

INFORMED SOURCES e-Preview September 2019

Only two items this month – a genuine case of 'profit before safety' and a techie investigation into overheating diesel engines. Plus New Train TIN-watch, of course, where the arrival of new entries is accelerating.

Commercially-driven rule change encouraged a less-safe railway

New trains – it's too darned hot!

New Train TIN-watch

A Rail Accident Investigation Branch (RAIB) report into a case of over-speeding by an LNER train at Sandy in 2018 has highlighted the importance of drivers having the latest information on their route. The basic source is the Weekly Operating Notice, or WON. This contains updates on Temporary Speed Restrictions, engineering possessions and changes to signalling or permanent way.

However, the railway is a dynamic system. Speed restrictions may be imposed or lifted after the WON has been published. To cover such eventualities drivers have traditionally consulted the 'Late Notice Case' when signing on for a shift.

These display details of Emergency Speed Restrictions (ESR), diversions and other urgent matters. They were introduced following a serious accident at Goswick on the East Coast Main Line in 1947, where a train derailed due to excessive speed while running over a diversionary route.

Up to 2008, the relevant section of the Rulebook said this:

#### '9.3 Information to drivers

If the emergency speed restriction is continuing for more than a short time, Operations Control will arrange to issue a special notice to each train operator affected. Arrangements will be made for you [the driver] to be informed of the emergency speed restriction.'

But in March 2007, a freight operator challenged this requirement in the Rulebook on the basis that it was costing the company £60,000 a year. The company argued that lineside warning equipment was sufficient to notify drivers of ESR in time to reduce speed.

The issue was investigated by the Rail Safety & Standards Board (RSSB), which concluded that there was no evidence that there would be any discernible change in safety by removing the requirement to post ESR details in Late Notice Cases.

Despite concerns raised by ASLEF and RMT, the relevant industry Committee decided that the requirement to post notices about ESRs should be removed from the rule book. In June 2008 Section 9.3 was removed, although most operators continued to issue late notices, or adopted other means of providing the information to drivers.

One operator that stopped providing information on ESRs was National Express East Coast. It seems that this policy was perpetuated when National Express was replaced by Operator of Last Resort (OLR) East Coast, its successor Virgin Trains East Coast and the current OLR, LNER.

As part of its investigation into the Sandy incident, RAIB asked four 'similar' operators about their procedures for notifying their drivers of ESR. All reported that they inform their drivers in advance, where possible, either by written notices, email, electronic signs or a combination of these methods.

In the case investigated by RAIB, an LNER driver heading south at 125 mile/h missed the warnings of a 20 mile/h ESR for a cracked rail at Sandy South junction, and ran through at 121 mile/h. The driver had not been informed of the ESR and was thus relying on trackside information to alert him to the need to brake.

All the lineside equipment was in place, including AWS permanent magnets providing warnings of lineside boards. So how could the driver miss this sequence of warnings?

Lacking foreknowledge of the ESR, a few second before arriving at the start of the warning sequence he was reaching into his bag to take out some medication for a medical condition. Distracted, he cancelled the warning horn at the first AWS magnet although he didn't remember the warning and did not see the board. Passing the second AWS magnet the driver says he acknowledged the warning and saw the warning board, but thought there was an arrow associated with it, indicating that it applied only to trains on a diverging route.

Not until passing over the AWS magnet for the signal at the end of Sandy station platform, did the driver see the ESR commencement board ahead, realised that the 20 mile/h speed restriction applied to his train and made a full service brake application. This reduced the speed to 121 mile/h over the crossing.

I am sure there are readers who will argue that the driver should have been paying attention and that the lack of foreknowledge is irrelevant. The RAIB clearly disagrees.

On 29 November 2018 RAIB issued an Urgent Safety Advice notice. This advised operators to review their practice in passing on to drivers the advice of ESRs issued by Network Rail.

LNER now notifies its drivers of ESR by email. ESR notifications are also printed on the top and bottom of the document issued to drivers at the start of each journey. This lists the information the driver needs, for example, calling stations.

However a chilling note in the Report is a reminder that Sandy was not a single aberration. On 25 March this year a 5 mile/h ESR was imposed at Bushbury Junction, West Midlands, because of a crack in the stock rail of a switch diamond. A watchman was put in place, and, reports RAIB, in the space of 24 hours, three trains, from different train operating companies, exceeded the emergency speed restriction 'by a substantial margin'.

## Keeping under-floor diesels cool

When I was an apprentice slaving over a hot 16CSVT engine in the diesel test house at English Electric's Willans Works at Rugby, the rule of thumb was that a third of the energy in the fuel went up the exhaust pipe, another third was dissipated by the coolant in the radiators and the remaining third generated power at the crankshaft. Five decades of progressive development later and the thermal efficiency of the MTU engine under your Class 800 bi-mode is a smidgeon over 40%.

Improvements in turbocharging have meant that more of the waste energy in the exhaust is recovered. But you still have to keep the engine cool.

Inside a diesel engine, air is compressed in the pistons until it reaches a temperature of 600-700°C. When the fuel is injected it ignites and the instantaneous flame temperature is around 2000°C. So there's a lot of thermal energy to be dissipated if the engine is not to overheat and do itself a mischief.

You cool the engine by circulating liquid around the cylinders where the heat is being generated. The coolant heats up taking away the energy which is then dissipated by the coolant being passed through a radiator where the heat is removed by a flow of air.

Cooling is relatively straightforward when you are installing an engine and its ancillary systems in a locomotive or power car. There is adequate space for the radiators, coolant pumps and control system, which are generally brought together in a 'cooler group'. The vehicle sides provide ample space for radiator grilles and the fans can be mounted in the roof.

But when HST2, with a diesel power car at each end, became the Intercity Express Programme (IEP) bi-mode with under-floor diesel Generator Units (GU), cooling became much more demanding.

Before IEP, the most powerful under-floor diesel engine within the UK loading gauge was the Cummins 750hp unit. Packing this engine and its auxiliaries into the engine rafts under Voyagers, Class 180s and Class 185s was a pretty clever piece of packaging and air management.

For the Hitachi Class 800 bi-mode, power pack supplier MTU had to fit a much larger Vee-12 cylinder engine rated at 940hp into the under-floor GU. Just to put that in context, a motored Class 800 vehicle has nearly the same installed power as a Class 20 diesel loco.

Which brings us to the July heat-wave on GWR. Last summer the Class 800 bi-modes showed a propensity for overheating, attributed to the radiator matrices becoming blocked with pollen, ballast dust and suchlike.

This year saw new records set for maximum temperatures. At high ambient temperatures the air passing through the radiators can take less heat from the coolant. A radiator clogged with pollen and dust reduces the flow of the cooling air exacerbating the problem.

As a result, the coolant returning to the engine from the cooler group is warmer and can thus extract less heat from the engine. This process repeats until the over-temperature switch cuts in and the engine shuts down – assuming it hasn't already done itself a mischief.

With today's Class 800 and Class 802 units drivers have an unprecedented ability to monitor their engines through the screens and menus of the Hitachi Train Management System (TMS). Hitachi's Traction Riding Inspectors on board are even more expert in looking inside the magic boxes.

As a result, the driver can use the TMS to monitor engine temperatures, note which engines are at risk of overheating and drive accordingly, with the aim of having the maximum sustainable power available when it is really needed.

So the technique in hot weather seems to be to try and keep the bi-mode engines around a maximum of 100°C. If an engine shows signs of overheating, you shut it down and restart it. It then runs at idle, cooling down, and when it is comfortable you push the 'diesel' button and it returns to work.

While this is happening, you can't afford to work the running engines too hard in case they over-heat. Drivers report that on the TMS they could see the TRI managing the engines to ensure power is there when it's needed.

Meanwhile, according to my chums at Hitachi, MTU has modification programme for the GUs which will form part of a wider programme of current work to increase performance and reliability of all the bi-modes. Hitachi is currently finalising these modifications with MTU.

Following on from the existing enhanced maintenance processes for the GUs, this next step will further improve performance and prevent any issues when running under higher temperatures. Most of the future modifications will be implemented while the GUs remain in situ.

However, a small number of modifications will require the GUs to be removed, and these will be implemented when they fall due for routine heavy overhaul. MTU have send me a cracking photo of a couple of Class 800 GUs in their East Grinstead overhaul facility, where a new Training Centre for maintenance staff has just been opened.

Not that Hitachi and MTU have been the only manufacturers with overheating problems. The diesel engine generator modules in the Viva Rail Class 230 Diesel Multiple Units (making their debut in TIN-watch this month) have also suffered.

What has surprised Viva Rail since the units starting running between Bedford and Bletchley has been the amount of pollen in the summer air which, guess what, has been blocking the radiators. An improved cooling system has been fitted which allows the pollen and other gunge to be blown out of the radiator matrix more frequently.

But Hitachi and Viva Rail are in good company. At the Austrian motor racing Formula 1 Grand Prix in June, held in temperatures of 33°C, World Champion Lewis Hamilton could finish only fifth because he had to lift off and coast before corners to prevent his Mercedes engine from over-heating.

This month we welcome West Midlands Trains' Viva Rail Class 230 diesel multiple units to the Table of truth. It's a pretty inauspicious debut at the bottom of the Table.

It was just under five years ago, in October 2014, that I met Adrian Shooter at St Pancras International for a chat over coffee about his proposal to re-purpose London Underground D79 stock into low cost Diesel Multiple Units. There was much cynicism about such conversions at the time.

But, with some hiccups along the way, the first units are in passenger service; Viva Rail has two manufacturing plants; and five diesel-battery hybrid three-car units are being produced for North Wales services. In the column there's a note on service experience to date.

Roger's blog

When it comes to organising new service launches, LNER show how it should be done. They can even organise the weather. At the Azuma launch at the end of July it was blue skies at York and Darlington for photographs with the blue and green kettles, while elsewhere in the country the rain was hissing down.

Talking of Azuma, I must apologise for not reporting back on the LNER trains despite having had two 'tasting' trips as part of the service launches. I have taken lots of notes and photos and will try to fit in a report in the next column.

What I can say is that despite the East Coast Main Line not being as smooth as it used to be, having borrowed a pound coin from our Assistant Editor it balanced on edge at 125 mile/h long enough for me to get my smartphone focused to record the standard test.

Overall the ride is reminiscent of a Mk 4 coach. Very smooth on very good track, but 'busy' on less than perfect rail, with a tendency to break-up over switch & crossing work.

As I write, I'm waiting for a date for my visit to see the new level crossing mentioned last month and then there's the visit to Didcot for an update on the Luminate Integrated Traffic Management system. This should include a consultant's analysis of the benefits for operations.

TM seems to have gone off the boil since the Digital Rail bubble burst, so this visit and other meetings should allow me to put together a comprehensive review of where the one-time salvation of the railway has got to.

Otherwise September is fairly quiet, which is not a bad thing as I have three desk jobs to get on with. The first is to analyse the award, announced last week, of the West Coast Partnership franchise to the First Group/Trenitalia consortium.

This was announced the day after the September Modern Railways went to press, so I have time to, among other research, try and reverse-engineer the premium profile, which nowadays requires a freedom of information act application to get out of DfT.

On 3 October I will be off to Derby for the Modern Railways Rail Vehicles & Enhancements (RVE) exhibition. This is a business-to-business show and last year I found something to put in the notebook on pretty well every stand. With so many specialist suppliers under one roof, it is also the ideal opportunity to identify technical and commercial trends.

Anyway, the second task is to write the introduction to the RVE Show-guide.

Finally, if it's September, it's time to start researching and writing my contributions to 'The Modern Railway', our annual industry directory and guide to the UK railway. The current issue sits in my 'ready to use locker' of reference books which I can pull out just by swivelling my chair and gets used regularly through the year.

It has become a tradition that the headline for my introduction setting the agenda for the new issue reads 'Year of ...'. For 2019 it was 'Year of reckoning', which was pretty accurate. 2020, which will be our 14th Edition, is looking like a 'Year of turmoil'.

Roger