**Ground vibration boom**

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BEHIND THE NEWS

Monorail for sale

AFTER going round in circles for a decade, Sydney's Darling Harbour monorail could be heading for pastures new. Australian business group TNT announced at the end of April that the single-track loop opened in July 1998 is up for sale. Built at a cost of A$65m to offer visitors a leisurely tour of the city centre and the refurbished waterfront, the line has failed to attract sufficient volumes of traffic and has never shown a profit. Asking price is said to be around A$30m.

Our correspondent also reports that TNT may be looking to pull out of the Sydney Light Rail consortium, whose 3-6 km line parallels the monorail along the back of the Darling Harbour exhibition and conference centre. The consortium wants to extend west to Lilyfield and north into the city centre to create a genuine public transport corridor, but the NSW government has decided to delay any decision until after the 2000 Olympic Games. No matter that residents might find a tramway into the city of practical benefit, the shopkeepers who have spent a decade watching the monorail rumble past their shop windows are rather more sceptical. With ridership still below budget, the delay could prove too much for the light rail promoters.

TNT's latest rail venture seems just as uncertain: it is backing the AS2bn InterCity Express venture to introduce German high-speed trains between Sydney and Canberra. ICE was shortlisted in April along with the Speedrail TGV venture backed by GEC Alsthom, Capital Rail with an Adtranz X2000 derivative, and the ever-hopeful Transrapid promoters offering a 550 km/h maglev line which could cut the journey time to just 59 min.

All four groups envisage they could have the line ready by around 2002, but none is now in a position to harness the publicity and business incentive serving the Olympics. If Canberra really is the 'controversial' playing, it could be a dead-end monorail instead. Going cheap, low-mileage, with one careful owner.

UP woes over?

ATTACK is the best form of defence, so the saying goes. Perhaps this explains Union Pacific's May 1 decision to pour $1.4bn into its Texas and Louisiana operations over the next five years, with up to $1bn to be spent this year. Of this, $1bn will go on upgrading track and signalling, on the 800 km SJ line from安东尼—New Orleans corridor. The rest will be invested in expanding line capacity, yards and terminals.

UP's plans have been drawn up as a result of a strategic study carried out in the wake of the congestion which nearly crippled the network at the end of last year (RG 119 271), and which led the Surface Transportation Board to issue an emergency order in December (RG 138 p18). However, Union Pacific CEO Dick Davidson has made it clear that the proposed capital investment will only be made if UP has exclusive use of the facilities it upgrades, giving a fair return on its investment. This may be seen as a move to try and head off the prospect of third party operators which could follow if open access is allowed. Even in late April UP still had lingering trouble spots. A report filed to the STB revealed that the Memphis intermodal terminal was full and causing delays (UP is spending $55m on its expansion), and there was also a shortage of double-stack wagons in southern California and congestion on the central corridor to the Midwest. There were fewer delayed trains, but still about three times more than normal. Yet at the same time UP's wagon inventory showed a fall from 300,000 at the height of the crisis to 250,000, little more than the normal level. Cross-border traffic into Mexico has also returned to normal, with UP ending the permit system controlling airfreight-bound wagons on April 23 after the backlog had been reduced from 24,000 to 2,000. UP may just have turned the corner, but nonetheless, at least all the shippers, is going to be forced to pay.

Integral slips

CZECH railwaymen looking forward to running 200 km/h tilting trains between Berlin, Praha and Wien may have to wait a little longer. CKD Praha announced last month that delivery of the prototype Class 680 Integral had slipped by another nine months to April 15 next year.

When the contract for 10 sets was awarded to the CKD-MSV-Siemens-Flint consortium in 1995, the prototype was due to roll by the end of 1997, but last year this was postponed to July 1998. Citing problems with the tilt equipment and aluminium bodysells, CKD also admitted that the price has risen from Kc4-1bn to Kc5bn.

The company still hopes to begin trials before the end of this year and claims that test running under three electrical systems in Germany, Austria and the Czech Republic can still be completed in time to have all 10 sets in service by the May 2000 timetable change as planned.

Patience exhausted

BACK in 1992 Norwegian State Railways placed a NK1200m order for a small fleet of Type D6 diesel locomotives from Kripp-MAK and Siemens for delivery in 1994-95. They arrived in Norway two years behind schedule.

Since then the locos have had a chequered history, and at one stage they were returned to Siemens Schienenfahrzeugtechnik in Kiel for modifications. Among the problems were higher than specified lateral track forces, and one locomotive catching fire. NSB refused to accept the locomotives until December last year, when it agreed to take 11 out of 12 units under a deal which provided for Siemens to extend the guarantee period for two to four years.

All seemed to be well, but more problems then surfaced. NSB says another unit caught fire, and the electronics failed to function at -35°C whereas the specification required -40°C. The railway issued a statement on April 28 saying that the 'availability has up to now not been at the agreed level and new faults have occurred in 1998, prompting it to issue 'a written notice about rescission of the contract'. This means that 'the contract will be terminated on July 1 if the availability does not come up to the agreed level.'

NSB comments that this means 'termination for new diesel locomotives. At the same time an upgrading programme for the old locomotives must be initiated in order to keep the existing engines from the 1950s, the D6, in working order a few years more.'

Ground vibration boom

RAILWAY-generated ground vibrations can cause significant disturbance for residents of nearby buildings. As speeds rise, the intensity of vibrations generated by trains generally increases. Recent theoretical investigations of ground vibrations have shown that high-speed trains undertaken at Nottingham Trent University have contributed to a better understanding of why this should be. Researchers had predicted especially large increases in vibration level would occur if train speeds exceeded the velocity of Rayleigh surface acoustic waves in the ground (Krylov V V. Applied Acoustics 44, 1995, pp149-164). If this happens, a ground vibration boom occurs, similar to the sonic boom predicted by Austrian physicist E Mach about a century ago.

More than 50 years passed between publication of Mach's theory and appearance of the first supersonic aircraft generating a sonic boom. Much less time elapsed between the first theoretical prediction of a ground vibration boom from high speed trains and the event occurring in practice. Dr Christian Madshus reported at a conference entitled 'Ground Dynamics and Man-made Processes: Prediction, Design, Measurement', organised by the Institution of Civil Engineers in London at the end of last year, that the research team from the Norwegian Geotechnical Institute observed a large increase in ground vibration level when train speeds exceeded the Rayleigh wave velocity in the supporting ground.

Swedish track authority Banverket observed the problem when SJ's 200 km/h X2000 trains began using the West Coast main line from Göteborg to Malmö. The X2000 operates Rayleigh wave velocities in this part of southwest Sweden, which is characterised by very soft ground. In particular, at a point near Länsjätet the Rayleigh wave velocity in the ground was as low as 45 m/s, so that an increase in train speed from 140 to 180 km/h led to a tenfold increase in generated ground vibration level. For speeds around 200 km/h the dynamic motion of the railway embankment was severe, with ground particle peak acceleration near 10 m/s2. These results agreed well with the theoretical calculations carried out for the reported value of Rayleigh wave velocity in the ground.

According to Prof Victor Krylov, Head of Acoustics & Vibration Research at Nottingham Trent University, this confirms that a ground vibration boom is not an exotic effect of the future. It is a reality for high speed lines crossing soft soil and so are 'supersonic' or more precisely 'trans-Rayleigh' trains. Builders and operators of high speed lines should take note.

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