High Speed Rail for Australia: Opportunities and Issues
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What is high speed rail?

High speed rail refers to passenger trains travelling at 250 km/h or more, on purpose-built tracks. Among the best known examples are the Japanese Shinkansen or bullet trains, the French TGV (Train à Grande Vitesse) and the German ICE (Inter-City Express).

The typical operating speed of high speed trains has increased to 300-320 km/h. The world rail speed record is 575 km/h, set by a French TGV in 2007.

The energy required for operation at such speeds means that high speed trains are invariably powered by electricity.

Although high speed rail systems are focused primarily on the movement of people, they are also used for high-value freight such as mail, as outlined later in this paper.

High speed rail around the world

High speed rail services are now operating in more than a dozen countries: Japan, France, Germany, Belgium, Italy, Spain, Switzerland, Turkey, Taiwan, China, The Netherlands, Britain and South Korea. In many of these countries the high speed networks are being extended.

New lines are under construction or being planned in Morocco, Saudi Arabia, Poland, Russia, Denmark, Sweden, India, Malaysia/Singapore, Brazil and the USA.

One of the most successful high speed trains is the double-deck French TGV (Train à Grande Vitesse), of which there are more than 150 in operation or on order, each seating 545 passengers. Many services are provided by two trains coupled, under the control of a single driver. The market for supply of high speed trains is very competitive, with manufacturers in Japan, China, France, Germany, Spain, Italy and South Korea. The picture at right shows a meeting room on a German ICE (Inter-City Express) train.
Benefits of high speed rail

For users, high speed rail is an attractive alternative to road and air travel over distances of 250-1000 km. High speed rail travel is fast, safe, reliable and affordable.

China has the world’s largest high speed rail network, with 6300 km in use at the end of 2011. Spain has the largest system in Europe, with 2060 km. Both countries are building more high speed lines. At left, two trains at Tianjin; at right, a stewardess waits to greet customers at Seville.

One of its advantages is that it serves regional centres en route as well as providing end-to-end travel. Intermediate stations have platforms on loop tracks so that through trains are not delayed. The importance of being able to serve regional centres is discussed later in this paper.

Climate change

High speed rail can play a part in meeting the challenge of climate change. If Australia is serious about reducing energy consumption and emissions in the transport sector, we will be driven towards the adoption of high speed rail.

Comparison of the energy efficiency of high speed trains with other modes of transport

Source: International Union of Railways (UIC)
This form of transport is much more efficient than air or road transport in its use of energy per passenger. According to the International Union of Railways high speed rail is, on a per passenger basis, eight times as efficient as aircraft in its use of energy, and six times as efficient as private car travel.

*Land use*

A high speed railway needs a corridor which can be as narrow as 20 metres, depending on terrain. This is very much less than the width of a freeway corridor.

*Safety*

High speed rail has an outstanding safety record. Since the start of operations in Japan in 1964, there has been only one accident with fatalities on a high speed line; a collision in China in July 2011.

*Current study*

The Australian Government is currently undertaking a study of high speed rail along a corridor linking Melbourne, Canberra, Sydney, Newcastle and Brisbane. The study has two stages. Phase 1, completed in July 2011, defined preferred corridor options, presented options for station locations and provided preliminary cost estimates for the various corridors.

Key findings from Phase 1 of the study included the following:

- Trip times could be achieved of three hours for Sydney to Melbourne and Sydney to Brisbane, and one hour from Sydney to Canberra
- High speed rail would capture 50% of Sydney-Melbourne and Sydney-Brisbane air travel, which is consistent with the market share of overseas high speed rail operations over similar distances
- The demand for travel in 2036, the reference year, would require about 50 train services per day (25 each way) between Sydney and Melbourne, and a similar number between Sydney and Brisbane
- The capital cost of the network linking Melbourne and Brisbane would be between $61 billion and $108 billion.

Phase 2 work includes:

- Development of the preferred alignment and system specification
- Recommendation of an optimum program for staging of construction
- Identification of public and private financing options
- Examination of preferred options in relation to other modes (e.g. airport capacity implications resulting from diversion of air traffic to train)
- Development of a proposed institutional framework and implementation plan.

**Opportunities and issues**

The first point to make is that high speed rail would be a new business for Australia, closer to aviation than to current rail services.

High speed rail is not just another land transport project. It is not just another rail project, nor would it resemble a train service as currently seen in Australia. Clearly the rail element is important, and the ability of high speed trains to use existing tracks or corridors to reach city centres is very significant. But as a business, high speed rail between capital cities is closer to aviation than it is to passenger rail services as they currently exist in Australia. And the link to aviation goes further; the relationship with airports is discussed on pages 6-9 of this paper.

**Regional development, and transport for a larger population**

The next issue is the importance of integrating planning for transport, including high speed rail, with how Australia plans for a larger population. Regardless of what we believe the exact population figure might be in say four decades from now, there is no doubt that there will be immense pressures on our cities, particularly those along our south-eastern seaboard, and on our transport links. If people are to be encouraged to live in regional centres, as they must be if we do not want to see Sydney as large as Tokyo, say, they will want access to capital cities. High speed rail can provide that access, and thus encourage growth in centres outside our state capitals. It will make regional cities more attractive places in which to live and work. High speed trains can link to the existing rail network: as an example, a map showing how such links might be provided in the region north of Sydney is shown at left.

**Linking to the existing rail system:** This map shows how a high speed railway could link to the existing railway north of Sydney. Fast commuter trains could use the high speed line to leave Sydney before connecting to the existing railway. Travel times to and from centres between the Central Coast and Newcastle would be dramatically reduced.
Train services that use high speed lines for part of their journeys are common in other countries. In Britain Javelin trains, pictured at left, run on the high speed line south from London at speeds of up to 225 km/h before turning onto the conventional rail network at Ebbsfleet or Ashford to reach their destinations.

If Australia is to be liveable, we cannot rely only on roads and air travel. We know that traffic grows to fill the available road capacity. I remember a conversation with a person in Los Angeles, who in a moment of reminiscence said “I can remember when the freeway had only eight lanes”. What will be the position of air travel, when the price of oil reaches $200 per barrel? This is a prospect currently predicted by some experts for the not too distant future.

When one considers the issues and the costs facing other transport modes, the question about high speed rail becomes not ‘What will it cost?’ Rather, it becomes ‘What will be the cost to the Australian economy and the community of not building a high speed rail system?’

**High speed freight**

High speed rail systems can carry freight as well as people. In France, mail is carried on a dedicated fleet of high speed trains, replacing the use of aircraft. Euro Carex Cargo Rail Express is planning a network of high speed freight operations with the first stage starting in 2017. Trains will link terminals, mostly located at airports, in Paris, Amsterdam, Lyon, London, Liège and Cologne. Later stages will extend to Italy and beyond. Partners in Euro Carex include airports, rail organisations, the French postal service La Poste, FedEx Express, TNT, UPS and others.

In March 2012 Euro Carex ran a demonstration freight service, pictured at left, between Lyon, Paris and London. The train had a capacity equivalent to seven Boeing 737 cargo aircraft. More information is at [http://www.eurocarex.com/](http://www.eurocarex.com/)
A high speed rail freight service between Melbourne, Sydney and Brisbane, with a three hour transit between terminals, could divert substantial volumes of high value merchandise off the roads and out of the air.

High speed rail’s other benefit for freight would be the release of capacity on existing rail tracks, particularly relevant to the line from Sydney to Newcastle. There are proposals to spend up to $4 billion on enhancements to the existing Sydney-Newcastle railway, which would add to capacity but not to speed. On this route high speed commuter services such as those described above could relieve capacity pressures on the existing railway, thus allowing more paths to be available for freight trains. The Phase 1 report from the current study examined this possibility. A large part of the proposed spending on the existing line could be avoided, and this benefit should be taken into account in the assessment of high speed rail.

**High speed rail and a second Sydney airport**

High speed rail would substantially delay the need for a second airport for Sydney. This is a major opportunity which must be recognised. The savings should be offset against the capital cost of the high speed rail system.

*The impact of high speed rail on air travel*

The competitive impact of high speed rail on air travel has been demonstrated in Europe and Asia. Between Paris and London, a journey of 2 hours 15 minutes via the Channel Tunnel, rail has a market share of 90%. In Spain, demand for air travel between Madrid and Barcelona fell 40% in the two years following the opening of the high speed line between the two cities. (Before the advent of high speed rail on the route, Madrid-Barcelona had the world’s busiest air service with 971 scheduled flights per week – both directions – in 2007). Air traffic between Madrid and Malaga fell by half.

Between Paris and Lyon, a two hour rail trip, high speed trains have completely replaced air services – an indicator of how high speed rail would replace air travel to regional centres in south-eastern Australia. In Japan, China and South Korea, high speed rail has had a similar impact on air travel on the sectors where they compete.
This graph from France indicates the relationship between high speed rail journey time and market share for air and train. For high speed rail trips of two hours or less (for example from Sydney to Canberra and regional centres) the train’s market share exceeds 90%. For trips of three hours (Sydney to Melbourne, Brisbane or Gold Coast) rail’s share exceeds 50%.

As noted earlier, the second phase of the current study in Australia is considering airport capacity implications resulting from diversion of air traffic to train. It is entirely appropriate that airports, air services and high speed rail be considered together – not separately – in the development of transport policy.

*Sydney airport and high speed rail*

The table that appears on the next page shows the number of flights in and out of Sydney, to and from destinations which could be served by an east coast high speed rail system. The figures are for total flights both ways, on 23 May 2012.

Flights to and from these centres – 430 per day – account for 70%, or more than two thirds, of domestic and regional movements at Sydney airport. These flights amount to just over 50% of all movements at the airport.
Flights from and to Sydney, to destinations which could be served by an east coast high speed rail system

Scheduled for 23 May 2012, as listed on 4 May 2012 on airline websites. Qantas flights include Qantaslink.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Number of flights per day</th>
<th>Destination</th>
<th>Number of flights per day</th>
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<tbody>
<tr>
<td>Melbourne</td>
<td>153 including 41 B767 or A330 (39 Qantas, 2 Virgin) (Qantas: 64 Jetstar: 23 Virgin: 58 Tiger: 8)</td>
<td>Coffs Harbour</td>
<td>14 (Qantas: 10 Virgin: 4)</td>
</tr>
<tr>
<td>Brisbane</td>
<td>79 including 9 B767 (all Qantas) (Qantas: 31 Jetstar: 8 Virgin: 40)</td>
<td>Port Macquarie</td>
<td>14 (Qantas: 10 Virgin: 4)</td>
</tr>
<tr>
<td>Gold Coast</td>
<td>38 (Jetstar: 18 Virgin: 20)</td>
<td>Newcastle</td>
<td>16 (Aeropelican: 10 Rex: 6)</td>
</tr>
<tr>
<td>Ballina/Byron Bay</td>
<td>12 (Qantas: 4 Rex: 6 Virgin: 2)</td>
<td>Canberra</td>
<td>56 (Qantas: 40 Virgin: 16)</td>
</tr>
<tr>
<td>Lismore</td>
<td>6 (Rex: 6)</td>
<td>Wagga Wagga</td>
<td>16 (Qantas: 8 Rex: 8 Virgin: 4)</td>
</tr>
<tr>
<td>Grafton via Taree</td>
<td>6 (Rex: 6)</td>
<td>Albury</td>
<td>20 (Qantas: 8 Rex: 8 Virgin: 4)</td>
</tr>
</tbody>
</table>

These flights total 430 per day, accounting for the same number of movements at Sydney airport.

Movements at Sydney airport, for year ended 31 December 2010

- Domestic and regional: 617 per day
- International and domestic on-carriage: 162 per day
- Freight and general aviation: 67 per day
- Total: 846 per day

Source: Sydney Airport Fact Sheet, February 2011
The first message from the table is confirmation that travel demand on key routes in south-eastern Australia is very large. This in turn indicates that the market for high speed rail on these routes would be very substantial.

Second, the table points to the potential for high speed rail to reduce pressure on Sydney airport. Phase 1 of the current study found that high speed trains would capture 50% of the business on the longer routes, from Sydney to Melbourne, Brisbane and the Gold Coast, consistent with overseas experience on routes of similar journey time.

On services to regional centres high speed rail would capture a higher proportion of the business, leading to the elimination of many flights. For example, as it will be quicker to go from the centre of Sydney to Newcastle or Canberra by high speed train than by plane, the air services to those centres would very probably end. This would also apply to many other shorter distance regional routes. It is likely that only the longer flights to Albury, Ballina and Lismore would remain viable.

It is reasonable to project that the 430 flights to and from the centres served by high speed rail would be reduced to approximately 200. This estimate assumes that airlines maintain two thirds of service frequencies on trunk routes (Sydney to Melbourne, Brisbane and the Gold Coast), but that services to regional centres, except the three mentioned above, are replaced by high speed rail.

High speed rail could thus reduce movements at Sydney airport by 230 per day, or 27%. Many of the flights replaced would be by aircraft carrying 30 or 40 passengers, freeing slots at the airport which can be better used by big jets. The need for a second airport would be significantly delayed.

A high speed rail station at Sydney airport, a necessary presumption, will facilitate interchange between rail and air, as is the case at Paris, Frankfurt, Shanghai and Amsterdam. Such a station at Sydney airport would also allow a high speed connection to a second airport, when it is eventually needed.

Airports and high speed rail should be seen as complementary rather than competitors. San Francisco Airport is reported as stating that “high speed rail is our next runway”.

**Broader relationship to aviation**

If high speed rail is likely to capture a substantial proportion of air travel in and out of Sydney – competing for two thirds of domestic aircraft movements at Sydney airport - an obvious question is: what would be the airline response?

It is likely to be both competitive and complementary; one or more airlines may become operators of high speed trains. Virgin runs trains in Britain. Air France sends its Paris-Brussels passengers by high speed train. Qantas was involved in the previous Speedrail proposal in Australia. Had the project proceeded it would have provided reservations, ticketing and on-board services, effectively being the operator of the service.

High speed trains compete successfully with low cost airlines: in France the TGV is referred to as “the low cost carrier”. The smartest airline in the room will be the one which is first to become a high speed rail operator in Australia.
More flights, but slower

In relation to aviation it is of interest to mention something which airlines do not talk about. It is the fact that flight times have gradually extended over the years. Scheduled flight times have become longer. In other words, air travel has become slower.

When jets were introduced to domestic flights in 1964, the scheduled flight time between Sydney and Melbourne was 65 minutes northbound and 70 minutes southbound. The scheduled times in timetables are what airlines call ‘doors’ times: from doors closed on departure until doors are opened at the arrival airport.

Today, flight times for jets between Sydney and Melbourne are 85 minutes northbound and 95 minutes southbound, an increase in journey time since 1964 of between 30% and 35%. These increased times result from congestion in the air, congestion on the ground and longer taxying distances to more distant runways. The scheduled jet times today are longer than those for Electra prop-jet aircraft 48 years ago, which took 80 minutes from Melbourne to Sydney or 90 minutes southbound.

Adding to this are earlier check-in times and earlier boarding calls. Passengers are expected to be at the airport 45 minutes before departure. They need to be, as they are called on board up to 25 minutes before the scheduled departure time.

To be fair, these increases in journey times have been compensated for by much more frequent services. An increased frequency is an important improvement in service quality. However we should not be under any illusion that domestic air travel is becoming quicker. It is not.

Need to address financing

Two previous high speed rail projects in Australia, VFT and Speedrail, did not proceed because of the failure of the proponents and government to agree on the issue of finance and specifically on the level of government financial support. This is the key to the development of any high speed railway. If one looks around the world, at the countries where high speed rail is in operation or being developed, the projects were or are all reliant on government finance for their development, either wholly or in part. In operation, these services readily cover their operating costs, but government finance is invariably needed to help meet the cost of construction.

However it is not unreasonable to assume that a future Australian high speed rail project would attract very substantial funding from the private sector. I anticipate that there would be separation of ownership of the tracks and the trains.

Accordingly there is a need to correct the assumption that the cost of a high speed rail system in Australia will be wholly met by the public sector. The call on the government purse should be very much less than the total cost of the system. In this, high speed rail stands out positively compared with the road network, which apart from a small number of toll roads in cities, is funded entirely by government. The call on public funds would be spread over many years – a minimum of fifteen years to build an east coast network, after planning and pre-construction activities – so that the impact on annual budgets would be manageable.
Conclusion

While the technology of high speed rail is impressive and exciting, and its opportunities and benefits are extensive, these are not the most important factors in decisions on its implementation. High speed rail technology is mature, and therefore carries low risk; construction is similar to other rail projects. The risk, in business terms, is whether patronage and revenue forecasts will be met. Who will carry this risk? The answer to this question will play a large part in determining how the project will be financed. And this financing decision is the one which will determine the future of high speed rail in Australia.

It was stated above that high speed rail is fast, safe, reliable and affordable. Those four words are important in summing up the attributes of high speed rail, but there are four other words which are even more important: finance is the key.

For further information, see the website of the International Union of Railways (UIC):
http://www.uic.org/spip.php?mot8