

INFORMED SOURCES e-Preview July 2017

With everything having gone quiet during the pre-election Purdah I decided to get in touch with my inner traction engineer. So this month's column is devoted to an HS2 Rolling Stock Special.

HS2 rolling stock procurement launched
Trains for HS2 – Technical Spec has its moments
Manufactures line up
New train blues

To kick off procurement of its rolling stock, High Speed 2 invited suppliers to an industry event in March. While the tone of the presentations was hiding-behind-the-sofa cringe making, there was useful information to be extracted.

Only seven of the eight rolling stock manufacturers who HS2 says have registered interest were present. The smart money was on Hyundai Rotem of Korea being the no-show.

As already reported the 'core fleet' for Phases 1 and 2a (London-Crewe) will be 54 sets, of the Conventional Compatible Very High Speed Trains (CCVHST), also able to run on the national network. Final service patterns may require a larger fleet – say 60 sets.

Phase 2 of HS2, opening in 2033, is likely to require around 100 additional train sets of which some 60 will be more CCVHST. HS2 is proposing a separate procurement exercise for this Phase 2 fleet. As Andy Cross, HS2 Rolling Stock Procurement Director, told the event, the current procurement process must generate an effective competition, 'while ensuring the decisions we make for Phase 1 don't limit or jeopardise Phase Two'.

This implies that HS2 is considering going out to tender again for a new fleet of CCVHST, potentially from a different manufacturer. These will enter service just when HS2 is stepping up to its 18 trains/h timetable.

HS2 Head of Rolling Stock Engineering Tom Williamson reminded the meeting that the combination of operating speeds of up to 360km/h on HS2 with through running on the national network will make CCVHST 'different from anything you might have worked on before'. So if you have something that is working why would you want to start all over again with someone new? When it comes to procuring the second batch for Phase 2, unless the first batch has been a total dog, the sensible solution is to place a repeat order, incorporating lessons learned and any useful technical upgrades. Engineering egos can be assuaged with the smaller Captive fleet.

CCVHST specification emerges.

HS2 has also published Pre-Qualification Technical Summary (PQTS) for the CCVHST. This occupies a commendably modest 38 pages. As the trains will spend much of their time on the Conventional Rail Network (CRN) the specification highlights some interesting contrasts.

For example the platform height at HS2 stations will be 1115mm where CRN Platforms are built to a nominal height of 915mm, but as the spec' reminds us, this is subject to 'significant variation'. The CCVHST is going to present an interesting challenge for the door designers.

Similarly, compared with the constant 5.08m height of the HS2 overhead line electrification contact wire, the height of the wire on the CRN is described, with masterly understatement, as 'variable'. Pantograph compatibility is likely to be another interesting issue.

Acceptance

Demonstrating the trains' compatibility with the infrastructure will be the responsibility of the manufacturer. This will be interesting on both HS2 and the CRN.

First the 360km/h 'anticipated' maximum speed exceeds the technical scope of the relevant Technical Specification for Interoperability (TSI) which assumes that 350km/h is fast enough. Some consultants are going to make a lot of money extrapolating specifications to allow for that extra 10km/h.

Incidentally, a leading European supplier of Overhead Line Equipment for high speed lines told me recently that that above 320km/h the maintenance needed increases not with speed squared, as you might expect, but 'exponentially'. 'Every extra 1km/h makes a difference', he warned.

Talking of acceptance, at the industry day the potential suppliers were told 'once we've actually got a train to work with, we'll need to carry out extensive off-network testing to prove the capability and reliability of the design before we take anything onto the new high speed network or our conventional network for real'. That raises the interesting question of where do you prove the capability and reliability of a 360km/h train off the network?

Speed

Performance is specified in terms of journey times, rather than a maximum speed. For London Euston-Birmingham Curzon Street the bogey time is less than 45 min 30 seconds, including stops at Old Oak Common and Birmingham Interchange stations with a 2-minute dwell time at each. London Euston-Glasgow Central via Handsacre Jct must take less than 3h 45min 30sec, also with two stops.

Journey times for two units in multiple on the CRN are still under consideration. As HS2 points out 'a train current limit of 300A will constrain achievable journey times for longer formations and (HS2) is therefore investigating whether the maximum line current can be increased for the CRN'. That depends on whose budget funds the upgrade, I suspect.

Acceleration is also specified. The basic requirement is for a train to reach a speed of 360km/h and cover a distance of 40km in no more than 535 seconds from a standing start on straight and level track. I have some more analysis to do here on speed/tractive effort curves and the like.

Energy

There will be contractual energy consumption Limit, with incentives to reduce usage. This will be based on the standard Euston-Curzon Street 49 min run, with two stops and the energy used measured over a return journey.

HS2's business case is based on an assumed energy consumption of 22.6 kWh/Unit km. That figure is meaningless unless you know the duty. However, to give it some context I have raided Professor Roger Kemp's 2007 paper for the Rail Safety & Standards Board and readers may find the comparisons with existing trains interesting.

There's some detail on legroom and capacity in the column. An interesting concept floated by HS2 is the ability to match the train's passenger accommodation to contrasting duties: the London-Birmingham dash versus London-Glasgow are instanced. Ideally, says HS2, the interior design would be adaptable 'to support changes in use during the week or even during a single day.' Hmmm.

Reliability

This is really going to make the bidders sweat, or get the lawyers smiling. HS2's reliability target gives a Moving Annual Average (MAA) delay per service 'on the HS2 Network' of no greater than 30 seconds at destination.

That is for the railway as a whole. Train reliability assumes 60 units travelling 610,000-670,000km per year which gives a Mean Distance between Failures (MDBF) causing a delay of over 3 min of at least 300,000 km.

Now the Golden Spanners awards are based on Miles per Technical Incident (MTIN) and a TIN is generated when a train has stopped for three min. So HS2 is looking for 186,000 MTIN.

This compares with the current most reliable electric train on the Network, the Siemens Class 444 Desiro, at 166,772 MTIN. It certainly rules out tilt, since nothing is so reliable as the system you don't fit.

Sexy Front Ends at Railtex

Several of the rolling stock manufacturers who have expressed interest in HS2 took advantage of the Railtex exhibition in May to showcase their wares. Mostly this was limited to models, artists' impressions and the odd virtual reality interior walk through.

Hitachi

Hitachi claimed to be 'Bringing UK rail into the 21st century'. Nothing like patronising your adopted home to win friends and influence people.

On show was a model of the concept AT400 driving vehicle dubbed 'The British bullet train'. This is 'broadly based' on the Shinkansen E5/E6 series.

E5 10-car trains have been in service since 2011, followed by the E6 seven car 'mini Shinkansen', which has a smaller cross-sectional profile, in 2013. Both are derived from Japan East's two Fastek 360 experimental trains. The 360 refers to the design speed in km/h, but note that having explored 360km/h Japan East also settled for 320km/h in regular service.

Talgo

Talgo presented the UK version of the AVRIL VHST which made its debut at Innotrans back in 2012, AVRIL is a Spanish acronym that breaks down to High speed, Independent Wheels, Lightweight.

Rather than insulting the customer, Talgo got with the Theresa May zeitgeist, offering 'High speed rail excellence: value for money for taxpayers'. You can almost hear the robotic repetition of this sound-bite in response to a journalist querying the award of the HS2 contract to a Spanish company.

Talgo reckons that AVRIL UK will be 20% cheaper to buy, cost 25% less to maintain and use 25% less energy. Than what is not stated. Maximum design speed is 380km/h by the way.

Alstom

HS2 has been using Alstom's AGV (Automotrice à Grande Vitesse) as the 'reference train' for technical and commercial development of the new line. Alstom also has the Avelia Liberty articulated high speed train ordered for Amtrak's North East Corridor which incorporates a derivative of Pendolino tilt technology.

Where Alstom was clever at Railtex was to have a display of 3-D printed model vehicles which could be coupled together to form 'trains'. This included pretty well everything from the Group's high speed range, including the new ultra-compact 18m long power car. There should be a photo of my 'super power' formation in the column.

Of the other runners present, Siemens was looking at HS2 as an integrated system including train control, electrification and even tunnel ventilation in addition to trains. Although there were more models on the Chinese CRRC stand than a Bassett Lowke enthusiasts convention, technical communication was limited. Bombardier wasn't exhibiting.

Slow progress with new trains

Building new trains is relatively straightforward. It's getting them accepted and into reliable service that is the really difficult part. Indeed, I must add 'nothing new works out of the box' to the Laws.

This eternal truth is currently being rediscovered courtesy of the big-three 'state-specified' rolling stock contracts - Intercity Express Programme (IEP), Thameslink and Crossrail.

Acceptance of Great Western Railway's Hitachi Class 800 bi-mode fleet has been deferred by six months because of Network Rail's delay in commissioning Route Section 3 of the Great Western Electrification Project (GWEP). Testing between Reading and Didcot should have started in September 2015.

But RS3 wasn't energised until July 2016, when the first runs revealed interference between the train's traction equipment and the Overhead Line power supply, halting running. Further tests in September 2016 were no better and acceptance was halted pending a solution to the problem.

Having followed Hitachi from their first Verification Train I reckon the traction power supply is the problem, rather than the train. However, changes to the Class 800 control software have now allowed the acceptance testing programme to re-start, but with over a year of test running lost, the IEP contract has had to be revised.

Under the new programme the first train should be accepted this September. Seven Class 800 sets should then be available for the start of passenger services during October. Delivery of the Virgin Trains East Coast IEP fleet is likely to experience a knock-on delay.

Crossrail was due to have started infiltrating the first Bombardier Class 345 Aventra EMUs into revenue earning service on the Liverpool Street-Shenfield route at the end of May. This target was missed due to what Informed Sources described as 'paperwork and some snags that showed up in driver training'.

At the beginning of June Transport for London was anticipating testing being completed 'within the next few weeks'. The first 11 Class 345 units are due to be running on the Shenfield line by September.

While Hitachi and Bombardier are still grappling with acceptance, Siemens is in the thick of commissioning production trains, a process which in my experience makes acceptance running seem restful. Progress is reflected in the 'bathtub curve' which refers to a graph plotting failures against time.

In theory the graph starts at a high rate before falling rapidly to a consistently low level as problems are resolved. Hence the term 'bathtub'.

However the Class 700 Thameslink fleet seems stuck in the soap tray and unwilling to take the plunge. Despite 42 sets available and nine months' operating experience, MTIN remains stubbornly below 4000.

There is an argument that a fixed formation 12 car EMU is statistically disadvantaged compared with three four-car EMUs in multiple. If both run 10,000 miles with a single failure, the three EMUs will count as 30,000 unit miles while a 12 car Class 700 will be recorded as 10,000 unit miles. So, the four car fleet is recording 30,000MTIN compared with only 10,000MTIN for the 12 cars. But even multiplied by three, current Class 700 performance is still short of its peer group.

Late breaking news

Back in the April column I reported Network Rail's intention to sign a contract with Resonate to add integrated Traffic Management(TM) facilities to the company's Scalable Integrated Electronic Control Centre (IECC) at the Thames Valley Signalling Centre. It was hoped to sign the contract early in April, but in the event I got the phone call from Network Rail confirming that the deal was done on 8 June.

Full report and analysis of this significant development in next month's column.

Roger's Blog

Last month's blog was written in the run-up to the grand daughters competing in the local semi-final of the All England Dance competition, which involved much chauffeuring around to rehearsals. With all that excitement I overlooked a couple of up-coming events when I said June was going to be quiet.

First of all, on 6 June I spent a productive day at the Institution of Mechanical Engineer's Electrification seminar. I know I've said it before, but the IMechE Railway Division has the knack of putting on events at exactly the right time and this was no exception. The choice of speakers and topics could not have been bettered and while the attendance was on the low side there was a wealth of experience in the audience. There were some robust debates during the day, not least on the subject of electrical clearance regulations.

On a personal note, it was just over 50 years ago that I was in the same hall for the conference celebrating the technical achievements of British Rail's Euston-Liverpool/Manchester electrification. From triumph to disaster in half a century.

I also forgot to mention that the fourth Friday Club meeting this week incorporates the 2017 Rail Industry Innovation Awards. Network Rail Chief Executive Mark Carne is the guest speaker and I will be doing my MC bit. More details can be found on www.4thfriday.co.uk.

Next week it's the Stagecoach Summer Reception, which is always a jolly and notebook-filling occasion, but this year may be overshadowed by the imminent loss of the South West Trains franchise. I'm also waiting on an early morning appointment for my briefing on the Great Western TM contract.

So far the only entry in the diary for July is the Hitachi Summer Social in Wapping which, it is claimed, will be the rail event of the summer.

However, the railway writer's summer is not one long round of canapés and Pimms. DfT has to present its High Level Output Specification (HLOS) and Statement of Funds Available (SoFA) for Control Period 6 (2019-2024) to the Office of Rail & Road by 20 July.

So brace yourselves for a heavy read after the holidays. Unless of course, given the political turmoil, DfT revisits the 1974 Railways Act and the shortest HLOS ever simply says 'provide a public service which is comparable generally with that provided at present'.

Roger

