INFORMED SOURCES e-Preview September 2020

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This month's column focuses on rolling stock issues. It includes some fresh analytical research in New Train TIN-Watch, where I go in search of the elusive reliability bathtub curve.

Alternative traction – the big guns open up
Software – too much of a good thing?.
New Train TIN-Watch

In July both Alstom and Hitachi went large on their alternative traction proposals for UK railway decarbonisation.

As expected, Alstom, in conjunction with Eversholt, is looking to accelerate the import of its hydrogen fuel-cell technology already in service in Germany. Hitachi, the bi-mode specialist, is promoting battery power. There is an interview with Hitachi elsewhere in the September Modern Railways.

As applied to decarbonisation, alternative traction comes with a health warning: 'this can damage your electrification prospects'. Politicians love batteries and hydrogen because they sound modern and cutting-edge tech, compared with boring 20th century electrification.

However, when it comes to decarbonising the railway alternative traction will have a minor role. As the Traction Decarbonisation Network Strategy (TDNS) and Transport Scotland's new Plan (featured in this month's News pages) both show, the long-term requirement for alternative traction will be limited.

Typical applications are the West Highland and Far North lines in Scotland and the Central Wales lines. However the insignificant amounts of CO2 emitted by these infrequent rural services means that, other than for political vanity, there is no urgency to replace diesel traction.

Completing the Midland Main Line electrification to Derby, Nottingham and Sheffield would eliminate 100 times the annual CO2 emissions of the Far North Line. And that is before you replace ScotRail's current 1980s DMUs with Porterbrook Turbostars retrofitted with MTU hybrid (diesel/battery) engine rafts. The demonstrator should have its hybrid rafts installed by September.

Angel Trains, too, is responding to the TDNS view that economic decarbonisation will require low-emission DMUs to run on into the 2030s and perhaps beyond. It is offering the more technically-ambitious Class 165 HyDrive hybrid diesel electric drive conversion.

Hydrogen

Meanwhile, Eversholt Rail and Alstom are injecting a further £1 million into the Class 321 'Breeze' conversion to fuel cell power. Design work is already underway and the conversion will be carried out at Alstom's Widnes facility.

Where Eversholt and Alstom are going for the straight DMU replacement market, Porterbrook and Birmingham University are looking to challenge batteries with their Hydroflex Class 319 conversion. Battery traction is generally being promoted as a means of extending operation of EMUs beyond the wires, but the range is limited.

By retaining the donor Class 319's electric traction equipment, Porterbrook is promoting Hydroflex as a bi-mode, offering longer range beyond – or between – the wires than battery power. The recent £400,000 innovation grant is funding the team at Birmingham University responsible for the detailed final production design and testing.

Batteries

Compared with the relatively modest fuel cell projects, in July Hitachi came out with all PR guns blazing, announcing that a new agreement 'opens the way for battery trains across Britain'. The agreement is with a North East-based battery specialist Hyperdrive Innovation, an SME with an impressive record.

Under the exclusive deal with Hitachi, Hyperdrive Innovation will develop battery packs for rail traction and create a battery hub in the North East. Hitachi sees this as mass-producing power for 'hundreds of battery trains across the UK'.

According to Informed Sources, one 800 Series bi-mode owner is already discussing a trial conversion with a diesel generator unit replaced by a battery power pack. More practical, and also being considered, would be adding battery packs to some of LNER's Class 801 all-electric Azuma fleet – say the five-cars. This would allow operation to Lincoln, for example, just 17 miles beyond the wires.

Electrification

It may seem from the above that I am technophobic when it comes to alternative traction. Not at all. They will clearly have their uses, but replacing diesel traction for the sake of it in the short term should not be one of them.

However, my main concern is that the hype around alternative traction supports the institutional opposition within the DfT and the Treasury to electrification. As mentioned at the start, alternative traction is attractive to civil servants and politicians because it gives the impression that they are committed to decarbonising the railway while continuing to duck the issue of electrification.

A letter in July to the Mayor of Sheffield and the Chairman of Transport for the East Midlands from Rail Minister Chris Heaton-Harris, highlighted the continuing institutionalised prevarication within DfT. They had had written to Transport Secretary Grant Shapps with their concerns about completing electrification of the Midland Main Line.

In reply, Mr Heaton-Harris noted that the TDNS will 'will provide an evidence base to help Ministers decide – looking across all transport modes – to what extent, and how quickly, rail must decarbonise, how much that will cost, and which technologies fit which parts of the network'. It will also identify the areas of the network 'likely to need electrification to decarbonise the railway'.

Then came another cut and paste of the Grayling sidestep. 'Large electrification projects can be challenging, for instance electrification causes disruption for users of the railway and has its own environmental impact'. Even so, 'there are likely to be parts of the network where further electrification is the only credible solution' and these included the Midland Main Line.

Note this complete denial of the findings from the Railway Industry Decarbonisation Taskforce, the TDNS and the independent analysis by David Shirres in last month's Modern Railways – not to mention Transport Scotland's Plan.

While differing in the fine detail, all four agree that the priority is main line electrification with alternative traction on lightly used lines.
Software – too much of a good thing?

Volkswagen has described its new electric cars as 'computers on wheels'. Manned space capsules have been referred to as a container for software. Trains too have become software wrapped in steel and aluminium and in the column I provide a brief history of the growth of electronics and computer control in traction and rolling stock. Plus the problems it causes fleet engineers.

All the suppliers of the fleets entering service have had software issues of varying degrees of severity. For the Class 345 units Crossrail prudently specified a version of Bombardier's existing Class 387 Electrostar software. The Class 710 Aventras for Arriva Rail London and the 720s for Greater Anglia have the new-generation software, development of which has delayed deliveries.

A good example of the practical impact of software on modern rolling stock are the Class 345s. These have all been delivered, unlike the railway they are intended to operate, with many going straight into store.

While nominally 9-car units, to allow service on TfL Rail's Great Eastern service, a sub-fleet of 30 7-car units had to be created. Thus we have 'Full Length Units' (FLU) and 'Reduced Length Units' (RLU).

As followers of TIN-Watch will have noted, the RLU are at 11th place in the new fleet reliability table but the FLUs are last. The explanation for this yawning gap is software and systems complexity.

Creating a short-term, stand-in for operation under conventional signalling into Liverpool Street meant that the RLU would not need to interface with the Computer Based Train Control System (CBTCS) in the Crossrail tunnels, nor the European Train Control System (ETCS) on the Great Western between Paddington and the Heathrow Terminals.

Signalling interfaces would be limited to conventional systems in the form of the Automatic Warning System (AWS) and the Train Protection & Warning System (TPWS). With simple, known interfaces, the Class 345 RLU have had a relatively benign service introduction. In terms of reliability, it is the 'best of the rest' after the Hitachi and Siemens fleets.

Interfaces

But to the West of London, the Class 345s FLUs have retained their full house of interfaces. But, pending commissioning of ETCS between Paddington and Airport Junction, AWS and TPWS have had to remain operational.

Rather than have separate arrangements for these legacy systems AWS and TPWS are integrated with the ETCS, using what are called 'Specific Transmission Modules' (STM). These read the ETCS and AWS instructions and translate them into ETCS-speak. Because of the integration, ETCS remains 'live' when running on the GW mainline, but is limited to supervising the AWS/TPWS STM.

This includes informing the TPWS and AWS which cab is active and then handing over responsibility for train protection to the AWS/TPWS equipment. Once the AWS knows which end of the train has the driving cab, the AWS in the front cab is activated.

However, on two occasions earlier this year the AWS failed to operate approaching a signal. Analysis of data logs found that the AWS failure was due to messages not being sent in the train's computer system. Since January 2019 there had been 94,408 cab activations, with two known failures.

This is a pretty low failure rate, but you only need one SPAD for a disaster. So the FLUs were withdrawn from service. By mid June new software had been written and validation began. Testing started early in July and on 30 July, without any fanfares, Class 345 FLUs started running into Heathrow Terminal 5 again.

Such numbers highlight the challenges of commissioning, operating and maintaining the new generation of software enabled trains. There are challenges for drivers, too.

A Bombardier analysis of 58 failure incidents with Class 345 FLUs showed that around a third were due to what used to be called finger trouble. For example, start-up of the train is complicated by ETCS.

Drivers have to go through a menu of start-up options. As anyone who has filled in a form on-line, will know that a single error will stall the process. Another problem has been the ability of the train control system to handle the unexpected. A classic example was inability of drivers to restart some of the Siemens Class 700 Desiro Cities after the Thameslink power supply problems.

Similarly, if an overloaded train control system trips the ETCS, the driver has to go through the start-up menu again. A 15 minute reset on the main line is not good practice.

Finally, a quick update on the Greater Anglia Class 720 Aventra fleet. This received authorisation from ORR on 8 June Fault free running followed and as I sent this off Greater Anglia Announced that the first six units had been accepted.

New Train TIN-Watch

This month's table has gained an extra column. This is down to reader Graham Heald who wrote in pointing out that TIN-Watch would be more useful if it included trends and even more so if I could show some reliability bathtub curves for new trains.

With Miles per Technical Incident (MTIN), more is better, with improvement giving a an upward line on the graph. To get a bathtub curve you need a reliability metric where fewer is better.

Some trial and error resulted in 'TINs per 100,000 miles' which produces a manageable range of numbers. A provisional rule of thumb is that anything under 5 is respectable, 2 or below is excellent.

In the column I have plotted the TINs per 100,000 miles graphs for six of the new fleets going back to Period 3 2019-20. All the manufacturers in the UK market are represented.

As for finding the classic reliability bathtub curve, one train builder excelled. You'll have to read the column to find out which one.

Hot air

I start and finish the column with my favourite locomotive DP2. It saw my first encounter with frustrating electronics and I conclude by using it as a comparison for the cooling challenges faced by the designers of the Stadler Class 755 bi-mode multiple units.

This was triggered by the noise from the cooling fans which have had to be uprated to run faster to provide sufficient cooling power . A chum posted a video of his quiet street in Norwich near Crown Point Depot at night and the wail from the fans of an idling Class 745 was pronounced.

Residents of Sheringham have also been complaining about the noisy Flirts as they wait in the station for the return journey, describing the sound as 'like a jumbo jet taking off'. So in the age of the software enabled train, old fashioned physical engineering skills like diesel traction air management haven't gone away.

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Video previews
Each month we produce two video previews explaining more about what's in the new issue of the magazine.
Go to our Facebook page (www.facebook.com/modernrailwaysmag) to see the Editor talk to Roger Ford and Ian Walmsley in a 'Zoom' call, or head to our YouTube page (https://rb.gy/jog4f7) where Ian Walmsley hosts a longer video with individual contributions from the magazine's writers. Both videos are usually published on the day the magazine goes on sale, normally the fourth Thursday of the month.
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Roger’s blog

With a high capacity home line and professional video equipment, my colleague Tony Miles led the Modern Railways’ response to calls from the broadcast media following the Carmont derailment in Scotland. The editor and I covered calls from the newspapers.

This is always a challenging time for those of us in the railway press. The first rule is ‘no speculation’, but the reporter is trying to find out what might have happened. The task then becomes using our experience to provide context.

Thus, in one phone briefing the reporter was asking about landslips and I was able to explain the mechanics and refer to Network Rail’s long standing programme of making railway structures more resilient to climate change. With the odd exception, the media coverage I saw was relatively factual, with no attempts to attribute blame as we have seen in the past.

On happier matters, conference calls and Zoom sessions continue to replace face to face meetings. For example, I joined an excellent Zoom meeting updating progress with the water-spray adhesion improvement project described in last month’s report on the latest round of research funding.

Modern Railways videos, introduced in response to lockdown, have now become a regular feature. You can find details of how to view them in the box.

Filming them has become less fraught, although this month it was my turn to disrupt the Zoom call. I made the classic error of writing down what I was going to say. Should have known better.

I also tried to video an introduction to my contribution for the YouTube video on location at Welwyn North. However the wind and a bloke firing up his hedge trimmer may have scuppered that.

Meanwhile, the year races by. It’s time to start researching my contributions to the 2021 edition of our annual publication, The Modern Railway. I think I’m going to have to turn the crystal ball up to ‘11’.

Roger