PART B: Proposal

5. Strategic context and need for the proposal

This chapter describes the strategic planning context, and the key issues and demands, that have influenced the need for, and development of, Inland Rail together with the proposal as part of the overall Inland Rail project. A summary of the need for Inland Rail and the proposal is also provided.

5.1 Strategic planning context

5.1.1 The existing situation

There is no direct continuous inland rail link between Melbourne and Brisbane, with interstate rail freight travelling between Melbourne and Sydney via Albury, and then between Sydney and Brisbane, generally along the coast. About 70 per cent of the freight between Melbourne and Brisbane is carried by road, principally the Newell Highway in NSW, and connecting highways in Victoria and Queensland (Transport for NSW, 2015).

The idea for extending the Australian rail network to provide an inland railway between Melbourne and Brisbane has been around for at least one hundred years (Inland Rail Implementation Group, 2015). In the last decade, the concept of an inland railway between Melbourne and Brisbane has been subject to significant analysis for the following reasons (ARTC, 2010):

- the existing north–south coastal railway will reach capacity in the medium term, and additional capacity will be required to service future demands for interstate and regional rail freight
- the efficiency and service quality associated with the existing coastal route is currently impacting on freight productivity and transport costs
- road freight transport has a competitive advantage over rail, making it difficult for rail to increase its market share
- road freight is associated with the potential for safety, congestion and environmental costs as a result of the movement of heavy vehicles on roads
- rail paths on the coastal route through Sydney are shared between passenger and freight trains, impacting on the reliability of rail freight, and constraining opportunities for the expansion of passenger services.

Two major studies have been undertaken in relation to the development of an inland rail route between Melbourne and Brisbane. The first study, the *North–South Rail Corridor Study* (Department of Transport and Regional Services, 2006) considered potential corridors for the rail line. This study is described in section 6.1.3. As an outcome of the study the 'far-western sub-corridor', via Parkes, Moree and Toowoomba, was identified as the preferred corridor for a Melbourne-Brisbane inland railway.

In 2008, the then Minister for Infrastructure, Transport, Regional Development and Local Government announced a study to determine the optimum alignment, as well as the economic benefits and likely commercial success, of a new standard gauge inland railway between Melbourne and Brisbane. This study, the *Melbourne–Brisbane Inland Rail Alignment Study* (ARTC, 2010) developed the current Inland Rail alignment (as shown in Figure 5.1).

Figure 5.1 Proposed alignment for Inland Rail

The conclusions of the *Melbourne–Brisbane Inland Rail Alignment Study* include:

- there is demand for an inland railway
- the route for an inland railway would be more than 100 kilometres shorter than the existing coastal route
- the preferred alignment could achieve an average Melbourne to Brisbane transit time (terminal to terminal) of less than 24 hours, compared to a transit time on the existing coastal route of about 27 hours and 30 minutes
- the inland railway would free up rail and road capacity through Sydney
- the inland railway would achieve a positive economic net present value between 2030 and 2035, and if demand volumes grow more strongly than forecast, viability could be reached sooner.

In November 2013, the Minister for Infrastructure and Regional Development announced that the Australian Government had committed $300 million to enable the development of Inland Rail to commence, starting with pre-construction activities such as detailed corridor planning, environmental assessments, and community consultation. The Minister also announced that a high-level Implementation Group would be formed to drive the project. The alignment identified by the *Melbourne–Brisbane Inland Rail Alignment Study* (ARTC, 2010) was endorsed by the Implementation Group as the base case for further work (Inland Rail Implementation Group, 2015).

In 2014, the Implementation Group appointed ARTC to develop a business case and a 10-year delivery plan for Inland Rail. Planning and design work for the two projects in NSW is underway:

- Parkes to Narromine (the proposal)
- Narrabri to North Star (subject to a separate application).

Further information on the options and alternatives considered is provided in chapter 6.

5.1.2 Consistency with Australian, State and regional strategic planning

The strategic context of Inland Rail (including the proposal) is influenced by the outcomes of a number of strategic plans for transport, development, and freight that have been prepared at the national, state, and regional levels. Key national and state strategies, policies, and plans have also informed and influenced the vision, objectives, and development of Inland Rail and the proposal.

The proposal, as part of Inland Rail, is consistent with the following relevant strategies:

National

- *Australian Infrastructure Plan* (Infrastructure Australia, 2016)
- *State of Australia's Cities 2014-2015* (Department of Infrastructure and Regional Development, 2015)
- *Urban Transport Strategy* (Infrastructure Australia, 2013)
- *National Land Freight Strategy* (Standing Council on Transport and Infrastructure, 2013)
- *National Ports Strategy* (Infrastructure Australia, 2011)

NSW

- *State Priorities: NSW Making it Happen* (NSW Government, 2015)
- *Newell Highway Corridor Strategy* (NSW Government, 2015)
- *Rebuilding NSW – State Infrastructure Strategy* (NSW Government, 2014a)
- *NSW Freight and Ports Strategy* (NSW Government, 2013)
- *NSW Road Safety Strategy 2012-2021* (Transport for NSW, 2012)
- *NSW Long Term Transport Master Plan* (Transport for NSW, 2012)

Regional/local

- *Draft Central West and Orana Regional Plan* (NSW Government, 2016)
- *Economic Development Strategy for Regional NSW* (DTIRIS, 2015)
- *A Plan for Growing Sydney* (NSW Government, 2014b)
- *Central West Regional Transport Plan and the New England North West Transport Plan* (Transport for NSW, 2013)
- *Central West Freight Study* (Regional Development Australia Central West, 2013).

Further information on these strategies and their relationship to Inland Rail and the proposal in provided in Appendix E.

5.2 Summary of key issues and demands

A summary of the key issues and demands relevant to the development of, and need for, Inland Rail (including the current proposal) is provided below. A detailed analysis of the issues and project drivers is provided in the *Programme Business Case* (ARTC, 2015) and in the *Inland Rail Implementation Group Report* (Inland Rail Implementation Group, 2015).

5.2.1 Growth in freight demand

In 2011, the domestic rail freight task totalled 261.4 billion tonne kilometres, accounting for approximately 46 per cent of total domestic freight. This represents an increase of 91 per cent since 2000–01 (Infrastructure Australia, 2015).

The *Infrastructure Audit* (Infrastructure Australia, 2015) notes that:

- the national land freight task is expected to grow by 80 per cent between 2011 and 2031
- demand for freight rail infrastructure is projected to grow, in particular for resource bulk commodity haulage in WA, Queensland and NSW
- freight rail will need to play a growing role in the movement of goods between ports and inland freight terminals, and in the movement of containerised and general freight over longer distances.

The Melbourne to Brisbane corridor is one of the most important general freight routes in Australia, supporting key population and employment precincts along the east coast and inland NSW. The non-bulk and complementary volumes moving within the corridor are currently estimated at 21 million tonnes per annum. This is expected to grow to over 40 million tonnes per annum by 2050 (Infrastructure Australia, 2016).

The eastern states of Australia comprise 18 million residents (79 per cent of Australia's population), nine million jobs (78 per cent of Australia's national employment) and contributes $1.1 trillion in gross state product (75 per cent of gross domestic product). Interstate freight transport is projected to increase by 70 per cent between 2015 and 2030, to 140 billion tonne kilometres. The Melbourne to Brisbane corridor already supports 17 per cent of these interstate movements (ARTC, 2015).

With the population of the eastern states forecast to increase by 60 per cent over the next 40 years, the need for efficient and effective freight transport will continue to increase. Strong forecast population growth, accompanied by comparable growth in employment, is likely to place significant pressure on existing infrastructure and services (ARTC, 2015).

Without the increased use of rail, the growth in freight demand is likely to result in increasing pressure on the road network and associated issues, increased freight costs, and a loss of economic opportunity.

5.2.2 Existing freight capacity and infrastructure issues

As the demand for regional and interstate freight transport grows, rail and road infrastructure in the north–south corridor will face progressive challenges in meeting future demand. There will be increasing pressure on freight capacity between capital cities and from the regions to export ports and urban freight destinations.

Freight trains travelling along the Melbourne to Brisbane corridor currently travel through the Sydney metropolitan rail network, often experiencing significant delays. Travel time reliability is poor, as a result of the priority given to passenger services, freight transit curfews in the Sydney metropolitan area, and substandard rail alignments elsewhere. Limited capacity during morning and afternoon passenger peaks restricts freight movements at these times (NSW Government, 2013).

The *Australian Infrastructure Plan* (Infrastructure Australia, 2016) notes that the existing north–south rail corridor between Melbourne and Brisbane does not provide a service offering that is competitive with road transport. This is largely the result of 19th century alignments leading to low travel speeds and reliability, and major bottlenecks, most notably in the Sydney metropolitan area.

Infrastructure Australia (2016b) notes that the demand for urban transport infrastructure is projected to increase significantly. Without action, the cost to the wider community of congestion on urban roads could rise to more than $50 billion each year by 2031. Demand for many key urban road and rail corridors is projected to significantly exceed current capacity by 2031.

The *National Land Freight Strategy* identifies a number of existing challenges facing road and rail freight in general, including:

- congestion from increasing numbers of passenger vehicles, and the priority given to passenger vehicles over freight vehicles in urban transport, can adversely impact on the efficiency of freight vehicle movement
- the encroachment of urban development on freight routes and precincts as cities grow in size and density leads to an increased potential for amenity, environmental and interface issues.

The *Melbourne–Brisbane Inland Rail Alignment Study* (ARTC, 2010) indicated that:

- there are likely to be capacity constraints on the existing coastal railway unless significant capital works are undertaken
- the coastal railway between Sydney and Brisbane would reach capacity around 2052.

The issues associated with the existing regional rail systems also include the fact that much of the infrastructure is old and has maintenance and renewal issues. Poor maintenance of rail lines leads to more freight being transported by road, imposing additional maintenance burdens on the affected councils (Infrastructure Australia, 2015).

5.2.3 Assessment of demands for Inland Rail

Continued growth in freight volumes is giving rise to a range of increasingly complex challenges for government, industry and the community. Over the last four decades, the Australian freight task (that is, the amount of freight transport, usually measured in tonnes or tonne-kilometres) has quadrupled, with major increases evident in road and rail transport. Forecasts indicate that the total freight task will continue to grow, and is estimated to nearly double by 2030 based on 2010 levels (Infrastructure Australia, 2012).

The Programm*e Business Case* (ARTC, 2015) provides a detailed description of the potential demand for Inland Rail. The demand projections have been used to:

- estimate the potential revenue of Inland Rail
- assess the economic benefits arising from mode shift from road and the coastal route to Inland Rail
- determine the appropriate capacity of Inland Rail
- determine appropriate service frequency and the impact of this on capacity utilisation, railway and train operating costs.

The main categories of freight that are expected to comprise the market for Inland Rail are non-bulk manufactured products, including bulk steel, paper, coal and grain. The demand analysis indicates that (ARTC, 2015):

- Inland Rail is expected to increase rail's share of the Melbourne to Brisbane freight market from the current 26 per cent to 62 per cent by 2049-50. Similarly, it is estimated that Inland Rail would increase rail freight's share of the Adelaide to Brisbane market by 28 per cent and Brisbane to Perth's share by seven per cent
- better connections to the Port of Brisbane would result in an estimated two million tonnes of freight shifting from road to rail by 2049–50, particularly grain and cotton from New England, as well as grain on both rail and road from the Darling Downs to the Port of Brisbane. In NSW, a significant tonnage of grain (approximately 7.5 million tonnes, spread) would also use Inland Rail on its way to NSW ports
- Inland Rail would attract induced freight such as coal in the Surat and Clarence-Moreton Basins, which would increase from the current eight million tonnes to 19.5 million tonnes.

5.3 Need for the proposal

5.3.1 Need for Inland Rail

As noted in the *National Land Freight Strategy* (Standing Council on Transport and Infrastructure, 2013) 'The efficient movement of land freight is crucial for Australia's productivity and competitiveness, and affects the lives of every Australian'. The existing rail mode share of freight between Melbourne and Brisbane (averaging the two directions) varies between approximately 22 to 27 per cent for non-bulk freight, to 60 to 90 per cent for commodities transported in bulk (ARTC, 2010).

The National Land Freight Strategy notes that the infrastructure supporting the movement of land freight, such as road, rail and ports, must be sufficient for the significant projected growth in demand for freight transport (noted in section 5.2.1).

Rail is generally the most productive and efficient mode for freight travelling from regional areas to export ports and urban destinations. Rail has traditionally dominated the freight market for mining and agricultural commodities, particularly iron ore, coal, grains, rice, cotton, and sugar for processing or export (ARTC, 2015). As noted by the Minister for Infrastructure and Regional Development (2013), 'an efficient rail freight network is the key to effective supply chains, national productivity and competitiveness'.

Inland Rail is needed to improve the efficiency of freight moving between Melbourne and Brisbane. Inland Rail would bypass the Sydney metropolitan area, it would substantially cut the overall journey time to less than 24 hours, and increase the reliability of services between Melbourne and Brisbane (Infrastructure Australia, 2016). This is expected to increase the competitiveness of rail transport relative to road transport (ARTC, 2014).

As noted by the *Australian Infrastructure Audit Report* (Infrastructure Australia, 2015) 'Rail offers an alternative to road transport and societal benefits in terms of lower emissions, reduced road congestion and increased safety per tonne kilometre, particularly over longer distances or when carrying heavy goods.'

In summary, Inland Rail is needed to respond to the growth in demand for freight transport (as described in section 5.2.1), and address existing freight capacity and infrastructure issues (described in section 5.2.2). The analysis of demands undertaken by ARTC indicated that there would be sufficient demands for Inland Rail (described in section 5.2.3).

With respect to the need for the proposal, the Inland Rail Implementation Group (2015) found that:

- without Inland Rail, the amount of freight travelling by road between Melbourne and Brisbane in 2050 will be approximately 7.1 million tonnes, 2.3 million tonnes more than what would be on the road with Inland Rail
- key transport links are experiencing increasing capacity constraints and congestion as a result of inadequate infrastructure
- current investment in road and rail is insufficient to address Australia's future freight task
- further population and freight growth along the north-south corridor will increase the demand for transport services at a local, state and national level, placing freight corridors under severe pressure and compounding the inefficiencies that already exist
- if capacity constraints and congestion resulting from inadequate infrastructure are not overcome, national productivity and economic growth will be constrained with environment and safety outcomes also becoming increasingly sub-optimal.

5.3.2 Need for the proposal

Inland Rail consists of 13 geographically based projects, involving:

- building sections of new or 'greenfield' route
- upgrading sections of existing secondary lines to meet Inland Rail's performance specification
- enhancing sections of existing main lines, mainly to improve vertical and horizontal clearances between infrastructure above the rail corridor and the tracks themselves, to enable trains with double stacked containers to pass safely beneath.

The proposal involves upgrading an existing secondary rail line to meet Inland Rail's performance specification. Development of both the proposal and the Narrabri to North Star project is required to enable implementation of Inland Rail to align with funding availability.

6. Alternatives and proposal options

This chapter provides a summary of the alternatives that have been considered as part of the development of Inland Rail. These included the strategic alternatives to Inland Rail as a whole (including road upgrades, upgrading the east coast railway, and greater use of maritime and air freight), and alternative route locations. The chapter also includes a summary of the main options that were considered during the concept design process for the proposal. Information on how the options were developed and assessed is provided.

6.1 Inland Rail alternatives

6.1.1 Strategic alternatives - alternative freight transport solutions

Alternative freight transport solutions with the potential to address Australia's current and future freight challenges were considered as part of a strategic options assessment set out in the *Programme Business Case* (ARTC, 2015), and examined in the *Inland Rail Implementation Group Report* (2015).

Strategic options assessment

Three options were assessed by the *Programme Business Case* (ARTC, 2015):

- progressive road upgrades
- upgrading the existing east coast railway
- an inland railway.

These options were subjected to a rigorous assessment consistent with Infrastructure Australia's Reform and Investment Framework Guidelines. The options were assessed against seven equally weighted criteria:

- capacity to serve east coast future inter-capital regional/bulk freight market needs
- foster economic growth through improved freight productivity and service quality (including improved reliability and resilience)
- optimise environmental outcomes
- alleviate urban constraints
- enable regional development
- ease of implementation
- cost-effectiveness.

Overall, constructing an inland railway ranked highest, with an average high likelihood of improving outcomes across all criteria. Progressive road upgrades and upgrading the existing east coast railway both had an average medium overall ranking across all criteria. In relation to individual criteria, progressive road upgrades outranked an inland railway only in relation to ease of implementation, and ranked equally with an inland railway in relation to enabling regional development outcomes. An inland railway was found to be the best option across all other criteria.

Review of alternatives

The following alternatives were reviewed by the Inland Rail Implementation Group:

- maritime freight
- air freight
- road freight
- rail solutions.

The results of the review of alternatives undertaken by the Inland Rail Implementation Group are summarised below:

Maritime shipping

Maritime freight was examined as a potential alternative to Inland Rail based on two types of services:

- a dedicated service between the Melbourne and Brisbane (coastal shipping)
- using spare capacity on vessels calling at Melbourne and Brisbane as part of an international voyage.

The Inland Rail Implementation Group report (Inland Rail Implementation Group, 2015) concluded that:

- shipping is unlikely to be a strong alternative to Inland Rail, as it does not provide the level of service (transit time and service availability) required by the majority of the Melbourne to Brisbane interstate market
- shipping still has a role to play, especially due to its strengths in transporting high volume and long distance cargo around the coast. Shipping must be used in conjunction with other modes such as inland rail to meet Australia's future transport needs.

Air freight

Domestic air freight accounts for less than 0.01 per cent of total domestic freight movements in Australia by weight. The majority of these movements are comprised of newspapers and parcels between major cities, on either dedicated freight flights or on existing passenger flights. Air freight is highly specialised due to the inherent constraints on aircraft size and the nature of the goods that can be carried. The report (Inland Rail Implementation Group, 2015) concluded that:

- air freight has a limited role in the transport of bulky or heavy goods on the Melbourne to Brisbane corridor, but will continue to play a crucial role for small, high-value and time-dependant goods
- air freight is not a viable alternative for addressing Australia's freight requirements on the Melbourne to Brisbane corridor into the future.

Road freight

The role of road transport was considered as a potential alternative to Inland Rail. While rail carries a larger volume of freight overall, road transport is the main mode of transport for the majority of commodities produced or consumed in Australia. Along the north–south corridor, the main routes for road freight are on the Hume Highway (between Sydney and Melbourne), the Pacific Highway (for coastal transport between Sydney and Brisbane), and the Newell Highway (between Melbourne and Brisbane).

The identified issues and considerations relevant to road freight on these corridors include:

- the north–south road corridor will face significant local and regional capacity constraints for road freight in the medium to longer term
- the mix of local traffic, private vehicles, and freight vehicles on road transport corridors reduces reliability as a result of the different average travel speeds between cars and heavy vehicles, and increases accident rates
- conflicts between local traffic, private vehicles and freight vehicles on these corridors will increase in line with significant forecast growth in population, employment, and demands for freight transport
- compared with rail, road freight results in additional environmental costs, including from air pollution, greenhouse gas emissions, and water pollution

- the cost to freight operators of congestion in urban areas as a result of reduced travel speeds and reliability for freight transport is estimated to be around $60 million per year for Melbourne to Brisbane inter-capital freight alone
- Australian and State governments are investing in road infrastructure along the north – south corridor. However, this investment will be insufficient to remove all the existing and predicted future issues along the full length of the corridor, leaving trucking productivity exposed to the cumulative effects of the remaining deficiencies.

The report concluded that:

- while road transport will continue to contribute to Australia's freight task, unless substantial additional investment is made, it will be unlikely to meet the longer term needs for Australia's freight task alone
- should the Australian Government decide not to proceed with a rail solution, further investigation of road transport is required to determine its capacity to manage the future north–south freight task.

Rail solutions

The two main rail solutions considered were enhancing the existing east coast railway, and constructing a new inland railway.

The report noted that there are a number of capacity, reliability, and performance issues associated with the existing east coast railway, mainly relating to constraints associated with moving freight trains through the Sydney metropolitan rail network.

As a sub-option of enhancing the existing east coast railway, the report noted that the proposed new Outer Sydney Orbital corridor would provide opportunities for a rail route that could ease freight congestion on Sydney freight networks. However, the main role of this corridor is to address freight capacity constraints on other routes, such as those for intrastate and export freight. In addition, this option would not provide significant transit time savings for Melbourne to Brisbane freight, as the missing link between northwest NSW and southern QLD would still be required, or the existing coastal line would need to be upgraded. The report concluded that use of the Outer Sydney Orbital corridor would complement, but not replace, Inland Rail.

The report concluded that:

- for Melbourne to Brisbane freight, the existing east coast railway would not be competitive with road in terms of cost or time, even with significant further investment, and it is not a viable alternative to Inland Rail
- Inland Rail would meet Australia's future freight challenge, and bring significant and positive national benefits by boosting national productivity and economic growth, while promoting better safety and environmental outcomes.

Summary of findings

Overall, in relation to the various alternatives to Inland Rail, the Implementation Group concluded that (Inland Rail Implementation Group, 2015):

- while shipping and air will continue to play a role in the interstate freight market, they are not viable alternatives to rail
- without Inland Rail, road is the only mode capable of addressing the majority of the future freight task, with associated direct and indirect costs.

6.1.2 The 'do nothing' alternative

Not developing Inland Rail would result in continued growth in the use of road for freight transport between Melbourne and Brisbane, particularly along the Newell Highway. The issues associated with using road transport alone to address Australia's freight needs into the future are considered in section 6.1.1. In addition, road transport will be unlikely to meet the longer term needs for Australia's freight task alone unless substantial additional investment is made (Inland Rail Implementation Group, 2015).

6.1.3 Alternative locations/route options for Inland Rail

Alternative routes for Inland Rail have been considered by the following two studies.

- *North–South Rail Corridor Study* (Department of Transport and Regional Services, 2006)
- *Melbourne–Brisbane Inland Rail Alignment Study* (ARTC, 2010).

The results of the studies are summarised below.

North–South Rail Corridor Study

The *North–South Rail Corridor Study* considered potential corridors for the rail line to determine which route would deliver the best economic and financial outcome.

Options identified

Potential options were identified within a 'north–south rail corridor', which comprises an elliptically-shaped area defined by the standard gauge rail line along the NSW coast, and a broad arc west of Shepparton, Jerilderie, Coonamble, Burren Junction, Goondiwindi and Toowoomba. This area covers all sections of the existing rail network in Victoria, NSW, and Queensland that currently form, or could potentially form, part of a freight route between Melbourne and Brisbane.

Within this corridor, four sub-corridors were identified for comparative analysis, each of which could be combined with alternative routes between Melbourne and Junee, via Shepparton or via Albury. The four sub-corridors comprised:

- Far-western sub-corridor – linking Junee to Brisbane via Parkes, Dubbo and/or Narromine, Coonamble, Burren Junction, Narrabri and/or Moree, North Star, Goondiwindi, Warwick and/or Toowoomba.
- Central inland sub-corridor – linking Junee to Brisbane via any inland route that includes the Werris Creek to Armidale to Tenterfield rail links.
- Coastal sub-corridor – following the existing coastal route between Junee and Brisbane (via Goulburn), through Sydney.
- Hybrid sub-corridor – combining elements of an inland and coastal route, linking Junee to Brisbane via Muswellbrook and Maitland.

Within each of these sub-corridors, the feasibility of 136 possible route options was investigated. These options involved different amounts of new track and/or upgrading existing sections of track.

Analysis of options

The route options were compared using an optimisation model specifically developed for the study, based on the following criteria:

- operating efficiency
- infrastructure requirements
- market demand
- environmental constraints
- financial and economic viability.

The study identified potential demand, financial issues, environmental issues, and infrastructure costs relevant to the four sub-corridors. The analysis undertaken for the study concluded that the far-western sub-corridor was markedly superior to the other alternatives.

Melbourne–Brisbane Inland Rail Alignment Study

The purpose of the *Melbourne–Brisbane Inland Rail Alignment Study* was to determine the optimum alignment as well as the economic benefits and likely commercial success of a new standard gauge inland railway between Melbourne and Brisbane. The terms of reference for the study required it to develop a detailed route alignment, generally following the far western sub-corridor identified by the *North-South Rail Corridor Study*.

Options identified

The *Melbourne–Brisbane Inland Rail Alignment Study* short-listed and analysed a number of route options. The stages of route analysis involved:

- identification of the route – evaluation of the route options and preliminary analysis for the three main areas: Melbourne to Parkes; Parkes to Moree; and Moree to Brisbane
- analysis of the route – the route was analysed in terms of capital cost, environmental impacts and journey time, as well as its preliminary economic and financial viability
- development of the preferred alignment – the alignment was developed considering environmental and engineering factors.

The study noted that, with the combination of numerous route options and sections, there were over 50,000 possible options for the route between Melbourne and Brisbane. As it was not feasible to analyse each option, two key criteria (capital cost and journey time) were used to establish a shortlist of route options in each of the three main areas. The shortlist included:

- Melbourne to Parkes – two main options:
  - via Albury, using existing track from Melbourne to Parkes (with a possible new direct line from Junee or Illabo to Stockinbingal by-passing Cootamundra)
  - via Shepparton, using the existing broad gauge Mangalore–Tocumwal line via Shepparton, the disused standard gauge line to Narrandera, and a new direct connection through to near Caragabal, before re-joining the existing line to Parkes.
- Parkes to Moree – four main options:
  - Parkes to Moree via Werris Creek, using existing track (with a new section of track at Binnaway and Werris Creek to avoid reversals)
  - Parkes to Moree via Binnaway and Narrabri, using existing track to Binnaway, and then a new section connecting to the existing track near Emerald Hill or Baan Baa
  - Parkes to Moree via Curban, Gwabegar and Narrabri, using existing track to Narromine, predominately new track between Narromine and Narrabri, and existing track from Narrabri to Moree
  - Parkes to Moree via Burren Junction, using existing track to Narromine, and predominately new track via Coonamble and Burren Junction to Moree.
- Moree to Brisbane – two main options:
  - the Warwick route, a new 'greenfield' route via Warwick to the existing standard gauge Sydney–Brisbane lined
  - the Toowoomba route, a new corridor direct from Inglewood to Millmerran and Oakey, near Toowoomba, and then a new alignment down the Toowoomba range, and use of the proposed Southern Freight Rail Corridor from Rosewood to Kagaru.

Analysis of options

The shortlist of route options was subjected to more detailed technical, financial and economic assessment. The option involving use of existing track towards Werris Creek had the lowest capital expenditure whilst still meeting the performance specification. This option had a length of about 1,880 kilometres. The option involving the more direct route between Narromine and Narrabri had the fastest transit time for a reasonable capital expenditure. This option, which had a length of about 1,731 kilometres, became the focus for more detailed route, demand, economic and financial analysis.

Refining the proposed alignment involved an iterative process, with evaluation of the following:

- environmental and land issues
- railway operations considerations
- engineering assessments
- capital cost estimates.

The final preferred alignment, between South Dynon in Melbourne and Acacia Ridge in Brisbane, incorporated:

- Melbourne to Parkes – 670 kilometres of existing track and 37 kilometres of new track on a greenfield alignment from Illabo to Stockinbingal, bypassing Cootamundra and the Bethungra spiral
- Parkes to North Star – 307 kilometres of upgraded track, and 291 kilometres of new track on a greenfield alignment from Narromine to Narrabri
- North Star to Acacia Ridge – 271 kilometres of new track on a greenfield alignment, 119 kilometres of existing track upgraded from narrow gauge to dual gauge, and 36 kilometres of the existing coastal route.

6.2 Proposal option development

6.2.1 Approach to the option development and design process

Option development has been an integral part of the overall design process for the proposal. An iterative process of option selection, design development, and evaluation has been undertaken to define the proposal to date. Further to the strategic and initial planning studies for Inland Rail, as described in section 5.1, the design process for the proposal involves the following general phases:

- phase 1 – concept design
- phase 2 – feasibility design
- phase 3 – detailed design.

The proposal as described in this EIS is based on the outcomes of the feasibility design. The detailed design would take into account the outcomes of the feasibility design phase; the findings of this EIS, including the mitigation measures detailed in chapters 9 to 26 (and summarised in chapter 27); and any conditions of approval (if the proposal is approved).

The design has, and will continue to, evolve over these phases as a result of engineering, traffic, financial, economic and environmental considerations. The option selection and design process has also taken into account the issues raised during consultation with relevant stakeholders (refer to chapter 4), and the findings of preliminary environmental investigations.

6.2.2 Option assessment process

Options assessments have been undertaken for the following features of the proposal:

- track upgrading
- crossing loops
- level crossings

- Parkes north west connection
- Brolgan Road overbridge.

A summary of the outcomes of the options assessments for these features is provided in section 6.3. In general, the assessments involved the following tasks:

- confirm requirements
- identify options to be assessed
- review potential impacts, constraints, risks and opportunities associated with each option
- agree on evaluation criteria
- assess the options against the criteria using a multi-criteria analysis
- identify the preferred option
- reporting.

6.3 Options considered for proposal features

6.3.1 Track upgrading

Within the existing rail corridor, the existing track and formation needs to be upgraded/replaced to meet the operational requirements for Inland Rail, in particular, for the types and speeds of trains that would use Inland Rail.

Options considered

The track consists of the rails, fasteners, sleepers and ballast. The formation consists of the foundation material beneath the ballast and above the sub-grade. It is comprised of structural fill but may also include a capping layer. Three options for upgrading the track and/or formation were considered:

- track reconstruction – replacing the existing track and formation
- skim reconditioning – using the existing track ballast and sub-ballast as structural capping on the existing consolidated subgrade
- skim plus reconditioning – a combination of skim reconditioning and track reconstruction.

Assessment

Geotechnical investigations were undertaken along the existing rail corridor to provide a preliminary quantification of the extent of each potential treatment option. The results of this investigation were tested against the key parameters for each option.

Preferred option

All three options would be implemented as required, depending on the existing track and formation conditions. The track would be reconstructed in areas where the subgrade strength is inadequate, the existing formation has failed, and/or there is insufficient quality material in the existing track to be retained. Skim reconditioning would be used in areas where the existing ballast and sub-ballast is suitable for reuse. Skim plus reconditioning would be used in areas where there is not enough existing ballast.

6.3.2 Crossing loops

Initial options

A crossing loop is a section of track off to the side of the main track/s that allows a train to move to the side so that another train can pass along the main track. Trains move to the crossing loop via turnouts.

Crossing loops are positioned along a rail line using a network modelling methodology. This identifies locations to provide the maximum number of possible 'train paths' on the network. The number of potential train paths on a network represents the capacity of that network. For Inland Rail, a crossing loop is required around every 25 kilometres.

Assessment

A multi criteria analysis was undertaken to determine the location of crossing loops as part of the proposal, based on network capacity requirements and taking into account local constraints. Considerations included:

- future train lengths
- minimising impacts on level crossings
- existing structures currently recommended to be retained
- distance to a receiver (noise)
- earthwork cut and fill volumes
- access
- geometry.

Preferred option

Based on this assessment, three new crossing loop locations were selected to allow trains to pass safely – at Goonumbla, near Peak Hill, and at Timjelly.

6.3.3 Level crossings

A total of 71 level crossings are located along the proposal site. Of these, 33 are located on public roads (a number of which are Crown roads providing access to a single property), and 38 crossings are located on private roads or maintenance access tracks.

The majority of level crossings along the proposal site have passive forms of control, consisting of stop signs only (66 crossings). Other crossings have active controls (either signage with flashing lights, or signage with flashing lights and boom gates).

Initial options and assessment

ARTC has prepared a level crossing strategy for the proposal. The level crossing strategy involves reviewing all crossings along the proposal site to determine the works required to meet relevant crossing standards, guidelines, and Inland Rail operational criteria. The level crossing strategy consists of two stages:

- Stage 1 – identify options for level crossings and the preferred approach
- Stage 2 – consult with relevant stakeholders (including landowners and road owners) to confirm the preferred approach, and finalise the strategy.

Stage 1 of the level crossing strategy involved:

- identifying all level crossings across the proposal site
- field assessments of crossings
- review existing crossings with regard to Australian and ARTC level crossing design standards
- consulting with stakeholders about the use of crossings
- identifying preferred works and consolidation options for further stakeholder consultation as part of stage 2.

The following options were considered for each level crossing:

- retain existing crossing controls
- upgrade the level of control at the crossing
- construct a gated crossing with administrative controls, such as a requirement to phone train control prior to use
- consider crossing consolidation based on the outcomes of further investigation and stakeholder agreement.

Preferred option

The preferred option for level crossings across the proposal site is listed in Table 6.1.

Table 6.1 Summary of preferred option for level crossings

Action	Number of crossings affected		
	Public	Private	Total
Retain existing crossing controls	20	19	39
Consider crossing consolidation	2	17	19
Upgrade crossing from passive to active (boom barriers)	6	0	6
Upgrade form of active control (from flashing lights to boom barriers)	5	0	5
Provide a gated crossing	0	2	2
Total	**33**	**38**	**71**

The next stage

The next stage in the level crossing strategy involves:

- consulting with stakeholders regarding the preferred option
- reviewing the proposed works for each crossing in detail, taking into account input from stakeholders
- reviewing consolidation options in accordance with the requirements of the *Transport Administration Act 1998*
- preparing detailed designs for works
- stakeholder consultation
- finalise the detailed designs for each crossing, taking into account the results of consultation.

As noted in section 3.4, any closure of level crossings needs to be undertaken in accordance with the requirements of the *Transport Administration Act 1998*. Private level crossings cannot be closed unless there is an alternative means of legal access to the property. Further information on the requirements of the *Transport Administration Act 1998* in relation to level crossings is provided in section 3.4.

6.3.4 Parkes north west connection

Initial options

As described in chapter 2, the southern end of the proposal site commences to the west of Parkes on the existing Parkes to Narromine line. At this location, the existing Broken Hill line extends in an east–west direction. A new connection between the Broken Hill line and Inland Rail is proposed at this location. The connection would enable trains travelling to and from the west on the Broken Hill line to travel north via Inland Rail (currently the Parkes to Narromine line), and for trains travelling south on Inland Rail (currently the Parkes to Narromine line) to travel west via the Broken Hill Line.

Location and configuration options for the new connection were identified with consideration given to the following:

- operational speed
- environmental impacts
- impacts on the existing use of Goobang Junction
- length of new track required
- volume of excavations required
- road changes
- number of properties impacted
- services relocations required.

The following options were identified for further assessment (options are described using the terminology from the assessment report):

- Option 1 – involves 5.3 kilometres of new track that consists of a major departure from the existing corridor (two kilometres long at its furthest point). This option has at grade connections to the main alignment at both the northern and southern ends. A road overbridge would also be required, to enable Brolgan Road to pass over the rail corridor.
- Option 4 – involves three kilometres of new track that consists of a departure from the existing corridor. This option has at grade connections to the main alignment at both the northern and southern ends. A road overbridge would also be required at Brolgan Road.
- Option 5 – involves 0.7 kilometres of new track and realigning the existing track for a distance of 1.7 kilometres. This option has at grade connections to the main alignment at both the northern and southern ends. This option also involves closing the existing road crossing at Brolgan Road, and constructing two new road overbridges.
- Option 6 – involves 0.6 kilometres of new track and realigning the existing track for a distance of 2.3 kilometres. This option has an at grade connection to the main alignment on the eastern end, and it runs next to the existing alignment on a grade separation for 200 metres at the western end.

The location of the options is shown in Figure 6.1.

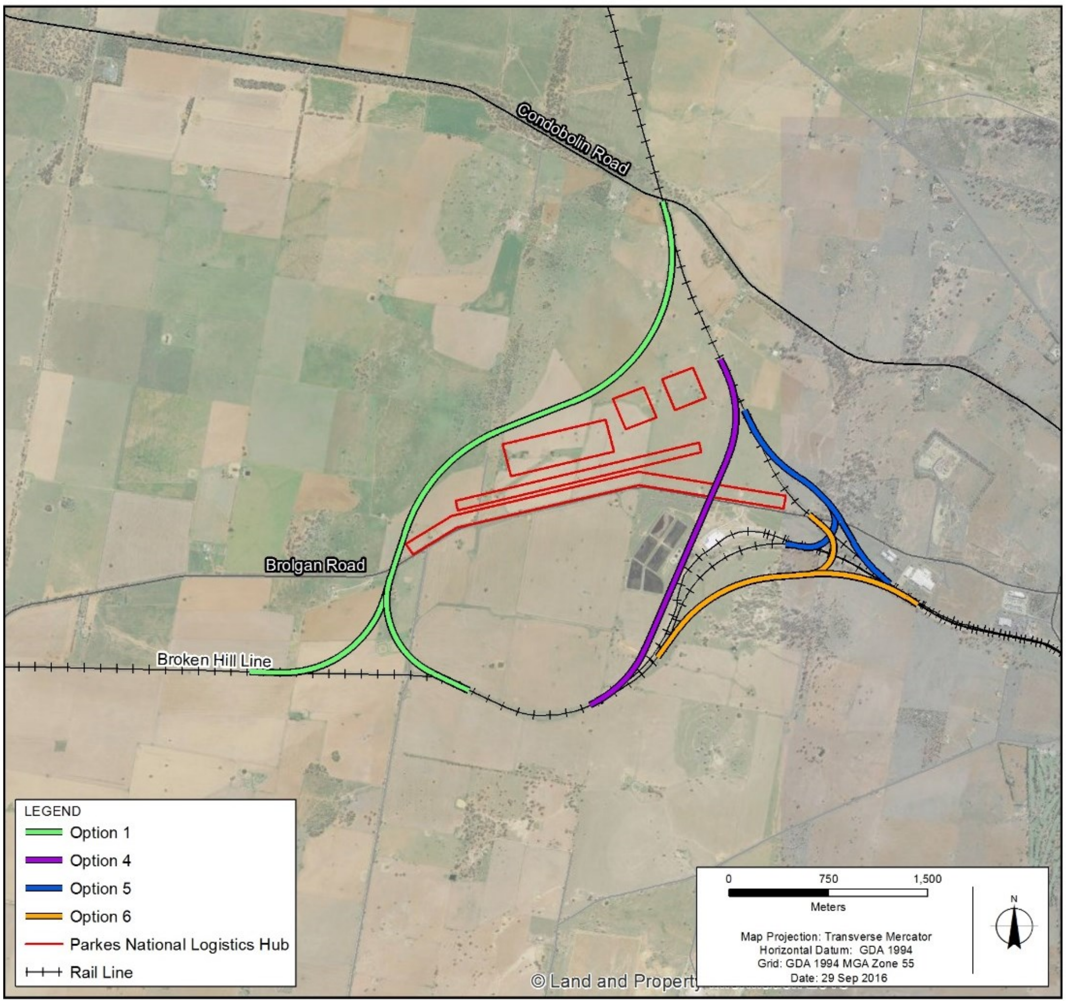

Figure 6.1 Parkes north west connection options

Assessment

A multi-criteria analysis of the options was undertaken. The following criteria were used:

- operational benefits
- safety
- maintenance
- road impacts
- utility impacts
- environmental impacts
- property impacts
- land use
- track
- civil and geotechnical
- structures
- capital cost (based on quantities).

Option 5 scored the highest in the multi-criteria analysis. Further assessment was then undertaken based on additional contributions from stakeholders. This assessment considered the following in more detail:

- turnout arrangements
- interaction with Goobang Junction
- impacts on future intermodal facilities and existing logistics compounds
- weightings of criteria were modified to put more focus on operational benefits, maintenance, and land use.

Another multi-criteria analysis was undertaken.

Preferred option

As an outcome of the additional assessment, option 1 scored the highest and was identified to be the preferred option. This option forms part of the proposal, and further information is provided in chapter 7.

6.3.5 Brolgan Road overbridge

Initial options

As described in section 6.3.4, option 1 for the Parkes north west connection would involve the provision of a road overbridge to enable Brolgan Road to pass over the rail corridor. Following confirmation of option 1 as the preferred option, an options assessment was undertaken to determine the preferred option for the overbridge.

The objectives of the overbridge are to:

- provide a road connection across the Parkes north west connection at Brolgan Road
- provide an overbridge of sufficient height to cater for the height of trains that would use Inland Rail
- minimise environmental impacts
- minimise property impacts
- minimise disruption to road users via closures during construction
- minimise disruption to road users once the Parkes north west connection is operational
- provide the opportunity to construct an extra rail line in the future (if required)
- avoid building new level crossings wherever possible.

The following options were identified and assessed (options are described using the terminology from the assessment report):

- Base case – level crossing: this option would involve provision of a level crossing with active protection.
- Option 1 – online: the overbridge would be constructed at the location of the existing road.
- Option 2 – offline north: the overbridge would be constructed to the north of the existing road.
- Option 3 – offline south: the overbridge would be constructed to the south of the existing road.

The location of the Brolgan Road overbridge options is shown in Figure 6.2.

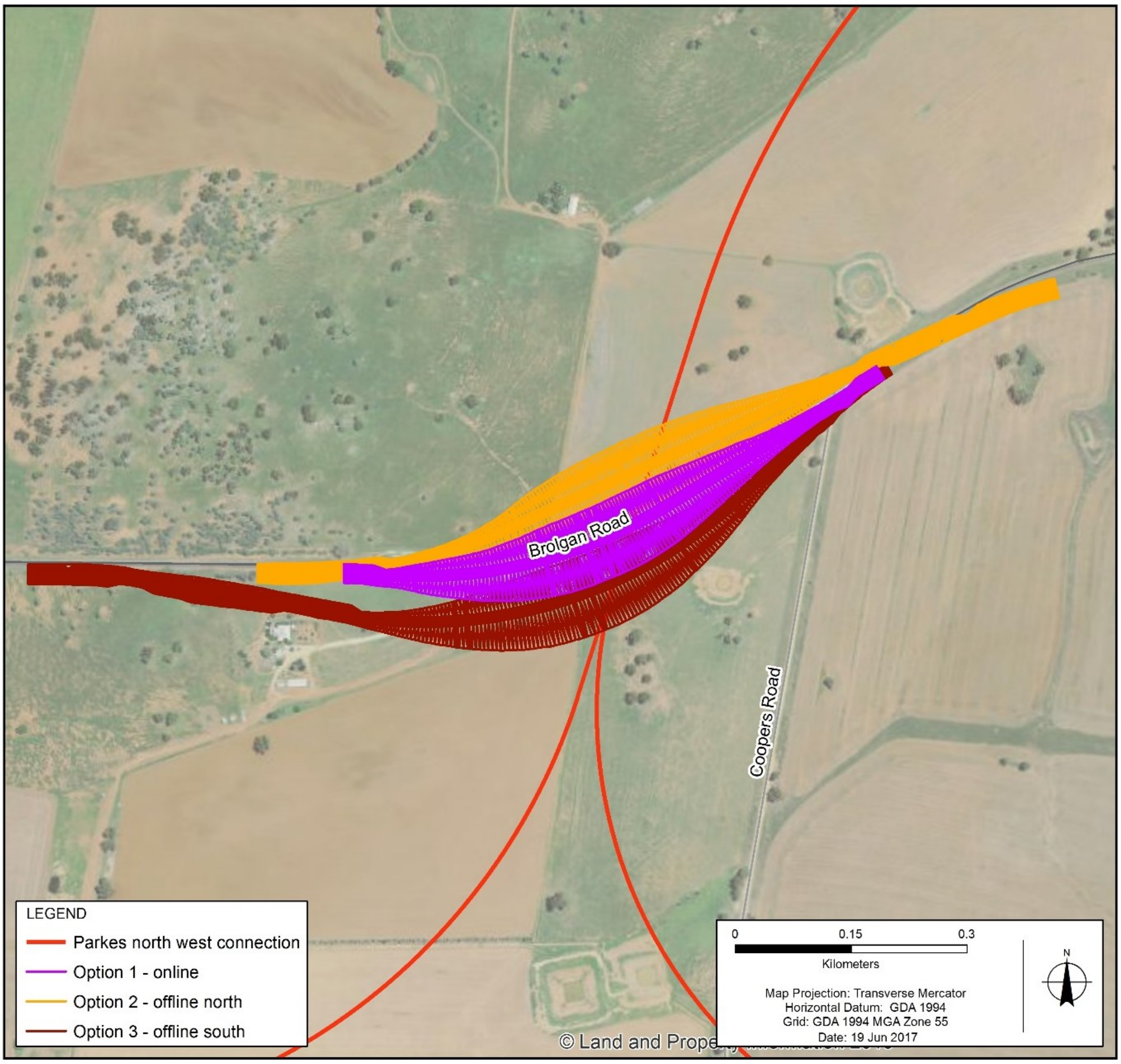

Figure 6.2 Brolgan Road overbridge options

Assessment

A multi-criteria analysis of the options was undertaken. The following criteria were used:

- technical viability
- safety
- operational approach
- constructability and schedule
- approvals and stakeholder risk
- environmental and heritage impacts
- community and property impacts.

Preferred option

The assessment concluded that option 2 (the offline north option) is the preferred option, as it scored highest as an outcome of the multi-criteria assessment. This option has the following benefits:

- improved bridge and road environment (shoulder, line marking etc)
- direct access to cutting material, meaning limited interaction with live traffic apart from tie-in works (minimal staging works)
- no high voltage impacts (clearances to be confirmed)
- no turnout at the bridge location
- limited bridge skew and no horizontal curve through the bridge
- minimal impact to nearby residents.

This option forms part of the proposal (as part of the works required to undertake the Parkes north west connection), and further information is provided in chapter 7.