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VFT TOPICS

What is the VFT?

The VFT is a proposed high-speed railway system to link Sydney, Canberra and Melbourne. Travelling between Melbourne and Sydney in three hours, the trains will have a cruising speed of 350 km/h to sustain an average of 292 km/h. Their design will use wheel-on-rail technology on standard-gauge double tracks. Trains will be electrically powered from overhead lines. The VFT project will be funded by private enterprise and will run at a profit.

An artist's impression of Australia's proposed VFT. – Phil Belbin painting

It isn't easy to come to grips with what makes the VFT so different from the trains we are used to throughout Australia. Most people do not have the time to study the project in depth by reading our major reports — the *VFT Concept Report*, published in December 1988 and *VFT: Focus for the Future*[1] published in October 1989. This issue of *VFT Topics* is intended to give a broad-brush picture of the VFT. If you would like more detail, you will find interest in other issues of *VFT Topics*.

In many ways, the greatest barrier to understanding the VFT is having too many pre-conceptions about existing trains. That can be quite difficult for many people, because they have been familiar with trains since childhood. And yet, Australians who have travelled on fast trains in France, Japan, Germany, Italy and Britain invariably mention a host of contrasts with the trains we know in Australia. Most are very enthusiastic about those contrasts: we haven't met one such traveller who hasn't been totally keen on going by high-speed train.

Perhaps we can start by outlining those contrasts to explain more clearly — but without exaggeration — what is the VFT.

If you catch a train between Melbourne and Sydney today you will take 13 1/2 hours to get to your destination, if you arrive on schedule: that's an average speed of a little over 70 km/h. The train stops at many small towns. Many people who have made the journey have made comments like "I enjoyed it once off, as a slightly quaint, leisurely experience." Travellers reported they were tired at the end of the journey, as they would be at the end of a 13 hour bus journey between the capitals.

But most travellers will never have that experience, because slow train journeys don't satisfy their needs. Our market surveys have shown very clearly that most people are looking for:

- short journey times (most people try to avoid more than three hours travel);
- comfort;
- reasonable price; and
- convenience.

We'll look at these factors in turn.

Short journey times

How do you get from A to B much faster than at 70 km/h? Perhaps by improving the technology of the

1 $5.00 from the VFT office and public displays, plus $5.00 postage and packing.

A French TGV-A: clean, harmonious transport, free of fire risk. Its corridor width of only 40 metres is much less than the six-lane highway that would be needed to carry the same capacity. – photo SNCF

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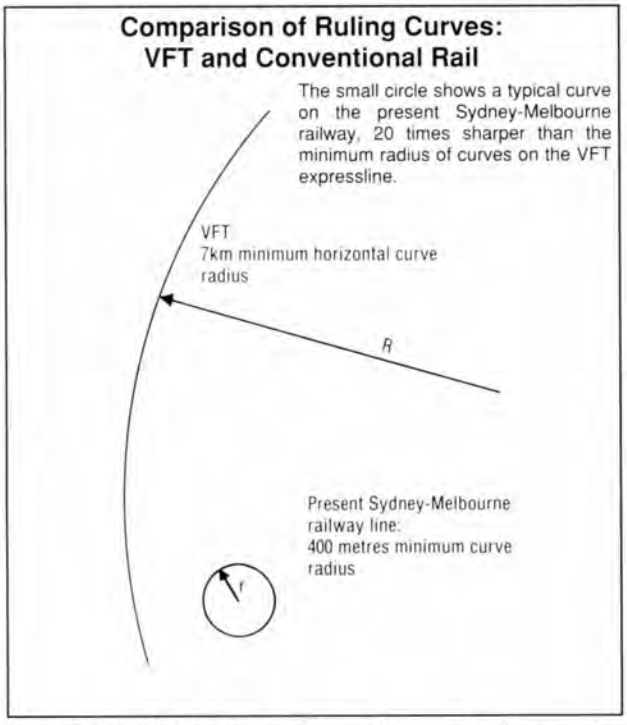
trains? Unfortunately, that hardly improves things at all. A journey between Junee and Cootamundra was simulated on a complex computer program. It showed that one of the current NSW State Rail Authority XPTs would trail behind a French TGV high-speed train by only 1 1/2 minutes in the half-hour trip. So it isn't the train that's important for high-speed running. In fact, the critical factor is the track.

The design of track is one of the contrasts between high-speed and conventional trains. On the Sydney-Melbourne railway line, the sharpest curves are about 400 metres in radius. To be comfortable, a 350 km/h train needs to have curves 18 times more gentle: about 7 km in radius. Figure 1 shows the enormous difference between these minimum radii. Where possible, the VFT expressline will have curves of 8.5 km radius.



Building a VFT expressline would be enormously costly — about $3 billion — if a conventional alignment had to be followed. However, because of the physics involved in high-speed trains, gradients on a high-speed line can be very much steeper.[2] Earthworks will only cost $800 million because the VFT will generally follow the natural undulations of the land.[3]

At speeds of 350 km/h, the track must be extremely smooth. The maximum vertical mis-alignment allowable for every 1.8 metres in track length is less than 0.3 of a millimetre (about the thickness of a business card). That sort of accuracy requires advanced track levelling machines which use laser beams for measuring. Very high standards of track engineering, including continuously welded rail, are needed to maintain a smooth ride. To many people's surprise, the type of track used on most high-speed lines looks like conventional railway line. However, the rails, ballast and sleepers of the VFT expressline will be built to standards of engineering much more rugged than on Australian government lines. The track will be like that of the very heavy duty iron ore lines of the Pilbara region of North-western Australia. Whereas 1 000-tonne trains are commonplace elsewhere, these isolated lines carry 28 000 - tonne trains, about 2 kilometres long, around the clock: they lead the world in heavy-haul technology, much of it originating in Australia.

A logical question is: if gentle curves are the key to high speeds, what would happen if conventional locomotives had their gears changed to allow much higher speeds on a gently curving expressline? They would in fact work very well. But there is a catch. Diesel-electric locomotives have traction motors weighing as much as 2 tonnes on each of their four or six axles. These motors are not mounted on springs, so they have a very damaging effect on track — much as the heavy wheel assemblies on semi-trailers damage highway surfaces. High-speed locomotives overcome this problem by having motors bolted to the chassis or bogie frame; only the axles and a small portion of the gear assembly are un-sprung. Therefore, they can run at much higher speeds without damaging the track.[4]

2 The enormous significance of the energy of movement (kinetic energy) at high speeds is shown by two trains whose drivers cut off power at the foot of a 40 metre hill before coasting to the top. A train travelling at 100 km/h when the power is cut off would come to rest at the summit. A train travelling at 350 km/h (the projected cruising speed of the VFT) when the power is cut off would pass over the summit at 335 km/h. High speed trains are able to use this energy of movement to climb gradients that are much steeper than on conventional railway lines.

3 Some of this cost includes the need for large numbers of underpasses and overpasses for traffic, farm vehicles and animals; there will be no level crossings on the VFT line!

4 XPTs have relatively low unsprung weight, much like high-speed electric trains. If track on existing lines were improved, XPTs could average much higher speeds than at present (they can only travel at their 160 km/h cruising speed on short stretches of suitable State Rail track). Their suitability for running at VFT–type speeds is limited by power output, as explained in the next paragraph.

Private West Australian iron ore railways are world leaders in rail technology. Their heavily engineered but conventional looking track, similar to the VFT's, carries freight trains up to 20 times heavier than those on State rail systems. – M. Hardoe photo

The next question is: what method of traction can produce the power needed to propel a train at 350 km/h? As a starting point, let's look at a good example of a modern conventional train: the Express Passenger Train — XPT — of the State Rail Authority of New South Wales. Based on a very successful British design, the HST, and modified extensively for Australian conditions, they are Australia's fastest passenger trains. Where the track allows, XPTs can travel at 160 km/h. They are driven by diesel-engined power cars (locomotives) at both ends. Their power output is close to the maximum practicable in the push-pull configuration needed for high-speed trains. They produce 3 megawatts of power per train. However, the VFT will need about 8 megawatts to achieve its cruising speeds. That power output can only be achieved by electric propulsion. Either 25 000 or 50 000 volts alternating current will be used outside the metropolitan areas of Sydney and Melbourne. Within those cities, 1 500 volts direct current, compatible with suburban trains, will be used. VFTs will change from one type of overhead current collector to another, at speed, on the outskirts of the cities.

To summarize the enormously different features of VFTs that will enable them to go between Sydney and Melbourne in three hours:

- Curves will be extremely gentle.
- Track will be exceptionally smooth.
- Trains will be specially built to minimize track damage caused at fast speeds by high un-sprung weight.
- They will be powered by electricity from overhead wires to gain enough power for high-speed running.

Above: The VFT's quest for excellence will be reflected in on-board cuisine as much as in standards of comfort, convenience and reliability. – SNCF photo
Left: An XPT of NSW State Rail: a brilliant design at the upper limit of power output for diesels, but hampered over much of its route by very tight curves. – Dale Budd photo

Comfort

Far from providing a "take it or leave it" method of fast travel, the VFT will offer a travel experience which, from start to finish, will be comfortable and enjoyable. Already, research has been undertaken to determine the best seating positions, spacing and design, recognizing that Australians prefer more room than is provided on many forms of transport.

In high-speed trains overseas, standards of ride, quality of décor and sound levels are already excellent, but the VFT will set even higher standards of comfort for passengers. Catering services will be first-rate. The comfort of physically disabled people will also be specially provided for.

The ultimate factor in comfort — freedom from fear of accident which for many people spoils long journeys by road — is reflected in high-speed rail safety figures. In over a quarter of a century of operating Shinkansen trains, the Japanese have carried over 2.5 billion passengers (equivalent to half the world's population) without a single fatality; and there have been no fatalities on French high-speed lines in almost 10 years of operation.

The aim of the VFT will be to attract customers through quality of experience as much as through the short duration of the journey.

Cost

Final decisions have not yet been taken on fares. It is intended that they will be well below prevailing airline fares. First class fares and a range of discount tickets — including off-peak, apex and standby fares — will probably be offered.

The VFT will be a form of travel that can be afforded by average Australians; its profitability to its private enterprise owners will depend on having very high levels of patronage.

The $1 million VFT passenger market study has found such levels to be achievable, as with overseas high-speed trains.

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Convenience

Apart from the convenience of on-board facilities such as telephones, office suites, fax machines, children's play rooms, babies' feeding rooms and personal grooming salons, the VFT will offer fast ticketing, short check-in times, and a high standard of punctuality in all weather conditions. As with high-speed trains overseas, travellers will be sure that VFTs will leave on time all the time, allowing them to plan travel for business or pleasure without having to make contingencies for delays.

Telephones, fax machines and other business facilities will be a key feature of the VFT.
(above) – Deutsche Bundesbahn photo
(below) – French National Railways photo

The main convenience of the VFT, however, will be:

- its short journey time: three-hour between the centres of Sydney and Melbourne, and two-and-a-half hours for the proposed VFT-N between Sydney and Brisbane; and
- the frequency of services: more than 35 fast trains each way between Melbourne and Sydney on a typical week-day.

Time is the scarce commodity as we move to the 21st century. Not only short journey times and frequency, but also convenient access, the minimum of waiting and the maximum of time usable for other activities while travelling, are distinctive features of the convenience of high-speed rail travel.

There are many more things that may be said about the VFT; we have only scratched the surface. If you're interested in finding out more information, please ask for other sheets in the *VFT Topics* series, and for *VFT News*.

VFT Topics is a series of information sheets about Australia's high-speed train. The sheets are published individually, as required, to advance public understanding of the project. Publisher: the VFT — a joint venture of The Broken Hill Proprietary Co Ltd, Elders IXL Ltd, Kumagai Gumi Co Ltd and TNT Australia Pty Ltd. The VFT office address is: 5th Floor, Capital Centre, 54 Marcus Clarke Street, Canberra. Address all mail to: GPO Box 2188, Canberra ACT 2601. Telephone: (06) 257 2565. Facsimile: (06) 257 2319.

Single sets of *VFT Topics* are posted free on request. Please inquire for the cost of sending multiple copies.

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