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 monorails rumbling 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 Inter-Capit 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 GE/Alstom, 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 wants its "high-tech” playing field, it might be able to buy a second-hand 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 $1.6bn to be spent this year. Off this, the end of July will go on upgrading track, and signalling on the 850 km Sydney-Canberra line. 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 12.9.97), and which led the Surface Transportation Board to issue an emergency order in December (RG 1.19.98). 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 well be seen as a move to try and head off the prospect of third party operators which could follow Kalita for open access. 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 $5m 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 few 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 235,000, little more than the normal level. Cross-border traffic into Mexico has also returned to normal, with UP ending the permit system controlling single-unit westbound trains on April 23 after the backlog had been reduced from 1,000 to 2/00. UP may just have turned the corner, but none, least of all the shippers, is going to forget.

**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-Fiat 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 bodysides, CKD also admitted that the price has risen from KRC14bn to KRC18bn.

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.

**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 show that high-speed trains undertaken at Nottingham Trent University have contributed to a better understanding of why this should be. Researchers had predicted that especially large increases in vibration level would occur if the 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 Madsbus 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 Ledsjärde 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 embodiment 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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