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Introduction

Population and employment growth will continue to challenge the capacity of existing transport networks and public infrastructure along the east coast of Australia over the coming decades[1]. Travel on the east coast of Australia is forecast to grow steadily at around 1.8 per cent per year over the next 20 years, increasing by approximately 60 per cent by 2035[2]. By 2065, travel on the east coast will have more than doubled, from 152 million trips in 2009 to 355 million trips[3].

A strategic study of the implementation of a High Speed Rail (HSR) network on the east coast of Australia (the study) was announced by the Minister for Infrastructure and Transport, the Hon Anthony Albanese MP, in August 2010. This strategic study investigates whether HSR could play an effective role in helping to meet future travel demand. It is anticipated that the study will inform the Australian Government's, and state and territory governments', consideration of the next steps for HSR[4].

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1 Australian Bureau of Statistics (ABS) mid-range population projections (cat. no. 3222.0) 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.

2 Based on forecast population and income (GSP/capita) growth. See **Chapter 2** for detailed discussion on the forecast travel market.

3 Growth in the base travel market on the east coast comprising inter-regional and inter-city trips and excluding commuting and other local travel. The base travel market is forecast to grow at 1.8 per cent per year from 2009 to 2035, 1.5 per cent per year from 2035 to 2050 and 1.0 per cent per year from 2050 to 2065. See **Chapter 2** for more details.

4 High Speed Rail Study Terms of Reference, Department of Infrastructure and Transport, 21 October 2010.

The first phase of the study, which was published in August 2011:

- Provided an assessment of the likely range of costs.
- Identified potential corridors and stations.
- Estimated the potential future market demand for HSR.
- Considered potential social and regional impacts.

In November 2011, the Department of Infrastructure and Transport (the Department) appointed the AECOM Consortium[5] to undertake phase 2 of the study. This second phase builds on the first phase, but is considerably broader and more detailed in its objectives and scope, and has therefore refined many of the phase 1 estimates.

The second phase of the study has examined in more detail the issues surrounding the potential introduction of HSR and has considered alternative technologies, corridors, alignments and station locations to design a preferred HSR system for the east coast of Australia. Phase 2 has also included a comprehensive economic, financial, environmental and social appraisal of the preferred HSR system, including a rigorous assessment of potential future demand, together with an appraisal of alternative institutional and governance arrangements that would support the implementation of HSR.

1.1 Background to HSR

1.1.1 What is HSR?

HSR is generally defined as a purpose-built, fixed-track mode of transport, capable of speeds of at least 250 kilometres per hour, usually over long distances. It typically offers services between major cities, occupying the same travel market as aviation, but also provides opportunities for intermediate stops in regional areas. HSR can also provide capacity for fast commuter rail services from outer metropolitan areas to city centres.

Originating in Japan in the 1960s, HSR systems now operate in 14 countries: Japan, Italy, France, Germany, Spain, Switzerland, the three Benelux countries (Belgium, Netherlands, Luxembourg), China, United Kingdom, Korea, Taiwan and Turkey. The rapid increase of HSR in recent decades is evidenced by the increase in total global kilometres of HSR track, from just over 1,000 route kilometres in 1980, to more than 15,000 route kilometres in 2011[6]. The growth in HSR is illustrated in **Figure 1-1**.

Most HSR systems operate on purpose-built tracks at maximum speeds of between 250 and 300 kilometres per hour, with some more recent systems operating in excess of 300 kilometres per hour. Services in Spain and France have commercial operating speeds of 310 kilometres per hour and 320 kilometres per hour, respectively[7]. All HSR systems currently in operation are based on electric traction using traditional steel wheels on rails, but with a range of track and train technology options[8]. While most HSR services run on dedicated HSR tracks, some HSR trains also use short sections of conventional tracks at lower speeds, such as at entries to cities or extending from a dedicated line.

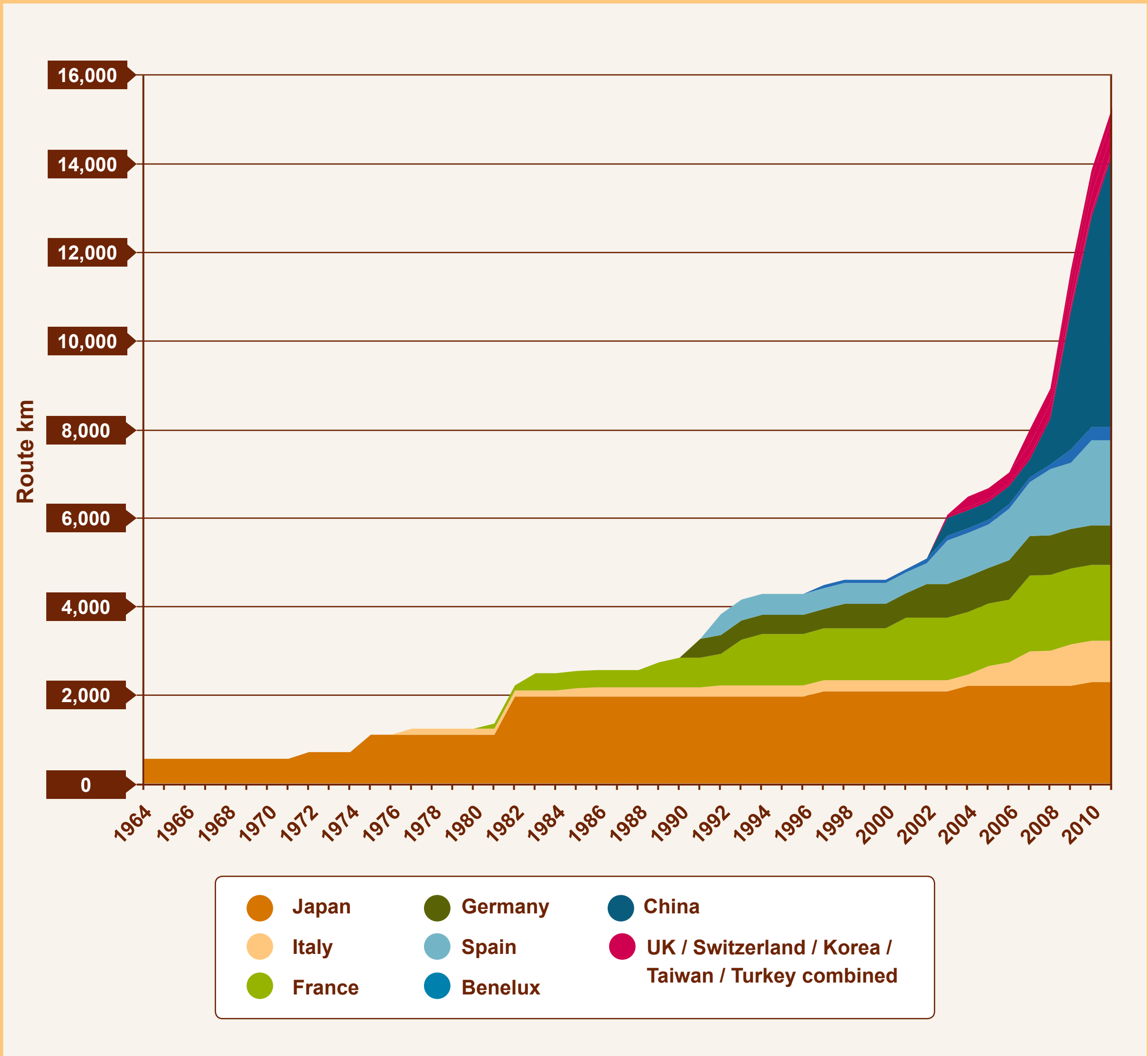
5 Comprising AECOM, Grimshaw, KPMG, SKM, ACIL Tasman, Booz & Company and Hyder.

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

7 Commercial operating speed is the maximum operating speed in commercial service.

8 Maglev or magnetic levitation technology systems are excluded from this definition of HSR.

Figure 1-1 Growth in route kilometres of HSR (1964-2011)



Source: World Bank[9].

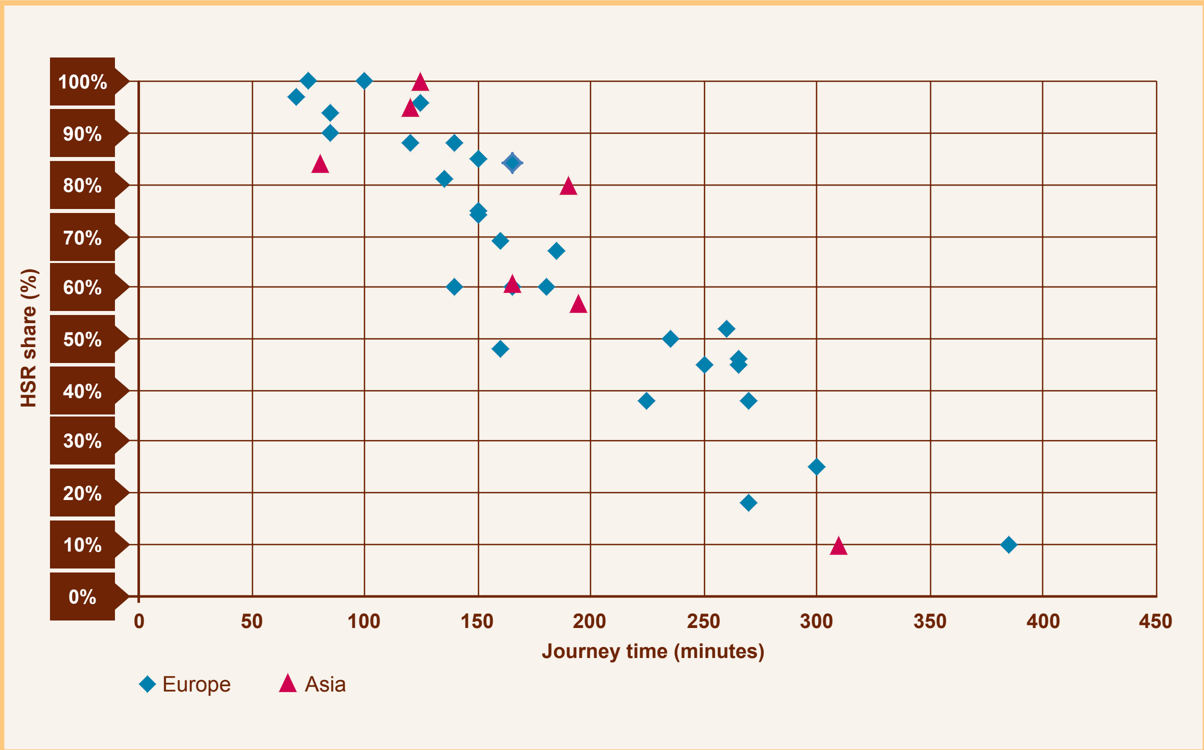
1.1.2 Why people choose HSR

According to a paper prepared for the European Community (EC) on the effectiveness of HSR in relation to its competitiveness with air, based on a review of eight European HSR routes, the main factor driving HSR market share (as long as rail had a competitive service frequency) was the rail journey time[10]. The time required for airport check-in and other procedures prior to departure was considered part of the journey time, and the absence of these procedures on HSR was seen as a competitive advantage.

9 The World Bank, loc. cit.

10 Steer Davies Gleave (for the European Commission), *Air and Rail Competition and Complementarity*, 2006.

Figure 1-2 Relationship between journey time and market share for HSR



Source: Compilation of international data from Steer Davies Gleave, Arup-TMG and Nash[12].

Figure 1-2 presents international data showing that the shorter the HSR journey time, the higher its market share. Each point represents a city to city journey time and HSR share, based on data on operating HSR services collected and provided in the EC report, the Arup-TMG East Coast Very High Speed Train Scoping Study (VHST) and Nash[11]. Further detail is provided in **Appendix 1A.**

Beyond door-to-door journey time, international research shows that a range of other factors also influence people's choice of travel mode:

- The convenience of accessing one mode versus another (for example, journey times to airports versus journey times to an HSR station).
- Price and ticket conditions, including the availability of alternative lower-priced modes such as bus (coach) and car.
- Reliability and punctuality, particularly considering current congestion at airports and on motorways in some countries.
- On-board service quality (although this may be becoming less important as common service attributes begin to appear on both air and HSR services in some markets)[13].

1.2 Approach to the study

The purpose of phase 2 is to advise the Minister for Infrastructure and Transport on 12 matters ('the study objectives'). Six interrelated technical modules, as illustrated in **Table 1-1**, combine to address these study objectives in two parts:

1. Definition of the preferred HSR system for the east coast of Australia.
2. Appraisal of the preferred HSR system.

11 Arup and TMG (unpublished, for the Department of Transport and Regional Services), *East Coast Very High Speed Train Scoping Study Phase 1 – Preliminary Study Final Report*, November 2001.
Nash, *HSR Overseas experience Report, High Speed Rail Study Phase 1*, 2011.

12 ibid.

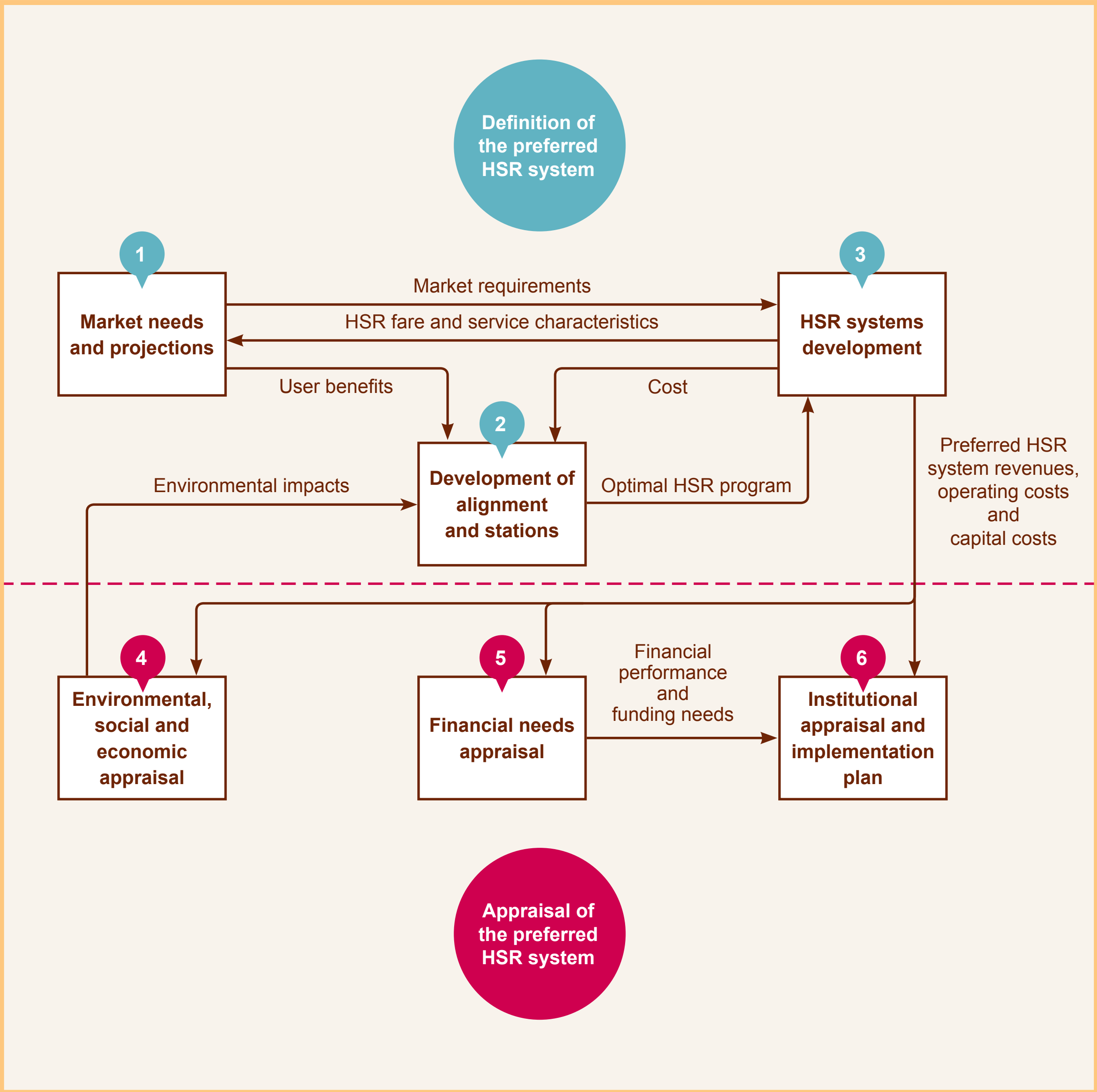
13 Steer Davies Gleave (for the European Commission), loc. cit.

Table 1-1 Phase 2 study modules

Module		Study objectives
System definition		
1	Market needs and projections	Projected travel demand in the east coast corridor.
2	Development of alignment and stations	The preferred HSR system, including corridor, alignment, transport products and system specifications. The optimal HSR program for staging the physical construction and provision of services on the preferred HSR system.
3	HSR systems development	HSR system alternatives that could best serve the projected travel market effectively, and the aggregate and segmented travel demand and market shares that could be served by each.
System appraisal		
4	Environmental, social and economic appraisal	The specific environmental, social and economic impacts of the recommended HSR program, their effect on community groups, and the overall net cost or benefit of those impacts to Australia. The nature, extent and value of any opportunity created for an integrated HSR/corridor regional development concept. The nature and cost of any complementary access projects and their contribution to achieving the assessed performance of the HSR program.
5	Financial needs appraisal	The financing needs, financial performance and commercial viability of the HSR program. Any commercial financing gap and ways of funding and financing such a gap, including through public-private financing and funding partnerships. The key risks to the HSR program and its successful performance, the implications of these risks and possible mitigation measures, if any.
6	Institutional appraisal and implementation plan	The most appropriate institutional framework for governance, planning, procurement, construction, operation and regulation of the HSR program. An effective implementation plan for creating the recommended institutional framework and delivering the HSR program and for securing, if merited, an integrated HSR/corridor regional development concept.

The modules and their associated interrelationships are shown in **Figure 1-3** with the arrows indicating the module interdependencies (i.e. the key information that passes between the modules). The approach taken in each module is described further.

Figure 1-3 Phase 2 modules and interdependencies



1.2.1 Definition of the preferred HSR system

Module 1 – Market needs and projections

Demand models were developed to forecast the likely future travel market on the east coast of Australia and the potential future demand for HSR, based on the likely attractiveness of travel via a future HSR system compared to travel via alternative modes. The first year of HSR operations was designated as 2035 for assessment purposes, and a long-term horizon of 50 years was adopted, consistent with Australian Transport Council (ATC) guidelines.

For the purposes of demand modelling, the base year was 2009 and three forecast years were established (2035, 2050 and 2065) for which detailed forecasts were developed. Forecasts without HSR (the 'base case') and with HSR (the 'reference case') were then derived for each year of the evaluation period. Demand for intermediate years (between 2035 and 2065) was derived by interpolation, and for years through to 2085 by extrapolation.

Primary market research was undertaken to support the development of the demand models and to define various inputs to the appraisal (such as the value of time for travellers).

HSR fares were modelled on a per kilometre basis (incorporating a 'flagfall' and a distance component) and set such that they were broadly comparable with corresponding forecast air fares on the Sydney-Melbourne and Brisbane-Sydney air routes. Access costs such as taxi fares, airport and station parking charges and metropolitan bus and rail fares were assumed to remain constant in real terms.

Forecasts were prepared for the reference case (i.e. with HSR) as part of the central case for evaluation purposes, and for a range of sensitivities. An assessment was made of the potential inter-city and regional markets for HSR, broken down by business and leisure travel. In addition to forecasting inter-capital and regional travel, potential demand for high speed commuter services was investigated in two corridors – Newcastle-Sydney and Brisbane-Gold Coast. Newcastle-Central Coast-Sydney is likely to be the biggest commuter market on the HSR network. Under fare assumptions consistent with conventional commuter services (i.e. with subsidies), there would be a demand for these services. However, these services would not 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 demand forecasts in **Chapter 2** and the financial and economic appraisals in **Chapters 7** and **8**, although it was allowed for in the capacity planning.

Module 2 – Development of alignments and stations

The development of alignment and station location options had to be compatible with delivering the necessary system performance to meet market needs while also ensuring the environmental, social and economic sustainability of the system. A large number of alternative alignments (up to 50 for each regional alignment section) and station locations were tested, with the preferred alignment and station locations selected based on a balance of construction and operating costs, user benefits (e.g. relative journey times) and environmental considerations.

Regional station locations were selected on the basis of potential demand. Similarly, stations on the periphery of the capital cities (other than Canberra) were selected on the basis of their accessibility to the potential market.

A strategic environmental assessment framework, consistent with Australian Government guidelines, was developed and its key principles incorporated in the selection of the preferred alignment and station locations to reduce the potential for negative environmental impacts. The findings of the assessment are reported in **Appendix 5C**.

Rationale for tunnelling

Journey times that are competitive with other forms of transport are key for HSR if it is to secure a sustainable market share and reliable revenue base. International experience shows that HSR journeys of less than three hours tend to attract over 50 per cent share of the travel market. This is illustrated in **Figure 1-2**.

To realise these competitive times, HSR in Australia, because of the long distances between centres, must be able to achieve an average operating speed of more than 250 km per hour. This is reliant on track geometry that is capable of accommodating these speeds. Existing road and rail alignments were not constructed for these speeds and their geometry is inadequate. Were HSR to follow existing transport corridor alignments, speed restrictions would be necessary, with an associated increase in the transit time of the service, to the extent that it would not be competitive, particularly in serving the long distance inter-city travel market.

In densely populated areas, the track geometry required to achieve speeds of 250 kilometres per hour would make a surface alignment highly disruptive, would require extensive land acquisition (and associated costs), and would result in noise impacts, community severance and poor visual amenity to a large number of people, particularly when passing through the middle and inner suburbs of the capital cities.

Tunnelling was therefore considered, in addition to where it was required by the terrain, in locations where no dedicated surface route providing the required operating speed could be created without unacceptable dislocation and/or environmental costs.

Module 3 – HSR system development

The design of the preferred HSR system was based on the premise that any future HSR system would need to become an effective component of future integrated transport networks on the east coast[14]. A central consideration was the need to ensure that the HSR would deliver an effective and affordable transport solution that was attractive to customers. To achieve this, HSR fare and service characteristics, such as end-to-end journey times, would have to be competitive with alternative modes, particularly air travel.

For the purposes of the demand assessment and appraisal, average fares for HSR business and leisure travel were designed to be competitive with, and comparable to, air fares on the main inter-capital routes, after taking into account relative access times and costs. For example, the reference case assumes the average HSR single (one-way in $2012) economy fare between Sydney and Melbourne in 2065 would be $141 for a business passenger and $86 for a leisure passenger. This variation reflects the tendency for passengers travelling for business to pay more for a ticket than those travelling for leisure (a result of the booking methods used, the higher tendency of business travellers to purchase flexible tickets, and the tendency to travel at peak times). The corresponding average air fares (one-way in $2012) in 2065 were estimated as $137 and $69 respectively. 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, where current air fares paid for inter-city business travel can vary from the overall average by as much as 65 per cent. Sensitivity tests also considered average fares up to 30 per cent and 50 per cent higher, as well as 50 per cent lower in the context of a price war with the airlines.

For inter-capital markets, reliable HSR transit times of up to three hours between the city centres (Sydney-Melbourne and Brisbane-Sydney) were considered competitive with air travel, once all journey components (such as travel time, waiting time, check-in time, access time and interchanges) were taken into account. These target transit times were then used to define the HSR system requirements for maximum and average operating speeds and reliability.

This in turn required a technical assessment of likely HSR technologies, with the technical components of the system – including the track type and geometry, power supply, signalling and the train itself – all combining to deliver the desired HSR system performance.

The technical components of the system, combined with the preferred alignments and station locations, then determined the cost of constructing a future HSR system. Cost components were developed from Australian unit costs and benchmarked against international HSR systems, taking account of a range of manufacturers' delivered costs for existing HSR systems and reflecting the use of proven HSR system technology (such as train control and power supply systems) and train sets already in service, and readily available. No new technology was assumed.

Indicative service plans, including service types (inter-capital express services and regional services with intermediate stops) and service frequencies required to meet projected demand, were developed and used to inform the assessment of operating costs and the required number of train sets.

14 Department of Infrastructure and Transport, *Request for tender for the second phase of a strategic study into the implementation of a high speed rail network on the east coast of Australia*, Part A: Statement of Requirements, Canberra, 2011.

1.2.2 Appraisal of the preferred HSR system

The appraisal of the preferred HSR system first required an understanding of the likely future travel market, including consideration of likely future travel options without HSR (the base case), and the alternative future with an investment in HSR (the reference case). By comparing the base case with the reference case, the incremental costs and benefits of a future HSR system are able to be assessed.

Development of the base case

The long-term horizon for the study required assumptions and forecasts extending well beyond existing transport and land use plans of the relevant jurisdictions. Therefore, a set of assumptions was developed to reflect the likely future without HSR, based for the most part on existing policy settings. These assumptions were then reviewed to ensure that, when extrapolated over an extended period of time, they did not result in implausible outcomes.

The base case assumes that, without HSR, travellers on the east coast will continue to rely on existing modes of transport:

- Aviation will remain the primary means of transport for long distance interstate (and some inter-regional) trips.
- Road-based travel and private vehicle usage will remain the primary mode for connections with and between regional centres.
- Public transport will play an increasingly important role in meeting travel demand within cities served by conventional rail and bus transport.

For road and rail modes, the base case assumes that governments will continue to augment supply by providing infrastructure and services to meet demand. For aviation, given the uncertainty around the future of airport capacity in the Sydney region, the base case assumes that there will be no additional investment in airport capacity in the Sydney basin and that airport service levels within the Sydney region will become increasingly constrained.

As outlined within the recent Australian/NSW *Government Joint Study into Aviation Capacity in the Sydney Region* (hereafter referred to as the Joint Study), demand for aviation services in the Sydney region is expected to double to 88 million passenger trips per year by 2035, and then double again by 2060[15]. Sydney (Kingsford Smith) Airport does not have the capacity to meet the expected demand, leading to:

- Slower and more unreliable air journey times as airlines and airports are faced with higher levels of congestion.
- An increasing requirement for air passengers to shift their travel time because of a lack of capacity at their preferred travel time.
- An increasing number of travellers who are forced to travel by other means or who do not travel at all (otherwise known as unmet or suppressed demand).

The Joint Study's projection has added complexity to the modelling of the base case to take account of some of the constraints at Sydney Airport. Given the likely significance of this projection, a sensitivity analysis was developed and tested which allowed for additional aviation capacity in Sydney and removed the effects of unplanned delays from the demand modelling.

Development of the reference case

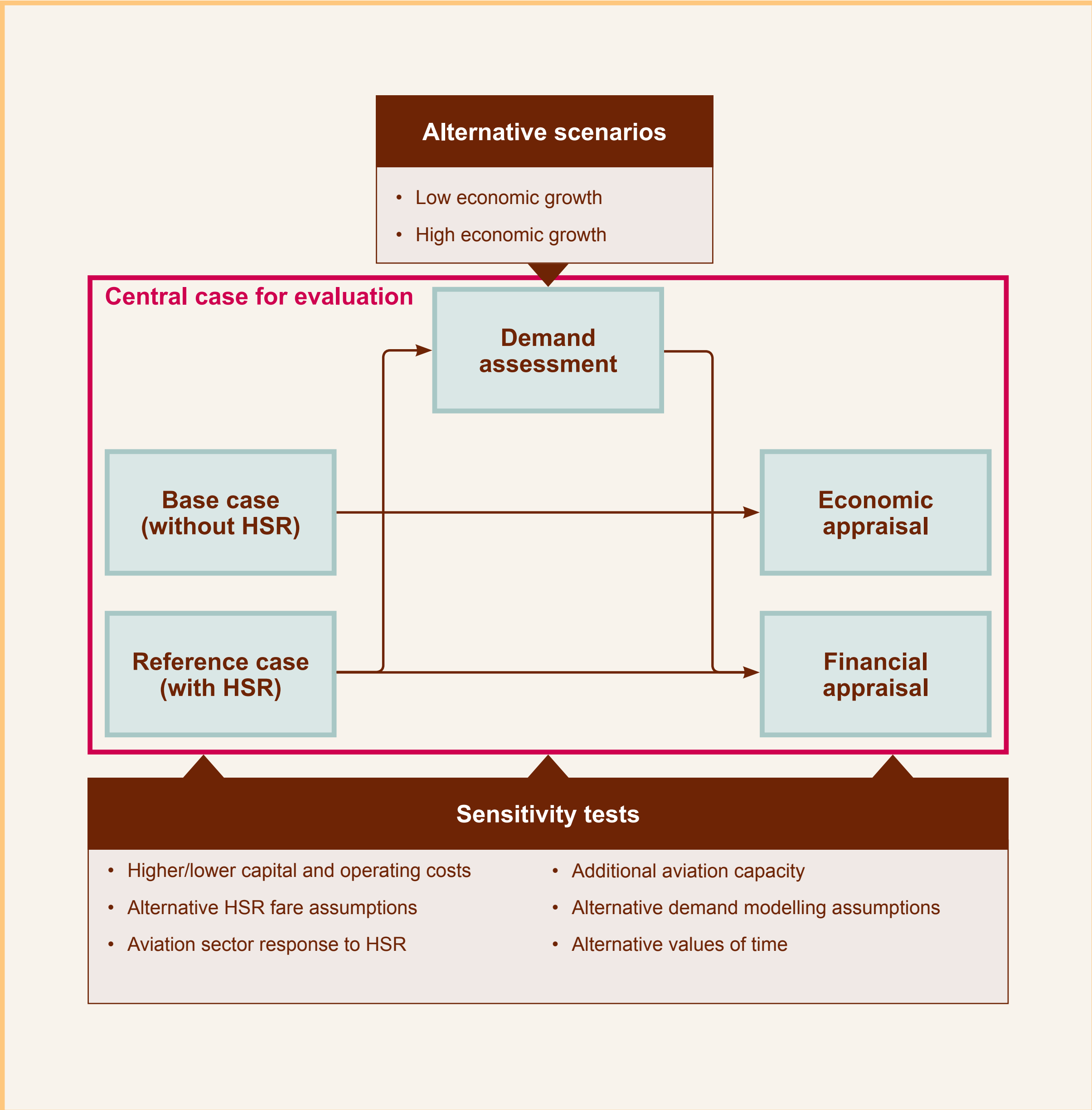
For the purposes of appraisal, a reference case was developed as part of the central case for evaluation and comparison against the base (without HSR) case. The reference case incorporates the primary assessment of future demand, revenues, operating costs and capital costs for the preferred HSR system.

Sensitivity analysis

Reflecting the inherent uncertainty of assumptions that underpin the appraisal of long-term infrastructure programs, the appraisal was complemented by a number of alternative scenarios and sensitivity tests, as illustrated in **Figure 1-4**.

15 Australian Government and NSW Government, *Joint Study on aviation capacity in the Sydney region*, Canberra, 2012.

Figure 1-4 Phase 2 alternative scenarios and sensitivity tests



In this context, a *scenario* is a projection based on a set of internally consistent assumptions and parameters, in this case, variations to the reference case that represent an alternative outcome.

Sensitivity tests are generally variations to a single assumption or parameter, to assess their importance to the modelling and its outputs. In this study, some sensitivity tests have varied more than one assumption.

Two alternative economic scenarios were developed, one unfavourable and one favourable to HSR:

- The ‘low growth’ scenario assumes lower economic and population growth (relative to the reference case). This scenario results in lower overall demand for transport and thus lower demand for HSR. Per capita GDP growth rates are assumed to be 0.3 per cent per year lower than the reference case, and population growth within the study area 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, 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 within the study area is assumed to be 103 per cent between 2010 and 2065, compared to 72 per cent in the reference case.

In addition to the two alternative economic scenarios, several sensitivity tests were developed that assessed the impact of alternative assumptions and forecasting model parameters on the economic and financial results. The tests undertaken assessed the effects of:

- All HSR fares increased by 30 per cent with a corresponding decrease in HSR demand.
- All HSR fares increased by 50 per cent with a corresponding decrease in HSR demand.
- Competitive pricing between HSR and aviation when the line opens between Sydney and Melbourne, with both air fares and HSR fares assumed to be reduced by 50 per cent 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.
- Setting the alternative specific constant (ASC) within the demand model to zero. The ASC quantifies the preference for HSR as a travel mode relative to air for inter-city and long regional trips, and relative to rail for short regional trips, over and above the measurable improvements in level of service.
- Applying a weighting of 1.0 to the time taken to access and egress the principal mode of travel, compared to the weighting of 1.4 used in the reference case. This reduces the benefits of HSR in comparison to air travel, but increases the benefits of HSR in comparison with car travel.
- Lower values of time. Given the long time horizon for the assessment of HSR, growth in the values of time over the evaluation period was considered appropriate. However, economic evaluation of rail and road projects in Australia does not usually use real increasing values of time in appraisal, and this test assumed fixed values.
- Low demand and high costs, leading to a set of circumstances that is unfavourable to HSR. This test combined additional aviation capacity in the Sydney region, a 30 per cent increase in pre-risk capital costs, low growth scenario and a 50 per cent increase in HSR fares.
- Higher (+30 per cent) capital and operating costs.
- Lower (–10 per cent) capital and operating costs.

Economic results for all the sensitivity tests were presented using both a four per cent discount rate (the reference case assumption) and an alternative rate of seven per cent. Some sensitivities, such as higher fares, have a positive impact on the financial results but a negative impact on the economic results (with higher fares, fewer people use the system). These trade-offs were explored through the appraisal.

Finally, in addition to the growth scenarios and the sensitivity tests outlined above, alternative staging assumptions were tested to determine the preferred staging for the HSR program. The following changes in the assumed timing of HSR development were assessed:

- Accelerated roll-out, bringing the construction timeline forward by five years.
- Deferred roll-out, pushing the construction timeline back by five years.

Module 4 – Environmental, social and economic appraisal

An 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 that identified sites of ecological and heritage value along the HSR alignment options. These assessments were combined with other considerations, such as engineering parameters, constructability, cost, and user benefits, to determine the preferred alignment and station locations. In addition, the assessment of environmental issues associated with HSR addressed noise and vibration, energy use, carbon emissions/greenhouse gas considerations, the implications of climate change, and the promotion of ecologically sustainable development.

The likely social impacts of a future HSR program were identified through case studies into three key areas based on research and stakeholder consultation:

1. Workforce and community development.
2. Access to health and other public services.
3. Tourism, recreation and social inclusion.

Insights from the case studies were used to outline the potential social impacts of a future HSR system.

A standard Cost Benefit Analysis (CBA) was undertaken to provide a comprehensive assessment of the costs and benefits to users and operators of HSR over the evaluation period from 2035 to 2085. It included an assessment of externalities, such as environmental impacts, accident cost savings and decongestion benefits. The CBA establishes the overall economic merit of a future HSR program and guides decisions on the optimal staging of the HSR program.

The CBA was undertaken in real 2012 terms, (expressed as '$2012') utilising a discount rate of four per cent with a base year of 2028. A discount rate of seven per cent was also tested. Where necessary, costs and benefits for earlier years have been escalated to $2012 using the Consumer Price Index (CPI).

The construction of a new HSR system to help meet future travel demand would influence the future development of cities and regions, as well as where people choose to live and work. The appraisal of HSR therefore also considered the opportunities for future urban and regional development, and the implications for the way transport systems might evolve and develop to meet future demand.

Module 5 – Financial needs appraisal

Financial modelling of the reference case was undertaken to assess the potential financing needs, financial performance and commercial viability of the HSR program over the evaluation period from 2035 to 2085, having regard to the proposed staging of the preferred HSR system.

Future costs and revenues were expressed in $2012 prices discounted to financial year 2028, the assumed commencement of main construction compatible with starting operations in 2035. Air fares were reduced in real terms by 0.5 per cent per year until 2015 and held constant thereafter, consistent with the assumptions about air fares in the Joint Study. Labour-related operating costs were assumed to increase in real terms by 0.2 per cent per year, with actual real wage increases offset by productivity improvements. Fuel prices were assumed to increase in real terms, although much of the increase would be offset by efficiency improvements. Future budgetary impacts for governments were assessed based on the projected future cash flows, which incorporated allowance for risk.

Module 6 – Institutional appraisal and implementation plan

Appropriate governance and institutional arrangements would need to be established to ensure that, if adopted, the HSR program is subject to proper public oversight, is effectively and efficiently delivered, and meets its objectives. Specific governance arrangements were developed, having regard to the multi-jurisdictional nature of a future HSR program and the potential role of the public and private sectors.

An implementation plan was developed for the preferred HSR system that took account of the staging analysis, the economic and financial appraisals and the proposed governance and delivery model for HSR. The plan also considered additional preparatory work required by governments before any formal decision to proceed with the construction of an HSR system.

1.2.3 Optimism bias and how it is addressed

International experience of major infrastructure projects has found there is a tendency for project costs to be under-estimated, and traffic projections and benefits over-estimated, compared to actual outcomes[16]. Some major greenfield infrastructure projects in Australia (e.g. a number of privately financed toll road projects)[17] have similarly suffered from over-estimated traffic projections. These major projects may be described as having suffered from an 'optimism bias'.

To mitigate the risk of optimism bias in this study, a number of safeguards were adopted:

- Specific surveys of the Australian travel market were conducted to test the validity of international experience in the Australian context.
- The results of the Australian demand analysis were assessed against actual international travel demand outcomes. The results were also subjected to independent peer review[18].
- The average prices assumed to be charged for travel on HSR were market-based and derived from analysis of what would be necessary to compete with air travel in particular. The fares took into account both current and projected fares and costs for other modes, principally aviation and car.
- The infrastructure construction cost estimates were developed using Australian observed unit rates wherever possible, in a bottom-up process, and benchmarked against recent domestic and internationally observed rates.
- The physical and environmental constraints of proposed alignments were built into the route selection process to avoid areas where there is a high risk of cost escalation.
- Technology systems (such as train control and power supply systems) and rolling stock cost estimates were based on known technologies that are currently in use and took account of a range of manufacturers' delivered costs elsewhere.
- Train operating costs were estimated from an indicative operating plan, using unit cost rates, reflecting Australian markets.
- A risk assessment was undertaken to arrive at risk-adjusted cost and revenue estimates.
- A wide range of sensitivity tests were undertaken to assess the impact that alternative assumptions would have on the CBA results, including higher and lower capital cost estimates and higher and lower demand forecasts.

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16 Flyvbjerg, Holm, and Buhl, How (In) accurate Are Demand Forecasts in Public Works Projects? The Case of Transportation, *Journal of the American Planning Association*, Vol. 71, No. 2, Spring, 2005, pp. 131-146.

17 Bureau of Infrastructure, Transport and Regional Economics (BITRE), *Review of Traffic Forecasting Performance: Toll Roads*, 2011. GHD, *An investigation of the causes of over-optimistic patronage forecasts for selected recent toll road projects*, 2011, http://www.infrastructure.gov.au/infrastructure/public_consultations/patronageforecasting.aspx.

18 The Institute of Transport Studies, University of Leeds, UK.

1.3 Structure of the report

The remainder of this report is organised as follows:

Chapter 2

Discusses the future travel market in the east coast corridor.

Chapter 3

Describes the preferred HSR system, including the transport products proposed to serve the travel market, the system specifications, operations and maintenance facilities, and system-wide greenhouse gas and noise impacts.

Chapter 4

Presents the preferred HSR route, with conclusions on alignments and station locations.

Chapter 5

Presents the proposed HSR stations in more detail, describing in particular how HSR would be integrated with the major capital city termini.

Chapter 6

Defines the possible staging for implementing an HSR system, with a focus on the first stage.

Chapter 7

Presents the capital and operating costs of HSR, discusses the commercial performance of the preferred HSR system and summarises the financial performance and risk.

Chapter 8

Presents the economic appraisal of the preferred HSR system using a conventional CBA and discusses the likely flow-on effects to the broader economy.

Chapter 9

Presents an appraisal of regional development effects and opportunities.

Chapter 10

Identifies potential governance and institutional structures and the regulatory mechanisms required for delivery of an HSR program.

Chapter 11

Presents potential delivery structures for an HSR system, discussing the roles of the public and private sectors and strategies for procurement and packaging.

Chapter 12

Presents an implementation plan for the delivery of a future HSR program.

The report is supported by appendices, organised as follows:

Group 1 – Travel markets.

Group 2 – Preferred HSR system.

Group 3 – Preferred HSR alignment.

Group 4 – Cost and program.

Group 5 – Environmental, social and economic appraisal.

Group 6 – Commercial appraisal.

Group 7 – Procurement, institutional appraisal and implementation plan.

The responses to individual study objectives can be found in the chapters and appendices listed in **Table 1-2**.

Table 1-2 Location of responses to the phase 2 study objectives

Study objectives	Response
The projected travel market in the east coast corridor.	**Chapter 2** **Group 1 appendices**
HSR system alternatives that could serve the projected travel market effectively and the aggregate and segmented travel demand and market shares that could be expected to be attained by each.	**Chapter 3** **Group 1 and 2 appendices**
The preferred HSR system including corridor, alignment, transport products and systems specifications.	**Chapters 3, 4 and 5** **Group 2 and 3 appendices**
The optimum HSR program for staging the physical construction and provision of services on the preferred HSR system.	**Chapter 6** **Appendix 4A**
The specific environmental, social and economic impacts of the recommended HSR program, their incidence on community groups, and the overall net cost or benefit of those impacts to Australia compared to the base case.	**Chapters 4, 8 and 9** **Group 5 appendices** **Appendices 4B and 4C**
The nature, extent and value of any opportunity created for an integrated HSR/corridor regional development concept.	**Chapter 9**
The nature and cost of complementary access projects and their contribution to achieving the assessed performance of the HSR program.	**Chapter 5**
The financing needs, financial performance and commercial viability of the HSR program.	**Chapter 7** **Group 6 appendices**
Any commercial financing gap and ways of funding and financing such a gap, including public-private financing and funding partnerships.	**Chapter 7** **Group 6 appendices**
The key risks to the HSR program and its successful performance, the implications of these risks and possible mitigation measures, if any.	**Chapter 7** **Appendix 6C**
The most appropriate institutional framework for governance, planning, procurement, construction, operation and regulation of the HSR program.	**Chapters 10 and 11** **Appendix 7A**
An effective implementation plan for creating the recommended institutional framework and delivering the HSR program and for securing, if merited, an integrated HSR/corridor regional development concept.	**Chapter 12** **Appendix 7B**