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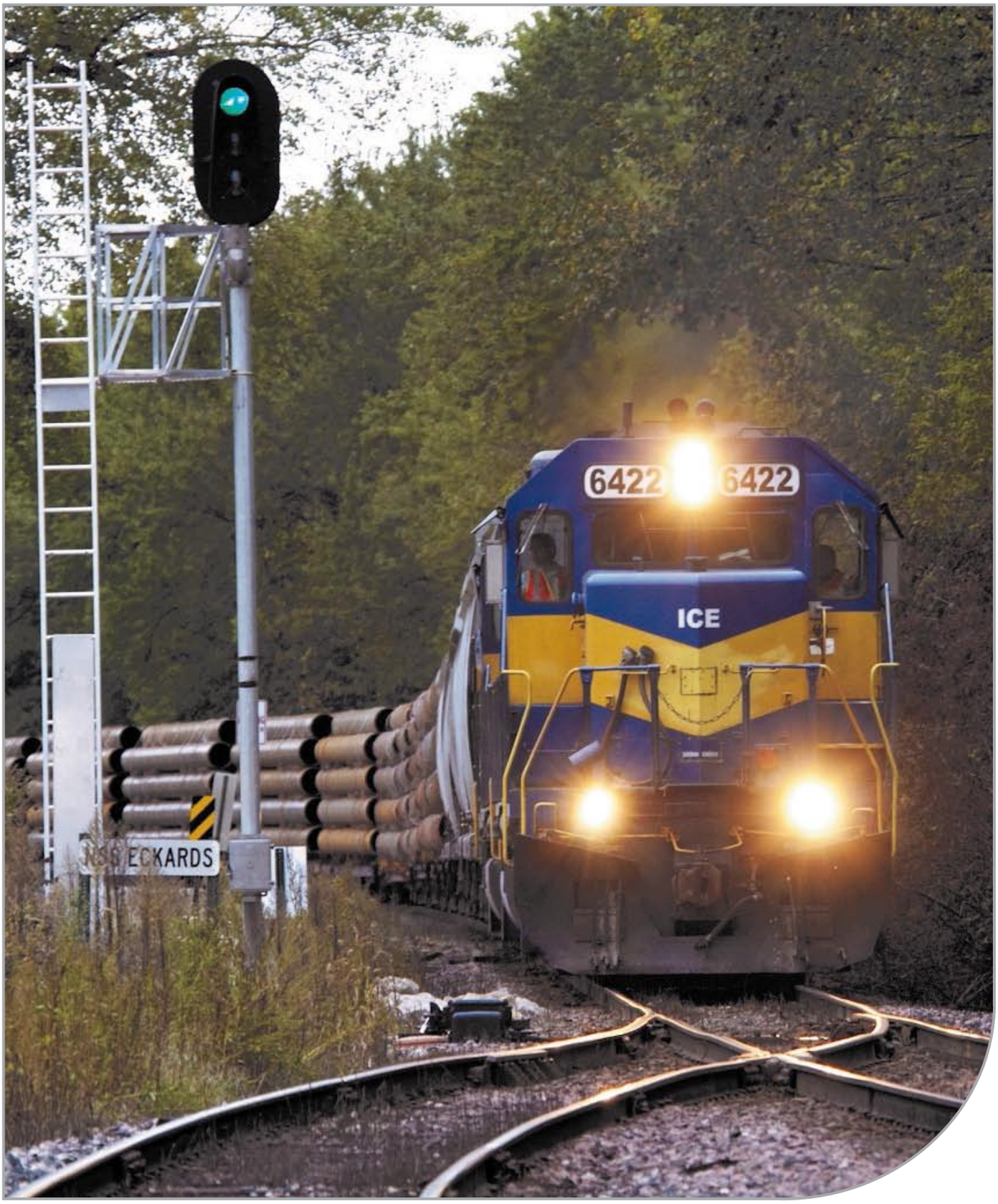

Front Cover: Dakota, Minnesota & Eastern train Second 170, bound from Minneapolis, Minnesota to Kansas City, Missouri, passes the radio-activated switch at the north siding switch Eckards, Iowa, on 4 October 2009. This is one of several locations on the DM&E system where radio-activated switches are used to expedite train operations without the expense of a full Centralized Traffic Control (CTC) installation.

Photo by Jon Roma

NEWS VIEW 161

Let's plan for the future

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The UK Government has unveiled their spending review during October, pledging to invest more than 30 billion pounds on transport projects over the next four years, with this sector seen as a particular key driver for economic growth and productivity. This includes 14 billion pounds of funding that will go to Network Rail to support maintenance and investment, including improvements to the East Coast Main Line, station upgrades around the West Midlands and signal replacement programmes in various parts of Wales.

This may be good news for the signalling and telecommunications industry in the UK and in Europe, but how long will it take to undertake the tender process and award the various contracts? Is it now a common issue that signalling and telecommunications contracts take a long time to tender and costs quite a bit of money to do so, both in the UK and the rest of the world? Your feedback from your part of the world would be appreciated.

After becoming a successful contractor and winning work, the next issue is resources. In this day and age, we need experienced and competent resources to undertake any required works. But these appear to be becoming fewer and fewer.

As an Industry, we must start thinking about our current and future resource requirements now, in order to avert problems in the future. As a modern Institution, we wish to assist and develop our current and future members as to their particular needs and requirements for their ongoing career development. Project Sponsors around the world are requested to provide an indication of the resource requirements overall for the Industry and the Institution to work together to ensure these requirements are achieved in a timely manner!

I write these words a few days before departing to India for this year's International Convention, to which I am very much looking forward to attending. Please continue to support the Deputy Editor in my absence to ensure the timely production of the December issue!

The Editor

IN THIS ISSUE

Engineering High Speed Rail for Great Britain

By Andrew McNaughton FREng FICE FCILT CompIRSE

Paper to be read in London on 10 November 2010.

In Britain, about once a century for the last few hundred years, a new long-distance surface transport system has been planned and built to meet the developing needs of a continually advancing society. The 18th Century brought the canals which enabled freight, raw materials and finished products to be transported at the start of the industrial revolution; the 19th brought the railways which enabled the move from rural to city living and also made possible the mass movement of people. The 20th Century of course brought the trunk motorway network, which transformed personal travel. That it has taken over sixty years from initial agreement on the purpose, basic standards and shape of the motorway system to provide a continuous link between London and the central belt of Scotland reinforces the epic nature of such enterprises - they are the work of generations.

We are now well into the 21st Century, but only now are we considering what we need to promote the economic and environmental health of Great Britain for the next hundred years. That there will be significant changes to our way of living during this period is increasingly accepted, even if just what those changes will be is not. I discuss here the extent to which high speed rail is one of the necessary solutions to Great Britain's communication needs, as well as how we harness the technology. In this I draw on material from many sources, good friends and colleagues, but the assertions, comments (some possibly provocative) and conclusions are mine and mine alone.

High speed rail has of course been constructed successfully in many countries across Asia and Europe, and it is being developed seriously in North and South America currently. What we now recognise as high speed rail was first seen in the opening of the Tokaido Shinkansen in 1964 - its essence being a step change in speed and reliability through creation of a new line, dedicated to high traffic flows between major cities and optimised in all its engineering and operational aspects for that purpose.

In Britain we have followed a different path so far - we have become known for our expertise in progressive improvement of our Victorian heritage. However, the more successful our classic railway has become the more difficult it is to achieve further improvement at an affordable cost. Also we do not escape the fundamental constraints of the configurations and standards adopted by our forebears, despite their considerable foresight, and they make it increasingly difficult to meet the needs of, and harness the technology available in, 21st Century Britain.

Ask the person in the street what high speed rail is, and they may speak admiringly of French TGVs, sprinting long distances across largely unpopulated countryside, or Japanese "bullet trains" - a term which, I observe, covers anything above a fast crawl. The positive side of this is that the engineering concepts and technologies underpinning high speed rail are accepted as providing a known and proven safe transport system. However it is the business need which determines how those engineering systems and technologies are deployed - in other words, how high speed rail "looks and feels". By far the most important question, before embarking on a national infrastructure project, is not an engineering or operational one, or a "railway" one, or even solely a transport one. It is, "What is it for?" Thus there are very great differences between what has been built in France or Spain, with long stretches of separate new lines between major population centres, and in Germany or Holland, where people live in a multiplicity of cities which are very close together, and new lines plug into a complex network.

Two of the fundamental step changes which could be offered by high speed rail are **speed** (not surprisingly) and **capacity**; let us consider what the scope for each of these is and what they might bring to 21st Century Britain.

The maximum commercial speed of high speed rail has increased steadily since that first Japanese line was opened, in step with the world rail speed record, through developments in every engineering discipline. The 300 km/h of a decade ago is now 350 km/h, and we edge ever nearer to the 400 km/h (250mph) which many of us believe to be the "sound barrier" of high speed rail - the point at which diminishing journey time savings resulting from going faster will probably always be outweighed by the exponentially increasing energy and other costs of doing it.

Why high speed at all? There is no virtue in speed for its own sake. What is the opportunity that high speed can bring to Great Britain? We already run the fastest **classic** trains in the world, achieving station-to-station average speeds of up to 160 km/h. For that we have to consider the geography of the country - the economic geography as well as the physical.

For high speed rail to equal the door-to-door journey times by air between the major centres of London and the central belt of Scotland, typically 4 hours, the rail journey time needs to be around 2½ hours (see Figure 1). However the number of air travellers in Britain is rather small, and there could never be a case for constructing a huge surface infrastructure system to replace a few handfuls of air movements.

Andrew McNaughton is Chief Engineer of High Speed Two Ltd. He is also Special Professor of Rail Engineering at Nottingham University and Visiting Professor of Engineering at Imperial College, London.

Careers in Signalling & Telecommunications

Project Engineer - Signals
Job Type: Permanent
Location: Reading
Salary: £35,000 - £45,000

Project Engineer - Signals
Job Type: Permanent
Location: Reading
Salary: £35,000 - £45,000

Senior Signal Engineer (Tools & Methods)
Job Type: Permanent
Location: Birmingham
Salary: £50,000

RDE - Signalling - Midlands
Job Type: Temporary / Contract
Location: Derbyshire
Salary: £400 - £500 per day

Signalling Design Verifier
Job Type: Temporary / Contract
Location: Manchester
Salary: £350 - £450 per day

Project Management Assistant - York
Job Type: Permanent
Location: York
Salary: £19,000 - £25,000

Project Engineer - ATC
Job Type: Permanent
Location: Chippenham
Salary: Negotiable

Signalling Project Engineer
Job Type: Permanent
Location: London, England
Salary: £40,000 - £47,000

Senior Project Engineer - Signalling
Job Type: Permanent
Location: Rugby
Salary: £48,000

Lead Design Manager - Croydon
Job Type: Permanent
Location: Croydon
Salary: Negotiable

Delivery Project Engineer - London
Job Type: Temporary / Contract
Location: London
Salary: £350 - £400 per day

Rail Infrastructure Estimator - Contract
Job Type: Permanent
Location: Birmingham
Salary: £48,000

Principles Design Engineer
Job Type: Permanent
Location: London
Salary: Negotiable

Signalling Design Manager
Job Type: Permanent
Location: Manchester
Salary: £2,500 - £2,750 per week

Senior Technology Engineer [Radio]
Job Type: Permanent
Location: London
Salary: £40,000 - £50,000

Site Manager
Job Type: Permanent
Location: Birmingham
Salary: Negotiable

Design Engineer (Signalling)
Job Type: Permanent
Location: Manchester
Salary: £41,000

Project Engineer (Signalling)
Job Type: Permanent
Location: Swindon
Salary: £38,000

Assistant Project Engineer (Signalling)
Job Type: Permanent
Location: London
Salary: £25,000

Senior Project Engineer (Signalling)
Job Type: Permanent
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Technical Planner - Rail
Job Type: Temporary / Contract
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By far the greatest volume of "long distance" travel is by car - by one or two people. Even in Japan, when a family plus luggage wants to visit relatives or go on holiday, the car is the rational transport solution. Classic rail competes well with the car on city to city journeys of around 250 km or more, particularly with the amount of road congestion approaching our urban centres. On shorter journeys the time difference door-to-door is not enough to promote modal shift.

If the connectivity at the starts and ends of journeys is appropriate then high speed rail has the potential to create a very different passenger transport landscape. As an example, one of the biggest daily flows is between our second and third cities, Manchester and Birmingham, which are just 120 km apart. Classic rail and road have similar centre-to-centre journey times, and in consequence rail has 4% of the market where road has 96%! To compete with the car, the main rail leg - assuming well-placed stations, which I discuss further below - has to be less than three quarters of an hour. Only genuinely high speed rail, by which I mean at least 320 km/h, has the ability to meet this challenge.

The latest generation of high speed trains, now emerging from testing, can cruise at 350 km/h while accelerating to and braking from full speed in the same envelope as the last generation of 300 km/h trains, and they use no more energy and make little more noise in so doing. Are these trains attractive to car users? For many years, Ferrari advertised successfully with the slogan, *No Italian dreams of growing up to be a train driver.* The first buyer of the new Alstom AGV train is a consortium which includes Ferrari!

We in Britain have the constant issue of our 19th Century standards - a small structure gauge and smaller stations with short platforms, positioned in locations which were highly relevant to Victorian Britain. If we create a high speed network then we would seek to future-proof our designs - including for 400 km/h when we can, and serving the cities which will grow through the century - with confidence that our children will thank us. But in our crowded country this will not be easy. Our country is going to become more crowded, and planning is based on the inevitability that, even without significant further economic migration, the population will grow by around twenty million over the next half century. Combine this with an increasing desire for mobility - which developments in personal commuting and connectivity promote rather than diminish - and a policy of avoiding building major new motorways, and there is indeed a rail transport capacity "crunch" in the near future. And that is before inroads are made into the modal share of existing journeys.

It is the potentially very high growth in demand that makes it possible for us to countenance the very high cost of building a high speed rail network in our densely populated country, and the business case depends absolutely on exploiting its potential capacity to the maximum.

Practical capacity is an outcome of balancing **speed** (or more accurately the ability of trains to stop, hence headways), the **mix** of speed and stopping patterns of trains using the line, and **reliability** (robustness to minor perturbations). All technology and operational practices being equal, if we increase one of these parameters then we can expect to compensate by reducing one of the others.

Capacity can be expanded though, by exploiting the freedom of operational practice which a new high speed rail system permits, and targeting engineering innovation where it will make a difference. Into the first of these categories comes avoidance of multiple speed bands and stopping pattern services (see Figure 2). On our classic railway this is still the biggest destroyer of capacity, and with it the business case. Indeed the ability to avoid mixed working has been at the heart of the success of high speed lines around the world.

Technological advances continue to be made, improving train braking performance from high speed as well as increasing acceleration. We can foresee the need for control system developments to enable us to reduce train separation at full high speed (say 360 km/h) on open line to around two minutes. But of course practical headways depend on junctions and turnouts. The Civil, Mechanical and Electrical engineering worlds of the humble turnout actually dictate capacity, not the open line. One of the bigger challenges to achieving optimum capacity is the further development of high speed turnouts. Today's maximum diverging speed of 230 km/h is tolerable provided advances are made on operational time to hold headway at no longer than around three minutes.

At this point, as well as seeking better turnout control systems we have to reduce variability in running; otherwise reliability will be the component of this equation which suffers, as has been seen elsewhere on occasion. The Japanese achieve reliability with stunning discipline on the part of all those involved in the operational process- - in control centres, by drivers and, crucially, by platform supervisors.

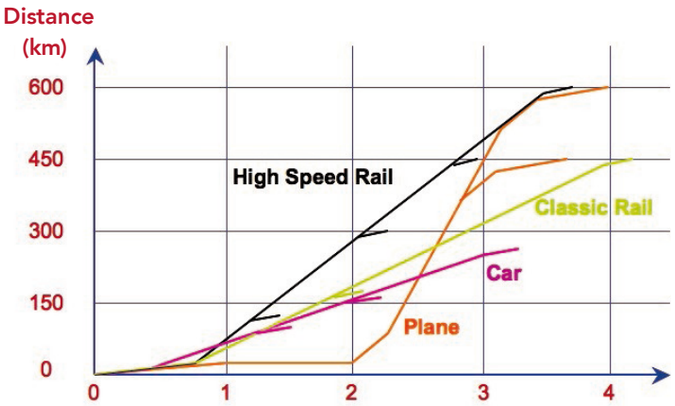


Figure 1 Door to door journey time

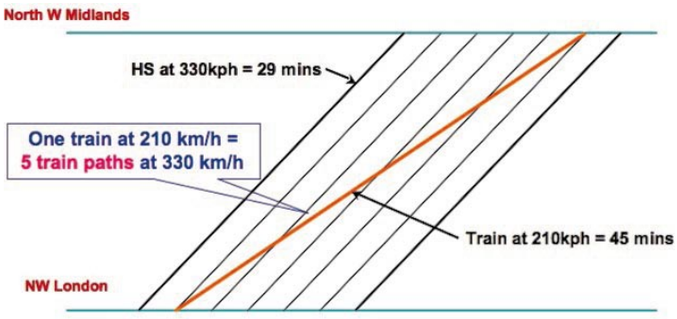


Figure 2 Avoiding traffic speed mixes

Figure 3
Higher, wider trains

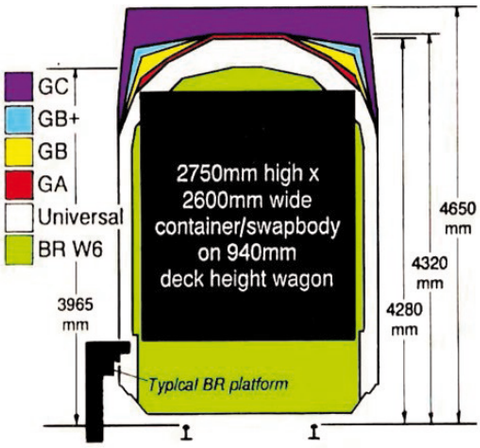


Figure 4 The Olympic Park Box at Stratford on HS1

The human operators, their selection, training and leadership, will remain the make-or-break of intensive high speed line operation, and thus its capacity and business success. However, by the time a British network is constructed I am convinced automated train control and operation will be possible on high speed lines, just as with aircraft and metro rail systems.

Put simply, ERTMS Level Three or its modern equivalent replacement - operating on a modern radio based bearer system, rather than obsolete GSM - and automatic train operation, ATO, are what will be needed for high speed rail to deliver the capacity that the travel needs of this country will demand.

Where we can run trains on a new route separated from classic rail, and thus from our Victorian legacy of train size, we can exploit not only the economics of adopting European standard products and technologies but also the capacity opportunities as well. Thus by using interoperable 200 m long trains coupled in multiple, with the greater internal space which European gauge permits - including potentially double decking - each high speed train service could have around double the seating capacity of a classic British inter city train (see Figure 3).

Specially designed high speed trains needing to run on to the classic network to reach their destination (which tend to be called "son of Eurostar") would not have such capability - there is no magic solution to overcoming our heritage. So an initial service as envisaged for High Speed Two, using today's technology of trains and control systems, with allowances for all the factors of a majority of specially designed trains running on to the classic network, would have a capacity of around 9000 passengers per hour. Even this is equivalent to one new motorway.

In time though a wider, largely segregated network with mainly standard high speed trains, exploiting the technology advances to be expected during the two decades required to build even High Speed Two, would give an hourly capacity of double that – 18 000 passengers per hour or more. Two new motorways' worth of capacity are avoided in one high speed line using just a 25 m wide strip of land.

The implications of this enormous capacity have to be thought through for the remainder of the system, the stations themselves and passenger handling and dispersal through connecting modes. At full capacity a terminal station at the end of this trunk in London would be handling the equivalent of a full jumbo jet departing and arriving every minute at peak times. Thus into the biggest city in Europe we are seeking to add something the size of an airport terminal. We will need to spread the load, with a second station on the approaches to central London constructed where there is sufficiently good connectivity with public transport systems that the train journey time penalty would be more than an offset by the improved connectivity and the lessening of the load on connecting modes at the central terminus.

This leads on to the wider question of "city centre" or out of town "parkway" stations. Before addressing this major issue, let us reflect on the scale of the facilities involved in either for any significant sized city north of London. A station is more than the platforms alone, substantial as they are at over 400 m long. As can be seen at Stratford in East London (Figure 4), a site over a kilometre long is needed to construct the simplest of stations. It has been observed to those who would wish to build "through" stations in our great Northern cities that superimposing a plan of even the size of the Stratford "Box" on any such city centre would largely eliminate it.

It will be challenging enough to create central terminus stations. Mostly the classic rail corridors are full, and the policy of the last fifty years of commercial disposal of railway terminal and line-of-route land deemed surplus to immediate requirements stands as a monument to the British aversion to strategic land use planning.

The answer to the question "city centre" or "parkway" is almost certainly "both" for our larger conurbations if the objective is to exploit fully the expensively created potential of high speed rail. For every journey which is from city centre to city centre - and there are sufficient of those to make the very expensive central access viable - there are many more which are not. Travel between many cities is often from home in the suburbs of City A to centre of City B or to its suburbs. People can then travel from home to parkway (or interchange if we are really progressive and plan our local public transport around the new facility) and thence by fast frequent high speed rail services to their destination city. If they have to spend time and effort first going into the centre of their home city, the journey will not be attractive.

For smaller cities, where demand is sufficient to make stopping a high speed service viable but not enough to justify the cost of urban penetration, the optimum solution may well be to get as close to the centre as possible with a through route and then concentrate on providing excellent connections in the city itself. Again success stories abound in Europe, where in following years the city has grown towards the high speed rail

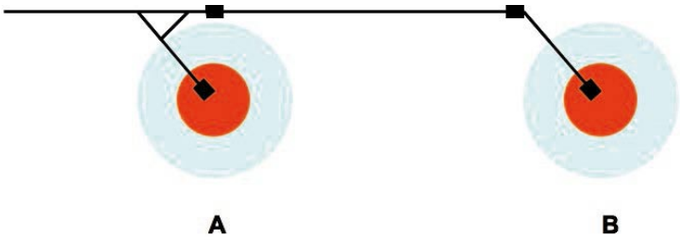


Figure 5 City centre AND parkway stations

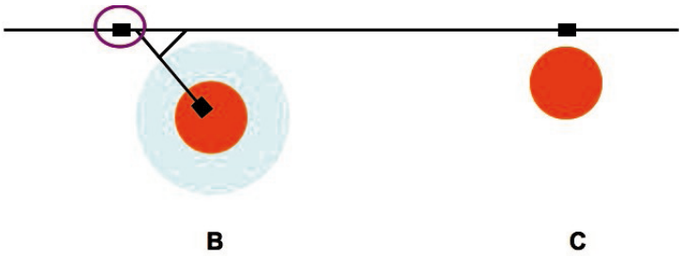


Figure 6 An alternative approach

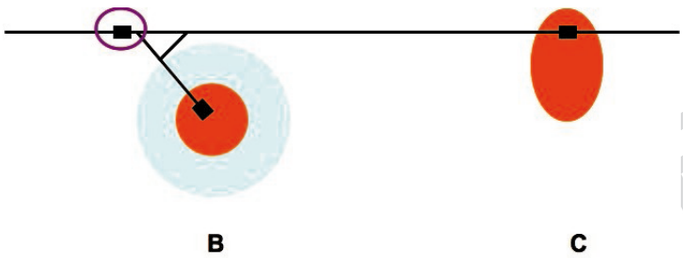


Figure 7 City C develops towards the high speed line

station with new business development complementing historic and commercial quarters. (See Figures 5, 6 and 7).

What we see elsewhere, and must seek to replicate in Britain, is a proper joining up of land use planning as well as transport. High speed rail is sufficiently dramatic in its effect to make joined-up thinking a necessity if the full benefits of a very expensive new transport system are to be captured.

The realities of high speed rail route design in the most crowded country in Europe, starting with its most densely populated part, may be illustrated by the challenges faced by High Speed Two Limited in devising, not simply a route, but the **best** route for a new high speed line between London and the West Midlands and beyond. One-sixth of the route is urban, just to get clear of London. The next sixth is in the Chilterns, an area of outstanding natural beauty and one in which a surprisingly large number of people live in an almost continuous succession of towns, villages and hamlets allowed by the planning policies of laxer times. There is then some equally attractive and equally populated countryside before the last sixth in the built-up areas of the West Midlands. A new high speed line has to miss centres of population as well as places of historic significance and of natural beauty, and wildlife and other habitats. Alignment to avoid impacts is very challenging.

Following existing transport corridors is impractical. Not only are existing alignments far too twisted to allow the necessary speed, but examination of maps quickly shows how townships and extensive transport and other infrastructure have built up beside and along much of their length. High speed trains do however have sufficient power to mount relatively steep gradients. This is most useful in that it enables a line to be designed to hug the undulating land which much of the route traverses, minimising high embankments and viaducts which may be seen as intrusive both visually and acoustically.

Then there is the possibility of tunnelling. Some are such enthusiastic advocates of this that they must obviously remember the maxim, "Out of sight, out of mind," from their childhood. Before the movement towards creating the world's first high speed tube line is launched though, it needs to be remembered that tunnels cost many times as much as surface routes, are very large indeed to cope with aerodynamic pressure effects, even at relatively slow speeds above 250 km/h, and cause great disruption during construction with the movement of vast quantities of excavated material. The energy to create a tunnel dominates any calculation of the construction carbon of a new line, and similarly dominates the operational energy consumption equation.

European research leads to the conclusion that high speed rail is more energy efficient than other long distance transport modes (see Figure 8). This includes classic rail if it is used for high-volume flows between major conurbations, so that trains have high loads factors and the line capacity is exploited to the full. Like planes, high speed trains use most energy in initial acceleration. Intermediate stops have a second negative effect in lowering load factors over the end to end journey.

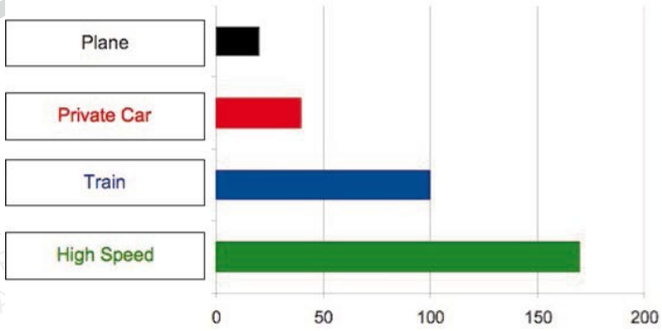


Figure 8 Passenger km per kg equivalent petrol

The energy debate is further complicated by carbon issues. Having touched on construction carbon for a new line, we have to remember that the energy for high speed rail is as low-carbon as the means of electricity generation. In France this is a very good story, with over 90% of electricity coming from zero-carbon sources, mainly nuclear. In Britain the picture is currently poorer, and likely to become even worse, with even the relatively small proportion of non-carbon electricity generation coming from nuclear power stations being replaced largely by gas (carbon), as they are due to close in the next decade (see Figure 9).

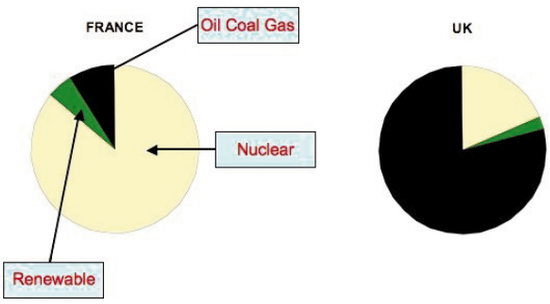


Figure 9 Power generation mix

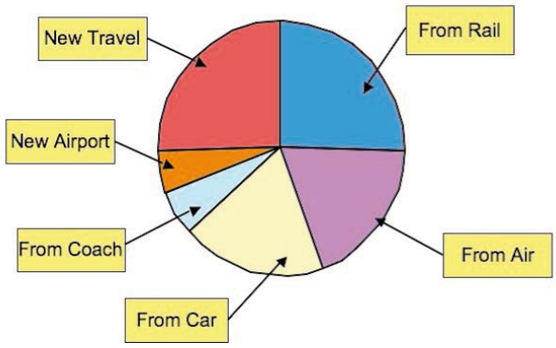


Figure 10 Modal shift and growth

From	To	Present best	High speed rail
London	Birmingham	1 hr 24 min	49 min
	Manchester	2 hr 08 min	1hr 15 min
	East Midlands	1 hr 40 min	53 min
	Leeds	2 hr 15 min	1hr 20 min
	Newcastle	3 hr	2hr 35 min
	Scotland	4 hr 20min	3hr 30 min
Birmingham	Manchester	1 hr 34 min	40 min
	Leeds	2 hr	1hr 05 min

Of course the green credentials of high speed rail are boosted by modal shift from less energy efficient alternatives. Across Europe, high speed rail has been very successful in drawing traffic from classic rail, air and car (see Figure 10). However it has also made it easier to access airports, promoting airline growth, and it generates new traffic through promoting economic growth and prosperity.

Meanwhile the air industry is making significant progress in reducing energy overall, and carbon in particular, by optimising new plane design for specific markets and by being at the forefront of exploiting new materials, fuel mixes and engine technologies. Cars too continue to improve. A saloon widely used by today's motorway-based business traveller has a petrol consumption around 35% better than the same model when introduced two decades ago, and yet more passenger friendly features have been engineered into its design.

The problems and opportunities arising from through running, off the new dedicated high speed routes on to classic rail infrastructure, drive a need for some fresh thinking about solutions which is not wholly constrained by traditional, accepted opinion. When the dedicated new high speed line covers less than a third of the total journey for a London to Scotland run, the costs and complexities of special trains are probably inevitable. The balance might change though were that new line to extend to halfway or further.

Figure 11 shows the HS2 initial network.

Just how difficult can it be to convert a two-track railway in open country free of tunnels to at least GB+ gauge, and what additional opportunity might that bring to other flows such as freight? In reality, the bigger questions are lateral rather than vertical. The stations would require to be placed on loop tracks and the tracks generally would need easing apart. The overhead line would need some adjustment.

An alternative approach, which balances more cost with less disruption, may be to consider creating a third line before moving to adjust the existing ones, or even to follow former railway practice and design sections of "cut-off" route to by-pass certain speed- or capacity-limited sections, which may eventually be joined together to create a continuous high speed line (see Figure 12).

Many of the possibilities around the discussion of connections to London Heathrow Airport lead us, quite properly, to consider solutions similar to France, where the country's main hub airport is located on a line running around, rather than from, its capital city. To what extent Heathrow is potentially a location on a network from the south coast or western cities towards the Midlands and the North is a stage beyond anything considered so far. The physical options are not hard to visualise, but any business case starts with demand and benefit, not fantasy network design.

Our Prime Minister has spoken about the importance of re-balancing the economic activity of Britain, both for social cohesion and to control the trend for London and the South East to be seen as the sole economic generator of wealth and therefore of population growth. High speed rail could make the latter trend unstoppable, with our great northern cities reduced to suburban satellites, or it could promote the future the Prime Minister seeks. The key is in the network

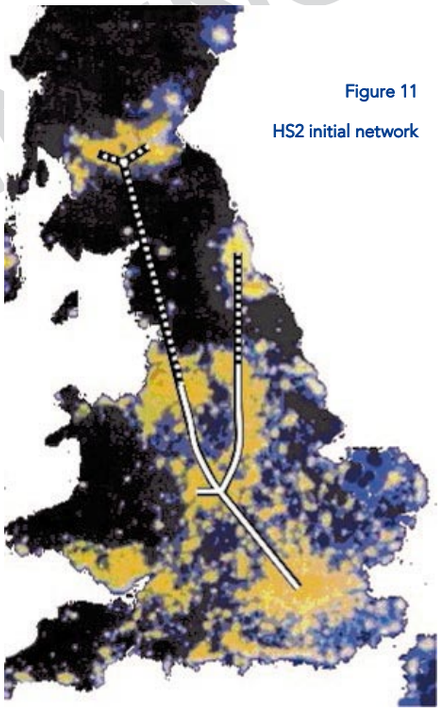


Figure 11

HS2 initial network

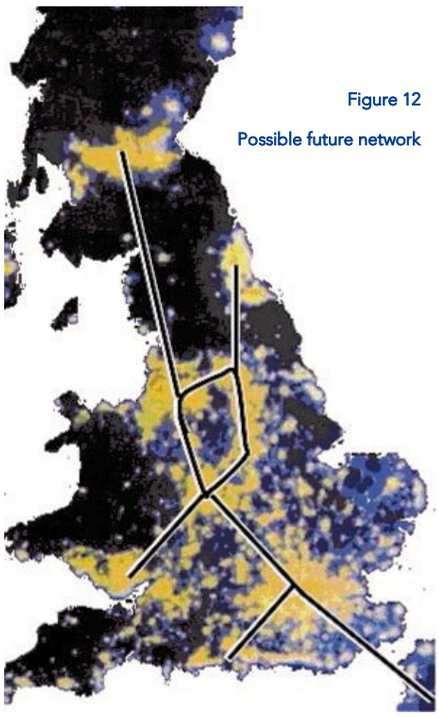


Figure 12

Possible future network

design. Many published studies seem to accelerate the former tendency. However a network designed around the needs of Birmingham starts to look very different and, as ever, the view from Scotland is the opposite of the one from London (Figure 12).

High speed rail holds out the possibility of melding the great cities of the Midlands and North into combined economic units, with the opportunity for a successful future separate from London and the South East, competing on the European stage. London is a large city when business and social meetings are half to three-quarters of an hour apart. Replace Westminster with Birmingham and the Docklands with Manchester or Sheffield - high speed rail can shrink the distance between our cities enough to make this real.

The alternative is that people continue to drift to the South East. Someone cleverer than me could work out how many high speed networks one could build from the money saved from otherwise creating the necessary infrastructure – water, waste, schools, hospitals as well as transport - to accommodate the rising population of Britain in the South East alone.

The engineering technology of high speed rail has been explored, including the opportunities of leaving British railway history behind and developing an operational concept suitable for the country's particular physical and economic geography. The engineering challenges arising from the impact of new very large movements of people on complementary travel modes for the whole door-to-door journey, and of mitigating the effects on communities and landscapes on the new high speed rail corridors, have been outlined.

High speed rail has been placed in the context of future land use planning and the future social and economic landscape of Britain. Politically and economically led, engineering-driven, high speed rail offers Britain a sustainable future.

SSC ATP – A new approach in train protection

By Marco Palombi, SSC Product Manager, and Alessio Ferrari, SSC Systems Engineer

The authors are with GE Transportation ICS

SUMMARY

This paper reports on the SSC Automatic Train Protection approach to rail safety taking into consideration two major topics of this kind of systems: safe track-to-train transmission and how to include different customers/countries driving rules into the ATP functions design.

All of this keeping the product safe, with an affordable cost, minimum traffic disruption and quick deployment.

NOTATIONS

ATP	Automatic Train Protection
BPSK	Bipolar Phase Shift Keying
BTM	Balise Transmission Module
EIRP	Equivalent Isotropically Radiated Power
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
ETSI	European Telecommunication Standards Institute
IP	Information Point
MAAB	MathWorks Automotive Advisory Board
RFI	Rete Ferroviaria Italiana
SCMT	Sistema Controllo Marcia Treni
SIL	Safety Integrity Level
SNR	Signal To Noise Ratio
SSC	Sistema di Supporto alla Condotta
UML	Unified Modelling Language

INTRODUCTION

The SSC (Sistema Supporto alla Condotta, i.e. Driving Support System) ATP is one of the three primary signaling systems now used in the Italian railways (SCMT/SSC/ETCS). It was introduced in 2005 to increase the safety on secondary lines (5000+ km of the entire Italian network) that, until that time, were without any train protection.

One of the basic features of the SSC ATP is the short installation time and minimal traffic disruption during the installation in order to upgrade all the Italian network with train protection.

Moreover, the SSC ATP is to be a cost-effective solution but with the highest Safety Integrity Level (SIL) according to CENELEC norms.

All of these characteristics are achieved using effective design strategies at various levels: from radio matters as well as for software design.

SSC SUBSYSTEMS

The SSC ATP is composed by two subsystems: the Wayside and the On-board unit. The SSC Wayside subsystem is overlaid on the existing infrastructure and it is designed to minimize installation costs and deployment time.

Safe track-to-train transmission occurs at signal locations via low-power microwave channel.

- The SSC Wayside equipment (SSC encoder) is connected to the existing infrastructure (for both power and information) locally at the signal, without the need to pull cables along the line;
- The Wayside equipment including the transmission device (i.e. Transponder) can be installed entirely on the signal pole, with reduced costs for installation, no need to stop the traffic for both installation and maintenance, and higher vandal resistance.

Figure 1 – SSC Wayside equipment (Encoder and Transponder antenna)

The SSC On-board unit equipment is a fail-safe supervision system with minimal impact on the driver's behaviour and maximum benefit for the operating railway.

- The SSC On-board unit equipment is easily installed even when reduced space is available;
- The Man Machine Interface is simple;
- The solid state patch antennas for track-to-train microwave communication (i.e. Receivers) are roof mounted: nothing needs to be installed under the locomotive, this makes the installation time very short and the absence of damage due to objects on the rails results in easy maintenance.

SSC ATP maintenance is simple and does not require any tuning of the equipment. Therefore training for maintenance personnel is greatly simplified.

Moreover, due to the fact that driving rules remain unchanged, training for train operators is therefore greatly simplified. So equipped trains can be immediately put in service to benefit from the increased safety and they can mix with unequipped trains in normal operation.

SSC SAFETY

SSC ATP is designed to be SIL-4 according to CENELEC, the highest level of safety defined by these norms. It is the level of safety required by most of passenger service operators especially in high density operations.

Safety at system level is maintained by linking each Information Point to the next one (rendezvous). The system therefore knows when it has missed an appointment and can take action accordingly.

Moreover, the absence of equipment on the track highly reduces risks for maintenance personnel:

Temporary speed restrictions can be easily set and removed without adding additional, non-linked information points.

SSC ATP is also vandal resistant in that the equipment is placed high above the ground, greatly reducing attractiveness for thieves and vandals. The absence of Wayside cables (from station to pole) also reduces the attractiveness for thieves.

Figure 2 – SSC On-board unit equipment

Figure 3 – SSC Receiver antenna

CASE OF STUDY – ITALIAN RAILWAYS

The evolution of the system has been managed with incremental steps of functional specification released by the RFI (Rete Ferroviaria Italiana, the infra-structure management company of the Italian National Railways).

The first step has been the SSC Baseline-1 that, in order to further augment the system safety, shall be upgraded to Baseline-2. Baseline-2 is characterized by longer telegrams where the concept of vital chain-linking between Wayside information points (basically the Wayside signals) is introduced.

In order to guarantee the train protection independent of the Wayside signalling subsystem (SSC or SCMT), RFI introduced a new set of functional requirements that affected the On-board unit subsystem only (Baseline-3).

The SSC Baseline-3 includes all the SSC functions and adds the SCMT functionalities: coded current cab signal-ling and Eurobalise reader (BTM – Balise Transmission Module). In order to meet these new requirements, GE developed an ERMTS/ETCS compliant BTM.

Moreover a touch-screen LCD panel, which gives enhanced flexibility in terms of information to be displayed to the driver, was added to the On-board equipment together with the Juridical Recording Unit (JRU).

THE DIFFERENT APPROACH TO TRAIN PROTECTION

The SSC ATP is based on a new approach to railway safety from different perspectives: from the radio communication between Wayside and On-board units to the development of the On-board equipment functions.

All of these functions are obtained ensuring the solution to be cost-effective as well as with high scalability and modularity. The goal of the following chapters is go through these items with more details.

THE MICROWAVE AIR-GAP LINK

The SSC Communication Channel (air-gap) is made up with components of the Wayside and On-board unit Subsystems that are dedicated to short-range microwave transmission between the Information Point (i.e. IP) and the On-board unit (namely the Wayside Transponder and the On-board unit Receiver).

The SSC system microwave air-gap works with a microwave carrier in the bandwidth of 5.725 - 5.825 GHz. The maximum power transmitted is 14 dBm (25 mW EIRP) according to ETSI EN 300 440-1. This choice is based on the following principles:

- Reduced antenna dimensions (both for Wayside and On-board unit);
- Component availability and reliability;
- Tested and commonly used technology;
- Directivity: both Transponder and Receiver antennas are designed with patch technology;
- Absence of electromagnetic interferences generated by the locomotive and electric mains.

The Wayside antenna device (Transponder) is semi-passive. The microwave carrier is transmitted from the On-board unit Receiver antenna to the

Wayside Transponder antenna that modulates it with continuity when the Receiver is within coupling range (short-range). The Transponder sends the BPSK modulated information back to the On-board unit for demodulation and decoding.

This principle is the same already in use for many toll payment system in the highways. The difference is that the Transponder is installed in the car, so in the mobile part of the system.

The use of semi-passive devices leads to:

- Power consumption reduction: the Transponder does not have to generate the microwave carrier, but simply modulates it;
- Reduction of interferences that a Wayside device could generate to On-board unit devices situated on a different tracks.

ANTENNAS DESIGN AND INSTALLATION

During the design stage of the SSC microwave air-gap, GE engineers performed several measurements in order to leverage the best performance and avoid of interference between tracks.

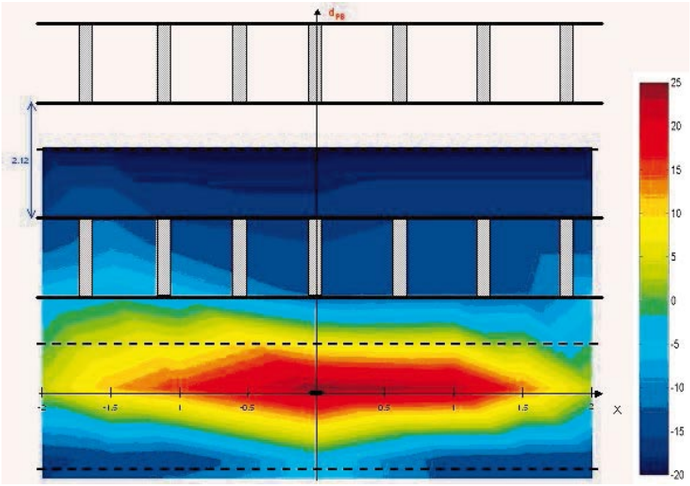
The post-processing of these data using the 6-Sigma process tools available in GE, led to:

- Design of directive beam Transponder and Receiver antennas with different antenna gains;
- Definition of installation rules that take into consideration the angles with which the two antennas are installed one respect to the other.

Figure 4 describes the layout of two adjacent tracks (2120 mm is the minimum distance, in Italy, between inner rails) where the Transponder is in the middle of X-axis. The colours represent the signal strength in terms of Signal-to-Noise Ratio (i.e. SNR), a typical measure of the radio link in digital modulations. The dotted lines represent the Receiver positioning.
The results are shown below:

- One Receiver antenna on a train on the track close to the Transponder varies its SNR level from a minimum required to receive the information to its maximum (yellow and red areas of Figure 4). This means that the Receiver antenna is able to receive the Transponder antenna a couple of metres before and after the Transponder itself long the train direction.

Figure 4 – SSC antennas radiation pattern



- One Receiver antenna installed on a train positioned on the adjacent track is not able to receive any information.

This leads to interferences rejection >30/40 dB (deep blue area) that, because of the semi-passive technology, represents a safe margin even in presence of any type of failure on each device involved in the transmission (Transponder or Receiver antennas).

MAIN BENEFITS

One of the main benefits of the SSC low-power microwave air-gap is the dramatic reduction of cabling needed along the line that greatly improves the cost effectiveness of the complete solution. Copper prices are constantly rising and reducing cables will certainly help containing costs.

For the operations, the Wayside installation requires no equipment between the rails: in most cases the installation of the Wayside equipment requires none or minimal interruption of service.

The limited need for cabling also allows rapid deployment of the solution. For the On-board unit, the absence of equipment under the train greatly simplifies the installation procedure, reducing direct costs (labour) and more importantly indirect costs (train out of commercial operations).

Regarding the maintenance of SSC antennas:

- Wayside equipment: can be done in most cases with no service interruption as the equipment is on the side of the line;
- On-board unit: Antennas for track to train communication are placed on the top of the train, so there is no risk of damage from obstacles along the line, resulting in decreased need of intervention. On-board unit maintenance does not require any intervention below the train so it's faster and does not require special facilities.

In terms of personnel safety the SSC antennas guarantees the following:

- The absence of equipment on the track highly reduces risks for maintenance personnel;
- Temporary speed reduction to protect maintenance people can be easily set and removed without adding additional, non-linked IPs. This capability preserves the chain linking of the IPs and hence the safety of the system.

SSC ATP FUNCTIONS - MODEL BASED DEVELOPMENT

The increase in productivity and facilitation of safety assurance that the adoption of formal modelling and code generation technologies can bring in developing reliable products is described in many case studies. In the metro and railway signalling domain, where the safety culture is traditionally and necessarily strong, there is increasing interest in formal methods and how they can be applied to the development of systems, with automatic train control systems being a leading candidate for these techniques.

Combining formal methods with model driven development and code generation is still at its initial stages within the signalling industry. GE was commissioned for the adaptation of its SSC ATP to Metro Rio. At that time GE was finishing its first

large scale development project that made use of formal model based development

Experimentation with the code generator led to the definition of an internal set of modelling rules in the form of an extension of the MAAB guidelines, a stable and widely accepted standard developed by automotive companies.

The SSC product provided the opportunity to refine the modelling activity toward a more formal approach. Indeed, despite the flexibility and ease of use of code generators, the tools have two fundamental limitations in this type of application: the lack of a rigorous formal semantics and the absence of a certified code generator. In the following chapters it is described how these shortcomings have been addressed during the design, introducing modelling rules to reduce the languages to a semantically unambiguous set, and how design practices have been adopted to gradually achieve a formal model of the system.

MODELLING GUIDELINES

Products traditionally provided by GE, like any railway signalling application developed for Europe and, recently, for many other countries in the world, shall comply with the CENELEC standards. This is a set of norms and methods to be used while implementing a product having a determined safety-critical nature.

In order to develop SIL-4 products, such as the ones GE is traditionally providing, strong constraints are given by the CENELEC standards both on the software quality and on the process recommended practices. Although the SSC for the Metro Rio project was not going to be delivered in Europe, GE decided to develop it with the objective of certifying it according to the CENELEC norm, since these standards remain the first reference for signalling applications and they are widely accepted outside European markets.

The CENELEC EN50128 norm, specific for software of railway safety-critical systems, assesses that the code shall be developed according to coding standards to ensure traceability, structuring and readability of the code. Concerning "autocoding", the guidelines ask for a validated, or proven-in-use translator. In the absence of such a code generator the compliance of automatically generated code to the guidelines is no different from that of handwritten code.

The approach investigated by GE was asking the generated code to obey the same rules about programming style and language subset which are asked for the hand-written code following the EN50128 guidelines. The idea was that only following a suitable modelling style during the model development it is possible to generate a code that is compliant with the guidelines and that can be successfully integrated with the existing one.

Formal modelling requires the definition of a formal language, and this has been addressed by restricting the code generator language to a semantically unambiguous subset through modelling guidelines. On the other hand, when a large requirements set is involved in formal modelling, also the architecture of the model comes to be a fundamental issue. Structuring the model can help in clarifying which are the components of the system and how they are interconnected, bridging the gap between requirements definition and component design. Furthermore, if one is expecting to auto-generate code from the model, its structure also has to take into account the software architecture: an effort has to be made to create formal models having a structure that makes sense also in terms of the architecture of the software system.

ARCHITECTURE DEFINITION

In the context of the project, we found useful to first represent the high-level software architecture through a UML component diagram.

UML component diagrams focus on the interfaces and dependencies of the functional units. Each component is basically defined by a set of implemented interfaces, a set of required interfaces and a set of dependencies.

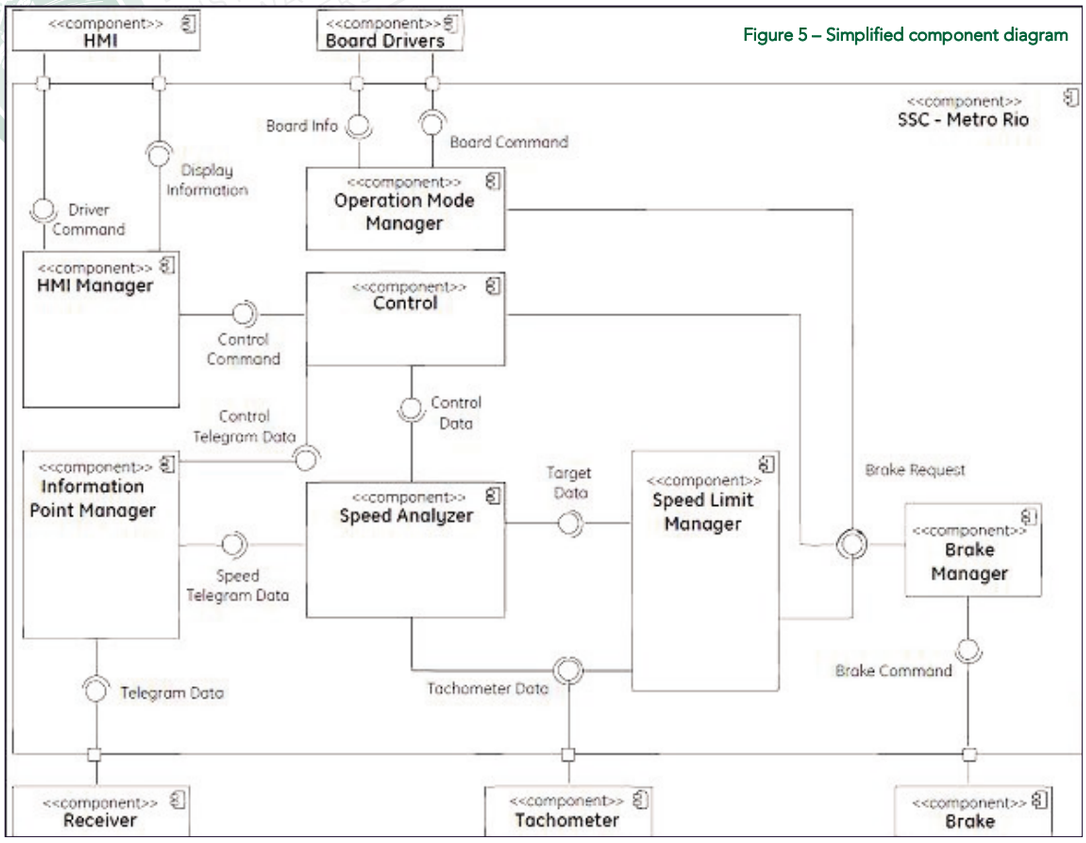


Figure 5 – Simplified component diagram

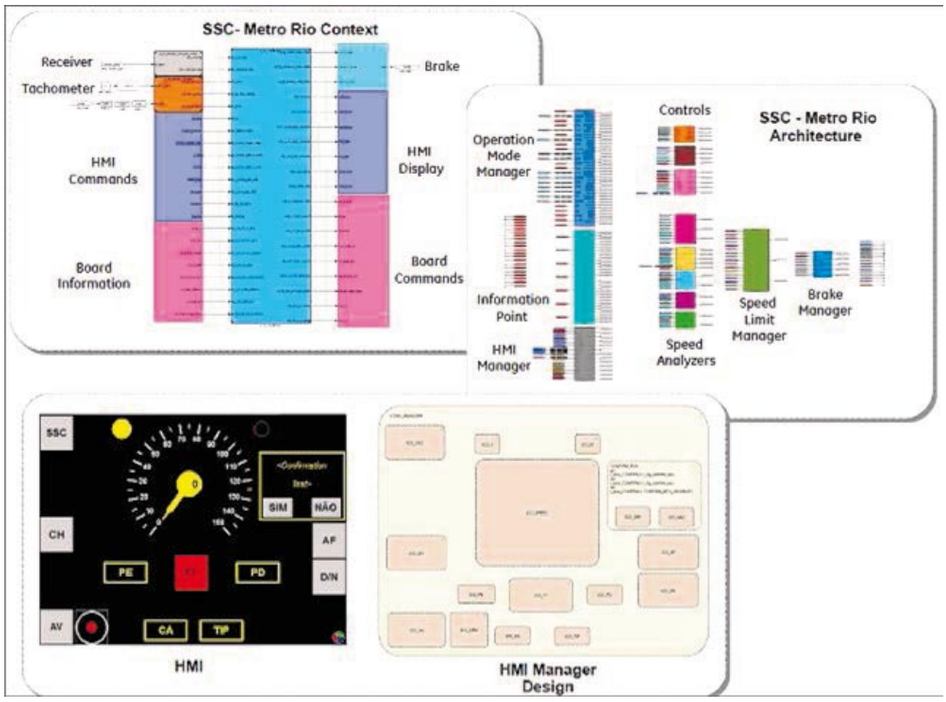


Figure 6 – The multiple level hierarchical model

In order to properly formalise this kind of architecture, the chosen strategy was to represent the system through a multiple-level hierarchical model (see Figure 6). The different levels are intended for different development stages, from a more abstract to a more detailed view. A first level is defining the context, which means the interfaces with the environment in terms of input/output data. Starting from the component diagram, this level has been derived considering the boundary ports and mapping them into signals entering or exiting the model blocks. This approach allowed us to define the borders of the software system, which can be treated as a black box completely defined by its input/output signals.

As part of this model other blocks are introduced simulating the actual interfaces (tachometer data, touch screen buttons, telegram data, etc.), to perform interactive testing of the model.

A second level represents the internal software architecture in terms of interacting functional units modelled through flow charts. For each one of the components of the original diagram, a flow chart has been defined having the same input/output interfaces in terms of variables: each required interface becomes a set of input variables, while each implemented interface becomes a set of output variables. This level focuses on the relationships between functional units.

A third level is actually the design level of the single flow charts, each of them being structured into parallel state machines formally modelling the system functional requirements. In order to derive such a formal model from the system requirements written in natural language, we first decomposed them into mutually exclusive sets of unit requirements, to identify the requirements apportioned to each single flow chart.

RESULTS AND LESSON LEARNED

The rules constraining the flow chart's semantics led to a notable reduction of bugs, while the well defined architecture derived from the novel design approach has allowed us to detect the errors in shorter time, even though, on the other hand, it has increased the number of modules.

If we have to compare the overall development efforts for the SSC project with a project based on hand-crafted code, our experience tells that a developer spends 30% of the time more on modelling than on coding. Nevertheless, this greater effort is balanced by the fact that notable cost reductions are achieved in terms of verification activities (with a time reduction of about 70%).

CONCLUSIONS

This article presented the experience of a signalling manufacturer, GE Transportation, in employing a fail-safe ATP system using the microwave technology for a Wayside/On-board communication link in as well as formal model based development of the On-board unit logics.

The microwave technology introduces benefits both in terms of deploying the system in field, vandalism and reduction of cables (the Wayside equipment is self-powered from the signal lamps so no need to pull cables from station). The safety of the system is guaranteed according to CENELEC as well as for maintenance people that can operate in a safe manner because no SSC ATP devices are installed on track but lineside.

A modelling tool-suite has been used to model and generate the code of the entire application software. The certification issues related to the tool-suite and the formal weakness of the languages that were used have been overcome by restricting the languages to a semantically unambiguous set and by introducing a multiple level architecture approach for deriving a formal model for the system. When compared with previous model based projects where the approach was not applied, the results in terms of number of errors detected and in terms of time spent for correcting them are encouraging.

REFERENCES

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Celebration marks 25 years of SSI

On 8 September 2010 – 25 years to the day after the original British Rail Solid State Interlocking (SSI) Pilot Scheme was brought into service at Royal Leamington Spa – 43 members of the original SSI tri-partite development team and others whose careers have been closely involved with SSI, gathered at the Angel Hotel in Leamington for a celebratory lunch.

Around 50% of those contacted were able to be present (plus a few the organisers had failed to contact, and who had asked to attend!). There was a good proportion of the original tri-partite SSI development team, from the former BR Research, BR HQ, BR London Midland Region, GEC-General Signal and Westinghouse Signals. As people arrived, many wearing the commemorative tie produced to mark the anniversary, they mingled in the bar over coffee or a drink before lunch. It was remarkable how easily everyone slipped into relaxed conversation with those they had worked with so many years ago, and possibly not seen since - it must be the mark of an effective team spirit. However, linking familiar faces to the correct equally familiar names stretched people's memories at times.

After the meal, Bob Barnard read apologies from several people unable to be present, including David Norton, the former Managing Director of Westinghouse Signals, and Dennis Lamb, BR's project manager for the Leamington Pilot Scheme. Those present noted the passing, in the intervening years, of several key figures who made SSI a reality, including Bill Whitehouse and Ken Hodgson from BR, and Tom Cunningham from GEC. Several people at the event had been involved in early applications of SSI overseas, including South Africa, Australia, Indonesia, Hong Kong, France, etc.

Bob then introduced Roger Ford of Modern Railways, always a champion for SSI, who had kindly agreed to say a few words. He spoke in customary fashion, and was very supportive of SSI and what had been achieved. His amusing and sometimes outspoken remarks about the UK railway industry created exactly the right informal note for the event. Next, a message was read from Tony Mercado, Director, Rail, Technical and Professional, at the UK Department for Transport, who had also been invited as a guest, but had a clash of meetings on the day. The DfT message was very complimentary about the achievement of SSI, the co-operative way of working that had brought it into service, and the contribution to British exports made by the system. Tony also drew parallels with the forthcoming challenges of introducing ETCS cab signalling in Britain.

Thanks to information from Alstom and Invensys (successors to the original SSI suppliers), Bob had estimated that there are just about 1000 SSI interlockings in service in at least 14 countries worldwide, representing around £4 - 5 Billion of business. The largest single installation in the world is thought to be at Berchem, Antwerp, and Belgium is also the largest overseas user of SSI, followed by Portugal, Australia and France.

Then, everyone was content to sit around and swap anecdotes of various strange and amusing goings-on during schemes we had been involved in, and the personalities involved.

All agreed that it was exactly the right moment to arrange such an event, just as Smartlock and Westlock are beginning to supplant SSI in the UK and overseas markets.

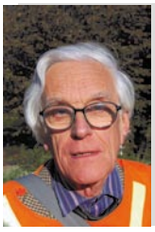
Bob finally presented Roger Ford with a Commemorative Tie.

The conversation continued in smaller groups until people dispersed, but the camaraderie continued at the station, and on the various trains home; it was good to see former colleagues again.

Afterwards, Roger Ford recorded the event in his Informed Sources blog as follows:

Imagine being invited to join George and Robert Stephenson and the Rocket mechanics at a lunch to celebrate the 25th anniversary of the Rainhill Trials.

I enjoyed the 21st Century equivalent when I joined the engineers responsible for the development of Solid State Interlocking (SSI) at a lunch to celebrate the anniversary of the commissioning of the first interlocking at Leamington Spa on 8 September 1985…. A great honour and a great day and an exclusive addition to my tie collection.



Tales of Old Reading (Part One)

By J.R.Batts with material from the late B.M.Ruffell

An opinion and viewpoint of S & T Engineering in previous years

In his excellent series of reminiscences of Reading S & T, the late Bryan Ruffell could give the impression that all the S & T staff were paragons of virtue, modesty and legality. Certainly railway staff have tended to be more civilised than their opposite numbers in many other trades and professions. This has long been recognised by the insurance profession in the form of lower premiums for railway staff. There were however exceptions. Bryan omitted them, he told me, out of consideration for his readers' finer feelings. I felt they should be put on record for the sake of completeness.

I have emphasised the untypical nature of the events chronicled and stated that they comprised the majority of what I could remember. I had indeed just about exhausted the sleazy recollections but many other non-routine happenings have since risen to the surface of my mind so I have now added a few of these.

My only concession to finer feelings was to give fictitious names to anyone guilty of tabloid-worthy behaviour. They are shown in *italics.* The real names can be found in the columns of the Reading local papers and occasionally national ones by anyone determined to know them. One name which appeared far more prominently than the others in the original article was *"Fred"*. Any of my contemporaries would probably also have thought of him first in that context but I have now learnt that he has recently, sadly, died and can thus use his real name, Charlie Mitchell. I have used real names throughout for persons of a decorous and refined nature.

I was originally a 'Signal Apprentice', the trainee grade for Drawing Office staff. The course started with two years in Reading Signal Works, then two years with various outdoor staff and finally a year in the office. Nowadays some such title as 'Engineering Student' would be used. Trainees for outdoor work were known as 'Probationers'. Note the distinction.

Reading Works – 29/9/52 to 30/9/54

The machine shop at Reading Works had waste material – swarf etc. – collected by a frail and filthy old man named Oliver Tegg with a wheelbarrow. One day having emptied the bin by my machine he failed to put it back. This led to an argument, which eventually he made physical by starting to hit me. He was not strong enough to hurt at all, but was filthy enough to cause slight distress. I therefore pushed him gently away. His frailty caused him to sit in his barrow. Someone who only saw the end of the affair accused me of bullying a poor old man and would not believe my protestations of innocence. I don't think an Oliver Tegg would be allowed near machinery in these Health and Safety conscious days.

Another less decrepit person was in charge of such duties as lavatory cleaning. The lavatory cubicles were locked by simple turn-over latches which rotated through 180 degrees and had no external indicators. They thus could not be operated in any way from outside. They were not at all stiff in their action and if balanced at their vertical mid point when the door was shut smartly would fall either to the full locked or fully unlocked position. The temptation was obvious and the cleaner was heard to complain that "Those apprentices are always locking the doors and climbing out over the partitions". He never found out how the doors were really getting locked and we never discovered how he opened them again.

In the days of the old privilege ticket orders there was a clerk in Reading Works named Jack Lee. He took a delight in obstructing the issue of these or of free tickets whenever he could find an excuse. He used to check journeys in the timetable, Bob MacGregor had great difficulty getting a ticket for the then unadvertised service between Clapham and Kensington. We thought of getting Jack to issue a ticket from Abergynolwyn to Dungeness which he would have found in the timetable in those days. An attempt to use it would have brought down the wrath of the TR (Tal-y-Llyn Railway) and RH&DR (Romney Hythe and Dymchurch Railway) on his head via the powers that be, but we chickened out eventually and left it as just an idea.

The Works Manager in those days was a former Swindon man. He was a fussy little self-important man with little idea of what really went on in the works. It was obvious why Swindon were prepared to lose him. One week-end day there was a works visit by the Railway Enthusiasts' Club. Being a member thereof I took part. In passing, it is interesting to note how many of us were S & T and REC: Myself, Philip Hingley, Bob MacGregor, Brian Neill, Viv Orchard, Brian and Ray Ruffell and Bill Young come readily to mind. Anyway, the manager was a little put out to see one of his own apprentices on the visit but put a brave face on it. I was able to correct the misinformation he gave the party after the visit. One thing I remember was a lamp in the Tin Shop like a traditional street lamp which although an ancient design was obviously a brand new replacement. He insisted it was an old one in for repair.

In the works was a large metal-shearing machine ("The Shears") with a large flywheel geared to an also large cam which continuously oscillated a series of assorted cutting heads. It ran all day with a gentle rumbling noise just waiting for people to insert rods, strips etc. as required. The machine was inherited from the old works and carried no manufacturer's details as it was German and had been bought soon after 1918 when it was thought necessary to conceal trading with the hated ex-enemy by removing the maker's plates. Everybody knew of course but had to humour the supposed deceit.

In those days I was involved with the Tal-y-Llyn Railway. The Towyn Wharf ticket dating press was showing its age with very worn main bearings. It was given an unofficial ("Government") overhaul in Reading Works including bushing the main bearings and repainting in GWR ATC green, a quite good match for the original. The derivation of this use of the word "Government" apparently dated back to World War I when the works was given non-railway military work to do. When a supervisor saw some unfamiliar objects being worked on and queried them he was told "Oh, it is government work" which was sometimes true. The name stuck. Other "Government" jobs included the bracket to attach a "Last Train" headboard to a lamp iron (Kent and East Sussex Railway, Northbound) which may now be inspected at the museum at Tenterden Town, and an adaptor to fit a Railway Enthusiasts' Club headboard to a GWR lamp iron instead of the usual RCH type, also the loose handle of my landlady's poker.

The works shunting locomotive was No.27, a 4w Simplex petrol machine. The driver was "Queenie" Harris. He always had the doors at one end tied fully open with string, presumably to resemble smoke deflectors. When it was under repair, a similar but not quite identical machine, No.20 was borrowed from Swindon. If both were unavailable, a steam loco was used. Once apparently, No.1925 ('Podge') the saddle tank of an otherwise pannier tank class presided. On the only such occasion during my time the loco was No.1153.

One day I went to the staff office on some small matter concerning travel, pay or some such thing. The serving hatch was answered by a new young clerk who told me not to lean my elbows on the window ledge. He was not pleased to be told that I had been leaning there long before he had come on the scene and would only remove them for someone senior to myself. I don't remember seeing him again, so he probably had a bigger disagreement with someone more influential.

Reading District – 1/10/54 to 30/11/56

My first outdoor work was at READING MAIN LINE WEST ("West Main") signal box. The chief lineman, Eric W.B.Wilcox was a fairly keen photographer. When he decided to upgrade to a better camera, he sold me his old Agfa Isolette II. To demonstrate its excellence he took a head on photograph of the Down Bristolian at speed and stepped clear just in time to secure survival. The driver appeared to be displeased.

At Reading Main Line West Signal Box I first met a probationer – Charlie Mitchell. He was well known as a sex enthusiast and non-respecter of law and order. He was however good and energetic at his work and easy to get on with. He was quite open, though not boastful, about his activities. His first serious affair apparently began at the age of 15 in the school photographic darkroom. He eventually committed matrimony with the same girl. When the film 'Rock around the Clock' was banned in Reading for its corrupting nature he joined the local teddy-boys in their expedition to see it in High Wycombe where it was considered harmless. This resulted in the High Wycombe Rock and Roll Riot with much damage to cinema seats and shop windows. He was detained by the police but not charged with anything and having made him miss his last bus home they had to take him back to Reading in a police car.

One source of female company in Reading in those days was trainee WRENS from the shore establishment H.M.S. Dauntless at Burghfield – claimed by the Germans in World War 2 to have been sunk. Charlie had an association with one of them until her habit of going to sleep in the cinema led to him changing seats to join another young lady he knew. This was not tolerated and she left him. One day Charlie came in to work in a hurry, having not got up in very good time – not unusual. He had not had time to open his post and did so at work. On reading the contents of one official looking buff envelope he changed colour and showed signs of distress. It was from the commanding officer of a WREN establishment to the effect that one of her WRENS claimed that Charlie was responsible for her condition. After some thought, he persuaded one of his friends to write back claiming to be his mother and saying that he had been killed in a motor-bicycle accident and could not therefore oblige with maintenance payments. This seems to have been accepted. It must have been about this time that I told him that continuation of his current life style would inevitably secure mention in the columns of the News of the World.

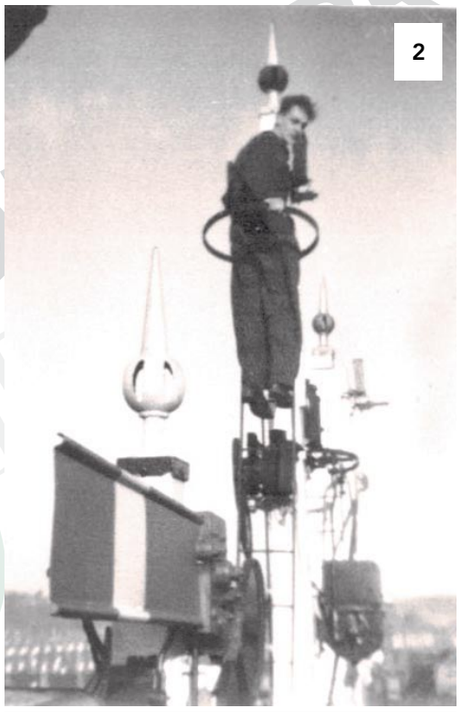
One of the Reading District Signal Depot clerks was *Bill Comfrey*. He was having a dubious affair and his wife found out and informed the police. He was tried, convicted and sentenced, I think to a short prison term, and sacked. The NUR however represented that the offence implied no unsuitability for his work and they secured his re-instatement. Subsequently he made approaches to some of the younger members of the staff which they found unwelcome. He was told that if he presented himself at the linemen's accommodation under West Main Signal Box one evening he might find something to his advantage. What he found in fact was a number of the younger members of the staff equipped with a quantity of railway lubricating and colouring materials which they applied to him in a fashion which he found unwelcome. In the long term it may

indeed have been to his advantage by discouraging activities which could have got him into more trouble.

Then there was Signal Apprentice Bob MacGregor. He never did anything out of place to my knowledge and before his much regretted recent death from cancer finally worked on the signalling of the F(f)estiniog Railway. One morning he was working for the telegraph side and up a pole (A not THE) between Didcot and Oxford when a train of compartment stock much used by school traffic was stopped opposite him by a signal. In the compartment by his pole were two scholars of opposite genders taking full advantage of the difference. On seeing that they were observed they put a coat over themselves and continued. Many people did things in full sight of railways which they would not have done in any other public place. It seems to be a widespread belief that railway staff and passengers have no eyes. One example of this was Peter and Iris, two school children whose way to school took them along the narrow footpath between the back of Reading General station and Vastern Road, past the Reading Main Line East linemen's hut from which they could be seen. She always wheeled his bicycle in order to leave his hands free to wander. Eventually they were seen on a rough piece of land known as 'The Ballast Holes' between Sonning Sidings Signal Box and the river giving full expression to their relationship. It is understood that they subsequently married. Another piece of "railways are blind" behaviour was at Oxford where couples along the Oxford Canal towpath quite ignored people in the old LNWR yard. It must be admitted however that some staff wanting a closer view hid in empty wagons and watched through cracks between the planking.

During a locomotive strike around this time, it was possible to do various maintenance tasks which normally were impossible or nearly so. One I remember was washing signal arms with domestic detergent on the bracket signals on Reading General station. It was also possible to take advantage of the deserted railway for light entertainment of kinds which would not meet with official approval. Detonators were always an attraction. Out of date ones had to be disposed of and exploding them was more fun than sending them back to stores. The main line crosses the River Kennet just East of Reading General station by a brick arch bridge. There is a towpath on the east side. We dropped a detonator on to the west bank, then half bricks until one hit it with a satisfying bang. We had not noticed the couple on the towpath nor considered the acoustics of the underside of a brick arch. They can never have known cause of their trauma. We did not repeat the exercise.


1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1. Chief Lineman Eric W.B. Wilcox at the desk under Reading West Main Signal Box taken in November 1954.
2. Mr Batts positioned on Reading West Main gantry in December 1954.
3. Reading Maintenance Drawing Office from the north west, taken in December 1960.
4. The interior of Reading Main Line East signal box, taken in July 1960.
5. A view of Royal Oak Exchange with the master clock on the left and the slave clocks on the right, taken in February 1955.

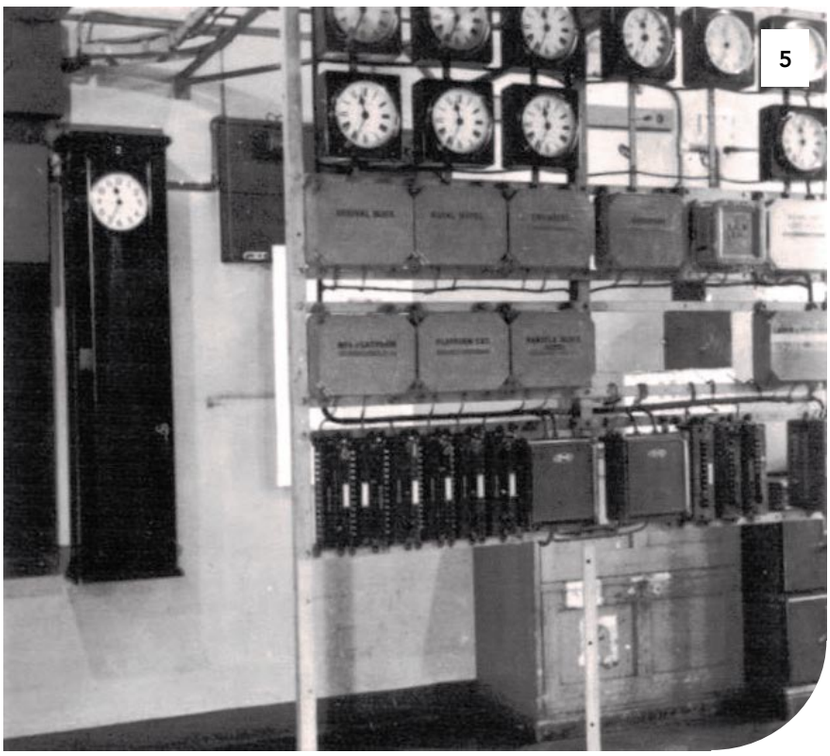
Similar in shape and size to a detonator were the pyrotechnic cartridges used to heat 'Mox ®' soldering irons – much used for work on overhead telegraph lines where no power for electric irons was available. They were ignited by pushing Bengal Matches through a paper seal in a cross shaped cut-out. Also in evidence in those days were 'Jetex ®' jet engines for model aircraft. These were set off by fuses consisting of fine wire with a pyrotechnic coating. A Mox cartridge could be lit easily with this, and if attached by insulating tape to a detonator made an entertaining and hazardous firework. One was set off in Sonning Cutting and sent the white-hot Mox ® 'shot' about as high as the main road overbridge – about 60 feet. This was harmless. On the way back to base, another one was done on the embankment by Reading Low Level Goods Yard. This was done by *Len Williams* – the same *Len* referred to later in connection with copper wire. The white-hot shot this time went up high and fell back on to the roof of a wooden box van. The roof started to smoulder. The shot rolled off and the smouldering died away. We were rather relieved and lost interest in fireworks for a while.

One winter's day with snow on the ground and in the air I was outside the signal box when a signalman threw a green flag down to me and asked me to display it to the driver of a train about to come off the branch, the signal having frozen. I was reluctant to do this irregular thing but eventually yielded to persuasion and the train went on without mishap.

To be continued.....


3


4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Chinese Cooperation

Invensys Rail has entered into significant agreements with a division of CSR Corporation Ltd (CSR), a leading Chinese manufacturer of rolling stock.

Under the terms of the agreements, Invensys Rail will licence Zhuzhou CSR Times Electric co. Ltd., (TEG), CSR's train control and signalling company, to manufacture and sell its interlocking solution, Westrace, in China. TEG and Invensys will work together to sell their broader train control and signalling solutions through TEG into the expanding Chinese domestic mass transit market, worth an estimated €670m a year (source: UNIFE) and CSR's rolling stock companies and Invensys Rail will jointly bid a number of major international contracts.

Invensys Rail will become CSR's exclusive signalling supplier on an agreed set of global projects that combine rolling stock and signalling solutions. Initial projects are in mass transit and span the Middle East, India and South East Asia.

Commenting on the agreement James Drummond, CEO of Invensys Rail said

"China is a strategically important market for us. The country is investing heavily in its railway infrastructure and represents a significant growth opportunity for us in Asia. We are therefore delighted to enter into these agreements with CSR and TEG, who are not only key players in China but are becoming an increasing force in the global railway market."

Ulf Henriksson, CEO of Invensys plc, said

"I welcome the signing of these agreements with CSR and TEG as they represent a new business model that allows us to gain greater access to the significant rail infrastructure and mass transit investment in China and elsewhere in the world.

The combination of our train control and signalling technology and CSR's expertise and efficiency in rolling stock manufacture will create a very competitive offering to rail operators around the world."

IRSE MATTERS

UK Rail industry consults on its technical strategy

The cross-industry Technical Strategy Advisory Group (TSAG), chaired by Steve Yianni, Network Rail's Director of Engineering, is launching a consultation to prepare the Rail Technical Strategy 2012. In mid-October, TSAG is consulting about the thirty year technical strategy for the rail industry. The consultation document describes the challenges associated with enabling innovation and indicates priority areas for research, including next generation traffic management, energy strategy, whole system reliability, data and communications as well as a range of other potential innovations.

The consultation is your opportunity to shape the Rail Technical Strategy 2012. The consultation closes on 17 December 2010.

As part of the consultation process, TSAG is organising a 'drop-in' event with displays and presentations on key aspects of the emerging strategy and the opportunity to quiz some of the TSAG technical experts. This will take place between 09:00 and 12:30 on Tuesday 23 November simultaneously at the office of RSSB: 1, Torrens Street, Islington, London EC1V 1NY and Network Rail: 40, Melton Street, London NW1 2EE.

The consultation document can be found on the TSAG website at *http://www.futurerailway.org/Pages/consultation.aspx*

YORK SECTION

The Chairman, **John Maw** welcomed 26 members and three guests to the meeting on Thursday 11 March 2010. He then introduced **Richard Genner**, Chief Engineer of Atkins Rail, and invited him to present his paper "If it begins with N….It could be ours".

Richard detailed the involvement of Atkins Rail in the refurbishment of the West Coast Main Line beginning with Euston in 1999 up to their current project at Nuneaton in 2009. They have been involved with other projects namely; Port Talbot, Basingstoke, Newport, and the North London Line Rail Investment Project. He went on to explain the Nuneaton resignalling project. The original plan proposed eight SSIs around Nuneaton Station, however a review carried out by Atkins revealed that in order for the project to be delivered successfully nine SSIs would be necessary. Other key facts of the project are six Management Control System (MCS) screens, axle counter train detection, 4-aspect LED signal heads, 200 stainless steel locations and 27 Relocatable Equipment Buildings (REBs), associated total renewal of the operational telecommunications system, 92 new S&C ends, 96 ends to be recovered, 33 500 m of track replacement, 31 km of new overhead wire and 280 structures for 25 kV traction, 100 km of cabling, eight new or altered bridges although most of the latter were at Rugby. All this work was to be carried out between early 2007 and August 2008. Richard emphasised that all work was to be carried out in maximum safety and he showed a video of an incident that occurred on the project.

The Newport (South Wales) project was the next to be explained. This involved complete resignalling installing two Westlocks in place of seven SSIs, rising to three Westlocks in place of eleven SSIs, WestCad control medium (late substitution for MCS), axle counter train detection, 4-aspect LED signal heads, 221 stainless steel locations and 16 REBs. There were five fringes to three technologies, the associated total renewal of the operational telecommunications, 144 point ends, total renewal at Severn Tunnel Junction, with 100 km of cabling installed. In all 400 staff were deployed at Christmas/New Year 2009. The project began in July 2008 and continued until December 2009/ October 2010.

The third 'N' was The North London Line. Again this was a complete resignalling which was specified at five SSIs, but six were supplied. Four IECC screens, a new IECC at Upminster requiring relocation and upgrade of existing the IECC, as well as alterations at Liverpool St IECC were carried out. Axle counter train detection, 3- & 4-aspect LED signal heads, 200 stainless steel locations and 27 REBs were also supplied on the project. It involved 17 fringes to a variety of technologies which could be a record for any project.

In summary, Richard detailed the challenges for all the projects which briefly had been; the geographically diverse volume, client relationships, occupational safety, to get our cost base down, declining levels of technical knowledge, fragmentation (= compartmentalisation), dumbing down and therefore Keeping the Safety Net in place.

Those involved in the question and answer session that followed were; Paul Hepworth, Ian Moore, Martin Huibers, Steve Bissel, Melvyn Nash and Tony Walker.

A vote of thanks for an entertaining and informative talk was given by Ed Warburton on behalf of Atkins Rail.

NORTH AMERICAN SECTION

North American Section

2010 has been a banner year for the North American Section. We continue to grow and provide important services to the members, and we are planning for new projects and exciting meetings in the future. Our Annual General Meeting (AGM) was continued with the format of a conference and field trip held in conjunction with the Railway Systems Suppliers C&S Exhibition. However, 2011 will begin a new process for the NAS to meet for an AGM that is held at convenient sites for the members as well as stimulate growth.

This year's Annual General Meeting was held at the Quest Convention Center in Omaha, Nebraska. On Monday, 17 May, North American Section held a technical meeting that consisted of a half day conference divided into two different sessions each with a total of five presentations. The theme of the Conference was: "Positive Train Control Implementation" (PTC). PTC is the legislated mandate to equip most rail lines in the United States with an interoperable train control system that enforces movement authorities, civil speed restrictions, prevents movement over improperly lined switches (points) and protects roadway workers by the end of 2015.

The event was well attended by over 65 interested guests. After an introduction to the AGM by NAS Chairman David Thurston, the program started with presentations from around the industry.

The speakers included:

Bill Scheerer, IRSE Country Vice President North America -

Bill discussed the IRSE NAS beginnings from 2002 and the progress made since. In addition, Bill moderated the first session of the Conference;

David Thurston with Parsons Transportation group who discussed the role of standards and their organisations in PTC implementation. Highlighting the work of AREMA Committee 39, there was detailed discussion about the new AREMA Manual parts that are being created for use in implementing PTC;

Greg Richardson from the Union Pacific Railroad gave a presentation on the implementation of PTC on the Union Pacific Railroad.

Included in the discussions were details on the size and complexity of the undertaking, and some details on the process included in the Interoperable Train Control Committee (ITC) that was formed to create the Main Line railroad PTC System;

Dan Guerrero the Signal Engineer with the SCRRA that will be the first rail line to be equipped with ITC type PTC, discussed the unique features of SCRRA (Metrolink) and how they are adapting to the expedited mandate in the Los Angeles area to fully equip their trains before the end of 2012;

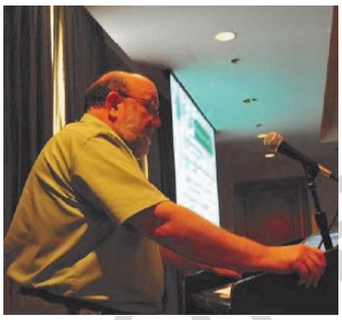
Ed Mortlock, with Parsons Brinckerhoff (but representing California High Speed Rail) talked about the features and requirements of PTC and Train Control for the California High Speed Rail project. The final results concluded that the project will seek a train control system proven in high speed operation using a performance and functional specification;

Wim Coenraad finished the presentation on PTC Implementation with a discussion on the lessons learned from the ERTMS and ETCS roll out in Europe.

After the last presentation by NAS members on the work that the Section is continuing within the field of education and certification, the floor was opened to questions from the attendees. At the conclusion of the Conference, David Thurston, NAS Committee Chair called the Annual General Meeting to order. Noting that a quorum was present, the minutes of AGM held on 20 May 2008 were approved.

The Section was again fortunate to have significant representation from London at this year's Annual General Meeting as **Paul Jenkins, President of the Institution** was on hand along with **Colin Porter, Chief Executive** , and **Wim Coenraad, Past President**.

Paul Jenkins provided some remarks on the state of the Institution and a vision for the section moving forward.



Kendrick Bisset, NAS Local Committee Vice Chair from LTK Engineering then updated the Members on the status of the Body of Knowledge project undertaken by the Section.

It was reported that over 1300 copies of the NAS book *Introduction to North American Signaling* have been sold, and that the next book project will involve either Interlocking or Positive Train Control as its topic. Other business discussed was the location of the next AGM. With the "Big show" of all organisations related to the rail industry meeting together for the first time, the idea was introduced to have the AGM in conjunction with the APTA Rail Conference as to not interfere with the RSSI/AREMA plans for a conference and concurrent product show. The matter was referred to the Local Committee for final resolution.

The business of the Section concluded with the election of two members to the Local Committee. These positions were filled by:

- Committee Member: Vic Babin, Northern Indiana Commuter Transportation District- to a two year term;
- Committee Member: Ed Mortlock, Parsons Brinckerhoff - to a two year term.

The AGM and Conference meeting room was graciously provided by the Railway Systems Suppliers, Inc, who also provide the NAS with booth space at the annual RSSI C&S exhibition (see photo below). Many information packets and book orders were passed out during the two day event, and the members wish to thank the individuals that volunteered their time to man the booth. A special thanks to Vic Babin for setting up the booth and organising our efforts there.

The Section was also fortunate to have sponsors for the Conference and Booth accessories that included:

Railway Age – advertising;
Parsons Transportation Group – A/V assistance;
Parsons Brinckerhoff – A/V assistance;
ISIS, LLC – Booth furniture.

On Thursday 20 May, the Section was hosted by the Union Pacific Railroad on a field tour of the Missouri Valley Junction area and the Harriman Dispatch Center. In total, 18 interested people took advantage of the railroads hospitality. Included in the experience were inspections of interlocking instrument locations, the latest technology in switch control, and review of anticipated work required for the PTC mandate. The picture below shows the group inspecting a rotary helper movement.

The group also visited the Harriman Dispatch Center from where where the entire Union Pacific Railroad is dispatched. Members were shown the "Bunker" where the operating theatre and dispatchers are located as well as the associated support buildings containing the communications and network management equipment. The photo shows some of the participants at the main entrance to the facility.

Preparations for the 2011 AGM are just getting underway. Any members interested in presenting a paper should contact Kendrick Bisset or Dave Thurston to find out more about this exciting opportunity. Details on the time and location will be sent out when available.

The North American Section (NAS) was formed on 24 May, 2002 to support the goals of the Institution in North America. The NAS presently has over 50 members, and is encouraging railroad communication and signal professionals to join.

North American Section officers are:

- David Thurston, P.E., FIRSE, Chairman. Vice President and Deputy Sector Manager – Systems Parsons Transportation Group
  E-mail: ***david.thurston@parsons.com***
- Kendrick Bisset, FIRSE, Vice Chairman
  Senior Systems Engineer, LTK Engineering
  E-mail***: kendrick@kendrickbisset.com***

MIDLAND & NORTH WESTERN SECTION

September Meeting

The M&NWS kicked off the 2010/2011 lecture season on the 14 September in Manchester, when Andrew Went (Head of Track & Senior Route Engineer (North) HS2) presented his talk on the proposed new UK high speed route, HS2. The meeting attracted a turnout of about 25 members and non-members from around the north-west, who wished to find out more about how the new line may affect them.

The UK currently only has 80 km of high speed rail, from St. Pancras to the channel tunnel, a short length when compared with countries such as France with around 1800 km and China with 5500 km. The addition of HS2 to the portfolio would take the UK network to between 204 km and 500 km, depending on which options are adopted for the new line. Although trains on the line will initially run at 360 km/h, the line will be designed for maximum speeds of 400 km/h, higher than most other counties. It will use the European 'GC' loading gauge and have gradients of up to 2.5%.

Against a background of increased UK rail passenger kilometres travelled over the last 30 years in the order of 166%, with a corresponding increase in infrastructure of 0.6%, it can be seen that pressure on network capacity already exists. Going forward, it expected that due to increasing road congestion additional freight will be carried by rail and passenger kilometres will increase by a further 30% (between 2007 and 2017). Both the East Coast Main Line and the West Coast Main Line are expected to be at full capacity within ten years. A radical alternative solution is necessary to overcome these constraints, providing significant growth capacity for passengers, leaving sufficient capacity on the traditional network for increased freight and local passenger journeys.

Andrew told the audience how the design of the new lines will be based around the European Technical Standards for Interoperability (TSIs), which will set the framework for the design. Significant benefits will be gained through increased capacity using shorter headways and new technology such as the European Train Control System (ETCS) level 2 with no signals. The control centre for the HS2 network will be built in the West Midlands, as will the train maintenance depot, probably in Washwood Heath.

HS2 will be built with an initial capacity of three minute headways and 14 paths per hour, giving around 14 000 seats per hour in each direction. Further into the future, 2.5 minute headways will give 18 paths per hour with c.18 000 seats per hour per direction. There will be two types of train, some captive within the high speed network, some going onto the classic network in the midlands.

London to Birmingham is planned to take 49 minutes, Birmingham to Manchester 40 minutes and Birmingham to Leeds 60 minutes. This will bring the cities closer together in terms of time, making journey between the cities quicker than a journey across the capital city. The shorter journey times will almost certainly attract numerous travellers from their cars and from parallel air corridors.

Once the thought provoking lecture concluded, there was an opportunity to ask Andrew questions, an opportunity the audience were not slow to respond to, the Chairman having to bring proceedings to a close in order to let people get their trains home on the slightly slower existing network. The Section wishes to thank Andrew for his time to come to Manchester and to Parsons Brinckerhoff for their sponsorship of the event.

Ian R Bridges

Technical Visit to B3 Cable Solutions in Blackley, Manchester

The Section has arranged a visit to B3 Cable Solutions in Blackley, Manchester to include a buffet lunch kindly provided by our hosts on **Thursday 18 November 2010**.

B3 is a copper and optical fibre cable manufacturer whose products build the vital connections that support the way we live, work and relax in the 21st Century. B3 products form the core of intranet, internet and other communications networks all around the world; are the backbone behind transport communications links, are critical to building management, are a critical link in industrial environments and they bring heat and light into homes and business.

B3 Cable Solutions is an international company with operations across Europe, the Middle East and Asia and has a track record of building successful, long-term partnerships with high-profile, blue-chip companies in the following industries: Telecommunications; Utilities; Railways; Buildings; Industrial.

Tickets for this event will cost £10 each and places are limited. In order to book your places, please either email or contact the Visits Secretary at *irsenews@btinternet.com* or on +44 7794 879286 with your requirements.

Please send cheques only to: Institution of Railway Signal Engineers, Midland & North Western Section, c/o 31 Bainbridge Road, Loughborough, Leicestershire. LE11 2LE.

Please note that bookings cannot be accepted without all individual details and requirements being stated at the same time.

All payments shall be due upon application and made by cheque only, made payable only to "IRSE Midland & North Western Section" unless otherwise agreed with the Visits Secretary.

Final details will be provided to those who have applied to attend one week prior to the day of the event by email only.

Please note that the Institution and administrations whose sites are visited on technical visits cannot accept any responsibility for injury, damage or other difficulty which may arise. Individuals are therefore advised to ensure that their own insurance covers all appropriate eventualities.

Dear Editors

Stretcher Bar Failures

Well the Potters Bar Public Enquiry has been completed, at last, and the Grayrigg Derailment a distant memory.

But are Stretcher Bars still failing, and if so why? May I suggest , from a standpoint as a 30 year Signal Engineer , with 20 spent as a Fault Team Leader, that the fracturing of brackets , or shoes - call it what you will , is the major cause of failure.

Many failures, may I suggest, are due to excessive drive or stroke. The escapement of the machine requires a certain length of travel - if the switch is fitting up but still has more drive then this travel will be taken up by a flexing of the stretcher bar hence fatiguing it - the normal fracturing point being across the bracket where it is bent in the foundry near to the stretcher bolts. Occasionally the Swan Neck fractures usually across the insulations.

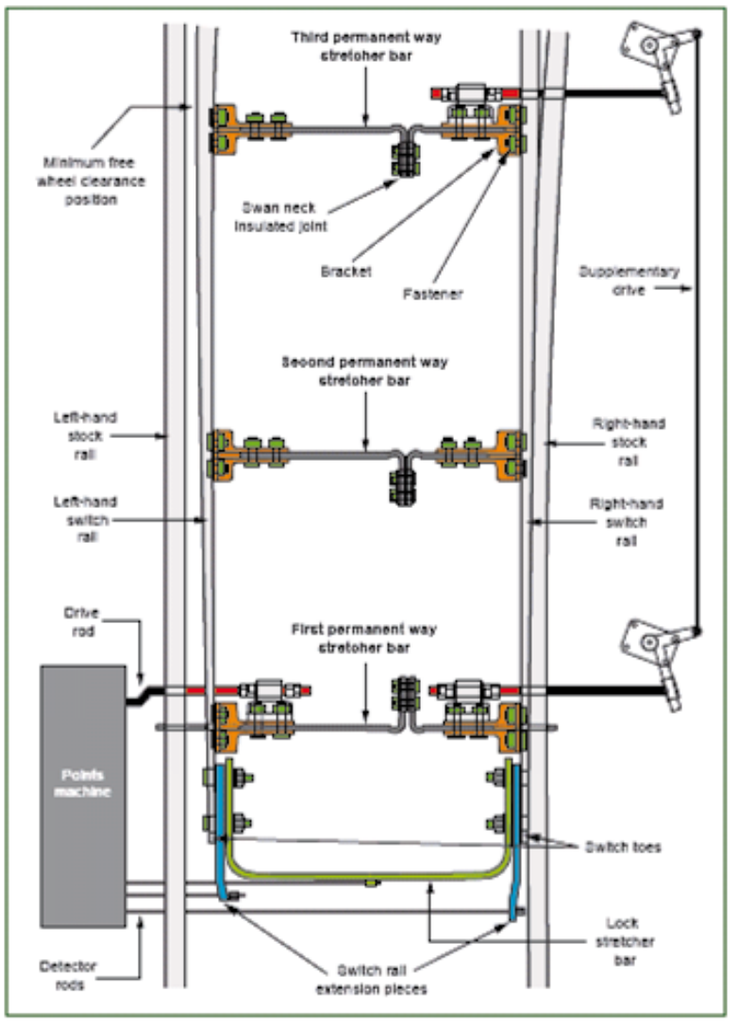
So make the bracket stronger, two pieces welded together - but hey there is still a bend put in at the foundry - where the bracket is bolted to the rail - the stress will find the weakest point and here it is. So - stronger still - but can I relate this to RCF - Rolling Contact Fatigue - where the improved suspension on the trains moved the forces into the wheel / rail interface - my point being that if we had 'indestructible' brackets and stretchers then the forces would be dissipated elsewhere - with, perhaps, worse results - for example machine fittings - or fixed machine components requiring a new machine.

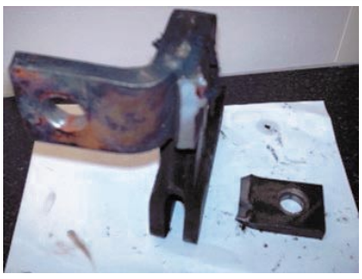
Perhaps the answer is a softer bracket which is designed to fatigue and fail , perhaps with a failsafe overlay piece of bar to hold the stretcher together until patrolling or maintenance identifies the crack - backed up by dye penetrant or maybe Ultrasonic Test,

I am interested to know if anyone else has an opinion regarding this and have any of our readership anything to add or challenge. I have been out of Signalling Overland Maintenance for a some time - so apologies to readers who think this correspondence has been superseded by technology - although I will be delighted to receive information regarding these new technologies.

Please feel free to contact me at: *ballch2@aol.com*

Colin Ball



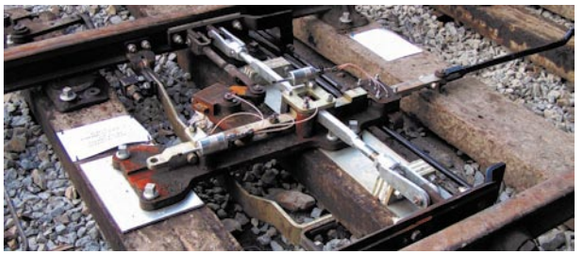


Typical fracture positions?

Curiosity Corner

The October 2010 "Curiosity Corner" mystery object is basically a "four-foot layout" point machine of the type used in times past by London Underground (see *http://www.trainweb.org/tubeprune/Point%20machines.htm*). But it shows several non-standard features: the insulation in the stretchers, drive rods and detection rods appears to be incomplete; the detection box which ought to be connected to the hole at the left hand end of the drive bar is missing; proprietary greasing pots and pipes have been added; the crude cover (a plank over the top) is missing; and the drive seems to be mechanical, via a black bar at the right-hand side of the picture.

The presence of a point machine with the cover off suggests that the photo was taken during an IRSE technical visit. The incomplete insulation implies a lack of track-circuits, and the rail head condition and missing chair screws suggest that there are few trains to detect. It looks like an experimental set-up, which is a strange thing to find, given that the mechanism is regarded as obsolete.



David Billin

FEEDBACK

48 Years of Solid State Interlocking

Harry Archibald is right to recognise Dingwall as the first operational SSI but if we are claiming firsts then I feel obliged to point out that the first solid state interlocking was commissioned well before the 1980s. A paper entitled 'Contactless Switching…' was read to the Institution in early 1962 and I provide an extract here*: Work has continued on the development of a practical interlocking installation using electronic units, maintaining similar standards of safety to those expected in existing relay interlockings. It is now possible to report that an electronic interlocking plant has been developed for a working installation at Henley-on-Thames. No relays whatsoever are used in that part of the installation which performs the interlocking function.*

So there we have it – the Western Region commissioned the first solid state interlocking! The installation also relied on a solid-state display interface (both interlocking and display interface used discrete components of course). The LM Region does take the credit for the first use of a solid-state transmission system. A Time Division Multiplex 'of a somewhat exploratory nature' was commissioned between Wilmslow and Slade Lane circa 1957. This latter was reported to 'have acquitted itself well especially in view of its complexity and the fact that the transistors it employs were very much an unknown quantity in the signalling field at that time – 1957/59'.

The basis of the solid-state interlocking at Henley was square-loop ferrite-core transformer switching and was developed by Mullard Equipment Ltd. In a paper presented to the IRSE in 1963 a second solid state interlocking is described. This one was manufactured by WB&SC Ltd. and installed at Norton Bridge. It also used transformer switching and the system shadowed the conventional interlocking: '*A series of static units have been manufactured for a small part of the interlocking, involving the control of a set of power operated points and associated signals. The two systems – conventional and "static" are operating in protective series arrangement for the period of the test*'. The Henley installation did not work in shadow mode but in fairness it should be noted that on the Western installation the points and FPL's continued to be operated from the lever frame (released electrically from the interlocking). The Henley paper states the reason for this was that '*To avoid non-essential expense the points are manually operated by levers adjacent to the control panel, since the electronic principles can be proved without the elaboration of point machines*' (Hum… well maybe that also could be considered a 'protective series arrangement').

Of course, if we properly distinguish between solid-state interlocking and computer-based interlocking then RETB and Leamington are rightly to be celebrated – they richly deserve the accolades. I should be interested to know if any earlier plant was installed, perhaps outside of the UK?

This is an informal letter so I haven't used academic reference notation in the text; but the papers referenced were:

- Heald. J A & Gore G W, *Contactless Switching, with Particular Reference to Square Loop Ferrites*, 7/2/62 London IRSE.
- Fews J H, *Planning Principles Underlying the London Midland Region Main Line Electrification Scheme*, 8/10/63 London IRSE.

Jonathan Tillin

News View 159

The editorial in Issue 159 rang so many alarm bells with me that I had to drop you all at IRSE NEWS a note.

All of my work now is as Independent Safety Assessor or Independent Verification & Validation on signalling projects. To do this properly we need people who have Systems Assurance skills, Signalling skills, auditing skills and experience of product development to CENELEC standards. We cannot find them!

If UK signalling engineers think that it is going to be much better outside the UK than "*reducing their stress levels*", "*working long hours all week and then the weekend. Attending teleconference at all times of the day and night*" and not so much "*covering for others who are on holiday or long term sick? Covering for vacancies that will never be filled? Working away from home for prolonged periods of time? Being told to achieve the impossible? Being influenced to reduce timescales via various means? Having to explain numerous times how things work? Having to explain what standards and procedures are*", the UK is not the only place where this sort of thing is rampant.

A typical month for me involves the following:-

- Travelling about 23 hours on the weekend to get to a client site in Asia;
- Starting each day at 07:00 and still not getting it all done by 18:00;
- Two or three teleconferences each week that start at 21:00 and do not finish until 23:30 or later;
- Having a supervisor who does not understand signalling at all;
- Having a supervisor whose sole motivation and Key Performance Indicators relate to writing new business (not delivering current business or client satisfaction or any of the values that I used to work to in the UK during my formative years)
- Long days in endless bilingual meetings followed by site inspections that do not commence until after midnight and conclude around 02:30;
- Having to write proposals for work that we know we cannot deliver because of skills shortages;
- Having to deal with clients who are irate at missed time scales due to our lack of skilled resources;
- Continually letting down family who would like to see me a) in the country more often, and b) not grumpy from working so much.

To those in the UK who might think things are greener on the Australian/Asia side of the fence – think again!!! Things are bad for signalling engineers everywhere – not just in the UK.

Why do I continue to put up with it? Because I still care about the railway signalling industry and our ultimate clients – the fare paying passengers of the world's railways.

Name and Address supplied

FEEDBACK

Tripcock Testers

Ian Allison's article in issue 160 re tripcock Testers on London Underground, reminded me that the use of these is not wholly confined to this railway system. When I was a lad with British Rail in the 1970s, I was involved with the GN Suburban Electrification & Resignalling. A certain Tony Rowbotham was in the hot seat for lead contractors GEC.

The scheme took over the former tube line from Drayton Park to Moorgate, and connected it to the main line at Finsbury Park. Apart from realising the dream of the Moorgate line's Victorian promoters, as a new commuter route into the City, it also introduced tripcock fitted class 313 stock, which could run on both 25 kV OHLE and 750 V d.c. 3rd rail. The latter traction system was used from Drayton Park southwards, where trainstops were also required at stop signals.

So as Moorgate-bound trains approached Finsbury Park, their tripcocks had to be tested. If the test was successful, the signaller would be able to set the Moorgate route. Should the test fail, a purple "tripcock test failed" indication lit adjacent to K384 platform starting signal. The signaller received an alarm and then had the option of routing the train overground, to Kings Cross terminus. As the Moorgate line was self-contained, there were ramps at Finsbury Park to test the tripcocks at both the front and rear of the southbound train. The rear one would become leading when the train returned north.

A further complication was the use of three car trains off peak, extended to six car at rush hour. So two rear test ramps were provided, for either scenario. One was these was driven down clear, as the length of the approaching train was measured by track circuits. If a six car train was subsequently split into two x three car sets, then the position of the previously intermediate tripcocks had to be visually checked.

Soon after commissioning, it became evident that the first trainstop south of Finsbury Park - at an auto signal in a dive under - was being severely knocked out of alignment. This was found to be caused by six car trains. The intermediate tripcocks between the two sets were generally left lowered but were electrically isolated from the braking system. The train's front passed the auto signal overlap and replaced the signal, also raising the trainstop, before the intermediate tripcocks has passed. So an offside tripcock was being latched back at high speed.

The quick fix was to make the auto signal last wheel replacement. This transferred the problem to controlled signals ahead, where trains always slowed to stop at Drayton Park for traction changeover. I recall that more elaborate measures were subsequently taken, to deal with the intermediate tripcocks.

In one of my last industry incarnations before retirement, I became involved with checking design for the refurbishment of Kings Cross SB panel. I noted that Drayton Park area stop signals were now additionally fitted with TPWS. This gave flexibility to reverse overground traction units here, perhaps in the event of the main line into "The Cross" being closed.

I took the attached 1970s photo of a 313 departing Finsbury Park towards Moorgate. The single stencil indicator left of the signal's red aspect is the tripcock test indicator.

Finally if anyone is visiting York, I can recommend a ride on the red open top "City Sightseeing" bus. You may encounter me working as a live guide.

Paul Hepworth

Safety Assurance Processes

I read with eager anticipation the article in the July/August magazine on explaining the Safety Assurance Processes. It has long been my impression that this was over complicated and that too many 'specialist' firms were making far too much money from what should really be a simple progressive procedure. Unfortunately, I found the Principles as set down difficult to read and by the time I got down to around Principle No 7, I decided I was not really understanding exactly how I would use these principles in practice. However, I explained this away by not being a front line signal engineer, and that those actively in the business would appreciate and understand exactly what was being said.

Recently, the Railway Engineers Forum held a seminar to examine the high costs of Railway Engineering and Rod Muttram did a session on Signalling Safety Approvals. He went through the IRSE stated Principles one by one and I watched the audience reception. My impression is that the presentation seemed to be having little impact on them, even though it is acknowledged that not many present were from the S&T community. I remain uneasy to whether signal engineers as a general group will fully appreciate what is being put forward. Perhaps the IRSE has not made the best of this important opportunity.

Now, I am in no way denigrating the work of the group who compiled these Principles. It is long overdue that the IRSE should have pronounced on this very contentious issue. However I would suggest that the format of the presentation does not come over in a way that will benefit the wider signal engineering community.
I spoke with Rod afterwards and he agreed that it all reads as if it had been written and prepared by a committee, with everyone having insisted that their particular point is included. Others I have mentioned it to have said much the same.

So, can I suggest that the Principles are re-written by a professional editor with probably each of the 14 Principles having a title, supported by a series of punchy bullet points and with some real examples that can relate to what actually goes on in the real world, both good and bad.

Clive Kessell

MEMBERSHIP MATTERS

ELECTIONS

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

Fellow

Agrawal	R C	Ministry of Railways	India
Kumar	M	Indian Railway Project Man.	India
Lam	G B S	MTR Corporation	China
Sharma	K D	Additional Member/Signal	India
Sikdar	P M	IRCON International	India

Member

Cheuk	S W	MTRC	Hong Kong
Cochrane	M	Thales Rail Signalling Solutions	
Hall	R	Bombardier Transportation	Netherlands
Johnson	N P	United Group	Australia
Vattamattathil	S	GM Corp	India

Associate Member

Gunti	P B	Infotech Enterprises	India

Associate

Besse	A	Thales Security Asia	Singapore
Best	T	Ricardo UK	
Foley	F	Invensys Rail	
Gajadevasangary	S	Signalling Solutions	
Hoare	A	Coffey Rail	Australia
King	A C	Babcock Rail	
Macdonald	A	Coffey Rail	Australia
Munro	A	Arriva Trains Wales	
Ng	T Y	MTR Corporation	Hong Kong
Parker	P D	Invensys Rail	
Pylyp	M D	Invensys Rail	
Satla	R B	Atkins Tech. Investigation Centre	
Thomas	A J	London Underground	

Student

Sirikhant	A	Ansaldo STS	Australia
Zia	M A	Ansaldo STS	Australia

TRANSFERS

Member to Fellow

Barrow	R J	RSSB	
Tiesma	T H	ARCADIS Infra	Netherlands
Trovo	J L A	Colas Rail	

Associate Member to Member

Attwal	J	Network Rail	
Nettleton	R	Scott Wilson	Australia

Student to Member

Witts	D	Thales Rail Signalling Solutions

RE-INSTATEMENTS

Braun	A G
Chung	Y S S
Das	A K
Gu	E
Hardwick	I
Ran	U

RESIGNATIONS

Collins	S
Ferguson	T O
Hall	C F
Harrison	P M
Smith	T S
Williams	S A

DEATHS

It is with great regret that we have to announce the death of the following member:

Scott	P J	Member

Elected members removed from database (due to non-payment of first subscription)

Mr R Balasubramanian	India	Mr M Abbas	India	Mr S V H Hanumanthappa	India
Mr S P Beck	India	Mr J Brigino	UAE	Mr R P R Isireddy	India
Mr V Sreenivas	India	Mr P Chinna	India	Mr O N Kjellberg	
Mr V Subrahmanyam	India	Mr P S Dhakate	India	Mr P McDonald	
Mr P Venkataswara Rao	India	Mr G Dharmaraj	India	Mr K Nag	India
Mr W K Ansa-Otu		Mr B Gupta	India	Mr K Nanji	
Mr R L Bichet	Israel	Mr S Kapil	India	Mr A E Wells	
Mr M Chimakurthi	India	Ms Y Loganathan	India	Mr J Kumar	India
Mr A De	India	Mr A A Mahammad	India	Mr R C Prajapati	India
Mr C Ganti	India	Mr L Mohan	India	Mr D A L Price	
Mr S S Goje	India	Mr M Natarajan	UAE	Mr S P Sahu	India
Mr V Govil	India	Mr J Shaikh	India	Mr N K Singh	India
Mr B S Guduri	India	Mr J E T Sorreta	UAE	Mr D Bishop	
Mr T Kandiah	Sri Lanka	Mr J J G Todkill	South Africa	Mr J M Bencke	Australia
Mr S Khader Basha	India	Mr S S Turumella	India	Mr P G Talla	
Mr P Kumar	India	Mr R Bhim Singh	India	Mr A Bansode	
Mr R K Rai	India	Mr R Dharani Krishna	India	Mr G Arora	India
Mr A Simtheam	Thailand	Mrs H Gaunt			

Current Membership Total is 4618

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