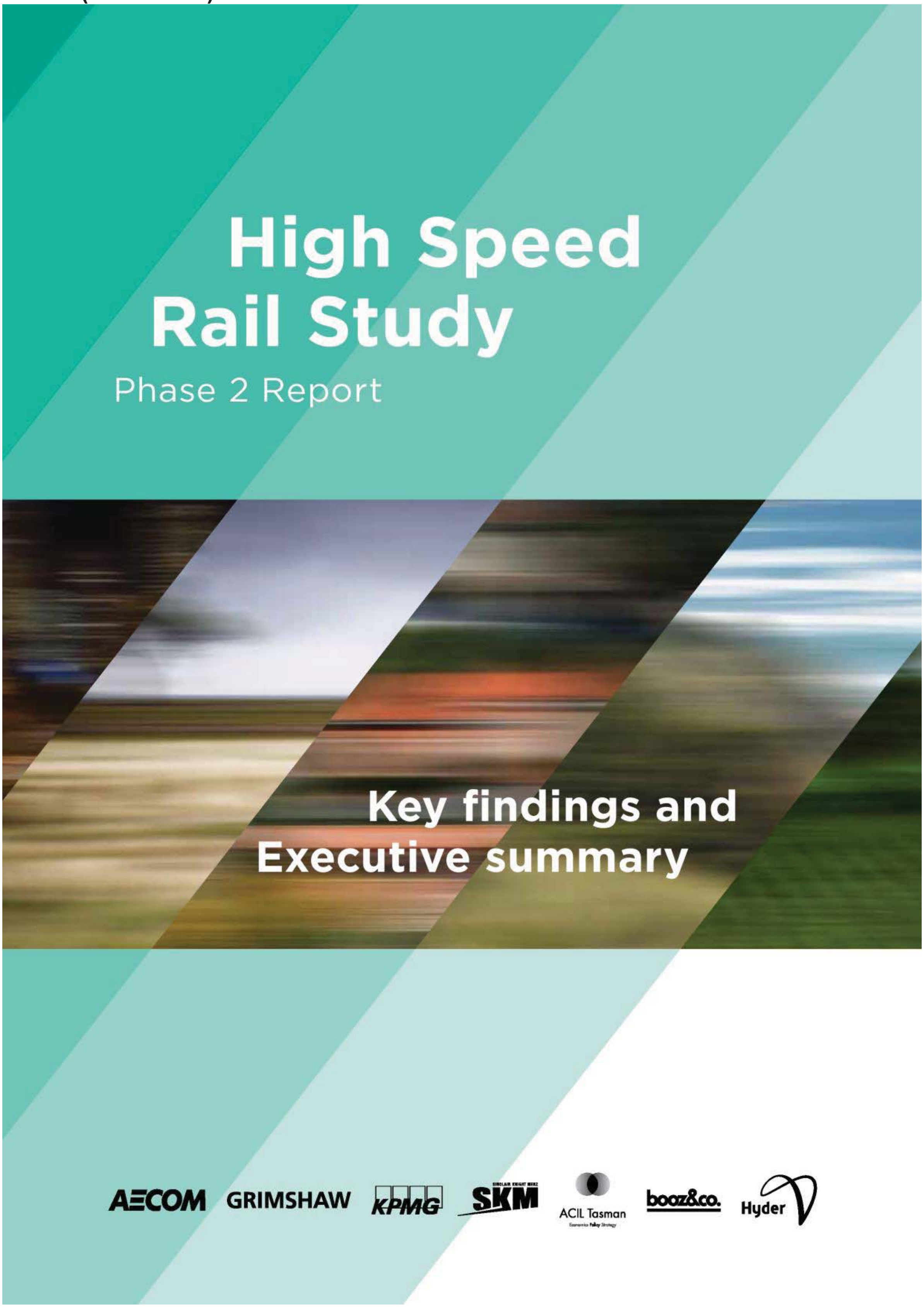
ITEM 9 (continued) **ATTACHMENT 1**



ITEM 9 (continued) **ATTACHMENT 1**

ITEM 9 (continued) **ATTACHMENT 1**

Overview

A strategic study on the implementation of a High Speed Rail (HSR) network (the study) on the east coast of Australia between Brisbane, Sydney and Melbourne was announced by the Minister for Infrastructure and Transport, the Hon Anthony Albanese MP, in August 2010.

The study has been conducted in two phases. Phase 1, published in August 2011, identified a short-list of corridors and station options and estimated preliminary costs and demand for HSR on the east coast of Australia. Phase 2 built on phase 1, but was considerably broader and deeper in objectives and scope, and so refined many of the phase 1 estimates, particularly the demand and cost estimates. This phase 2 report presents detailed findings on the 12 advisory objectives established for the study.

Drawings and maps have been prepared for the purpose of depicting the recommended alignment for the HSR system and to enable civil construction cost estimates to be made.

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Key findings

ITEM 9 (continued) **ATTACHMENT 1**

Definition of the preferred HSR system

The HSR network would comprise approximately 1,748 kilometres of dedicated route with four city centre stations, four city-peripheral stations (one in Brisbane, two in Sydney and one in Melbourne) and 12 regional stations.

- HSR would require a dedicated railway network to deliver the necessary level of system performance, in terms of journey time and reliability, to be competitive with other modes of transport, particularly aviation.

To meet expected demand, the HSR system would offer a combination of services, including direct express services and limited stop services.

- Typical express journey times would be two hours and 37 minutes between Brisbane and Sydney, one hour and four minutes between Sydney and Canberra, and two hours and 44 minutes between Sydney and Melbourne.
- The HSR would operate frequent services between capital cities and regional centres.
- In 2065, it is forecast that peak period demand for Sydney-Melbourne would be met by two non-stop inter-capital express services per hour per direction and three one-stop inter-capital express services per hour per direction, calling at either Sydney South or Melbourne North city peripheral stations.

The dedicated HSR network would need to be integrated into the hubs of existing urban public transport systems and road networks to maximise its connectivity with other transport networks.

- All city centre stations must be integrated with other public transport networks and the city-peripheral stations must have good access to major road networks.
- Most of the stations on the network would require some local enhancements to public transport services, parking and interchange arrangements to ensure good connectivity.

Cost of constructing the HSR system

The estimated cost of constructing the preferred HSR alignment in its entirety would be about $114 billion (in 2012 terms), comprising $64 billion between Brisbane and Sydney and $50 billion between Sydney, Canberra and Melbourne.

- The preferred HSR alignment has been designed first and foremost to meet market needs (in terms of journey times and reliability), while also being environmentally and economically sustainable.
- Tunnelling has been adopted where no dedicated surface route could be created without unacceptable dislocation and/or environmental costs. Tunnels make up 144 kilometres (eight per cent) of the preferred alignment and are the most significant construction cost element (29 per cent of total construction costs). Access to and from Sydney would require the most tunnelling (67 kilometres) compared to Brisbane (five kilometres), Melbourne (eight kilometres) and Canberra (four kilometres).
- The HSR system would adopt internationally proven and available technology for train sets and associated systems (such as train control and power supply systems), which would cost less than if a customised design were required.

ITEM 9 (continued) **ATTACHMENT 1**

Forecast HSR demand

Between 46 million and 111 million passengers are forecast to use HSR services for inter-city[1] and regional trips[2], if the preferred HSR network were fully operational in 2065, with a central forecast of 83.6 million passengers per year.

- By 2065, HSR could attract 40 per cent of inter-city air travel on the east coast and 60 per cent of regional air travel (primarily long regional). On the three main sectors, Sydney-Melbourne, Sydney-Brisbane and Sydney-Canberra, HSR could attract more than 50 per cent of the air travel market.
- Actual passenger numbers would depend on the rates of population and economic growth, the levels of congestion at airports, including travelling to and from airports, and the fares charged.
- Sydney-Melbourne is expected to be the largest market for HSR, with about 19 million passenger trips per year forecast. This is considerably more than the next largest market, Brisbane-Sydney, with nearly 11 million passenger trips per year, and almost four times as many as the Sydney-Canberra market, with about five million passenger trips per year.
- Inter-city and long regional travel (>250 km) are expected to account for 49 per cent and approximately 36 per cent of total passenger trips and 62 per cent and 35 per cent of total passenger kilometres travelled respectively. Short regional travel (<250 km) would represent 14 per cent of total trips, and only a small per cent of total passenger kilometres travelled. Business travellers would account for about 35 per cent of total trips and 42 per cent of total passenger kilometres on the entire HSR system.
- For the purpose of assessing demand, average fares for business and leisure travel were set to be comparable to, and competitive with, air fare rates on the main inter-capital routes on the east coast. In practice, a range of fares would be offered, targeted to market segments and influenced by seat utilisation patterns and competitive pressures, as is currently the case with the airlines.

Staging the development of HSR

The optimal staging for the HSR program would involve building the Sydney-Melbourne line first, starting with the Sydney-Canberra sector. Subsequent stages would be Canberra-Melbourne, Newcastle-Sydney, Brisbane-Gold Coast and Gold Coast-Newcastle.

- International experience of large infrastructure developments shows that approximately ten years could be required for planning, consultation and environmental approvals, and five years for preconstruction and procurement activities.

1 The inter-city market is defined as journeys over 600 kilometres between the six main towns and cities in the corridor based on population – Brisbane, Gold Coast, Newcastle, Sydney, Canberra and Melbourne.

2 The regional market has been broken into long regional trips greater than 250 kilometres, which includes Sydney-Canberra, and short regional trips less than 250 kilometres, which includes Brisbane-Gold Coast and Newcastle-Sydney.

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Table 1 Commencement and operational milestones for optimal staging

Stage	Main construction commences	Operations commence
Sydney-Melbourne line		
Sydney-Canberra	2027	2035
Canberra-Melbourne	2032	2040
Brisbane-Sydney line		
Newcastle-Sydney	2037	2045
Brisbane-Gold Coast	2043	2051
Gold Coast-Newcastle	2048	2058

- Some preliminary ('enabling') works to enable construction of the HSR at Sydney Central station (e.g. moving platforms and utilities) would be undertaken before 2027.
- Construction of the whole HSR system would take around 30 years.
- The Sydney-Melbourne line has stronger forecast demand than the Brisbane-Sydney line, would be less expensive to build and is predicted to have higher economic and financial returns. It should therefore be completed first.
- The preferred staging of construction for the Brisbane-Sydney line (Newcastle-Sydney, Brisbane-Gold Coast and then Gold Coast-Newcastle) reflects both market demand and economic characteristics.
- For the purpose of evaluation, the study assumed the initial stage between Sydney and Canberra would operate from 2035, with the Sydney-Melbourne line operational from 2040.
- Brisbane-Gold Coast would be completed in 2051.
- Gold Coast-Newcastle would be the last stage to be built, with the complete Brisbane-Melbourne line operational by 2058.

It is possible the program could be accelerated, with the Sydney-Melbourne line operational by 2035. In this case the Sydney-Canberra stage could be operational by 2030.

- Assuming funding, financing and all relevant approvals were in place and preliminary design had been completed, the earliest that main construction work could reasonably start would be 2022.
- Bringing the program forward would reduce the economic benefits, primarily because the market volumes would be lower when operations began.

Table 2 Commencement and operational milestones for accelerated staging

Stage	Main construction commences	Operations commence
Sydney-Melbourne line		
Sydney-Canberra	2022 (earliest possible start)	2030
Canberra-Melbourne	2027	2035
Brisbane-Sydney line		
Newcastle-Sydney	2032	2040
Brisbane-Gold Coast	2038	2046
Gold Coast-Newcastle	2043	2053

ITEM 9 (continued) **ATTACHMENT 1**

Financial assessment

The HSR program and the majority of its individual stages are expected to produce only a small positive financial return on investment.

- The distribution of the economic benefits of HSR between users of the system and the operator(s) would depend on the prices charged.
- Based on charging competitive fares, the HSR operations and ancillary services (such as car parking and lease revenues from related property development) would not deliver sufficient revenue to fund or recover the expected capital costs of the HSR program.

Governments would be required to fund the majority of the upfront capital costs.

- The potential to attract private finance is limited. An expected return of at least 15 per cent would be required at this stage of project development to be attractive to commercial providers of debt and equity to major infrastructure projects. HSR would fall well short of this.
- The estimated real financial internal rate of return (FIRR) is 1.0 per cent for Sydney-Melbourne and 0.8 per cent for the whole network.
- If potential commercial funding were maximised, a funding gap in the order of $98 billion, or 86 per cent of the up-front capital cost of the HSR program, would remain.

If HSR passenger projections were met at the fare levels proposed, the HSR system, once operational, could generate sufficient fare revenue and other revenue to meet operating costs without ongoing public subsidy.

- Post construction, the HSR program as a whole, and each of its sectors (with the exception of Sydney-Canberra as a stand-alone sector) are expected to generate sufficient operating income to cover their ongoing operational and asset renewal costs.

HSR fares adopted for the study have been assumed to be comparable to air fares on the inter-capital routes, and it would appear HSR could sustain higher fares.

- Increasing the cost of fares would increase the financial returns and reduce the funding gap, although doing so would reduce the number of people using the system. Even so, the economic benefits of the program would remain positive.
- Given that airfares in Australia are already highly competitive on major routes, it is not expected that airlines would respond to HSR competition by reducing fares on a sustained basis. It has been assumed, in line with international experience, that airlines would quickly reduce capacity, either by reducing frequencies or aircraft sizes, to locations within the HSR corridor where there is significant passenger diversion to HSR. It is likely that any reduction in capacity would be redeployed to routes outside the HSR corridor.
- Nevertheless, to the extent that airlines are able to innovate in ways that have not been anticipated in this study, there would be an impact on HSR patronage and capacity to meet operating costs. The sensitivity tests included one scenario in which airfares were reduced by 50 per cent for two years.

ITEM 9 (continued) **ATTACHMENT 1**

Economic assessment

Investment in a future HSR program could deliver positive net economic benefits.

- The Sydney-Melbourne line would deliver a slightly higher economic internal rate of return (EIRR) on investment than the whole network would. The EIRR of Sydney-Melbourne is estimated at 7.8 per cent, compared to 7.6 per cent for an investment in the staged HSR program as a whole.
- The economic benefit cost ratio (EBCR) calculates the ratio of the present value of benefits to the present value of costs. When calculated using a discount rate of four per cent, the ECBR is 2.5 for Sydney-Melbourne and 2.3 for the whole network.
- The economic net present value (ENPV) of costs and benefits associated with a program of investment in the preferred HSR system would be $70 billion for Sydney-Melbourne and $101 billion for the network as a whole, calculated using a discount rate of four per cent a year until the start of construction in 2027 (financial year 2028), and expressed in $2012.
- The economic results remain positive under a range of changed assumptions. When calculated using a seven per cent discount rate, which represents a higher hurdle rate for judging economic performance, the EBCR would be 1.1 and the ENPV would be $5 billion.
- Most of the economic benefits (90 per cent) would accrue to the users of the HSR system. About two-thirds of the user benefits are attributable to business users travelling long distances, which reflects in part the relatively higher value of time attributed to business travellers compared to leisure travellers.
- Externalities would be relatively minor, accounting for only about three per cent of the benefits.

Environmental and social assessment

The preferred HSR alignment has been selected to avoid major environmental and social impacts. The residual impacts on natural environments and heritage can be managed by appropriate mitigation and, where necessary, offsets.

- Potential significant impacts in urban areas, such as noise and large scale property acquisition, have largely been avoided by the use of tunnelling on the approaches to capital cities.

ITEM 9 (continued) **ATTACHMENT 1**

Broader impacts of HSR

Aligning public policies, programs and capabilities across Australian Government, state/territory government and local government agencies as part of a corridor regional development concept would be necessary to realise the full benefits of HSR.

- The implementation of HSR would substantially improve accessibility for the regional centres that it serves, providing the opportunity for – but not the automatic realisation of – increased regional economic development. The ability of these centres to take advantage of the opportunities created by improved accessibility would require coordinated and complementary policies to be implemented.
- Emerging international evidence suggests that wider economic benefits may be generated by regional accessibility improvements, but the quantitative estimates are neither sufficiently certain nor robust for inclusion in the main economic assessment.

Implementing a future HSR program

Both the public and private sectors would play a significant role in the planning and implementation of a future HSR system.

- Governments would need to have a central role in the planning and development of the HSR system, including securing the necessary approvals. The primary public sector roles would be executed through a single HSR development authority.
- As HSR would be predominantly publicly funded, the Australian, ACT and relevant state governments would be the owners of the system and would assume the key role in the specification and procurement of network infrastructure, the allocation of its capacity for transport services and the specification of minimum service requirements.
- The private sector would be responsible for building the HSR infrastructure under contract to the HSR development authority, and for the delivery of train services to the public. Control of the movement of trains and maintenance of infrastructure would also be the role of the private sector, under competitively tendered concession arrangements.

The key risks to the HSR program and its successful performance are common to all major greenfield infrastructure projects; most notably, a lack of certainty about future demand and revenues, and the potential for cost over-runs during construction.

- Allowance for risk and uncertainty has been included in the demand, economic and financial assessments, but the risks cannot be perfectly controlled and a program of this nature, particularly extending over a long period of time, contains significant uncertainties.

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Key public policy issues for a decision to proceed

Whether to proceed with planning for a future HSR program must necessarily be a policy decision, taking account of many factors that cannot be known with certainty, and in the context of risks which cannot be perfectly controlled.

- This study estimates that HSR would have positive net economic benefits, using the Australian Transport Council's cost-benefit methodology guidelines, which are conventionally applied to major transport infrastructure projects. However, this appraisal extends to 2085, a necessarily distant time horizon for program delivery and market impact compared to most infrastructure feasibility studies.
- The long-term future is inherently uncertain and requires caution when making a judgement, but it is most likely that demographic and economic trends will support a steadily improving case for HSR on the east coast rather than otherwise. In that case, policy-makers, whether or not yet convinced of the merits of committing to HSR, may also legitimately weigh the possible consequences of not taking actions to preserve that option at some time in the future.
- In this regard, inaction is not benign. In the absence of a protected route, the spread of cities and other developments in the preferred corridor will gradually reduce the constructability and increase the potential capital costs of a future HSR program, rendering it increasingly more difficult to implement, even while the fundamental trends may become increasingly favourable.

As in all publicly-funded infrastructure projects, the balance between public benefit and public cost should be considered.

- The positive economic performance that is estimated to be achievable from an investment in HSR, most of which would directly benefit the users of the system, contrasts with low financial returns, which would need to be supported by public funding. Although this is true of many transport infrastructure projects, including national highways, it is an issue that must be confronted.
- The external benefits of HSR - fewer road accidents, reduced road congestion and so on – which might contribute to its rationale, would be positive but are estimated to fall far short of the public funding required.
- By contrast, the opportunities for urban and regional development in the HSR corridor will be considered by many people in Australia to have a high potential value in public policy terms, but those benefits do not follow automatically or with certainty. There would need to be confidence that they would be actively exploited and realised to justify any great weight in the decision on whether to proceed. That in turn would require policy commitment at all levels of government to pursuing an integrated corridor development strategy, synchronised with the delivery of the HSR program.

A related policy issue is the extent to which the initial capital costs of an HSR program should be recovered from users.

- Taxpayers would need to make a substantial contribution to the up-front costs of establishing an HSR system. The analysis suggests that charging higher fares than those assumed would be feasible, and would improve financial returns, but would reduce overall economic benefits as fewer people would use the system.
- While economic principles suggest that the community's economic welfare is best pursued by charging users only the marginal cost of infrastructure, establishing the balance between recovery of public investment in infrastructure and maximising its economic benefits is ultimately a policy matter.
- If an HSR program were adopted, there would need to be an up-front understanding of what principles would be applied to infrastructure pricing and cost recovery. Certainly, if passenger numbers were to grow over time, governments would be in a position to begin to recover some proportion of its capital investment.

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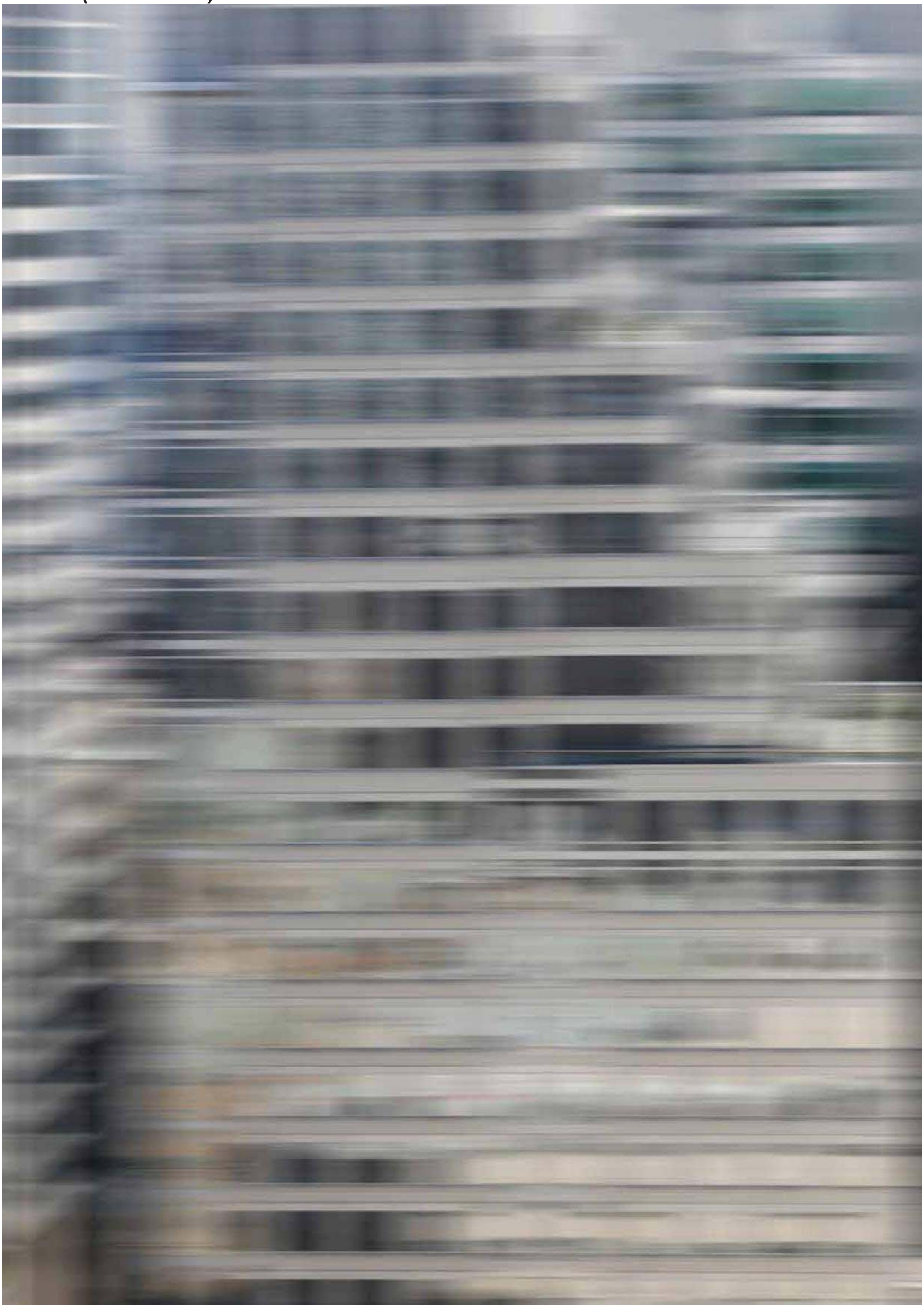

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Executive summary

The expected growth in travel demand

Population and employment growth will continue to challenge the capacity of existing transport networks and public infrastructure along the east coast of Australia[1]. Travel on the east coast of Australia is forecast to grow at around 1.8 per cent per year over the next 20 years, increasing by approximately 60 per cent by 2035. By 2065, travel on the east coast will have more than doubled, from 152 million trips in 2009 to 355 million trips per year[2].

Without HSR, aviation would remain the primary means of transport for long distance interstate (and some inter-regional) trips and road-based travel by private vehicle would remain the primary mode for connections with, and between, regional centres. Together these would carry over 90 per cent of the trips on the east coast, subject to capacity being available.

This strategic study investigates how HSR can play an effective role in meeting future travel demand by providing an alternative mode of transport that would be attractive for people to use.

1 Australian Bureau of Statistics (ABS) mid-range population projections estimate that between 2011 and 2050, the population will grow by 37 per cent in NSW, 49 per cent in Victoria and 80 per cent in Queensland. ABS, Population Projections Australia 2006 to 2101, catalogue no. 3222.0.

2 See **Chapter 2** for detail of how these forecasts were determined.

What is HSR?

HSR is generally defined as a purpose-built, fixed-track mode of transport, capable of moving people at speeds of at least 250 kilometres per hour, usually over long distances. Internationally, it typically offers services between major cities, competing in the same travel market as aviation, but also provides opportunities for intermediate stops in regional areas and fast commuter rail services from outer metropolitan areas. HSR stations are typically located within city centres, close to population and business centres.

Originating in Japan in the 1960s, HSR systems now operate in 14 countries[3]. Total global kilometres of track have increased from just over 1,000 kilometres in 1980, to 15,000 kilometres in 2011[4]. China is currently constructing an additional 10,000 kilometres of HSR network[5].

Most HSR systems operate on dedicated tracks at a maximum speed of between 250 and 300 kilometres per hour, with some systems now operating in excess of 300 kilometres per hour[6]. Some HSR services also use sections of conventional tracks at lower speeds, either on entry to cities or to extend beyond a dedicated line[7]. All current HSR systems use conventional steel wheels on rails and are powered by electric traction, although there are several variants in terms of rolling stock and infrastructure.

Definition of the preferred HSR system

HSR alignment and station locations

The preferred HSR route on the east coast of Australia has been developed first and foremost to meet market needs (in terms of journey times and reliability), while also being environmentally and economically sustainable. The route, illustrated in **Figure ES-1**, broadly follows a coastal alignment between Brisbane and Sydney followed by an inland alignment from Sydney to Melbourne, with spur lines to the Gold Coast and Canberra.

City centre stations would be terminal stations within the CBDs of the capital cities. These locations are the single most important origin and destination in each city and provide ready access to, and integrate with, other metropolitan transport services. CBD stations would be located beneath the Brisbane Transit Centre in Brisbane and on the eastern fringe of Civic in Canberra, and would share existing stations at Central in Sydney and Southern Cross in Melbourne. Each of the three main capital cities (Sydney, Melbourne and Brisbane) would also have a peripheral station (in Sydney's case it would have two – one to the north and one to the south of the urban area), for passengers who would find it more convenient to access HSR without having to travel into or out of the CBD.

The minimum corridor width required to accommodate two dedicated HSR tracks is 30 metres. This represents a refinement of the phase 1 evaluation, which was based on a 200 metre width to ensure that any significant issues were captured when comparing initial corridor options. The 30 metre width does not include the additional width required for embankments or cuttings necessary to maintain the smooth vertical alignment required for HSR.

In many developed urban areas, surface alignments would not permit competitive access times to the city centres for HSR services without major dislocation of the urban population and, in such cases, the alignment would be placed in tunnel. Sections of the regional alignment would also be built in tunnel or on viaducts to avoid built-up or environmentally sensitive areas. Although tunnels add to the capital cost, they would allow the infrastructure to be delivered in a way that minimises any potential negative impacts on the community and environment during construction and operation, and minimises delays and difficulties during construction.

3 Japan, Italy, France, Germany, Spain, Switzerland, Belgium, Netherlands, Luxembourg, China, United Kingdom, Korea, Taiwan and Turkey.

4 Derived from The World Bank, *High speed rail: the fast track to economic development?*, 2010 (updated).

5 Zhang Jianping, *Planning and Development of High Speed Rail Network in China*, UIC 8th World Congress on High Speed Rail, 2012.

6 For example, both France and Spain operate services with speeds of over 300 kilometres per hour in commercial service.

7 Particularly in France and Germany and, to a limited extent, in Japan and China.

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Regional stations were selected on the basis of potential patronage and have been proposed at the Gold Coast, Casino, Grafton, Coffs Harbour, Port Macquarie, Taree, Newcastle, Central Coast, Southern Highlands, Wagga Wagga, Albury-Wodonga and Shepparton. To minimise cost and avoid disruption to built-up areas, these stations would be located outside the current urban areas, although they would typically be within ten to 20 kilometres of the town centre and would have both car parking facilities and facilities to interchange with local public transport services.

Figure ES-1 Preferred HSR alignment and stations for the east coast of Australia

ITEM 9 (continued) **ATTACHMENT 1**

Types of HSR services

The market assessment showed strong demand on the east coast, now and into the future, for high speed travel between the capital cities and to and from regional centres. The preferred HSR system would therefore offer two types of services:

- Inter-capital express services, mostly operating non-stop between the capital city central stations but with some also stopping at the city peripheral stations.
- Inter-capital regional services offering high speed services between the capital cities and major regional centres. Regional services would also facilitate travel between regional stations, although some inter-regional movements with low demand may require passengers to change from one service to another at an intermediate station to complete their journey.

If built, the system would also have the capacity to accommodate fast commuter rail services between the capital cities and their nearer regional centres (such as the Central Coast and Newcastle in NSW), many of which currently have relatively slow, if any, services. Commuter services would probably be operated by third parties. They have been allowed for in the physical planning but they would not positively contribute to the financial performance of HSR, nor would they be the source of any significant incremental economic benefit in the cost-benefit analysis of HSR. Commuter demand was therefore excluded from the economic and financial appraisals.

HSR service characteristics

Australian market research and international experience have indicated that HSR would need to offer competitive door-to-door journey times, high standards of comfort and convenience and a competitive fare structure to successfully compete with other modes of transport, especially air. HSR could deliver non-stop journey times under three hours city centre to city centre, between Brisbane and Sydney and Sydney and Melbourne, as shown in **Figure ES-2** and **Table ES-1** and **Table ES-2**.

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Figure ES-2 HSR travel times between major cities

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Table ES-1 Typical HSR travel times and distances between selected stations on Brisbane-Sydney line

		Destination				
		Coffs Harbour	Newcastle	Central Coast	Sydney	
		Regional	Regional	Regional	Express	Regional
Origin	Brisbane	1hr 11min* (332km)	2hr 28min (662km)	2hr 43min (714km)	2hr 37min (797km)	3hr 09min (797km)
	Coffs Harbour		1hr 09min (330km)	1hr 30min (382km)	-	1hr 50min (465km)
	Newcastle			0hr 14min (52km)	-	0hr 39min (134km)
	Central Coast				-	0hr 27min (83km)

*With one stop. One hour 23 minutes with three stops.
Note: Distances may not add due to rounding.

Table ES-2 Typical HSR travel times and distances between selected stations on Sydney-Melbourne line

		Destination					
		Southern Highlands	Canberra		Albury-Wodonga	Melbourne	
		Regional	Express	Regional	Regional	Express	Regional
Origin	Sydney	0hr 29min (98km)	1hr 04min (280km)	1h 11min (280km)	1hr 55min (540km)	2hr 44min (824km)	3hr 03min (824km)
	Southern Highlands		-	0hr 39min (183km)	1h 31min* (442km)	-	2hr 29min (727km)
	Canberra				1hr 16min (366km)	2hr 10min (651km)	2hr 28min (651km)
	Albury-Wodonga					-	1hr 09min (284km)

*Plus interchange time at Wagga Wagga.
Note: Distances may not add due to rounding.

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Services would typically operate 18 hours per day for 365 days per year. Service frequencies would typically be at least hourly, increasing as demand grew to reach peak period service frequencies in 2065, as shown in **Table ES-3**.

Ultimately, train frequencies would be influenced by future market needs and the preferred train operating strategy (operating speeds and stopping patterns) but the indicative frequencies established for this study are compatible with the forecast demand and efficient train utilisation.

Table ES-3 Peak service frequencies in 2065 (per hour in each direction)

Route	Inter-capital express	Inter-capital regional
Brisbane-Sydney	3-4	2
Gold Coast-Sydney	-	4
Sydney-Canberra	1	2
Sydney-Melbourne	5	2
Canberra-Melbourne	1	1

Fares would be structured to be competitive with alternative modes of transport. For the purposes of the main demand assessment, average fares for business and leisure travel were designed to be comparable to, and competitive with, air fares on the main inter-capital routes on the east coast, taking into account the types of fares typically purchased by the different types of passenger[8]. In practice, a range of fares would be offered, targeted to market segments and influenced by seat utilisation patterns and competitive pressures, as is currently the case with the airlines.

Forecast HSR demand

An HSR system would significantly increase long and medium-distance transport capacity on the east coast of Australia and would provide an alternative mode of transport that, according to market research and supported by international evidence, would be attractive to many travellers. If the complete HSR network was fully operational, the study predicts that, under the reference case assumptions[9], it could attract approximately 83.6 million passenger trips by 2065, as shown in **Table ES-4**. **Figure ES-3** illustrates the main inter-city passenger trip flows.

8 For example, the average HSR single fares assumed in the reference case between Sydney and Melbourne were $141 for the average business passenger and $86 for the average leisure passenger but sensitivity tests also considered fares up to 30 per cent and 50 per cent greater. The corresponding average fares paid by air passengers were estimated as $137 and $69 respectively.

9 The reference case is part of the central case established for evaluation.

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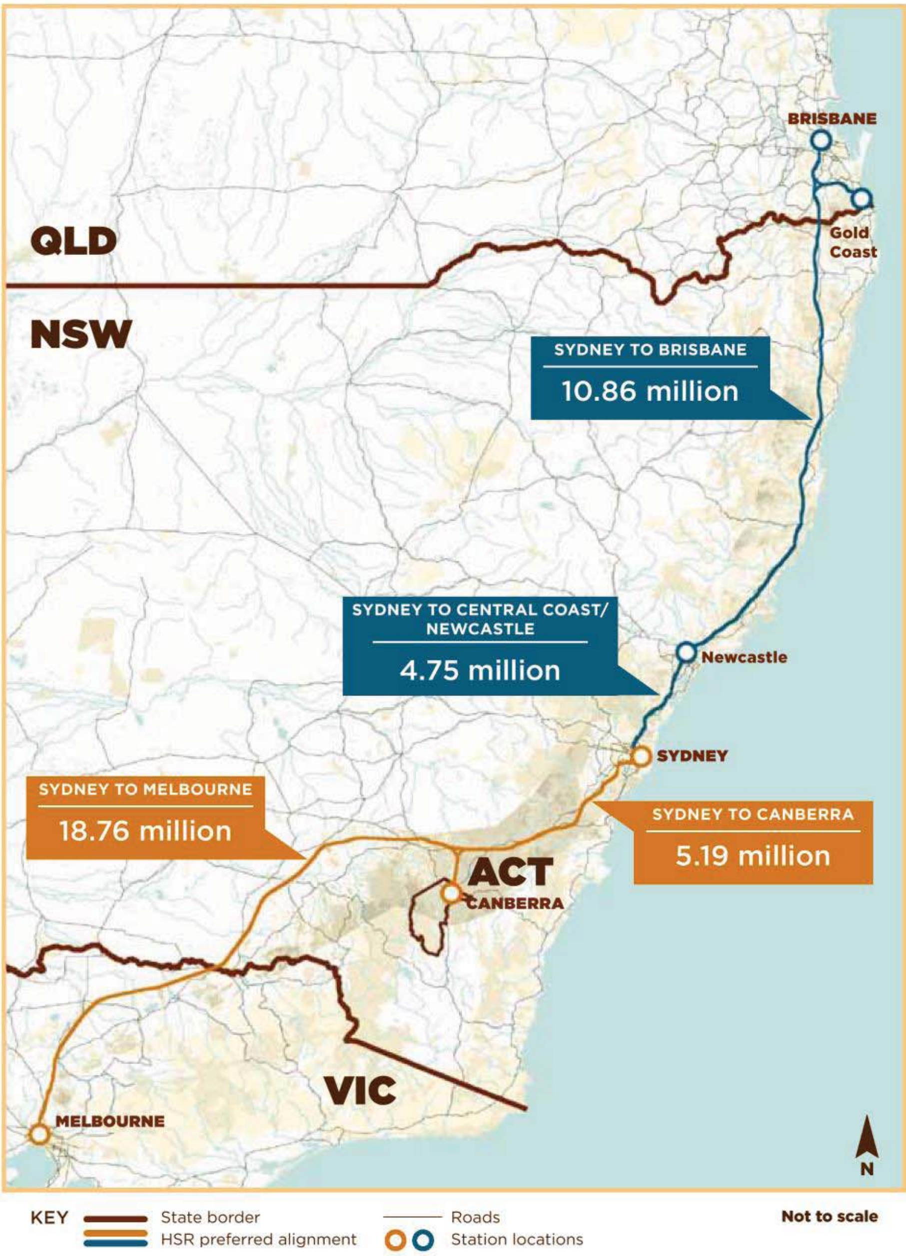
Figure ES-3 HSR travel demand in 2065 between major cities – passenger trips



ITEM 9 (continued) **ATTACHMENT 1**

Table ES-4 HSR travel market for 2065

Total travel market (inter-city and regional)	
Trips without HSR (million)	355
Trips with HSR (million)*	389
HSR travel market (inter-city and regional)	
HSR trips (million)	83.6
HSR passenger kilometres (billion)	53.1

*Includes new demand induced by the construction of HSR. Assumes the full system is operational.

A set of alternative assumptions produced forecasts for HSR in 2065, assuming a full system were to be operational, of between 46 million and 111 million passenger trips. The alternative assumptions included variations in population and economic growth, increases in airport capacity at Sydney (and hence improvements in the aviation level of service) and variations in HSR fares relative to the projected air fares and car running costs.

Forecast HSR travel demand by journey type in the reference case is presented in **Figure ES-4** (for passenger trips) and **Figure ES-5** (for passenger kilometres). Travel for business accounts for 35 per cent of forecast HSR patronage, with inter-city business travel being the most important[10]. Inter-city travel would make up about 49 per cent of total passenger trips and 62 per cent of passenger kilometres. Regional travel would represent about 50 per cent of total passenger trips and 38 per cent of passenger kilometres.

10 Inter-city trips are defined as journeys over 600 kilometres between the six main towns and cities in the corridor based on population (Brisbane, Gold Coast, Newcastle, Sydney, Canberra and Melbourne). Regional trips have been broken into long regional trips of greater than 250 kilometres, which includes Sydney-Canberra, and short regional trips of less than 250 kilometres, which includes Brisbane-Gold Coast and Newcastle-Sydney.

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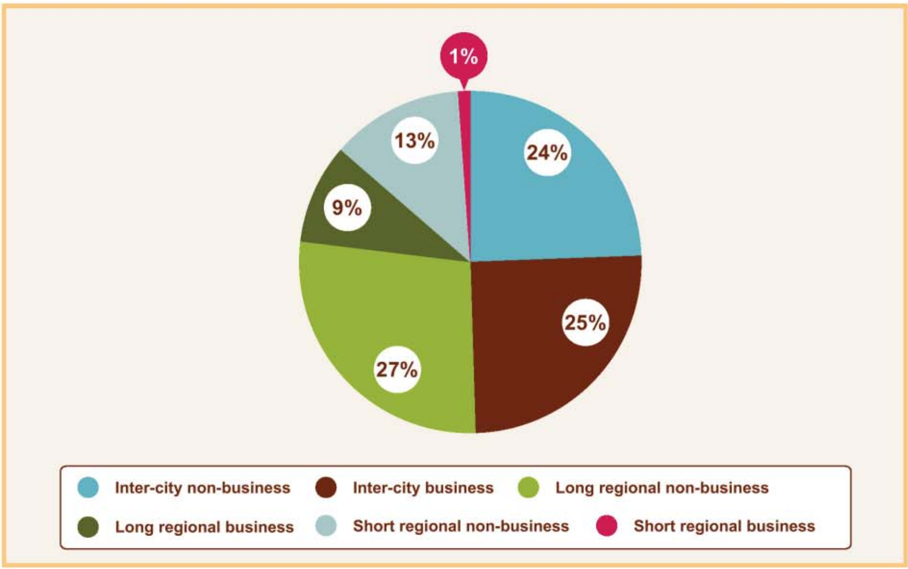
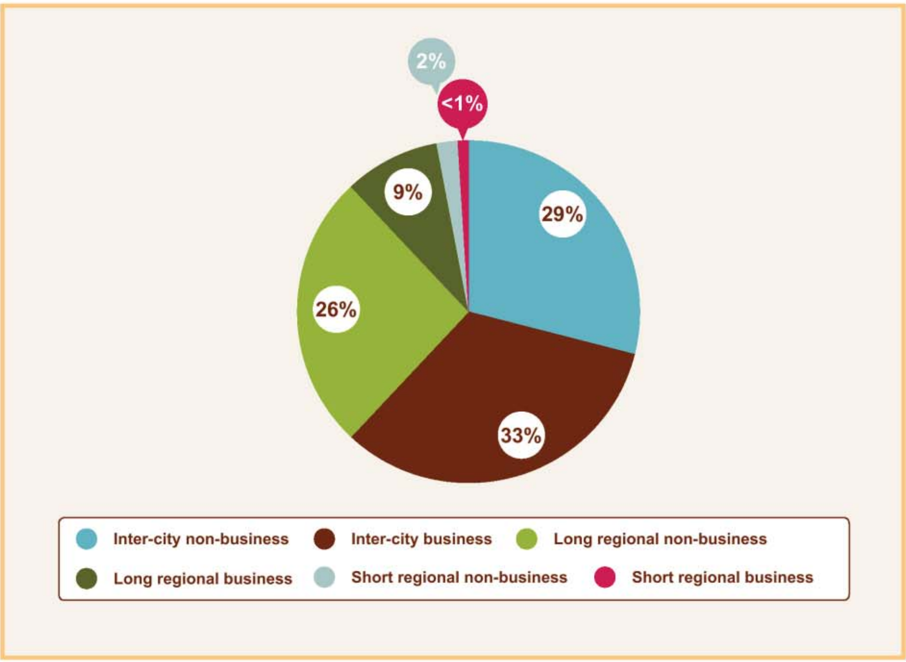
Figure ES-4 HSR travel demand in 2065 by journey type (assuming the full HSR network was operational) – passenger trips



Note: Total does not add to 100% due to rounding.

Figure ES-5 HSR travel demand in 2065 by journey type (assuming the full HSR network was operational) – passenger kilometres



ITEM 9 (continued) **ATTACHMENT 1**

Table ES-5 shows the forecast travel matrix for the reference case in 2065 when the full network would be operational. Intermediate stations between capital centres are aggregated for presentation purposes. Excluding commuter markets, Sydney-Melbourne is the largest market segment for HSR with about 19 million passenger trips, considerably more than the next largest, Brisbane-Sydney, with nearly 11 million passenger trips and almost four times Sydney-Canberra, with about five million passenger trips.

Some travel was omitted from the matrix because it covered only a short distance, or would be best served by car, implying that few such journeys would be likely to transfer to HSR. This included all travel wholly within each of the intermediate areas, other than that to and from Wollongong. A small proportion of the omitted longer trips could use HSR, and to this extent, the HSR forecasts are conservative. Trips to and from places external to the study area were also excluded. The excluded trips referred to above are shown by an X in the table.

About half of the HSR demand would be diverted from forecast air travel as shown in **Figure ES-6**. About 19 per cent of total trips would be new demand generated by the introduction of an HSR service (shown as induced demand).

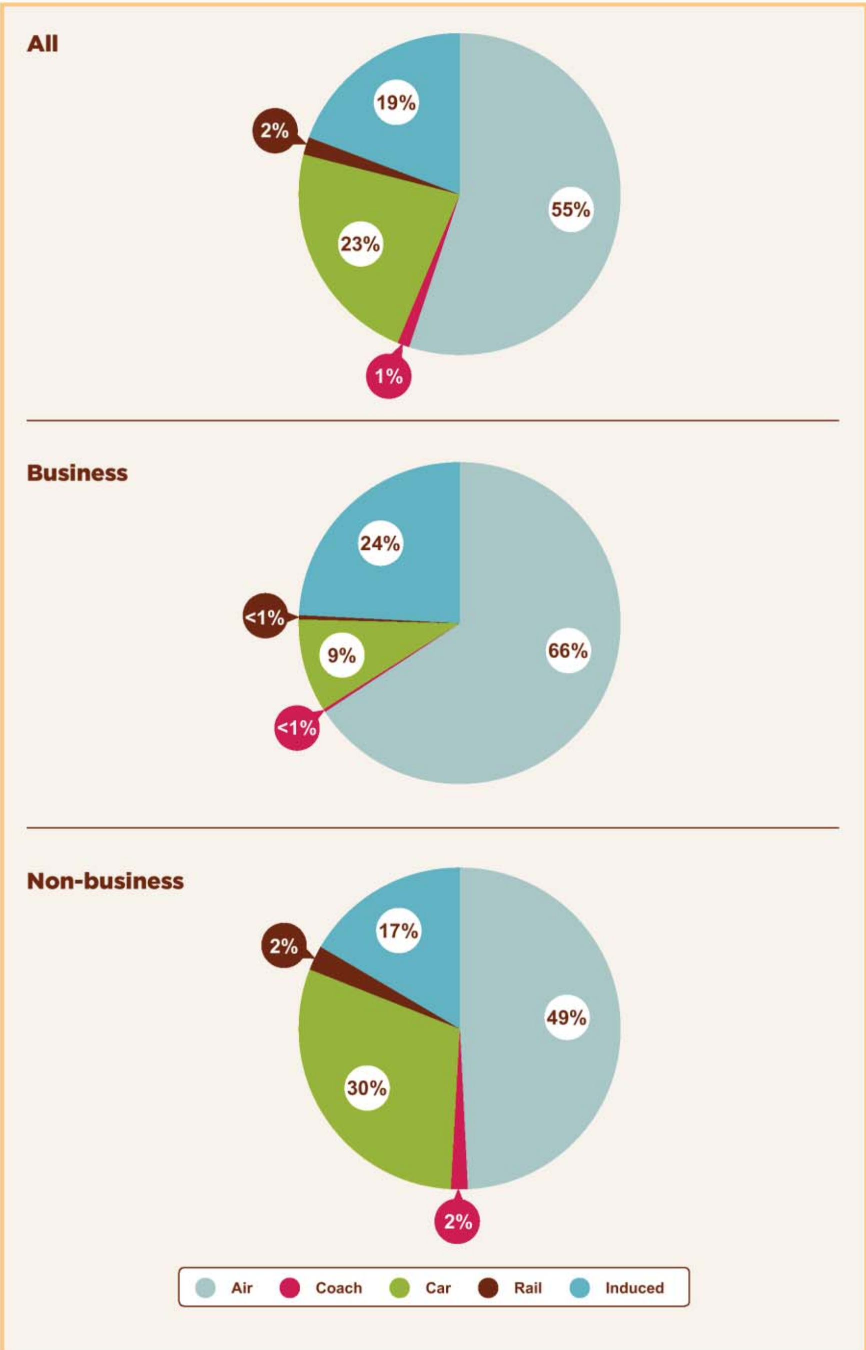
Table ES-5 HSR travel market matrix for 2065 ('000 trips in both directions per year)

Sectors	Brisbane	Gold Coast	Intermediate	Newcastle	Intermediate	Sydney	Intermediate	Canberra	Intermediate	Melbourne	Total
Brisbane	X	2,210	1,650	750	600	10,860	1,240	1,130	730	2,490	
Gold Coast		X	900	520	580	3,830	610	190	440	340	
Intermediate			X	810	X	5,500	190	330	X	850	
Newcastle				X	170	1,760	220	250	150	330	
Intermediate					X	2,990	20	300	X	730	
Sydney						X	2,690	5,190	2,290	18,760	
Intermediate							80	480	100	2,320	
Canberra								X	640	2,720	
Intermediate									X	4,660	
Melbourne										X	
Total											83,600*

*Cells may not exactly sum to the total due to rounding.

ITEM 9 (continued) **ATTACHMENT 1**

Figure ES-6 Source of HSR travel demand in 2065 by journey type (passenger trips)



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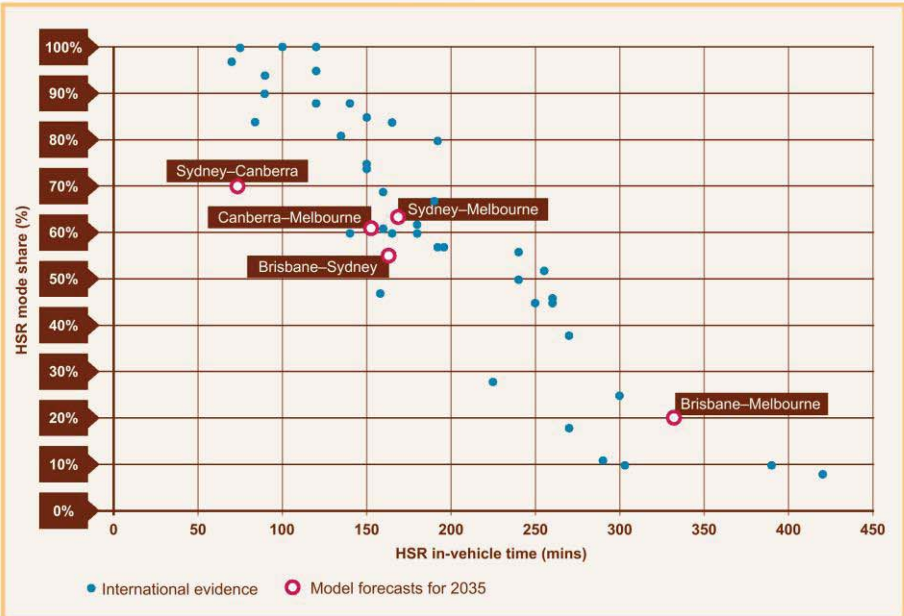
How the total HSR and air market would be shared between the two modes of transport is a key issue in the demand assessment. Considerable evidence has been assembled in the international literature on the impacts of HSR on inter-capital air travel in Europe and East Asia. In **Figure ES-7**, the international markets are represented by the blue dots, which show the proportion of the combined air and HSR travel market captured by HSR on selected routes. For HSR journey times of less than two hours, this is typically over 80 per cent, whereas if HSR journey times exceed four and a half hours, the HSR share falls below 30 per cent. For trips of up to three hours (as for Sydney-Melbourne and Sydney-Brisbane), observed HSR market shares range from around 55 per cent up to around 70 per cent.

This study's reference case inter-capital forecasts for 2035 have been included in the figure for comparison and show a high degree of consistency with the international experience. Sydney-Canberra is lower than the expected range for journeys less than two hours, but this is largely explained by the relatively high proportion of passengers transferring to connecting flights, which are assumed in the forecasts not to divert to HSR.

Figure ES-7 HSR share of combined HSR/air travel market, comparing the final model forecast for 2035 with international evidence



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Cost of constructing the HSR network

Internationally, HSR systems are very reliable when they operate as closed systems dedicated to high speed services with purpose-built infrastructure and train sets. Although mixing HSR services with conventional rail services on shared infrastructure may reduce capital costs, particularly for access into the urban areas, operational performance can diminish dramatically. Such systems are generally not capable of delivering the journey times that would be necessary for an HSR system on the east coast of Australia to achieve the required levels of reliability and competitiveness.

To achieve the target journey time of under three hours for Sydney-Melbourne and Brisbane- Sydney, an average journey speed of approximately 300 kilometres per hour would need to be achieved. This would require a system capable of a maximum operating speed of 350 kilometres per hour, to allow for some slower sections of track due to terrain or other operating conditions. Such average speeds would not be possible on the existing conventional rail infrastructure on the east coast of Australia, even if it was only used for short sections for city access and egress, so dedicated HSR infrastructure would be required. If the HSR network were used to provide fast commuter services, it is likely they would not operate at such high speeds; a maximum operating speed of 200- 250 kilometres per hour would effectively serve the commuter market, given the relatively shorter distances and more intensive stopping patterns of fast commuter services.

In addition to the physical components of capital cost (land, earthworks, structures, track, equipment and facilities), the cost estimates also include design, program and construction management, and asset renewal when it would fall due. Cost components were developed from Australian unit costs and benchmarked against international HSR systems to ensure the robustness of the estimates. Rolling stock (train sets) is equivalent to a further nine per cent of the total capital cost, but this would only be expended as demand built up over the appraisal period and service frequencies increased.

Tunnelling would be used where the terrain requires it, but would also be adopted where no dedicated surface route could be created without unacceptable community dislocation and/or environmental costs. This is particularly the case where the route passes through the middle and inner suburbs of the capitals, where no suitable easements are available. It has also been used in some locations which are highly environmentally sensitive. In total, the preferred alignment includes 144 kilometres of tunnel along the route, representing around 29 per cent of the total cost of construction. Sixty per cent of the tunnel length is in urban areas, with 67 kilometres in Sydney, eight kilometres in Melbourne, five kilometres in Brisbane and four kilometres in Canberra.

The cost estimates reflect the use of proven HSR system technology (such as train control and power supply systems) and train sets already in service, and readily available, and take account of a range of manufacturers' delivered costs for existing HSR systems.

The capital costs have been risk-adjusted to reflect uncertainty, principally around the scope of the major construction, engineering and operational elements of a future HSR program. Expected construction costs are expressed throughout this chapter in terms of risk-adjusted value, in $2012.

In total, the risk adjustment process increased capital costs by about 10.8 per cent[11].

The estimated capital cost for the full HSR system, excluding the cost of train sets[12], is $114.0 billion in $2012, as shown in **Table ES-6**.

Table ES-6 Risk-adjusted HSR program costs ($2012, $billion)

	Sydney-Canberra	Canberra Junction-Melbourne	Newcastle-Sydney	Brisbane-Gold Coast	Gold Coast Junction-Newcastle	Total HSR system
Project development	2.2	2.5	1.7	1.0	3.1	10.4
Construction	20.8	24.4	17.2	10.0	31.2	103.6
Total capital costs	23.0	26.9	18.9	11.0	34.3	114.0

Notes: Total does not add up exactly due to rounding.
The references to 'Canberra Junction' and 'Gold Coast Junction' describe the points at which the Gold Coast and Canberra spurs leave the main alignment.

Figure ES-8 presents the results of the @RISK analysis for total construction costs including development costs for the future HSR program[13].

The analysis illustrates that:

- In 50 per cent (P50) of simulations, total construction costs are expected to be less than $113.9 billion ($2012).
- In 90 per cent (P90) of simulations, total construction costs are expected to be less than $127.0 billion ($2012).
- In ten per cent (P10) of simulations, total construction costs are expected to be less than $102.0 billion ($2012).

11 This is the expected risk-adjusted cost and is within one per cent of the median risk-adjusted cost, commonly known as the P50; the difference between them is due to the risk adjustment applied to the individual cost components being non-symmetrical. Taking into account the allowances included in developing the non-risk-adjusted costs, the risk allowance is comparable with what would be allowed as a physical contingency for a project at a similar early stage of development.

12 Train sets are assumed to be leased in the financial assessment.

13 The frequency represents the likelihood of the total construction costs being within a $1 billion band centred on the corresponding point on the curve. Thus there is a two per cent chance that the cost will lie between $100.5 billion and $101.5 billion and a four per cent chance they lie between $107 billion and $108 billion.

Figure ES-8 Total construction costs (including development costs) ($2012, $billion)

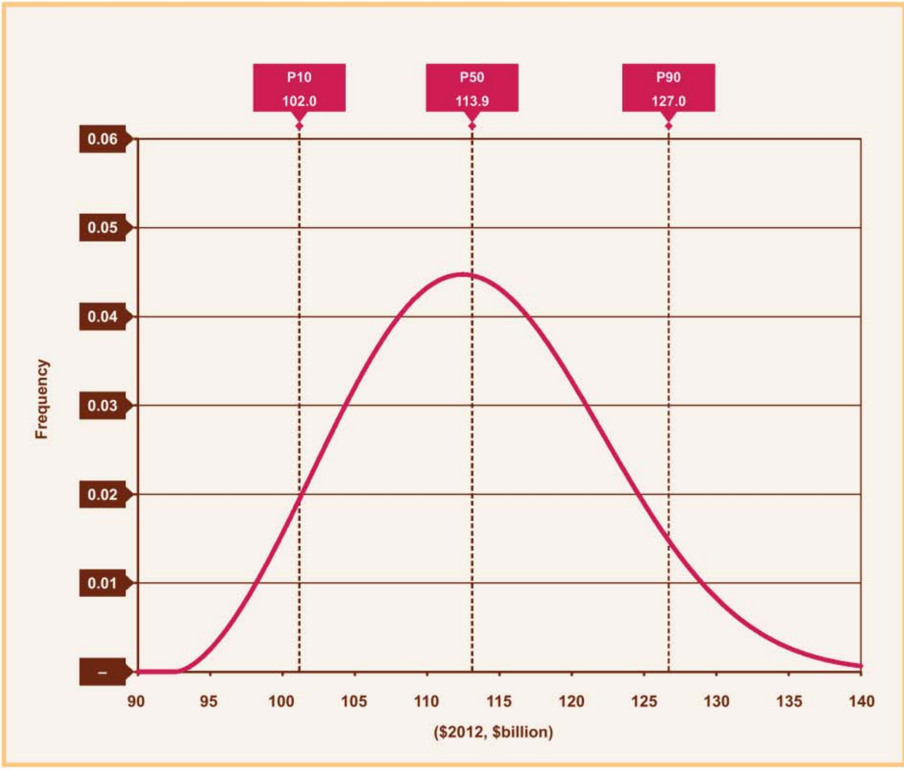
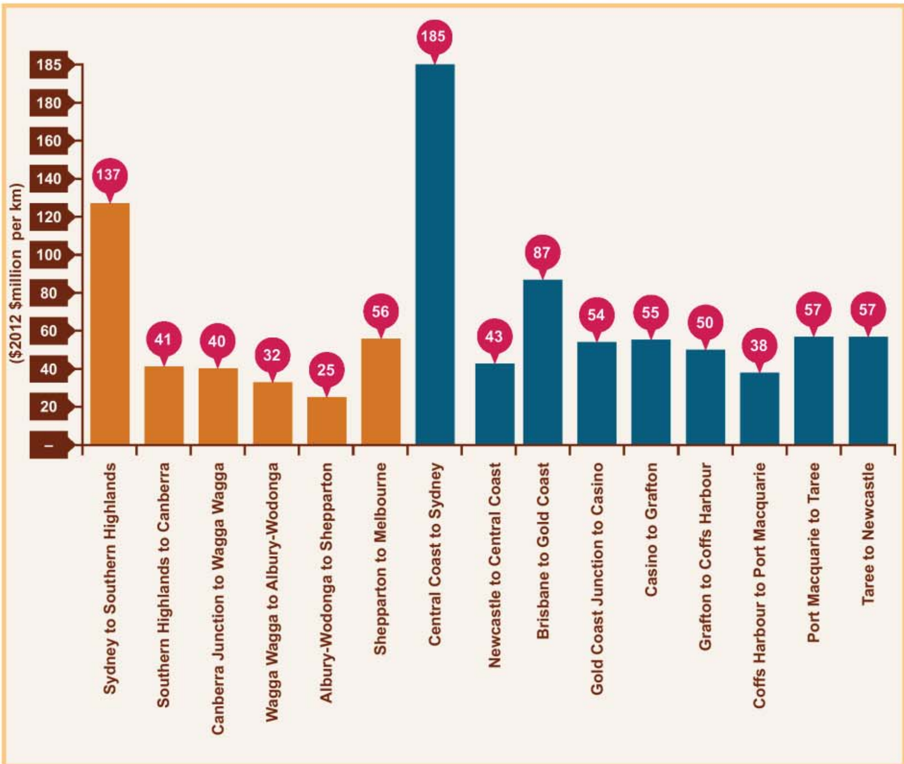


Figure ES-9 presents estimated average construction costs per route kilometre on a segment by segment basis. The extensive tunnelling required for access into and out of Sydney increases the cost per route kilometre for these segments by two to three times compared to the costs for the remainder of the network.

Parts of the route between Brisbane and Newcastle also have high costs, reflecting the volume of earthworks required in these areas.

Figure ES-9 HSR program average construction costs per route-kilometre in staging order ($2012, $million)



Staging the development of HSR

The size and complexity of an HSR system on the east coast of Australia would be such that it could not be delivered as a single project; instead, it would be delivered in stages linking the principal centres. Even these stages would be large projects by Australian standards. Staging would not only allow the upfront funding to be reduced and smooth future funding requirements, but would also better match system development to market growth and would allow revenue to be generated on sections of the system as they are completed.

The study has concluded that the benefits of HSR are strongly related to the volume of travel between the capital cities, in particular Sydney-Melbourne, and that establishing this link would be the first priority for any HSR network on the east coast of Australia. At a construction cost of about $50 billion in $2012 (risk-adjusted), the Sydney-Melbourne line would represent a major undertaking and would itself need to be staged. Canberra, which would be connected by a spur line to the Sydney-Melbourne line, is the next most important city on this line from a demand viewpoint and would be an appropriate terminal for the first stage to ensure revenue would be generated as early as possible.

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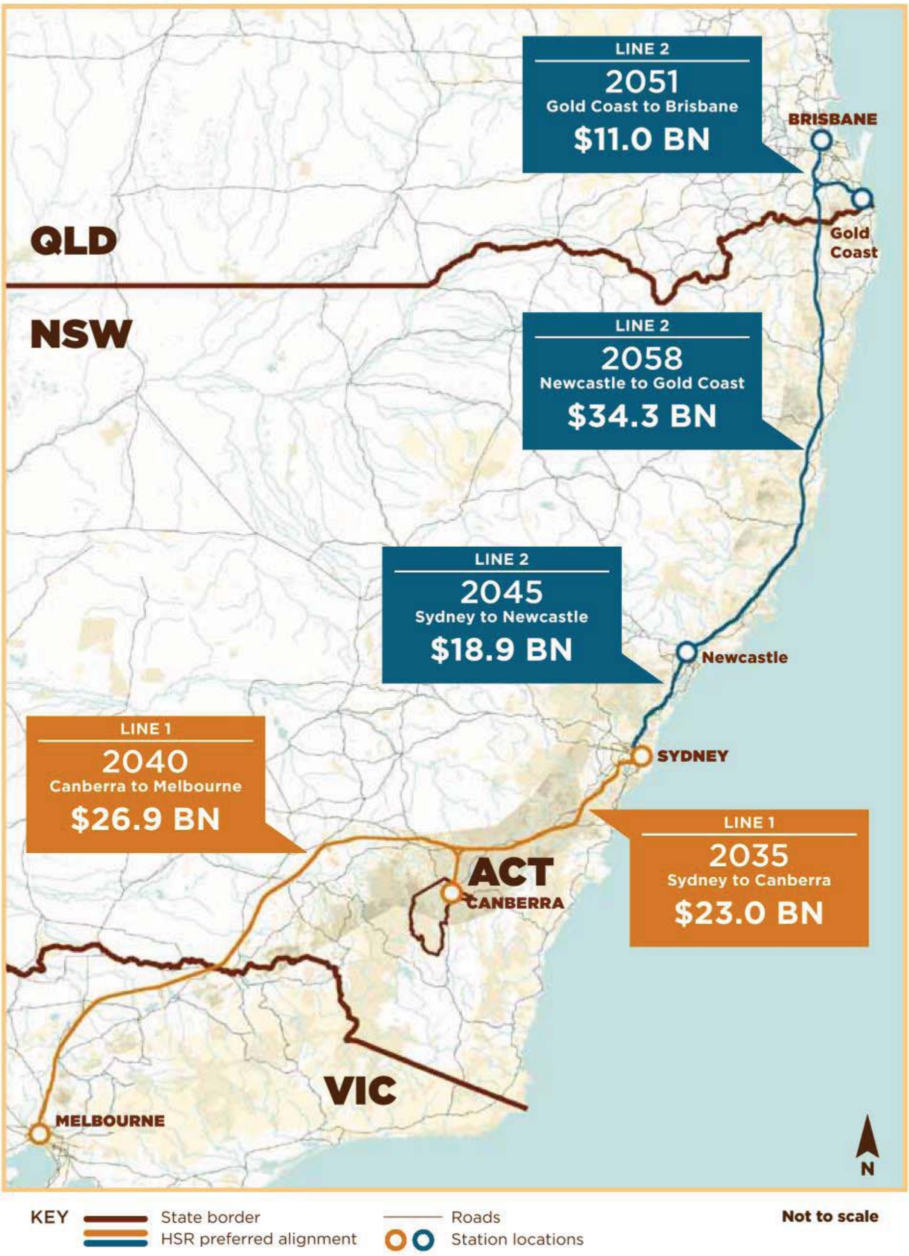
Figure ES-10 Staging of the preferred HSR system – commencement of operations



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The staging of the preferred HSR system assumed in the financial and economic evaluations, as shown in **Figure ES-10** and **Table ES-7**, takes into account the extent to which individual sections capture the forecast market, the cost of construction and the economic and financial returns of each stage.

Table ES-7 Staging of the preferred HSR system

	Built track (km)*	Risk-adjusted cost ($b)	Cost per km ($m)	Potential operational date
Line 1 Sydney-Melbourne	**894**	**49.9**	**56**	**2040**
- Stage 1: Sydney-Canberra	283	23.0	81	2035
- Stage 2: Canberra-Melbourne**	611	26.9	44	2040
Line 2 Brisbane-Sydney	**854**	**64.1**	**75**	**2058**
- Stage 3: Newcastle-Sydney	134	18.9	141	2045
- Stage 4: Brisbane-Gold Coast	115	11.0	96	2051
- Stage 5: Gold Coast-Newcastle**	606	34.3	56	2058
Total	**1,748**	**114.0**	**65**	**2058**

* Note that the built track includes spur junctions and other connections. These distances are different from the travel kilometres in **Table ES-1** and **Table ES-2**.
** Construction of Stages 2 and 5 would start at the Canberra Junction and Gold Coast Junction respectively, the points at which the Gold Coast and Canberra spurs leave the main alignment.
Note: Totals do not add up exactly due to rounding.

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Figure ES-11 Staging of the preferred HSR system – cumulative capital costs ($2012, $billion)

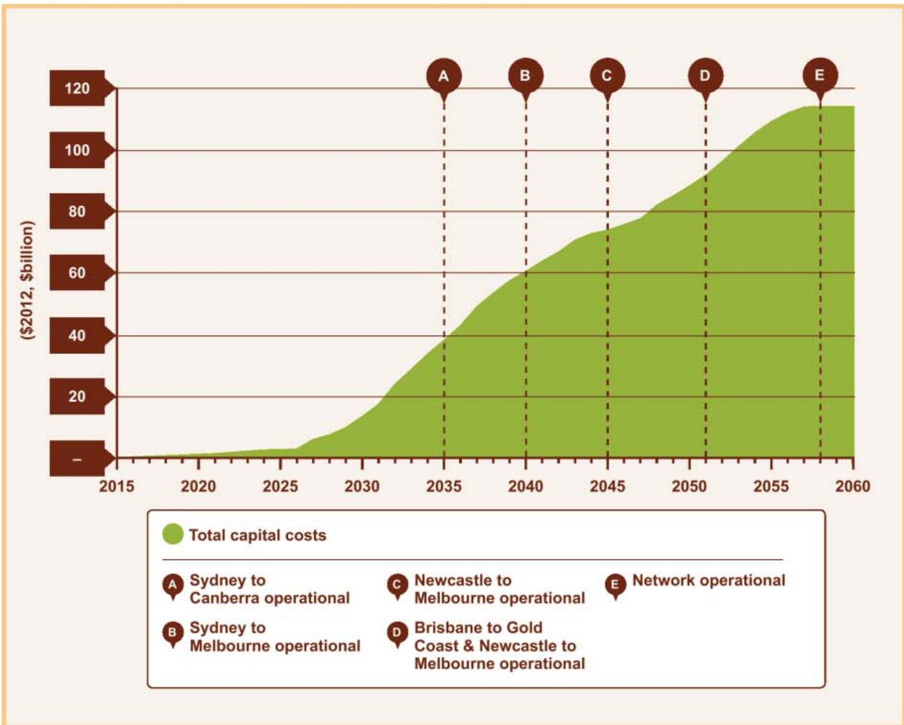

Figure ES-11 shows the profile of cumulative capital costs over the HSR program.

Line 1 between Sydney and Melbourne would be a major undertaking in terms of planning, construction, testing and commissioning and, based on current industry experience, would need to be done in discrete stages. For evaluation purposes, a start date of 2035 was assumed. Working back from that date, enabling legislation would need to be passed by 2019. Prior to 2019, the final preferred route and station locations would be determined, further technical investigations completed and all necessary government approvals obtained. Steps would also be taken to preserve the preferred HSR corridor prior to any commitment to proceed.

Following enabling legislation, a period of more than two years would be required for concept design, environmental impact assessment and public consultation, before a decision to proceed to implementation would be made in 2021. There would then be a procurement period of two to three years to let contracts and to acquire land. Enabling works would then be undertaken (critically at Sydney's Central station). These works are anticipated to take four years to divert the current services within the existing operational station before the main implementation contracts could commence in 2027 (i.e. financial year 2028).

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The implementation program of a further 84 months reflects the actual program to deliver the Taiwan HSR and includes a period of 34 months for testing and commissioning. Based on this evaluation program, the first public HSR services would start in April 2035. Subsequent stages would be delivered at five to seven year intervals, with planning of each stage overlapping with construction of the previous stage. Under these assumptions, the entire network could be in operation by 2058.

The staging assumed in **Table ES-7** could, however, be accelerated by about five years, although it would likely incur additional cost and risk. The time taken to pass the relevant legislation and to make a formal decision to proceed could be accelerated. The enabling works could also be started earlier, so as not to delay the commencement of implementation works at Sydney Central station; this would require funding in advance of the formal decision to proceed, but could save 18 months. There is also potential for the construction period to be shortened by as much as 24 months, but this would require extended working hours and could be limited by a lack of qualified resources. An accelerated program could therefore start with the Sydney enabling works in 2019, with Sydney-Canberra operational by 2030 and Sydney-Melbourne operational by 2035. Under this accelerated program, the full network could be operational by 2053.

Financial assessment

The future HSR program and the majority of its individual stages are expected to produce only a small positive financial return on investment.

The estimated real financial internal rate of return (FIRR) for the program as a whole is 0.8 per cent. For Sydney to Melbourne, the estimated (post-tax) real FIRR is 1.0 per cent. These fall well short of the financial returns that would be required by commercial providers of debt and equity to major infrastructure providers[14]. At a four per cent discount rate, the financial net present value (FNPV) of financial costs and revenues associated with an investment in HSR would be negative $47 billion[15]. Governments would be required to meet the majority of construction and establishment costs for the HSR network.

Post construction, the future HSR program and its stages (with the exception of Sydney-Canberra as a stand-alone stage[16]) are expected to generate sufficient operating income to cover ongoing operational and asset renewal costs. This forecast holds true for all but one of the scenarios and sensitivities tested. As a consequence, HSR operations would be financially self-sustaining if traffic and cost assumptions were met.

Table ES-8 summarises the results of the FNPV and FIRR analysis on a pre and post-tax basis for the future HSR program and its stages. These are presented on a cumulative present value basis, with the summary costs and revenue obtained by discounting cashflows by the evaluation discount rate of four per cent to financial year 2028. Sydney-Canberra delivers a negative financial return. Neither the program as a whole, nor any of the stages, returns a positive FNPV at a four per cent discount rate.

14 These would typically be around 15 per cent or more.
15 Discounted to 2028 and in $2012.
16 That is, if Sydney-Canberra was operated independently of any other HSR line.

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Assumptions about the timing of the various stages are also shown in **Table ES-8**.

Table ES-9 sets out the summary of risk-adjusted capital costs, revenues, operating costs and asset renewals over the evaluation period to 2085. The HSR program as a whole delivers a positive net operating surplus. That is, for the preferred HSR system, revenues would cover ongoing operating costs and the costs of renewing assets when they wear out. Therefore, provided traffic forecasts and costs estimates are met, no ongoing government subsidy would be required to sustain HSR operations once the system is constructed and operational. As traffic builds up, the ability of transport operations to return some of the capital costs would increase.

Table ES-8 Summary of FNPV and FIRR results (present value discounted to 2028, $2012, $billion, 4% discount rate)

	Future HSR program				
	Sydney-Canberra	Sydney-Melbourne	Newcastle-Melbourne	Brisbane-Gold Coast & Newcastle-Melbourne	Network complete [17]
Year operations commence	**2035**	**2040**	**2045**	**2051**	**2058**
Total costs	20.9	41.1	52.8	58.3	72.0
Net operating result*	-0.4	10.5	11.6	11.3	15.5
FIRR (real)	**n/a**	**1.0%**	**0.9%**	**0.4%**	**0.8%**
FIRR (real, pre-tax)	**n/a**	**1.4%**	**0.9%**	**0.4%**	**0.8%**
FNPV	**-21.5**	**-26.5**	**-35.2**	**-41.3**	**-47.0**
FNPV (pre-tax)	**-21.5**	**-25.0**	**-35.2**	**-41.3**	**-47.0**

Notes: * Revenues less operating costs including payments for rolling stock leases and asset renewal. Due to accumulated tax losses (primarily from depreciation on the infrastructure asset base), only the Sydney-Melbourne HSR stage pays corporation tax during the evaluation period. Where tax is not payable, the FIRR and FNPV do not differ on a pre and post-tax basis.
'n/a' denotes an FIRR of less than zero per cent that cannot be mathematically calculated.

17 Network complete represents the entire HSR network between Brisbane and Melbourne.

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Table ES-9 Summary risk-adjusted capital costs, revenues, operating costs and asset renewals over the total evaluation period to 2085 (present value discounted to 2028, $2012, $billion, 4% discount rate)

	Sydney-Canberra	Sydney-Melbourne	Newcastle-Melbourne	Brisbane-Gold Coast & Newcastle-Melbourne	Network complete
Year operations commence	**2035**	**2040**	**2045**	**2051**	**2058**
Total development costs	2.3	4.7	6.1	6.8	8.8
Total construction costs	18.6	36.4	46.7	51.5	63.2
Total capital costs	**20.9**	**41.1**	**52.8**	**58.3**	**72.0**
Total revenue	5.0	39.4	43.0	43.5	62.7
Total operating costs	4.4	25.1	27.3	27.9	42.2
Total payments for rolling stock finance leases	0.1	1.3	1.3	1.3	1.8
Total asset renewals	1.0	2.5	2.8	3.0	3.2
Total operating result	**-0.4**	**10.5**	**11.6**	**11.3**	**15.5**
Terminal value	**-0.2**	**4.0**	**5.6**	**5.4**	**9.1**
FNPV	-21.5	-26.5	-35.2	-41.3	-47.0

Note: Total may not be exact due to timing and rounding differences.

Risk-adjusted project cashflows for each year of the evaluation period, reflecting the proposed staging of the HSR program, are shown in **Figure ES-12**. Total annual project capital expenditure ranges from $2 billion to $8 billion in each of the eight years prior to the opening of the Sydney-Canberra section in 2035, and then continues at between $2 billion and $7 billion per year for the next 23 years until the full network is operational in 2058.

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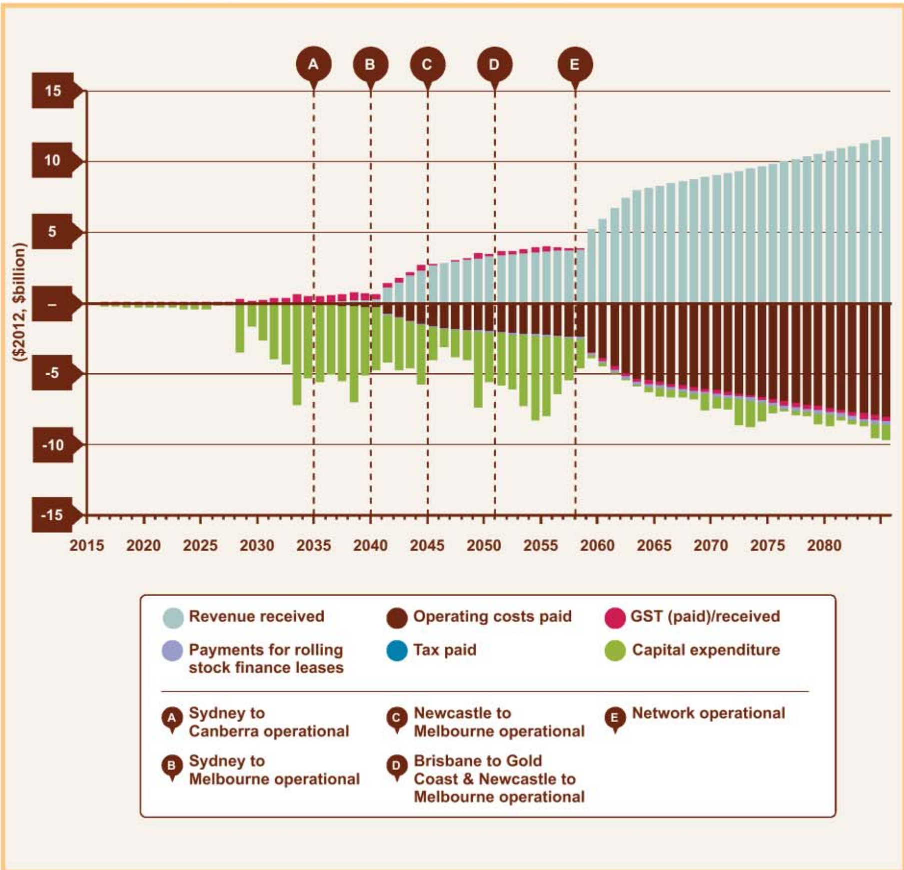
Figure ES-12 HSR program risk-adjusted project cashflows per year ($2012, $billion)



With the exception of the costs associated with accessing Sydney (as shown in **Figure ES-9**), capital costs increase broadly in proportion to the length of the HSR line being constructed. As indicated in **Figure ES-12**, extensions to the network lead to step changes in patronage and therefore are critical to the operating cashflows. For instance, completing Sydney-Canberra or Canberra-Melbourne as stand-alone segments would produce only moderate passenger demand and financial returns. When the whole line connecting Sydney-Melbourne is completed, significant additional demand would be generated (passenger numbers at that point increase by a factor of five). Operating cashflows and returns then also improve, reflecting the growth in patronage without a correspondingly material increase in capital costs. The same benefit would be observed when the Gold Coast is connected to Newcastle and the full HSR system is in operation, resulting in a considerable uplift in demand between Brisbane, Sydney and Melbourne. The financial performance (annual cashflow) of each stage is summarised in **Figure ES-13**.

Figure ES-13 HSR program risk-adjusted cashflows per year by stage ($2012, $billion)

Due to the future HSR program's expected low financial returns, significant private sector funding (debt/equity) would not be available or appropriate to finance the program. As such, a considerable commercial financing gap would exist between the total capital cost of the HSR program and the amount of financing that could be raised from the financial markets on commercial terms, based on the future HSR program operating cashflows.

Based on the detailed analysis of program cashflows, the commercial financing gap for the entire HSR program would be about $98 billion (or 86 per cent of the total risk-adjusted capital cost) as shown in **Table ES-10**. For the Sydney-Melbourne line, the commercial financing gap would be about $45 billion, or 92 per cent of the total capital cost.

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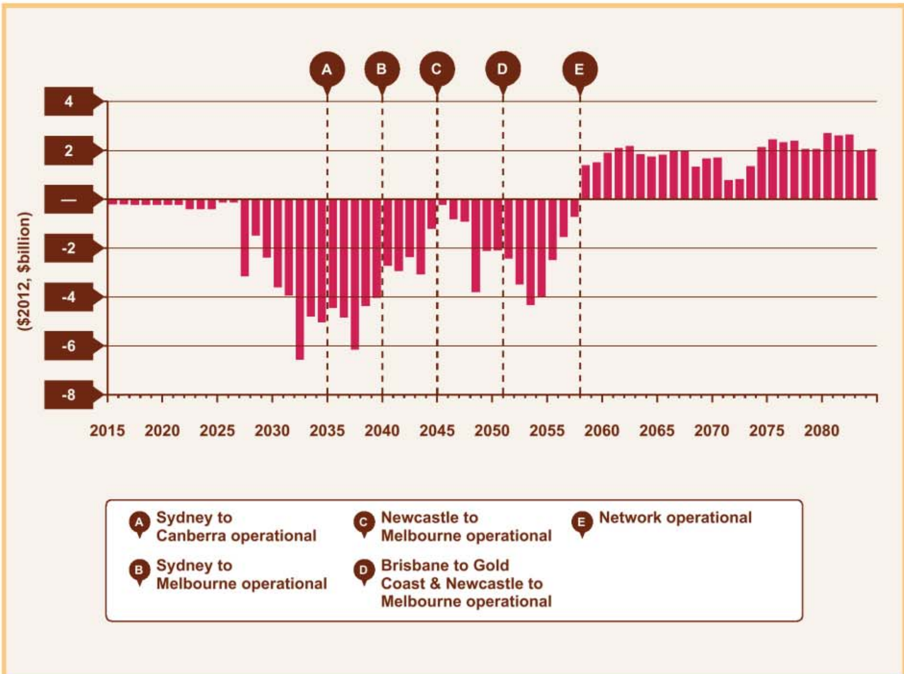
Table ES-10 Summary of the commercial financing gap – reference case ($2012, $billion)

	HSR program	Sydney-Melbourne
Total capital cost	114.0	49.9
Debt carrying capacity	16.3	4.1
Commercial coverage	14%	8%
Commercial financing gap	97.7	45.7

Value capture has the potential to partially close the commercial financing gap through measures such as government land sales and capturing the incremental impact that the HSR program would have on stamp duty, developments and rates in the HSR affected zones. However, this would be a small contribution at best. It is highly unlikely that all of these measures would be implemented and the ultimate benefit that value capture might have on closing the commercial financing gap is therefore difficult to determine at this stage.

Ultimately governments would be required to fund the majority of the future HSR program's upfront capital costs. A summary of the cashflow implications for government for the whole network is presented in **Figure ES-14.**

Figure ES-14 HSR program government cashflows ($2012, $billion)



Economic assessment

The study adopted a cost-benefit methodology that is conventionally applied to major transport infrastructure projects. The cost components of the analysis, including the necessary capital expenditure required to develop, construct and renew the HSR system as components wear out, depend on the proposed HSR engineering and technical specifications adopted for the preferred HSR system and on the assumed staging of network development set out in **Table ES-7**.

For the purposes of evaluation, construction of stage 1 of Line 1 (i.e. the Sydney-Canberra stage of the Sydney-Melbourne line) is assumed to start in July 2027 (start of financial year 2028).

Once constructed, the HSR system would generate a stream of economic benefits, linked to the assessment of future travel demand. In general terms, the total economic benefit of travel on HSR would depend on how much each passenger values their trip, often termed their 'willingness to pay'. This is calculated by measuring the differences in generalised trip costs when comparing the reference case (with HSR) to the base case (without HSR). Aggregating willingness to pay across all users of HSR and over time provides an assessment of the total (gross) economic value created for users of the system by the investment in a future HSR program.

Transporting passengers consumes economic resources such as labour and fuel. Because HSR could reduce demand for other modes of transport, and hence their consumption of resources, the additional resources required for HSR need to be offset against the resources avoided in other modes. The net change in resources is deducted from the gross economic value to calculate the stream of economic benefits derived from the investment in HSR.

The distribution of the net benefits between the users and the operator(s) of the HSR system is determined by the prices charged. Ultimately, prices would serve to transfer economic value from users of the system to its operators. Revenue is therefore included in the calculations (as a cost to users and a benefit to operators) to assess the relative benefits to users and operators.

The net economic benefits internal to the transport system are therefore measured by adding the two components:

- User benefits (or consumer surplus) are calculated based on the difference between a user's willingness to pay for a service and the actual price paid.
- Operator benefits (or producer surplus) represent the difference between the price paid or revenue generated by a service and the costs associated with (or resources consumed by) operating the service. The change in operator benefits is assessed for each mode (i.e. HSR, aviation, conventional rail and coach).

In addition, there would be costs and benefits that are external to the transport system that can be measured in monetary terms and included in the cost-benefit analysis. These externalities measure the impact of HSR to the broader community, including environmental and safety impacts, decongestion benefits and any alternative avoided or deferred transport network capital expenditure. A residual value has also been included to capture the remaining value of the assets at the end of the evaluation period[18]. The present values of costs and benefits by category, discounted at four per cent, are shown in **Figure ES-15**[19]. The economic net present value (ENPV) is the sum of the present value of the economic costs and benefits, which for the program as a whole is $101 billion.

18 A 50 year evaluation period has been adopted, commencing in 2035.

19 The discount rate converts cashflows of future costs and benefits into present day dollars to allow a comparison of costs and benefits, expressed in $2012, and using a common base year, in this case financial year 2028, which is the assumed start of construction of the first stage.

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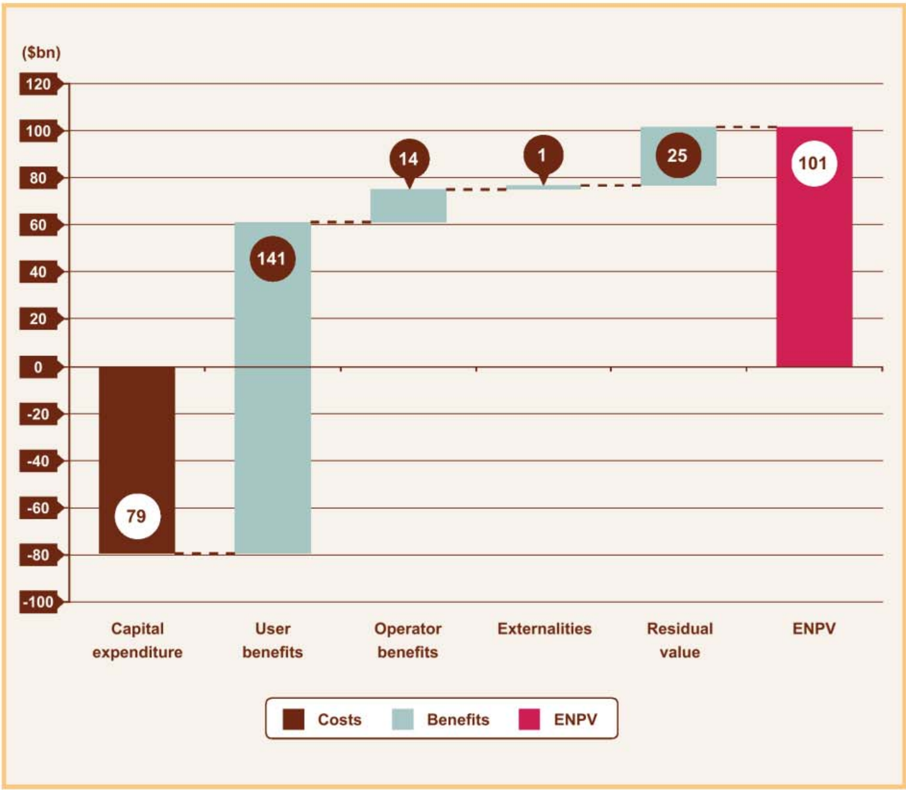
Figure ES-15 Present value of costs and benefits for the HSR program (present value discounted to 2028, $2012, $billion, 4% discount rate)



The HSR user benefits dominate the economic results and account for 90 per cent of the estimated benefits (excluding the residual value). A key component is the assessment of time savings for travellers across their full journey including travel time, waiting time, check-in time and access time, with adjustments for the inconvenience of having to change modes. Travel time savings are measured using values of time based on market research conducted for this study and tested for reasonableness against conventional values used in road projects, which vary by trip purpose (e.g. business versus leisure)[20].

Business travellers would gain the majority of user benefits due to their higher value of time, even though they only represent about 35 per cent of the total HSR travel market, as shown in **Table ES-11**.

20 Austroads, *Guide to Project Evaluation*, 2012.

Table ES-11 User benefit estimates by market segment (present value discounted to 2028, $2012, $billion)

	Business users	Leisure users	Total
Short regional	1.7	7.4	9.1
Long regional	31.3	27.1	58.4
Inter-city	60.6	12.6	73.2
Total	**93.6**	**47.1**	**140.7**

The summary results for the reference case predict that an investment in the preferred HSR program would generate an economic internal rate of return (EIRR) of 7.6 per cent and an economic cost-benefit ratio (EBCR) of 2.3 using a four per cent discount rate[21]. A seven per cent discount rate has also been tested and would reduce the ENPV to $5 billion and the EBCR to 1.1, as shown in **Table ES-12**; although marginal, the estimated economic benefits remain positive.

Table ES-12 Summary economic indicators for the HSR program (present value discounted to 2028, $2012, $billion)

	4% discount rate	7% discount rate
Total costs	79.3	58.9
Total benefits	180.6	63.8
EIRR	**7.6%**	**7.6%**
ENPV	**101.3**	**4.9**
EBCR	**2.3**	**1.1**

Sydney-Melbourne is the strongest performing line, with an estimated EIRR of 7.8 per cent, as shown in **Table ES-13**. It has an estimated positive ENPV of $69 billion and an EBCR of 2.5 when measured on a stand-alone basis.

Table ES-13 Summary economic indicators for Sydney-Melbourne (present value discounted to 2028, $2012, $billion)

	4% discount rate	7% discount rate
Total costs	46.5	38.9
Total benefits	115.7	45.3
EIRR	**7.8%**	**7.8%**
ENPV	**69.3**	**6.5**
EBCR	**2.5**	**1.2**

Note: Totals do not add up exactly due to rounding.

21 The EIRR represents the discount rate that makes the net present value of all economic cashflows equal to zero. The higher the EIRR the greater the net economic returns achieved by a project relative to its capital resource costs and if EIRR is greater than the discount rate, then the project would deliver a positive net economic benefit.

The incremental economic results for each additional stage of the preferred HSR program are set out in **Table ES-14**. The results support the preferred staging of the HSR program, with Sydney-Melbourne delivering an estimated EIRR of 7.8 per cent. The subsequent northern stages from Newcastle-Melbourne and Brisbane-Gold Coast add little incremental economic value on a stand-alone basis (i.e. ENPV does not materially change) and the results suggest they would not be undertaken unless the intention were to complete the line connecting Brisbane and Sydney.

Table ES-14 Incremental economic impacts for each additional stage of the HSR program (present value discounted to 2028, $2012, $billion)

	Future HSR program				
	Sydney-Canberra	Sydney-Melbourne	Newcastle-Melbourne	Brisbane-Gold Coast & Newcastle-Melbourne	Network complete (i.e. Brisbane-Melbourne)
Year operations commence	**2035**	**2040**	**2045**	**2051**	**2058**
Total costs*	22.2	46.5	58.6	64.3	79.3
Total benefits	20.4	115.7	126.7	126.7	180.6
EIRR	**3.8%**	**7.8%**	**7.3%**	**7.1%**	**7.6%**
ENPV	**-1.7**	**69.3**	**68.1**	**63.9**	**101.3**
EBCR	**0.9**	**2.5**	**2.2**	**2.0**	**2.3**

* Costs include rolling stock and asset renewal costs.

Overall, the results of the analysis present a positive economic case for the introduction of HSR. Forecasts were prepared for the reference case (i.e. with HSR) which was part of the central case for evaluation purposes. The reference case reflects a range of long-term assumptions and expectations, including:

- Strong growth in the base travel market over the 52 years to 2065 (travel on the east coast will more than double from 153 million trips to 355 million trips).
- No significant increase in aviation capacity in the Sydney basin. This results in increased delays and the inability of passengers to travel at preferred times, consistent with assumptions in the Joint Study on Aviation Capacity for the Sydney Region[22]. Assumed additional aviation capacity in Sydney has the effect of reducing the estimated EIRR for the HSR program as a whole from 7.6 per cent to 7.1 per cent and reducing the ECBR from 2.3 to 2.1. Additional aviation capacity also reduces the financial return from 0.8 per cent to 0.3 per cent.

22 Australian Government and NSW Government, *Joint Study on Aviation Capacity for the Sydney Region*, Canberra, 2012.

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- HSR fares would be structured to be comparable to and competitive with alternative modes of transport for both business and leisure purposes. HSR fares have been set to be competitive with air fares on the main inter-capital routes on the east coast, trending downwards over time by 0.5 per cent per year to 2015 and remaining constant thereafter, consistent with the forecast reduction in real air fares. Car operating costs increase over time due to a forecast real increase in the cost of fuel (13 per cent real increase by 2065 after allowing for forecast improvements in fuel efficiency).
  - If HSR fares were increased by 30 per cent, the EIRR for the program as a whole would reduce to 7.4 per cent. However, the financial return would improve from 0.8 per cent to 2.3 per cent, with operating cashflows becoming positive three years earlier in 2038.
  - If HSR fares were increased by 50 per cent, economic returns would fall further but HSR would still produce substantial net economic gains, with an EIRR of 7.2 per cent and an EBCR of 2.1 (at a four per cent discount rate). The financial return would improve further to three per cent.

Competitive aviation response

The study predicts that over half the 83.6 million HSR trips forecast in 2065 would be diverted from air, which would have a significant impact on aviation markets.

Airline services are mobile in the sense that there are few significant sunk capital costs in servicing particular routes and assets can be quickly redeployed to other routes. Airlines operating along key regional and inter-capital routes across the east coast of Australia already compete strongly against each other, and fare levels of many fare classes have declined over time, which suggests that airfare levels are already highly competitive on major routes.

It is not expected that airlines would respond to HSR competition by reducing their fares on a sustained basis. Rather, it has been assumed that airlines would quickly reduce capacity, either by reducing frequencies or aircraft sizes, to locations within the HSR corridor where there is significant passenger diversion to HSR. This assumption is consistent with overseas experience where, following the introduction of HSR, the airline response has generally been to reduce services on the competitive route.

Airlines do not control all of the components of an end to end journey by air that influence the relative competitiveness of air travel and HSR travel. Most important of these are the cost of accessing the airport, its location relative to HSR stations and airport capacity. Nevertheless, to the extent that airlines are able to innovate in ways that have not been anticipated in this study, it could have an impact on actual HSR patronage.

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A low demand/high cost sensitivity was developed that included a range of alternative assumptions which in combination result in a set of circumstances unfavourable to HSR. The low demand/high cost scenario includes:

- No aviation capacity constraints in Sydney.
- A 30 per cent increase in pre-risk capital costs.
- Low population growth and low economic growth.
- A 50 per cent increase in HSR fares.

While the combination of these assumptions may be unlikely, the results of the analysis provide a useful basis for comparison and an understanding of the economic performance of the HSR program. The combination of assumptions significantly reduces the economic return generated by the future HSR program from 7.6 per cent to 3.8 per cent. The impact on the financial return is, however, modest with the higher costs offset by the large fare increase.

The economic and financial results were tested against a range of sensitivity tests, with the results summarised in **Figure ES-16** and **Figure ES-17**:

- The low growth scenario assumes lower economic and population growth (relative to the reference case) resulting in lower overall demand for transport and thus lower demand for HSR. It assumes per capita GDP growth rates are assumed to be 0.3 per cent per year lower than the reference case, and population growth is assumed to be 51 per cent between 2010 and 2065, compared to 72 per cent in the reference case.
- The high growth scenario assumes that the Australian economy experiences strong growth into the future (high GDP growth), with high population growth. This scenario results in higher overall demand for transport and thus higher demand for HSR. Per capita GDP growth rates are assumed to be 0.3 per cent per year higher than in the reference case, and population growth is assumed to be 103 per cent between 2010 and 2065, compared to 72 per cent in the reference case.
- Higher (+30 per cent and +50 per cent) HSR fares.
- An aggressive competitive aviation response which results in a 50 per cent reduction in fares for two years.
- Additional aviation capacity within the Sydney region, which removes the negative effects of travel time on flights to/from Sydney from the reference case, and assumes there is no unmet demand.
- Additional aviation capacity within the Sydney region, combined with 30 per cent increase in HSR fares.
- Low demand and high costs (described above).
- Mode choice model sensitivities (including alternative specific constants (ASCs), access/egress weighting and values of time).
- Higher (+30 per cent) capital and operating costs.
- Lower (–10 per cent) capital and operating costs.

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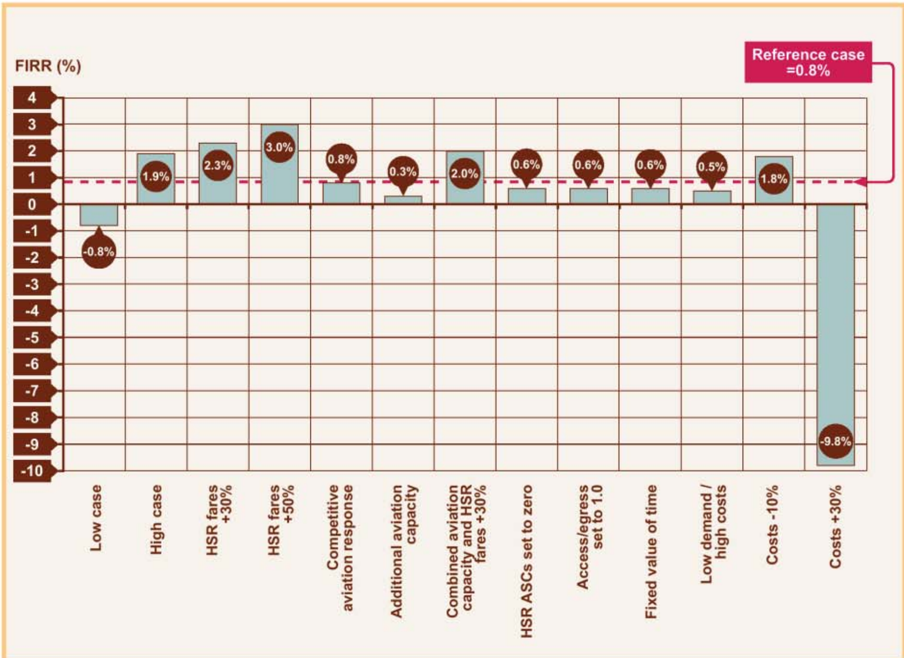
Figure ES-16 Impact of alternative assumptions on the economic results (EIRR)

Figure ES-17 Impact of alternative assumptions on the financial results (real FIRR post tax)



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Environmental and social assessment

A strategic environmental assessment framework, consistent with Australian Government guidelines, was developed and its key principles incorporated into the selection of the preferred alignment and station locations to reduce the potential for negative environmental impacts should there be a decision to proceed with HSR.

A preliminary strategic assessment of the environmental and social aspects of a HSR system on the east coast was undertaken for three reasons:

- To ensure that environmental factors were integrated into the development of the HSR system, including decisions about the corridor selection, alignment, station locations and design features.
- To ensure that the overall HSR system is consistent with principles of ecologically sustainable development.
- To identify important environmental and social issues to be further investigated and assessed in the implementation phases, should a decision be made to proceed with HSR.

The assessment of the environmental impacts of HSR was integrated into the evaluation of alignment options and station options, using a Geographic Information System (GIS) toolkit to identify potential ecological and heritage interactions and land use planning constraints and opportunities associated with the various options. These evaluations were combined with other considerations, such as engineering parameters, constructability, cost and user benefits to determine the preferred alignment and station locations.

The preferred HSR alignment and stations were selected to avoid, wherever possible, significant impacts on communities and ecological and heritage resources. Residual impacts would be managed by mitigation strategies developed during the concept and detailed design phases of HSR development, should a decision be made to proceed with HSR. This is a standard practice for large infrastructure projects. Where necessary, offsets for natural environments could also be used.

In addition, the assessment of environmental issues associated with HSR has addressed noise and vibration, energy use and carbon emissions/greenhouse gas considerations, the implications of climate change, and the promotion of ecologically sustainable development (ESD). Additional detailed investigations would be required across each of these disciplines, should governments decide to proceed with HSR, to minimise the environmental impacts and maximise potential positive outcomes.

The social impacts have been canvassed through theme-based case studies into three key areas identified through research and stakeholder consultation:

a. Workforce and community development.
b. Access to health and other public services.
c. Tourism, recreation and social inclusion.

The case studies highlight that HSR could potentially have a range of both positive and negative impacts.

Broader impacts of HSR

Impacts on regions

International evidence demonstrates that HSR can contribute to, but is not always a cause of, regional development. Implementation of HSR would significantly improve accessibility between capital cities and regional centres and would provide the potential for significant regional economic development. However, the extent to which regional towns and cities served by HSR take advantage of that potential would depend on:

- Supportive and aligned regional development policies at the Commonwealth, state and local levels.
- The availability and appropriate application of investment.
- Metropolitan and regional planning policies that encourage and support new development in regional centres with HSR stations.
- The timing of HSR opening in relation to broad economic trends.

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Robust and pragmatic planning would be required to determine how these initiatives should be developed and what outcomes should be pursued. In part, they are associated with the nature and scale of the proposed HSR network and require forecasting responses and conditions many years into the future. They are also uncertain, however, because they would require responses from outside the transport sector. They would need businesses to change how they operate, investments to switch to new locations, and tourists to change their travel patterns.

An investment of the magnitude and nature of HSR could also have unintended consequences and impacts, such as causing small regional cities to lose jobs and residents to nearby regional centres with HSR stations. These negative impacts would need to be managed though effective regional development policies, early and careful planning to position local businesses for change, and appropriate human and capital investment in complementary assets.

To gain positive and sustained benefits from HSR, regional communities along the corridors would need to follow deliberate strategies. HSR is not a panacea for regional development but, when coupled with appropriate strategies and plans, it could have a positive impact on regional communities over time.

In examining the potential impacts of HSR, the inherent uncertainties need to be acknowledged. However, with proactive and positive responses from key stakeholders, the implementation of HSR could result in improvements in regional productivity, changes to tourist spending patterns and, for regions closer to the capital cities, changes to commuting patterns. Emerging international evidence suggests that wider economic impacts at the regional level may be generated by regional accessibility improvements, though quantitative estimates of these are considered neither sufficiently certain nor robust for inclusion in the main economic assessment.

Impacts on cities

HSR could have wider economic impacts on cities through its impact on effective employment density, that is, by bringing places of residence and employment closer together by a reduction in travel times. Benefits can then arise in a number of ways:

- It is easier to match workers to specific vacancies and to find employees with appropriate skills.
- It enables greater specialisation of supply, leading to more efficient production of goods and provision of services.
- It leads to knowledge spill-over (i.e. greater opportunities for formal and informal contact through increased accessibility).
- Employees have a greater choice of jobs.
- There is more competition between companies and between individuals.

As the HSR system is constructed, accessibility to major cities from areas such as the Central Coast (to Sydney) and the Gold Coast (to Brisbane) would improve, allowing employers to access a larger labour pool and providing employees with a wider choice of employers. Internationally, positive economic benefits have been attributed to such impacts, so called agglomeration benefits, and included in the quantitative assessment of the benefits of investments in transport infrastructure. However, as noted above, because of the uncertainty of these effects in the current context, no adjustments to the economic returns have been made for them in this study.

Impacts on the national economy

Although the majority of benefits of HSR would accrue to users of the system, HSR would have a positive net impact on the size of the national economy, with GDP estimated to be 0.1 per cent higher relative to the baseline in 2085.

HSR would also raise the overall level of investment in Australia. In 2036, HSR investment would represent 0.8 per cent of aggregate investment in the economy, and would average around 0.4 per cent during the construction period as a whole. The assumption that HSR would be financed domestically means that, to accumulate

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the required HSR capital stock, some of Australia's pool of investment would be channelled into HSR instead of elsewhere. This investment substitution effect produces a negative impact on the economy, since it assumes that investment would be diverted away from sectors with a higher financial return than would be achievable for HSR (which is projected to achieve only a 0.8 per cent financial rate of return on capital invested), lowering Australia's average return on investment. Other things being equal, and in the absence of higher productivity benefits generated by HSR, this would lower consumption and GDP. However, business travel time savings generated by HSR are estimated to increase labour productivity, which over the long term drives gains in GDP, offsetting the negative investment impacts.

The investment impacts of HSR would be different if it were assumed to be financed by borrowing from foreign sources. There would be less crowding out of higher return capital, but costs involved with servicing the foreign debt would be incurred.

Real consumption is estimated to decrease during the construction of HSR (until around 2056). Post 2056, real consumption begins to increase relative to the baseline as benefits start to flow from the operation of HSR. As investment in HSR tails off and productivity gains flow from the operational phase, resources can be redirected to other investment uses and to consumption, and national income (moving closely with GDP due to the assumption of domestic financing) begins to increase and move above the baseline.

Similarly, the investment substitution effect means that HSR would impact each of the Australian states in different ways. All else being equal, an increase in investment in one state, for example, would result in a reduction in the level of investment across the remaining states. In the case of HSR, the impact on each state reflects the strength of investment in and operation of HSR, and the concentration of industries that compete for HSR inputs within each state.

Based on these assumptions, NSW/ACT is expected to be the primary beneficiary state from HSR due to the substantial investment it receives. The expansion in NSW/ACT's GSP would come at a cost to the other states, which would share the burden of reduced investment in other sectors. Productivity gains are also expected to be concentrated in NSW/ACT, although there would still be sufficient gains in Victoria and Queensland to yield a positive GSP impact.

The construction of HSR draws labour into NSW/ACT and away from other states. The assumed constraint on labour supply means that the bulk of the expansion in construction sector labour requirements in NSW/ACT would have to be offset by contractions in other sectors, leading to varying impacts on employment by state similar to impacts on GSP by state, but with less intensity.

While beyond the scope of the modelling, alternative funding arrangements involving a different sharing of the financing of HSR would clearly alter the pattern of gains and losses in different regions.

Implementing a future HSR program

Roles of the public and private sectors

The Australian Government, ACT Government and relevant state governments would need to have a central role in the development of HSR. This would be due both to its strategic nature and to the fact that the Australian public would have to fund most of the infrastructure. Governments would own the infrastructure and would have an obligation to ensure that it was efficiently and effectively provided and used.

With an initial capital cost in excess of $100 billion, a future HSR program would be one of the largest infrastructure programs ever undertaken in Australia. Its size would challenge the resources of the supplier industry, both domestically and globally, with only a limited number of organisations having the financial capacity and depth of skills and resources available to compete for the likely size of works packages. To achieve value for money, governments would need to carefully package and stage the procurement to ensure competitive bids were achieved for

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each package. Government would need to retain some of the risks around the integration of the component parts, but these risks could be mitigated through rigorous technical oversight.

Governments would retain an ongoing role in the stewardship of the HSR sector after construction, to ensure the objectives and economic benefits of the HSR program were achieved. This role would involve providing oversight of the delivery of HSR services against agreed price and service quality metrics, while being careful to avoid constraining the market agility and innovation of those managing the transport services. Governments would also be responsible for safety and environmental compliance.

The private sector should be closely involved in a broad range of roles:

- Design and construction of components of the HSR infrastructure network under contract to governments.
- Development of station precincts in partnership with the relevant government.
- Supply of rolling stock (train sets) and the signalling and communications systems.
- Control and operation of HSR trains to deliver high standard transport services to the public.
- Maintenance of the HSR system.

Development of HSR stations, and associated commercial opportunities, would offer an opportunity for private finance. A public-private partnership model is envisaged for greenfield station developments, with the private sector partnering with the relevant state or territory government for CBD station developments.

Under the preferred model, HSR train services would be contracted to a private sector operator through one or more concession arrangements. There would be separate concessions for Line 1 and Line 2, each being a combined exclusive concession for inter-capital express and regional services on that route, although a single operator would not necessarily be precluded from operating both concessions. The concession holder(s) would operate the train services, control the movement of trains through the network and maintain the HSR network.

The preferred model for Australia has common elements with many of the world's HSR lines, although overall it is perhaps closest to the Japanese model for new HSR lines. In Japan, a single state-owned entity (JRTT) is responsible for the development and strategic management of the HSR network, but operation of train services, control of the movement of trains and maintenance of lines is carried out by (mainly) private sector train operating companies serving particular high speed routes on an exclusive basis, for which they pay JRTT a fee for use of the line.

Delivering the public sector components of a future HSR program

If adopted, a future HSR program would be developed in discrete phases, starting with initial feasibility studies and investigations, leading on to construction and operation of the HSR system. Four separate phases can be identified, as illustrated in **Figure ES-18**.

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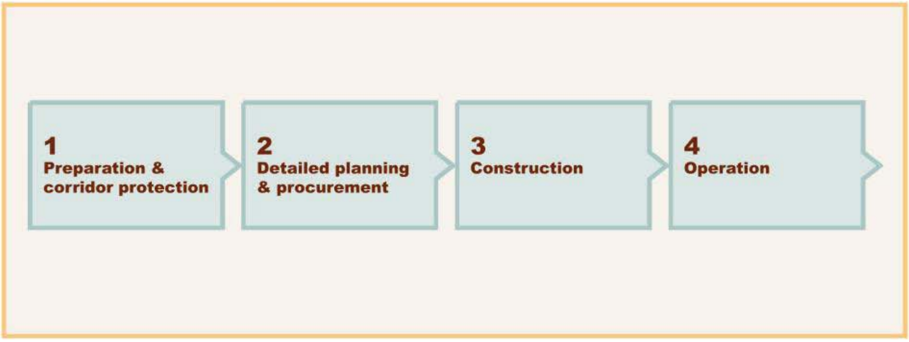
Figure ES-18 Four phases of the HSR program



The first phase in a future HSR program would be a preparation and corridor protection phase, which would precede a formal commitment to build the HSR system. This phase would provide the necessary policy foundation for the procurement, construction and operation of a future HSR program. It would require alignment between the participating governments on the program objectives, mechanisms and timeframes for resolving issues, and the delivery of enabling regulation or legislation.

The proposed model for pursuing multi-jurisdictional agreements of the type needed to support the HSR program is to adopt a 'gated approach' using a series of formal agreements. Each formal agreement in the process would need to be in place prior to progressing to the next stage, ensuring alignment of governments at critical milestones. The first gate would be a Memorandum of Understanding (MoU) between the Australian, ACT and state governments to formalise the engagement on the HSR program and to set out the responsibilities of the parties, the process to be followed and the timelines for resolving issues. Subsequent gates would involve formal inter-governmental agreements (IGAs), first to protect an HSR corridor and later to develop and implement a stage or stages of HSR.

Once there is a mandate to implement a preferred HSR system, a publicly-owned HSR development authority (HSRDA) would be created to develop, procure and integrate the HSR system, including procuring and owning the required land. A single coordinating authority, with appropriate professional management expertise, would be required to effectively and efficiently progress the detailed planning required to develop and procure an HSR system (the HSRDA would later evolve into an HSR development and management authority in the operational phase, and would prepare and manage train operations concessions). The HSRDA could be owned jointly by the Australian Government, ACT Government and relevant state governments.

Next steps

If it were decided that the case for HSR on the east coast of Australia has sufficient merit for further government action to be taken, there are a number of immediate next steps in the process that could lead to a decision to protect the HSR corridor and possibly to a decision to implement HSR.

The immediate next step following completion of the HSR study is to confirm the Australian government's interest in continuing the necessary preparatory works to inform a formal ministerial decision to proceed.

Following a decision to proceed, an MoU would be signed to allow planning and development work, including corridor protection, to commence. Governments would need to commit resources and funding to the development and delivery of the arrangements under the MoU.

The MoU would initiate a number of activities, including site investigations necessary for corridor protection and preparation of the IGA to protect the HSR corridor. The aim of the IGA would be to formalise the commitment to the protection of the HSR corridor by rezoning, resuming, purchasing or holding land within the corridor.

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