WESTRACE interlocking. The WESTRACE is being provided in a “Hot Standby” configuration with diverse communications links - resulting in high system availability and reduced downtime in the event of a failure. WRSA will also replace the existing manual unit level Newport panel with a new WestCad VDU control system. The new VDU based system will interface with a total of six different interlockings; four relay, one solid state interlocking and the new WESTRACE.

*Although the site presents a number of challenges, we have worked with the client to develop an innovative contract structure that enables the risk to be dealt with efficiently at minimal cost to the client. We believe our design solution was an innovative one, designed to increase service levels and capacity of the Werribee corridor by creating a ‘short starter’ station at Laverton* said WRSA’s Managing Director, Phil Ellingworth.

WRSA has to design, test, install and commission the new control centre and interlocking by September 2009, when work begins on the relocation and reconfiguration of the existing track layout. WRSA has been active in Victoria for over 120 years and continues to commit to local delivery integrating the most appropriate technologies from around the globe to deliver value added customer solutions.
When I started to work for Signalling Solutions Ltd (SSL) in 2007, after gaining my Masters Degree in civil engineering, I found everything new and very different from my homeland. As an apprentice signalling designer I tried to soak up all the knowledge I could as quickly as possible, so I could take a part in the ongoing or new signalling projects.

A typical day in my life, however, began to involve TASS more and more and it became something I have done almost everyday for the last 18 months. Becoming the team leader and proficient as a TASS designer was a great challenge giving me lots of experience with customer interfacing; time management, team leading and of course, design. I very quickly gained sufficient evidence to apply for my IRSE Assistant Designer’s licence, which I gained during 2008.

To describe a day in the life of a TASS designer is not particularly easy as the design process is very dynamic. The only thing that is typical for the day is that it differs from the previous and from the next one. Many of you reading this may not know what TASS is, so I will start with describing it.

TASS stands for Tilt Authorisation and Speed Supervision and is fitted to class 390 Virgin Pendolinos and class 221 Super Voyagers to allow the trains to tilt. Tilting trains can run at Enhanced Permitted Speeds (EPS), higher than the normal operating speed, without the passengers feeling any additional lateral forces on the curves. This leads to higher comfort and also shorter journey times. TASS is an ERTMS based system, using ALSTOM ERTMS balises and is required in the UK as not all areas of the West Coast Main Line (WCML) are gauge cleared for tilting operation. The balise is a piece of passive trackside equipment used to store a telegram (a description of the infrastructure ahead of the train), installed in the centre of the track. It is activated by a signal from the antennae of a passing train. Power from the signal is used to transmit the telegram to the trainborne system where it is processed.

The trainborne equipment then acts in accordance with data in messages from trackside. It is now five years since the first balises were installed on the WCML.

The TASS system manages the safe operation of tilting trains by Tilt Authorisation (TA) in the areas where it is safe to do so for the above types of train, and Speed Supervision (SS) of tilting trains where operation at EPS is permitted, especially when running through curves. The SS function is able to apply the train brakes when an excessive speed is detected by the trainborne system. This safety critical system prevents the tilting train from colliding with a structure or a passing train and mitigates the increased risk of overturning or derailment.

In 2008 Network Rail asked Signalling Solutions Limited to deliver the TASS requirements for the December enhanced WCML timetable. This involved upgrading of large parts of WCML, implementing speed enhancements with trains running at EPS of 125 mph (205 km/h) wherever possible. Without my team delivering this TASS work, EPS would not be possible. With the various WCML projects underway the TASS requirements gained considerable momentum and the trackside design workload associated with it increased almost seven times. Even small changes in the infrastructure result in a new TASS design but the changes between Euston and Glasgow were significant. At that time SSL assigned me as the team leader, running a team up to six people responsible for the design of TASS on the WCML. The major projects were TV4T, Crewe to Weaver, Coventry, Milton Keynes, Armitage to Stafford, Rugby to Nuneaton, West Coast Scotland and A09 Speed Enhancements on different routes. Further enhancement designs will be carried out during 2009.

All of these projects took their place within the tight timescales requirements, with my team working hard to deliver them on time. Days within this period were really busy with numbers of e-mails waiting in the mailbox in the morning, many others coming during the day and telephone calls with different queries to be answered. Resolving the never ending issues was sometimes difficult to combine with work that needed to be done to start more designs. We had to support each of the projects by discussing the potential TASS issues in advance at meetings.

Once the source information, in the form of the Infrastructure Data Spreadsheet (IDW) is issued from Signalling & Telecomms Programme Engineering (STPE) the design work can begin. Calculation of the mandatory balise location, (determined by the location of speed decrease, the diverging junctions to non-TASS fitted routes or tilt prohibited zones) then takes place. I have to make sure that all the locations are designed to the IDW and to the TASS standards by design verification. Conflicting scenarios are often encountered and it is at this point where the design becomes challenging. Decisions about what takes priority, modifying and amending the design to fit the infrastructure data, and still comply with all the standards are part of my daily ‘to do list’. This includes calculations of gauge clearance requirements or tilt removal point which I have to present to the client with suitable solutions.

Verified locations are sent from my office to the project team, who will then provide the information needed for installation. This is also critical part of the process as it is vital to place the balise at correct position for the system to work correctly. Sometimes it was necessary to spend time at the WCML project site offices gaining the data needed, to avoid any problems at later stage.

After the STPE confirms the proposed locations we get to the other half of the work – telegram design. One might think there’s nothing easier like creating a telegram using software but unfortunately the software only works under certain circumstances, otherwise the telegram data must be designed manually, and of course verified. The final solution is then tested on the train simulator. Assembly of balises, programming and verifying if the
right telegram is in the balise with the right identity is also a part of my duties. Finally, a member of the appropriate testing team comes to the office so I can support him by testing the telegrams. Now the balises are ready to be delivered to the client.

I would just briefly like to go back to the Rugby station area, which was the most challenging project. Because of its complexity, Rugby station was not previously TASS fitted, being considered as Tilt Prohibited Zone, even though it was gauge cleared throughout. In fact, in those days, the station layout was relatively simple in comparison with what it has changed to, plus almost all the lines are now bi-directional, complicating the design even more. Also, in Rugby station there are four different routes joining from the TASS point of view, only serving to increase the difficulty of the design further. All these points, and a few more besides, make the Rugby station area the most complicated for implementing TASS. In spite of this, it needed to be fitted as the speed through the station became 125 mph. Extended hours and weekend working took place in the office because of the complicated designs and the tight timescales. All the efforts of the TASS design team resulted in the delivery of 50 balises within six miles of track, on time. This is a huge number, considering the fact that on a plain fully TASS fitted four-track railway it would only be eight balises for the same distance.

Part of my duties is to provide technical support for the installation and commissioning of the balises. This is necessary because, even if the design is perfect, the TASS may still fail to work if the balises are not installed sufficiently accurately and the distances apart are different to that defined in the telegram within. So my colleagues and I spent the commissioning weekend on site at Rugby. As a leader for the TASS project I really felt a big responsibility and even bigger relief when it all went well. But trains were still not running at the highest speed for the first few days. So we were all waiting, expecting the unexpected. When the last remaining up line through the Rugby station was set to 125 mph EPS with no incidents, we received an e-mail from Network Rail representative. The message was clear – trains arriving at Euston between three and six minutes early. This gave us great satisfaction because we actually made it.

A day of TASS designer is actually a combination of the above mentioned activities, along with regular telephone conferences and frequent meetings with the client where we discussed all the issues and usually achieved suitable solutions. With the cooperation of all those involved - the TASS design team and different WCML projects - the goal was achieved. A great and a big ‘thank you’ belongs to all these people.
In May 2009 the Engineering Council of the UK (EC\textsuperscript{UK}) launched their new guidance document “Guidance on Sustainability for the Engineering Profession”. This guidance is broken down into six sections, each containing further thoughts relevant to that section.

- Contribute to building a sustainable society, present and future;
- Apply professional and responsible judgement and take a leadership role;
- Do more than just comply with legislation and codes;
- Use resources efficiently and effectively;
- Seek multiple views to solve sustainability challenges;
- Manage risk to minimise adverse impact to people or the environment.

Copies of this Guidance Document may be found at \url{www.engc.org.uk/documents/EC0018_SustainabilityGuide.pdf}

The EC\textsuperscript{UK} hope that this publication will help and encourage all the Institutions licensed by EC\textsuperscript{UK} (i.e. including the IRSE) to introduce their own guidance specific to their own disciplines. To boost this thought they have also produced ‘wallet cards’ to motivate and guide engineers, which they are including in all new registration packs. They are suggesting that all Institutions follow this idea, perhaps including the cards with subscription renewal documents.

As result of this initiative the IRSE Council will be discussing the subject and deciding how best to proceed with the implications of this guidance – for instance, would the basic guidance be satisfactory for our particular profession, or might it be necessary to add further more specific advice.
Annual General Meeting & Technical Meeting

ADELAIDE, AUSTRALIA

"Controlling Railways - Australia’s Next Generation Systems"

143 Members and visitors plus 26 partners attended the 2009 Australasian Section AGM and Technical Meeting held in Adelaide from the 3-5 April 2009. The meeting and convention was led by the Australasian Chairman, John Aitken supported by the Country Vice-President, Peter Symons and Vice-Chairman, Steven Boshier. The meeting was held at the Stamford Grand Hotel, Glenelg, South Australia, a sea-side suburb of Adelaide. The theme of the meeting was “Controlling Railways – Australia’s next generation Systems” and a local committee had arranged a series of papers, presentations and technical visits which enlarged on the theme. This local committee was made up, as the name implies, of members from South Australia. They were, Malcolm Menadue (Chairman) of Menadue and Associates, David Barry – TransAdelaide, Geoff Willmott – IRSE Secretary, George Erdos – Australian Transport Safety Bureau, Lee Tran – TransAdelaide, Michael Forbes – ARTC (Australian Rail Track Corporation) Services Company with Maxine Menadue organising the Partners Programme.

The three day meeting was arranged such that the Friday was spent with Technical Papers and the AGM followed by the Annual Dinner in the Hotel Ballroom in the evening. Saturday was spent visiting sites in and around Adelaide inspecting various signalling installations. The Saturday evening was enjoyably spent further up the coast from Glenelg at the aptly named Semaphore Palais where we were entertained by the “Cabernet Cabaret”. The Sunday was a social day spent touring the winery area of McLaren Vale followed by lunch at the Woodstock winery. The ladies had not been forgotten with a Partner’s programme arranged for both the Friday and Saturday and of course the ladies joined the members on both evenings and the Sunday.

The first day of technical Papers started after registration with opening remarks and introduction by the Chairman, John Aitken who then followed by introducing the South Australian State Minister of Transport, The Hon. Patrick Conlon MP. Mr Conlon gave a key note address “Adelaide’s Rail Revitalisation Project” which gave an outline of the Government of South Australia’s transport infrastructure investment strategy and rail initiatives.

The Minister started by telling the audience who he was and his background. He had been a lawyer before becoming an MP. He had been a senior minister since 1997 and his portfolio of Transport and Infrastructure was considered to be one of the largest in the state. He then gave some background into what had been done (or not) in SA infrastructure. From the 1970s there had been a significant “drop-off” in SA infrastructure spending and public transport with similar reduced spending in the rest of Australia. The 1980s saw the national economy changing with the breakdown of regulation and protectionism. SA was a much protected state especially in agriculture. ‘Here we are 20 years later where SA has enjoyed economic growth over the past 10 years with major spending in Infrastructure associated with Defence (ship building) and mineral exportation. In the future SA needs to invest heavily in Infrastructure associated with schools, hospitals, road and rail. A strategic plan had been drawn up in 2002 and further detailed plans in 2005. A $2 Billion plan had been announced for rail renewal and electrification of the Adelaide suburban area and the federal government had also announced extra monies for further...
extensions of the Adelaide rail network. Rail revitalisation was also in the strategic plan for Freight between Melbourne and Adelaide plus it was recognised that a high quality public transport system shaped the future of housing and standards of living. The revitalised Adelaide Network needed new electrified rolling stock (trains and trams), upgraded track and signalling and integration with Buses for good public transport. Even gauge conversion to standard gauge was being considered. Adelaide was looking for modern technology to provide quality public transport and to allow for growth over the next 30 years. ‘The minister finished off his keynote address with the slogan for Adelaide – “This is the Future”.

Then followed by a paper entitled - “Rail Revitalisation - A Decade of Change for TransAdelaide” given by Brett Baker, the Engineer responsible for Rail Engineering including Trains, Track and Signalling for TransAdelaide, the organisation responsible for public transport across the Adelaide Metropolitan Area. The paper spelt out the strategic priority for rail in South Australia, which was to maximise the use of rail transport for passenger and freight movements. Model shifts to rail for freight and to public transport for people in the metropolitan area offers significant benefits for greenhouse emissions, road congestion and safety. In the 2007/8 State budget, the Government of South Australia announced a range of public transport initiatives, including plans for the electrification of the TransAdelaide heavy rail network and further extension of the tram network. The announcement provided a programme of works to meet the State’s Strategic Plan targets to facilitate a significant increase in public transport patronage by revitalising Adelaide’s public transport system. The paper also reviewed elements of the budget announcement that impacted upon the future rolling stock and signal and communication system needs for public transport in Adelaide and how it presented major opportunities for TransAdelaide.

Morning Tea was then taken which allowed the attendees to inspect the various stands in the exhibition area and to network with their colleagues.

After the morning break the members then returned to the lecture theatre to hear a paper called “Port River Expressway Road and Rail Bridges – A project overview and the Challenges” This paper was given by David Bartlett, Project Director for the Department for Transport, Energy and Infrastructure, South Australia. David started by telling the members some of the history of the Port Adelaide Infrastructure and how it needed upgrading. The significant upgrading of the road and rail infrastructure called for opening bridges for the Port River Expressway and the extended rail infrastructure. The project was complex in scope and was at the time the largest contract entered into by the Department for Transport, Energy and Infrastructure. It was also the first Transport Project that contained a significant rail element. David explained that both the rail component and the opening bridges were challenging. He then went on to describe how the contractor worked closely with the client and a diverse range of consultants, subcontractors and suppliers to ensure that the project met all the requirements of the scope of works. There were many areas where innovative engineering solutions were employed to ensure a successful outcome. The rail component was multi-faceted, with a complex scope and the close involvement of ARTC who had a keen interest in the design and construction outcomes. Several elements of the rail works were unique.

The members then heard a presentation called “Port River Expressway – Dry Creek to Outer Harbour Resignalling” given by Michael Forbes, Signal Design Engineer ARTC Services Company. Michael explained that the upgrading of the road and rail corridors called for the installation of two opening bascule bridges over the Port River – one for road and one for rail. The upgrading also called for better freight facilities on the LeFevre Peninsula from Port Adelaide to Outer Harbour and installation of a new crossing loop at Wingfield. The primary objective of the project was to improve transport efficiency through better access to LeFevre Peninsular for both road and rail traffic and improving the amenity of the Port Adelaide Centre by reduction of through traffic and associated noise. Michael’s paper also discussed the re-signalling of the freight corridor from Dry Creek to Outer harbour and looked at the changes in technology and equipment on this line since the 1980s.

A Buffet lunch was then taken in the Level 1 Ballroom foyer of the hotel before gathering together for the 2009 Annual General Meeting. Unfortunately even with a quick annual report, the AGM did not manage to break the time record set in 2007 and took all of 10 minutes! John Aitken was re-elected as Chairman with Steve Boshier as Vice-Chairman. Peter Symons remained as Country Vice-President.

After the AGM the members then settled down to listen to a presentation on the “National Train Communications System – Project Overview” given by John Hall, who has had 10 years with The Australian Rail Track Corporation.

John explained that the primary purpose of the NTCS project was to provide a cost efficient, effective and interoperable Train Control communications network to support the current train control requirements and also future proof ARTC by providing a reliable high speed data platform to support the data intensive train management control system being planned for the future. The NTCS system is designed to replace the many disparate and old communication systems which ARTC is required to maintain and support for Train Control operations, and which were a legacy of different infrastructure owners before ARTC took them over and created a common national network. The project will provide 704 ICE (In Cab Equipment) units for rail operators to install into their Locomotives that operate across ARTC and adjacent controlled rail networks on Telstra’s Next G mobile network. Telstra will also provide an additional 78 radio sites along the rail corridor including 16 radio fitted tunnels. The Telstra network will also provide a single network for communication between locos, Train Control, track-side workers and wayside equipment. This seamless coverage will be backed up by a secondary communications platform provided by the Iridium Satellite Network.

The next paper to be presented was a paper that brought the members up to date with the Advanced Train Management System (ATMS) that is due to be installed over the whole of the National Network. The paper was entitled Advanced Train Management System (ATMS) – Proof of Concept Phase and was written and presented by Mike van de Worp (General Manager, Communications and Control Systems
systems until ICE became universally available. The paper told how the Australian Rail Track Corporation (ARTC) had announced in June 2008 an investment of $90 million Australian to improve capacity, safety and efficiency on the interstate rail network through the development of an “Advanced Train Management System” (ATMS). As part of this investment, ARTC had entered into a contract for A$73.2 million with Lockheed Martin for the company to design, develop, construct, integrate and test an ATMS prototype system on 105 km of the interstate network between Crystal Brook and Port Augusta in South Australia. Lockheed Martin had engaged Ansaido-STS to assist with the delivery of the project. The proof of concept phase of the programme was underway and was 10 months into the 39 month schedule. The audience was also told about the broad outline of the ATMS project, the broad programme plan and the rationale for and the description of the ATMS including a status report on the current “Proof of Concept Phase”. The authors’ also shared with the members some of the key issues that the program was addressing.

The next paper to be presented was called In Cab Equipment (ICE) Design, Testing and Acceptance and was presented by Grant Hodson and Ben Isles from Base2. The Authors explained that the ICE for the Australian National Train Communication System (NTCS) implemented the next generation for Locomotive Voice and Data Communications. The ICE platform had been built on design principles, hardware and protocols proven in critical life safety communications. The design consisted of a digital voice and data backplane with various communication integration modules plugged in to allow voice and data to be switched to different communication infrastructure. The primary suburban communications are 3G850 and Satellite whilst GSM-R is implemented for Urban Communications. The Hardware introduced design and test methodologies to railway electronics that had their origins in aerospace and military equipment. Real world testing was done in a class 44 diesel electric locomotive. Afternoon refreshments were then taken and the last opportunity to look at the trade stands erected by the meeting sponsors.

The next paper was presented by John Kessner from Pacific National. His paper was Locomotive Communication System Installation – Project and Operational Challenges. John explained that the Freight Rail Industry was going through some significant changes in the use of radio communication systems. The ARTC NTCS project was providing the industry with a big step forward in technology and complexity. The changes for locomotive fleet owners such as Pacific National have not been straightforward. It has meant a move from a culture of fitting locos with multiple stand alone systems to one of introducing a fully integrated system and was full of challenges. Loco cab design and space requirements were difficult aspects of the installation, made worse with the multiplicity of locomotive classes and variations in cab design. There were also many other project considerations to be taken into account such as legal considerations, industrial relations, human factors, safety, training, maintenance, and system retirement to name but a few! The project had fallen short in some features anticipated and required by Pacific National and other operators. Some of these had been rectified though project variations. Some remained unresolved or will be covered independently by Pacific National in the future. All in all it had been a project that needed a large effort and cost on Pacific National’s part, not least continuing to support existing systems and fitting new locomotives with interim systems until ICE became universally available.
The final paper of the day was *The Importance of System Integration & Integrated Logistic Support in the Design of Rail Transportation Systems* given by Arran Bollard, Jane Copperthwaite and Amanda Tooth, Technical Support Staff, Ansaldo STS.

The presentation told us that the rail transportation sector’s systems were characterised by increasing complexity of technology and system operations, an increase in need for higher capacity, a demand for reduced technical and operational risk and a requirement to contain and reduce system life cycle costs and effort. All this and a continued expectation for an effective, safe and available service life of at least 20 years (and often more than 30)! The paper then went on to examine the concepts and importance of the integration of systems engineering and supportability planning through the rail transportation life cycle which allowed the signal and system engineer to fulfill the hopes and aspirations of the customers.

The meeting closed with a vote of thanks to all the authors and presenters and the presentation of plaques from the Institution.

During the day’s proceedings the Partners were well looked after in a programme of events organised by Maxine Menadue. They had tours of various craft and glass designers’ galleries, visited historic houses and a farm shop in the historic town of Hahndorf.

The Annual Dinner was held in the evening in the Ballroom of the Stamford Grand Hotel, led by the Chairman and his wife. Much conviviality was imbibed and enjoyed.

The Saturday was spent in Site Visits to South Australian Department of Transport and Infrastructure’s Control Room and Port River Bridge plus visits to ARTC signalling associated with the extension of the Port facilities.

Transport from the Hotel in the morning was by Special Tram from Glenelg (Right next to the hotel) to the City stopping at South Terrace to inspect tram Signalling and Interlocking. Everyone then had morning coffee before boarding a coach to visit the Adelaide Control Centre that controls all of Adelaide’s traffic lights and the lifting bridges over the Port River. Lunch was then taken at the Port Dock Railway Museum with the opportunity to inspect heritage signalling and locomotives. Coaches were then boarded to take us to the two bascule bridges over the Port River and to view a special opening of the railway bridge. The coaches then returned the members to the hotel at Glenelg. The ladies in the mean time had a pleasant day visiting the Botanic Gardens and some free time looking around the shops in the centre of Adelaide.

On the Saturday Evening members and partners were taken for a Gourmet BBQ Buffet in the pavilion on the beach at the “Semaphore Palais by the Sea” at Esplanade, Semaphore. After the Buffet the members and their partners were well entertained by the “Cabernet Cabaret” and the evening was finished off by a leisurely coach journey back to the hotel at Glenelg.

On the Sunday after a leisurely breakfast, Coaches took the members and their partners to McLaren Vale Township (the middle of the wine growing area) for a tour and coffee before depositing everyone at the Woodstock Winery for Lunch and once again the opportunity to spend some money on wine to transport home. The Meeting ended with the coaches depositing members at the airport or the Hotel in Glenelg with everyone agreeing what a good meeting it had been!

*Tony Howker*
Autumn Technical Meeting and Visit to Devon

The Minor Railways Section first technical meeting & visit will take place in Devon, United Kingdom. The Section will be visiting the Paignton & Dartmouth Railway on Saturday 26 September 2009. This will be followed by a visit to the South Devon Railway on Sunday 27 September 2009.

Both railways being visited are providing special trains to allow the Section to visit the signalling and telecommunications installations along each route. In addition to this, a guest programme is being prepared to accommodate guests and families accompanying members wishing to attend the main event. It is also intended to have an evening meal together on the Saturday evening at a location to be announced.

Places will be limited and will be given out on a first come, first served basis. Prices for the event have been confirmed as £30 for adults and £15 for children. For further information about this event and accommodation nearby, please send an email to dave.g6fsp@orange.net or minor.railway.sig@btinternet.com. The Committee looks forward to receiving your support for this first meeting since the Section was formed earlier this year.

For further information about both of the railways, please go to www.paignton-steamrailway.co.uk and www.southdevonrailway.org.

Call for Technical Papers & Presentations

Saturday 7 November 2009 - Winter Technical Meeting - Kidderminster Railway Museum

The Minor Railways Section is planning to hold another technical meeting at Kidderminster, following on from the successful event of Saturday 4 November 2006.

There is an open invitation for the provision of technical papers and presentations regarding signalling and telecommunications projects, problems, solutions and issues within the minor railway and heritage community, to be presented at the above planned meeting.

Such projects or issues may include, but are not limited to:

- Preserved telecommunications;
- Resignalling the railway;
- Signal post renewal and siding installation;
- Level crossing upgrades;
- Additional signalling capacity for regular through trains;
- Signalling innovations & solutions;
- Narrow gauge signalling and operations.

(Please note the above items are only initial suggestions)

If you wish to present a technical paper or provide a presentation, please can you contact me with your thoughts? Please aim for your papers/presentations to last no longer than 30 minutes in total.

We look forward to hearing from you regarding your projects and your issues.

Ian James Allison
Chairman, Minor Railways Section
minor.railway.sig@btinternet.com
By Craig King

The sun shone brightly as the Midland and North Western Section assembled on the platform at Rowsley South station on the 14 June 2009 for the sixth annual luncheon and technical visit. This year we were invited to view the signalling and telecommunications equipment at Peak Rail in Derbyshire. The technical visit was to focus on the signalling installations at Darley Dale, Church Lane and the telephone exchange at Rowsley South.

In 1968 the railway between Matlock and Buxton through the Peak National Park was closed and lifted. This was once part of the Midland Railway’s line between Manchester Central and London St. Pancras. In 1975 a group of enthusiasts formed the Peak Railway Society with the aim of re-opening the line. Initially a Steam Centre was opened at Buxton, attention later moved to the southern end of the line, where undergrowth was hacked away and rails reinstated. Services commenced between Matlock and Darley Dale in 1991. The northern extension to the site of the former Rowsley Locomotive Depot saw its first passenger trains in 1997, where further facilities are currently being developed.

Following a short briefing and description of the day’s itinerary by Peak Rail’s Signal Engineer Dominic Beglin, we were invited to view the Telephone exchange at Rowsley South station. The railway has two automatic telephone exchanges and switching is carried out using Strowger type, two motion selectors. The exchange at Rowsley is housed in an ex GPO mobile unit which had its digital equipment stripped out and replaced with electromechanical switching that was so prevalent on the railway. The other exchange is located at Darley Dale. In addition a single omnibus telephone circuit connecting the two signal boxes at Darley Dale and Church Lane Crossing with Rowsley Booking Office. SPTs are provided and are local battery fed connected directly to their respective signal box.

Steam Locomotive 0-6-OST No 7136, Royal Pioneer suitably carrying “The S&T Engineer” headboard for the day was coupled to the train which included the Palatine Dining Cars.

Royal Pioneer was built in 1944 to the Austerity design for War Department service. The loco was first preserved at the now closed Dinting Railway Centre after an extensive overhaul at Hunslet’s in 1966. After arrival at Darley Dale in 1990, the loco was re-tubed, and had vacuum brakes and carriage heating equipment fitted to enable it to haul passenger trains. We boarded the train to make the short journey to Darley Dale and upon arrival disembarked from the up platform to view the signalling installation.

Darley Dale

The first section between Darley Dale and mid-way towards Matlock was opened in 1989, and ran to a short distance beyond the carriage museum at Red House cutting by Warney Lane Bridge, the method of operation being push-pull and a basic signalling scheme to control the level crossing at Darley Dale. The train movements over this was put into place using a seven lever Knee Type frame recovered from the Melbourne Military Railway and a Midland style ground level crossing cabin was constructed, which was designed to be temporary until the main signal box came into use.

For several years this operation remained unchanged, the railway did acquire the redundant ex Bamford signalbox and a
standard 23 lever frame which was placed inside, a few operational problems however meant that the signalbox was never put into use at the time, mostly due to the necessity to get a ships wheel worked gate gear into use as the signaler could be expected to leave the signalbox up to seven times for a train to go over the crossing, closing gates, swapping train staffs, clearing signals etc and the walk is around 100 yards every time. The desire to leave the commissioning of the structure until the two train running was put into place, this is one reason a ground level cabin has always been preferred here. The crossing gates are all steel construction, with electric locking and release based on the method in use at Astley level crossing on the Liverpool to Manchester line.

The wooden Midland style bracket signal upon the up platform was originally a straight post, but was altered at the bequest of HMRI as the sighting was poor with the signalbox behind it, this was altered to reflect a Midland style bracket type which has recently been re-timbered and refurbished, on the opposite platform the steel post bracket signal came from Nottinghamshire and was put in place should the railway ever decide to have a platform canopy so that sighting would remain good.

In 1991 the railway opened to Matlock and the north yard area between Darley Dale and Church Lane was signalled for operation of the sidings there and a run round for taking the locomotive off, this was always planned to be a temporary affair until the line extended northwards to Rowsley.

Matlock itself operates on a three lever LNWR stirrup type ground frame, with basic operations for running around the train.

**The Rowsley extension**

In 1997 the railway opened to Northwood, the site of the old Rowsley locomotive sheds, this site is constantly expanding, currently there is a turntable, locomotive shed, carriage restoration sheds and the Heritage Shunters Trust Depot, the site is operated from two LNWR stirrup style ground frames which control the north and south yard exits, a further Midland two lever ground frame will come into use later once the token project is commissioned to control the run round and north loop exit.

**Two train running and the passing loop.**

The railway incorporates the only two level crossings of the old Midland railway Manchester to St Pancras railway mainline, both located about ¼ mile apart, for the first few years the crossing at Church Lane was operated as purely a gate box rather than a signalbox with very minimal signalling, however around 2004 plans were put into place to bring about a passing loop and two train running, the plans involved Darley Dale controlling one exit/entry into the passing loop and Church Lane becoming a proper signalbox controlling the entry/exit from the Rowsley end of the loop, the platform loop lines at Darley Dale would be controlled by Absolute Block released from the exit signalbox, thus giving in effect a ¼ mile passing loop, the whole line from Darley Dale to Church Lane is fully track circuited with d.c. fed tracks and shelf type nine-ohm relays.

The point proving is cut into the block circuits so that the exit points must be set before a line clear can be obtained; this provides the necessary overlap for safety as well as controlling the trains to only one entering the loop at a time.

The single line sections from Matlock Riverside to Darley Dale and Church Lane to Rowsley South are controlled by the train staff key method, a small electrical key is attached to the train staff key to effect a one line clear release of the starting signals.

1. Darley Dale Down Platform Signal
2. Darley Dale Frame
3. Darley Dale Station
4. Strowger Exchange at Rowsley
5. The Palatine arrives at Matlock Riverside
6. Darley Dale Boxes & Crossing
7. Dominic Beglin explains the Josslock Point to members
8. JonTillin, Andy & Isobel Knight and Graham Hill (Chairman)
**Church Lane**

Whilst Darley Dale is a purely mechanical layout the pointwork at Church Lane is operated from a "Josslock point", this is a BR adaptation of the electro pneumatic point to operation from a hydraulic operation via a standard clamp lock power pack, an engineering panel is provided at the points for S&T testing of the points if the signalbox is closed, and to facilitate engineers shunting operations during possessions. The crossing at Church Lane is still protected by Midland lower quadrant wooden posted signals, which date to 1927, at some point soon they will be replacing the wooden post on the up signal and changing the operation to an upper quadrant in line with HMRI requests.

**Lunch**

A leisurely walk from Church Lane to Rowsley South before once again boarding the train followed by a superb three course lunch delivered efficiently by the on-board catering team. Three return journeys and three courses later on a very hot train allowed us time for presentation of the Sections Chairman’s Award. This award is presented by the Chairman to the individual or in the case of this year the couple who have staunchly supported the IRSE and the Award serves to recognise this support.

This year the award went to Andy and Isobel Knight of Signet Solutions for service to the Section and many congratulations were offered to both Andy and Isobel for their hard work. In time honoured fashion both Andy and Isobel, accompanied by Jon Tillin (founder of Signet Solutions) together with Graham Hill were photographed in front of the “S&T Engineer” bearing locomotive.

The Midland and North Western Section wishes to convey very many thanks to Peak Rail and its volunteers, in particular Dominic Beglin for his informative and interesting technical visit and indeed to all of the staff on and off the train that made for such an enjoyable day.

9. Dominic Beglin explains the Josslock Point
10. Church Lane & Rowsley Shared Distant Signal
11. Rex Johnson at Rowsley
12. Church Lane Frame
13. Members inspect Church Lane Box
14. 0-6-0 Saddle Tank No. 7136, Royal Pioneer, at the Darley Dale Up Platform signal

*Photos: Ian Allison, Mike Jolly, Craig King and Roger Phelps*
Dear Editors

Run-through Protection of Switch Systems

I seek to encourage a debate within the UK Rail Industry for the provision of a safe and reliable point operating system having ‘run-through protection’.

I believe it is possible to provide a safe point operating system that will provide adequate holding of a facing point switch blade pending the arrival of an approaching train movement onto the switch toe, yet also enabling a progressive collapse of those holding forces during a run-through.

I include a short paper that I hope will encourage debate and provide for a wider general understanding within the industry why we presently provide a ‘Facing Point Lock’ (FPL) to point operating systems over which passenger trains operate.

I am seeking through this discussion paper to improve point system reliability and reduce train delay. I am not seeking to reduce safety of point systems.

It is worth mentioning that once a wheel flange has transferred off the through running rail onto the discontinuous switch rail at the switch toe, the wheels’ presence on the switch rail holds the switch firmly against the stock rail. This fundamental holding force ensures safe train operations over many points in goods lines and sidings that are not currently provided with FPL’s.

Incidentally, the new Point Operating Systems Functional Specification stipulates that it is necessary to ‘hold the switch blades’ i.e. it is not stipulated to ‘bolt’ them.

The holding forces specified in current point system design inevitably results in severe damage and resultant heavy train delay when a set of points is ‘run-through’ (even at low speed).

Additionally the physical presence of rollers within switch blades during run-through may exacerbate this damage problem, as the closed switch rail now needs to lift over the roller whilst the switch is firmly held closed. Cen.60 rail section may increase the risk of damage or even lead to vehicle derailment during run-through due to its larger section.

I ask whether Network Rail considers the attached discussion paper is worthy of debate within the industry? If so, I would be pleased to offer a conceptual design for consideration.

Current UK design and the requirement to provide a Facing Point Bolt prevents a trailable switch design from being offered to for consideration.

I seek to encourage a debate within the UK Rail Industry for the provision of a safe and reliable point operating system having ‘run-through protection’.

The expression run-through refers to the passing through a point system in the trailing position when the point’s switches are not set for the route.

This results in damage being caused to the either the switch rails or operating equipment or both. In either case, run-through incidents cause very heavy delay and if not reported or detected by the system itself, can result in further damage or derailment.

The provision of run-through protection is not normally provided on UK point systems in main lines other than spring operated ‘run away’ trap points.

Limited provision is made in sidings by the provision spring points.

PROTECTION AGAINST RUN-THROUGH

Protection against run-through is often provided on other railway systems particularly in Europe.

UK railways have not regularly included this protection due to the difficulty of incorporating it within current UK designs and UK switch systems being required to have stretcher bars along the switches and Facing Point Locks (FPL’s) to meet HMRI requirements.

Protection against run-through in the UK is via the stringent Operating Instructions and Signalling Control and Interlocking Systems enforcing that train movements can only occur when the point switch blades are set in their correct position for the movement.

A failure to observe either the operating instructions or failure to obey signals often results in severe damage to point switches and operating mechanisms. In extreme cases the movement may lead to derailment of the rail vehicle. At the very least such incidents inevitably result in severe impact on train operating timetables; delay is inevitable and very costly.

DISCUSSION

The provision of a reliable run-through protection system has been raised on a number of occasions. All have come to naught, being seen as ‘too progressive’.

This is mainly because Network and / or the Railway Inspectorate require (as a principle) that a high retraining force must be maintained by the operating mechanism to hold the switch rail against its stock rail during a run-through. This requirement actually defies logical argument since the system is thereby being required to ensure damage is inevitable during any run-through incident.

Despite several attempts to have an open discussion of the principles involved I have been unable to obtain any indication of movement over this matter.

Discussion of the issues and agreement of the absolute essential requirements will, as a minimum, record the areas of concern / dispute. The outcome of discussions will lay down the criteria to be met by point systems during run-through. This knowledge will enable the preparation of an acceptable engineering solution.

FACING POINT LOCK

By far the biggest cause of damage caused to points during a run-through occurs when the point switch blades are provided with a FPL.

It may sound simplistic (even barmy) but in order to reduce this damage, could the FPL simply be removed from current power operated point systems?

In order to explain why HMRI require the fitting of FPLs on facing points on passenger lines I have undertaken some research into the matter.
FACING POINT LOCK REQUIREMENTS

The FPL requirements were recommended following a number of accidents culminating with a fatal train accident at Wigan in August 1873. A passenger train was derailed at a set of facing points resulting in fatalities.

The inspecting officer made the following recommendations:

♦ A Bolt shall be fitted to a separate stretcher bar on all facing points used by passenger trains;
♦ A similar Bolt shall be fitted to all points leading onto a passenger line;
♦ The stretcher bar will be provided so that the points will be securely bolted and proved to be closed against the stock rail before authority is given to the train to proceed over the points;
♦ The bolt shall not enter the notch with an obstruction greater that 3.5 mm between the switch and the relevant stock rail.

Similar requirements were introduced later at swing bridges etc.

FUTURE POINT SYSTEM DESIGN

In order to improve reliability and performance in S&C design, existing methods for provision must be challenged. Continued insistence in observing historic practices may be contributing to poor performance of many current S&C systems in use by Network Rail. Simply giving blind obedience to historical recommendations (which were made at a time when mechanical engineering expertise and materials available were very different.

Only those factors that are absolutely necessary for safety should be retained or improved.

My understanding of the intentions of the Board Of Trade Inspector requirements in 1873 was simply to make the railway points of the time safer for the carriage of passengers.

Given my understanding of purpose, the high level of security provided by a FPL must be retained whilst at the same time allowing a controlled release of the holding and restraining elements during run-through.

A full knowledge of the forces generated during a run-through are an essential prerequisite in enabling a safe and robust means of ensuring safety, whilst at the same time allowing controlled yielding during a run-through by unauthorised / accidental train movements.

PROPOSAL

I offer the following for debate:

‘That there is no longer a need to provide a ‘Bolt’ on modern Power Operated Point Systems.’

I make this assertion in all seriousness, it stems from the knowledge that there was not a mandated requirement (and there is still not a requirement) to provide FPLs on Goods Lines and other lines not carrying passengers.

The control required is the same whether the approaching wheel set belongs to a train conveying goods or passengers. Therefore, it follows that the FPL is actually provided as a mitigating factor in respect of the consequences following a passenger train derailment and not specifically for wheelset control at the point switch toe.

Many train movements are undertaken safely each day without incident, over facing points in Goods Lines and Sidings where FPLs are not provided. Many having electrical detectors and do not have any additional mechanical restraint applied to the switches other than their operating rod. This arrangement, confirms that under normal circumstances, there are insufficient forces (generated by interaction) whilst a wheel is traversing the point switch rails to cause the closed switch toe to come open. High forces that keep the switch rail closed tightly against the stock rail are generated. The ‘conical design’ of modern wheels adds to this natural wheel rail interaction. This feature coupled with the modern undercut switch toe and stock rail (which was not a feature of early point switch designs) makes the risk of switchblade opening whilst being traversed by a wheel less likely to be caused.

DISCUSSION

Given that is not necessary to provide a FPL in order to keep the switch rail tightly held against the stock rail during movements through the switch, why was it felt necessary to fit an FPL so at the time of the accident at Wigan.

The mode of operation of points in 1873 was via long runs of point rodding commonly 200-300 yards (in the order of 185-275 m) from their controlling lever. Thermal expansion and contraction of such long lengths of rodding exposed to sunlight caused point switch toes to open after initial setting movement.

The provision of a FPL prevented this expansion and contraction affecting the position of the switch toes (once it had been bolted in either the Normal or the Reverse position) thus preventing the switch toe being caused to move away from the stock rail prior to the arrival of a second train, no matter how long a time period or by how much the temperature had changed once the points were originally set into position.

By contrast modern point operating rods are very short. The switches are electrically proved in position by relatively short rods. The switch rail toes are undercut, thereby ensuring that they are ‘tucked in’ under the head of the stock rail ensuring the approaching wheel is several inches past the toe of the points before the wheel flange contacts the switch rail.

Is this worth discussing?

M E Tunley
Member (retired)
This letter is a late reaction on articles in the highly praiseworthy IRSE NEWS issue 141 of January 2009. There’s so much that sets off trains of thought (admittedly a lot cheaper than the other trains we tend to deal with) that I can’t help reacting after all. Especially Tony Howker’s article was a bit of a firelighter.

Look at those Mk1 carriage conversions in Australia. We are now putting together inordinately expensive rakes of four obsolete but basically serviceable Mk1’s, with old on-board equipment and those delay engendering slam-doors, topped and tailed by two class 67 diesel locos with more than 6000 HP per train and capable of 200 km/h or 125 mph. All that for utterly local services. In New Zealand, however, they put together push / pull rakes made up out of conversions of this same stock, which had to be brought over from the UK and then re-engineered and re-bogied, with their own hotel power aggregate, 1/3rd and 2/3rd automatic door configurations and one diesel loco at the other end. This is just what we want here around Bristol and similar places apparently not worth to be on the electrified network.

This must be a comparative cheap solution to a rolling stock crisis we experience, seeing that we only have to re-engineer the MkII and MkIII bodyshells and not sail them halfway round the world, whilst the New Zealand blueprints for the MkII conversion are available. It put in my mind an article on the use of apparently obsolete stock by Mike Weinman in the IRO magazine, who wondered why we didn’t do more creative things with the host of serviceable rolling stock laying around (at the moment of writing). And, of course, those converted rakes do not have to have a diesel loco but you can hang traction packages under them, or use an electric loco.

Wish I’d had that photograph of the New Lynn Trench Project at the bottom of page 15 at my disposition when selecting for the book on Level Crossings. What a gem!

The article by David Campbell about the wrong side failures of signalling was good, you could feel the hairs rise on your head when he describes how it was discovered that signals failed to stop trains the way they did. Bet the local media had field days out of that and I was glad to read that the driver’s unions were as co-operative as they were (read Phil Bassett’s letter in the same issue). As an aside, I think that in the light of increasing international through travel of cab staff some pan-European research on the most appropriate way of dealing with the light beam from a signal at all distances on the approach is necessary, seeing the various configurations of hot-strips, LED and fibre optic matrices used for close-up reading of the signal aspect.

Normally there will be no problems and if we specify that a train throughout Europe would be expected to come to a stop at 20 to 25 metres from the red aspect it would help, but it is in times of atmospheric, technical or emotional (playing chicken, stone throwing, other forms of vandalism) problems that the differences suddenly might be a contributing cause to something nasty further down the line. It is a personal experience that being at the controls of various train types in Europe makes you rather edgy due to the very different ways in which power and braking controls are arranged as you never trust that in time of an emergency you will instantly do the right thing. Let signals not come under the same heading, please.

Peter van der Mark,
Rail operations consultant, Author & Transport museology consultant.

Curiosity Corner: Issue 146

I recognised the photo location immediately as it is on my all time favourite railway line and I have seen the picture before. It is quite an interesting shot as it is on a closed railway line.

The train is a Lydford to Launceston officers’ inspection saloon run from the Plymouth division of the Western Region taken on 15 May 1964 and is seen on the return leg, approaching Lifton, passing the former Leat Corn Mills.

Lifton’s up fixed distant signal can be seen and in the background the line can be seen curving towards the River Tamar. Information suggests the inspection saloon was a converted GWR auto-coach in chocolate and cream livery.

I first saw the photograph published in a 1965 book on the Plymouth to Launceston line by T.W.E. Roche and I have also seen the picture elsewhere credited to the Western Evening Herald newspaper.

To understand the context of the photo some history is necessary: in 1859 the South Devon & Tavistock Railway opened followed in 1865 by the Launceston & South Devon Railway. Both these were taken over by the South Devon Railway and then the GWR resulting in the WR branch line from Plymouth to Launceston. Final passenger services ran on 31 December 1962, having been delayed by the blizzards in a notorious West Country winter and most of the branch closed except for freight services from Lydford to Tavistock South and Lydford to Lifton. BR though had desires to close the ex-LSWWR North Cornwall line but wanted to try and retain freight to Launceston so they investigated the possibility of re-opening the Lifton to Launceston section of the branch and hence this inspection special. The line was re-opened to freight on 7 September 1964 using D63XX diesel hydraulics but closed completely on 26 February 1966.

There is photographic evidence of a steam special on this line on 5 September 1965 so the inspection saloon was not the last steam loco to work over the branch. This class of loco did not work passenger or freight services on the line before 1963, services being in the hands of GWR 45XX, 4575, 57XX & 64XX classes in later years. The steam hauled freight from 1963 to 1964 did use Ivatt class 2 tanks serviced from Okehampton shed which is where the inspection saloon loco came from.

John Fissler
ELECTIONS

We extend a warm welcome to the following newly-elected members:

Companion

Jones S Thales Rail Signalling Solutions
Kilby M Thales Rail Signalling Solutions
Knight P Thales Rail Signalling Solutions

Fellow

Elavarasan M Southern Railway India
Kumar P Eastern Railway
Manohar S South Western Railway

Member

Advani P-C Westinghouse Rail Systems
Chawla P Ministry of Railways, Govt. of India
Holtzer J NS Passengers
Kaushik V Northern Railway
Leung K W MTR Corporation
Macheev O Canarail Consultants
Mukhopadhyay S Eastern Railway
Rogers D Connell Wagner
Sarveswara Rao P McML Systems
Senesi F Alstom
Tuhácek I AZD Praha
Veltman M Lloyd’s Register Rail Europe
Zigerman L DoorZigt

Associate Member

Ballal P Infotech Enterprises
Bhamidipati V S McML Systems
Bond S P Network Rail
Donaldson D Northern Ireland Railways
Duggirala V V N Infotech Enterprises
France M Babcock Rail
Jones G R Mott Macdonald Railways Division
Joshi K C SERCO Middle East
Lauthier J ALSTOM Transport
Montgomery S Westinghouse Rail
Ngandi M A Metro Rail South Africa
Theralo G B McML Systems
Thorne N TICS
Ukrayinets K Ansaldo STS

Accredited Technician

Stark G Network Rail
Wheatley M P Tube Lines

Associate

Fung S M J Alstom Transport
Kierans L Lloyds Register Rail
Lawrence K A WSP Group
Ly T Q Westinghouse Rail Systems Australia
Maddali S McML Systems Private
Onuoha V I Carillion
Packham C J IBI Group
Sharma M MA Softech Railway Solutions
Shunmugam G VicTrack Access
Smith D Westinghouse Rail Systems
Thompson A Network Rail
Thurston W Mauansell AECOM

Student

Akella N McML Systems Private
Bailey T Network Rail
Balasubramanian A McML Systems Private
Bhaskaran G McML Systems Private
Chaudhari S McML Systems Private
Dharmalingham K P McML Systems Private
Durairaj D McML Systems Private
Ganapa S McML Systems Private
Hanney S J Not stated
Gu E Ansaldo-STS
Joshi M McML Systems Private
Kumar A RITES
Kumuran N J McML Systems Private
Madhumati E McML Systems Private
Moona S McML Systems Private
Murugesan M McML Systems Private
Nazir F Rites
Nisbet A S C Network Rail
Singh K P McML Systems Private
Sriramulu Gajapathy G P McML Systems Private
Thiruvelaikandan G McML Systems Private
Verma S McML Systems Private
Yu Z K Westinghouse Rail Systems Australia

TRANSERS

Member to Fellow

Bates P H Network Rail -Thameslink
Findlay I A Network Rail
Majer C P Network Rail
Sundareswaran K P United Group Infrastructure

Associate Member to Fellow

Sinha A K Invensys Rail Systems India

Associate Member to Member

Gupta P Delhi Airport Metro Express
Hampton I M Siemens
Kettle P Network Rail

Accredited Technician to Member

Norton T Kellogg Brown & Root

Student to Member

Chong Y-Y Parson Brinckerhoff

Associate to Associate Member

Fenner M R Metronet
Sivapragasam U S Yeoh Tiong Lay
Wakankar M Bombardier Transportation India

Accredited Technician to Associate Member

Holmes R M TICS
Kenny N E Babcock Rail

Student to Associate Member

Uddin F Westinghouse Rail Systems

RE-INSTATEMENTS

Alli A O
RESIGNATIONS

Benson H Morrison MM
Cartlidge R Palm ET
Cassells A Pay PL
Cobb AJ Trimmer RJ
Foster J Vandecлись J-M
Giorgioni D Vickers DT
Hardie PGS Williams A
Harrison-Jones A Williamson F
Haseltine DH

DEATHS

It is with great regret that we have to announce the deaths of the following members:

Bowles A
Di Marco B C
Feuerherdt D J
McGoay M
Reeks J
Robinson S A
Shaw F

Current Membership Total is 4537

On the move …..

Christoph Theis spearheads Invensys Rail German expansion

10 June 2009- Christoph Theis has been appointed as Invensys Rail’s Business Development Director for Germany, as the railway signalling and control systems provider continues to build on its considerable successes in the European market.

Christopher Theis has extensive experience of the German rail industry, having worked in DB and as a consultant in the industry for many years. On his appointment, he said: “I am extremely excited about helping to build on Invensys Rail’s achievements in Germany. Our comprehensive range of solutions, already proven in many countries across the world, will ensure we can help maintain Germany’s position as one of the world’s great railway markets”.

He will be based in the new Invensys Rail office in Westhafenplatz 1, Frankfurt/Main.

Prophet foresees bright future with Invensys Rail

15 June 09- As the world’s rail industry ramps-up investment in advanced technology, railway signalling and control systems company Invensys Rail is enhancing its senior management team with the appointment of Richard Prophet as Global Sales Director.

Prophet joins from Cable&Wireless Worldwide, where he was VP International Sales. Before that, he held senior positions with market-leading IT companies including Lucent and Compaq.

“I am delighted to be joining Invensys Rail at this exciting time for the global rail industry. My experience in major outsourcing and managed services projects fits well with the company’s focus as it builds on its best ever results for the last 12 months” he said.

Richard Prophet will be based in Invensys Rail’s UK headquarters at Chippenham in the UK.

Obituary: Alan Bowles

Alan Bowles (61) sadly passed away at home on the 26 April 2009, after a long illness.

Alan had spent his entire working career in the railway industry, having started work from school on the 7 October 1963 for British Railways, which was then still part of the British Transport Commission. Alan’s first position was a P&T ‘A’ Junior Draughtsman based in Derby under the watchful gaze of Mr L R Insley, but he had to move to Nottingham shortly afterwards as part of a re-organisation. After a period in the drawing office learning his trade, he moved into his first management post in 1975 as the Electronics & Testing Assistant. Further promotion came again in 1983 when he became the Signalling Technical Support Assistant. In 1993 another re-organisation saw Alan move back to Midland House in Derby, where he was based for the next 15 years.

In 1995 privatisation came to Eastern Infrastructure Maintenance Unit, where Alan then worked. He took a position within the Balfour Beatty Rail Maintenance division as Development Engineer until re-bidding of the Midland Main Line maintenance contract, at which time he moved into the projects side of the business as the Signalling Compliance Engineer.

Testing and commissioning was a feature throughout Alan’s career, with his cool, calm and methodical approach helping to bring tranquillity to many a fraught situation. Even when trains were standing, it was only a minor irritation! He considered the re-instatement of Kentish Town relay room to be one of his proudest moments following the fire which destroyed the previous interlocking.

Away from work Alan found relaxation at home in his garden in Shelton Lock, Derby - there was always a project to be considered! Family and friends were always important to Alan. He was often to be found at the home of one of his children helping out with decorating or alterations. Travel always held a great fascination for Alan both, at home and abroad. In recent years he had attended many Institution technical visits and conventions across Europe with the ‘Derby posse’.

Alan will be sadly missed by all, not least for his knowledge of railway signalling but also for his sense of humour and as a companion in various world wide hostelries where the aim was stop the stock from going bad.

Ian Bridges
AUSTRALASIAN SCHOLARSHIP

The IRSE Australasian Section invites applications for a scholarship for the railway signalling and telecommunications course offered by Central Queensland University (CQU). The scholarship is available to a young engineer from an ASEAN country, that is Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand or Vietnam.

Courses
Applications will be accepted for either of the two distance education Railway Signalling & Telecommunications programs offered by CQU:

- Graduate Diploma of Railway Signalling & Telecommunications programme over six terms which can be completed in a minimum of two years;
- Graduate Certificate of Railway Signalling & Telecommunications programme over three terms which can be completed in a minimum of one year.

Eligibility Criteria
The candidate must be less than 27 years of age and be qualified with a Bachelor of Electrical/Electronic Engineering degree. Other engineering degrees will be considered.

- The candidate must be currently employed in the railway signalling or communications industry by a recognised employer and have completed at least 1 year of work experience in the appropriate field.
- In addition, the candidate’s employer must be agreeable to allowing time for study and providing a work-based course mentor available for the duration of the program.
- Candidates must also be selected by IRSE based on their personal aptitude, competency and motivation by completing an online test.

Scholarship Funding
The candidates eligible for the scholarship of Graduate Certificate of Railway Signalling program will receive a scholarship of AUD 8400, which covers the tuition fees for the total three terms that can be completed in a minimum of one year.

- The candidates eligible for the scholarship of Graduate Diploma of Railway Signalling program will receive a scholarship of AUD 16800, which covers the tuition fees for the total six terms that can be completed in a minimum of two years.
- In addition, the scholarship covers the cost of travel to Australia, accommodation and living allowance for the compulsory induction program at the start of the course and for the final project presentation for the diploma course.
- The scholarship funding will not cover any other fees associated with the course such as the provision of textbooks, reference materials.

Further Details
More details including additional Terms and Conditions and the Application Form may be found at http://www.irse.org.au. First click on Education, and then select CQU Scholarship.

WANTED – IRSE MEMBERSHIP CONTACT OFFICERS

There are many parts of the world where the IRSE does not have a local Section. In these areas it is often difficult for potential new members to find out about the Institution, and, more particularly, find someone who can help them with membership application forms – either understanding and completing them or alternatively finding people who can act as Proposers.

We wish to resurrect the idea of having Membership Contact Officers for a number of countries. These would be members of the Institution, ideally either Member or Fellow, who would be willing to have their name, and also if possible their contact details, i.e. email address and telephone number, published on our website so that potential members could contact them either directly or through the London office.

We do not envisage that this would be an onerous task, but you would need to have some understanding of the membership structure, i.e. Fellow, Member, Associate Member, Student, Associate and Accredited Technician. Full details are on the website in any case.

The countries we are particularly looking to cover are Austria, Belgium, Brazil, China, Denmark, Ireland, Finland, France, Greece, Hungary, Indonesia, Italy, Japan, Malaysia, Norway, Pakistan, Portugal, Saudi Arabia, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, UAE. In addition, we have a very small number of members in Eastern Europe, Poland, Czech Republic, etc. and so any help to cover that area would be appreciated.

If you are willing to be a Contact Officer, please would you email me at colin.porter@irse.org, and I will add your name to the list and send you some relevant information to help you in the role.

Colin Porter, Chief Executive