

Project Evaluation Summary

METRONET: Thornlie-Cockburn Link

Proponent Western Australian Government
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1. Summary

Infrastructure Australia has added the **Thornlie-Cockburn Link** project to the Infrastructure Priority List as a **Priority Project**.

Perth's population has grown strongly over the past 20 years, particularly in the southern suburbs between the Armadale and Mandurah Lines, such as Canning Vale, Southern River, Piara Waters and Harrisdale. Residents of these areas rely on buses or cars to access nearby railway stations, or use cars for their entire journey. Some of these bus services and major interchanges such as Murdoch are now at, or forecast to reach, capacity.

The Thornlie-Cockburn Link is a project within the Western Australian Government's METRONET program. It follows the Forrestfield Airport Link and the Rail Car Program which will be delivered as part of Stage 1 of the METRONET program. The Thornlie-Cockburn Link seeks to increase the capacity of Perth's metropolitan railway network and encourage urban infill by extending the Thornlie Line to Cockburn Central, creating an east-west link between the Mandurah Line and the Armadale Line through Jandakot, Canning Vale and Thornlie. Using part of the existing Midland to Kwinana freight corridor, it is an opportunity for urban renewal in a predominantly industrial area, and could reduce pressure on other stations such as the Murdoch Interchange.

The Western Australian Government's stated benefit-cost ratio for the project is 1.2 excluding wider economic benefits, with a net present value of \$151 million (using a 7% real discount rate and P50 capital cost estimate).

Infrastructure Australia identified a number of limitations in the proponent's cost-benefit analysis which, in combination, slightly overstate the reported benefit-cost ratio. These include the estimation of benefits arising from land use change within the corridor, which are encouraged, but appear to have been overestimated. Together with the high capital costs of the project, Infrastructure Australia considers that the benefits of the project would marginally exceed its costs.

2. Strategic context

The need for Perth's rail network to play an increasing role in encouraging more people to use public transport and reduce pressure on the road network was recognised in the Infrastructure Priority List. The Priority Initiative for *Perth Rail Network Capacity* identifies a broad range of potential options to increase the capacity and quality of rail services (potentially through upgrades to train control and signalling, rolling stock, rail lines and stations, line extensions, and level crossing removals), consistent with the METRONET Program.

Perth's population has grown strongly over the past 20 years. Before the mining investment boom, the population of Greater Perth grew at an average annual growth rate of 1.5%. Annual growth increased to 2.6% between 2002 and 2012 during the height of the mining investment boom, before falling to 0.9% from 2013 to 2016. Beyond 2017, the population is forecast to grow by 1.9% each year to 2050.

Reflecting on the predicted population growth rates and historical development patterns, *Perth & Peel @ 3.5 million* estimates that the population in the greater metropolitan region will increase from approximately 2 million people in 2017 to 2.9 million people by 2031, and 3.5 million people by 2050. It encourages greater urban consolidation and creates more integrated and connected transport networks.

Suburbs to the south of Perth, between the Armadale and Mandurah Lines, such as Canning Vale, Southern River, Piara Waters and Harrisdale have seen rapid population growth in recent years. Residents of these areas rely on buses or cars to access the rail lines at nearby stations, or use cars for their entire journey. Some of these bus services are predicted to have capacity constraints, and interchanges such as Murdoch are reaching capacity.

By increasing the interconnectivity of Perth's rail network and providing a new east-west rail connection, the project supports major planning policies and strategies such as the *State Planning Strategy 2050*, *Directions 2031 and Beyond*, and *Perth & Peel @ 3.5 million*.

3. Problem description

The proponent has identified three core problems which the Thornlie-Cockburn Link seeks to address:

- The connectivity of the existing transport system is insufficient to cope with population growth and support employment nodes in the South Metropolitan Peel sub-region
- The radial design of the current passenger rail network creates service gaps in public transport and reduces system resilience which limits passenger mobility in the South Metropolitan Peel sub-region
- Economic and population growth pressures in the South Metropolitan Peel sub-region are leading to increased congestion and crowding across the transport system, adversely impacting on the productivity of the system.

Murdoch Station is the busiest suburban station on the Perth rail network. The capacity of Murdoch Station has been identified as a significant network constraint. Between July 2017 and June 2018, the station catered for an average of 7,600 weekday boardings or around 2,700 boardings in the morning peak (two-hour). The station accommodated 1.9 million passengers in 2017, or 24% of the total boardings on the Mandurah Line.

This demand is placing pressure on the station, with an average of 2.2 buses arriving each minute between 7am and 8am (130 arrivals in total). Vehicle surveys at Murdoch Station have shown that a large proportion of passengers are travelling from the Canning Vale, Southern River, Piara Waters and Harrisdale areas.

There are currently 32 bus services per hour (2017 one-hour AM peak) across 8 routes in the study area, with 15 minutes between services during the morning peak. The Murdoch bus interchange is at capacity in terms of active bus stands and layover.

Population in the South Metropolitan – Peel region is forecast to grow by an additional 300,000 people by 2050 (2.3% per annum). Within the study area between the Mandurah and Armadale Lines, population is forecast to grow by an additional 29,000 people (or 40%) from the current 71,000 to 100,000 by 2031. As a result:

- Four bus routes are forecast to operate over capacity by 2031 (up to 180%), even with an additional 13 services by 2031 (totalling 45 services per hour).
- Murdoch Station boardings are forecast to nearly double to more than 15,000 passengers per day by 2031. The 2015 Australian Infrastructure Audit forecasts the Mandurah Line to exceed crush capacity by 2031.

- Daily vehicle trips to and from the study area are forecast to increase by 24,000 (60%) by 2031. A number of key roads are forecast to be operating close to or over capacity by 2031 (two-hour AM peak), including the Kwinana to Perth CBD and Roe Highway east-west connection (90% to over 100% of capacity at various sections).

4. Proposal

The Thornlie-Cockburn Link would link Thornlie Station on the Armadale Line to Cockburn Central Station on the Mandurah Line. There would be two new train stations (Nicholson Road Station and Ranford Road Station) and approximately 17 kilometres of rail track. The project includes the following elements:

- Beckenham Junction to Thornlie Station – duplication of 3 kilometres of existing single track
- Thornlie Station to Glen Iris Tunnel – 11 kilometres of new dual track passenger rail, parallel to the existing Midland to Kwinana freight line, which itself will be realigned to the northern side of the rail corridor
- Glen Iris Tunnel to Cockburn Central Station – a 3.5 kilometre extension to Cockburn Central Station, with the existing Mandurah Line tracks realigned to allow for the two extended Thornlie Line tracks to run between them
- Extending platforms at Cockburn Central Station to incorporate the project, while allowing the new link to operate independently of Mandurah Line train services
- A new station at Nicholson Road with a bus interchange and provision for approximately 1,000 park and ride spaces
- A new station at Ranford Road with a bus interchange and approximately 400 park-and-ride spaces
- Upgrades to Thornlie Station to accommodate six-car trains and other works to allow the station to function as a ‘through’ station to the existing Cockburn Central Station
- Four train services per hour in the AM peak between Cockburn Central Station and Thornlie Station
- Additional and rerouted bus routes to service the new stations, creating a requirement for 12 new buses.

On opening, the Thornlie-Cockburn Link would use the existing Thornlie Line A-Series trains, which are stored at the Claisebrook Depot in East Perth. In future, there will be a partial cascading of B-Series trains to the Thornlie-Cockburn Link when new-generation rolling stock are deployed on other lines. These B-Series trains would also likely be stored and maintained at the Claisebrook Depot, noting that other depot options are being considered by the proponent.

The new trains will be longer than the A-Series trains currently operating on the Thornlie Line. While the Thornlie-Cockburn Link stations will be designed to accommodate this rolling stock, selective door opening or platform extensions will be needed at existing stations on the Armadale Line section of the route. The proponent is developing a strategy to address this issue.

5. Options identification and assessment

The proponent identified a long-list of options to address the three problems identified above, which were assessed using a mostly qualitative two-stage multi-criteria analysis to select the preferred scope of the project. This was supported by a rapid-economic appraisal of the heavy rail option, which was compared to light rail and bus rapid transit options.

The long-list of options was developed by a wide range of stakeholders and included a “do-minimum” option, a regulatory reform option, and eight capital investment options. While the capital investment options ranged across road, bus, light rail and heavy rail solutions, identifying other options based on regulatory reform, governance reform and making better use of existing assets would have improved the rigour of the options identification and assessment process.

The proponent used multi-criteria analysis to qualitatively assess the long-list of options against a range of criteria, including improving transport connectivity, addressing service gaps, and the feasibility and cost of implementation. These criteria reflected the objectives of the project but, in some instances, were not mutually exclusive (e.g. improving transport connectivity, compared to addressing service gaps).

These three options scored the highest in the multi-criteria analysis:

1. Connect Thornlie Rail Link to Cockburn Central Station via Canning Vale (highest scoring option)
2. Extend Thornlie services to a new station at Nicholson Road in Canning Vale
3. Extend Thornlie services to new stations at Ranford Road and Nicholson Road in Canning Vale

The second phase of the multi-criteria analysis process assessed the three short-listed options against their effectiveness, duration, deliverability, adaptability and estimated investment cost. While this was an appropriate range of criteria, it differed from the criteria used in the first phase multi-criteria analysis for the options long-list. Infrastructure Australia recommends the use of consistent criteria throughout the options assessment processes. This will improve the consistency of results and ultimately the assessment of how each option could address the identified project objectives. Nevertheless, the second phase of the multi-criteria analysis also found 'Connect Thornlie Rail Link to Cockburn Central Station via Canning Vale' to be the highest scoring option.

The proponent also undertook a rapid cost-benefit analysis of this option compared with two bus rapid transit alternatives (one using the existing road network, and another running adjacent to the freight rail corridor). This analysis also showed that the heavy rail option had the potential for delivering the highest social, environmental and economic benefits, as measured by the benefit-cost ratio and net present value. This was the option that was taken forward to the final cost-benefit analysis.

We strongly support the use of rapid cost-benefit analysis in assessing a short-list of options compared to the use of multi-criteria analysis, which relies heavily on qualitative assessment and subjective scoring. This process could have been improved by introducing more quantitative measures to support scoring, using a consistent set of criteria and ensuring that criteria do not overlap. The Infrastructure Australia Assessment Framework (IAAF) also recommends that business cases consider at least two options, in addition to the base case, for transparency and comparability.

6. Economic evaluation

The proponent's stated benefit-cost ratio for the project is 1.2 excluding wider economic benefits, with a net present value of \$151 million (using a 7% real discount rate and P50 cost estimates). The major benefits of the project are travel time savings for public transport users (35% of total benefits) and road users (28%). The project would also reduce car crashes and environmental emissions by encouraging more people to use public transport.

The proponent has estimated second round transport benefits resulting from land use changes caused by the project (\$83 million, or 9%, of total benefits). While the project has potential to promote higher density land use around the stations, the appraisal has assumed a large proportion of people will relocate from areas such as Rockingham and Mandurah into the Thornlie-Cockburn Link corridor (i.e. 30 – 60 kilometres), whereas evidence shows people tend to relocate shorter distances (i.e. 5 – 10 kilometres), which would reduce the second round transport benefits, and slightly reduce the benefit-cost ratio for the project.

The proponent has estimated that the project would generate \$440 million in wider economic benefits, resulting in a net present value of \$591 million and a benefit-cost ratio of 1.7. However, as the change in density attributed to the project is relatively low, and the Thornlie-Cockburn Link corridor would initially remain largely industrial in the short- to medium-term, these benefits have been considered as an upside sensitivity to avoid potential double counting. The methodology underpinning the quantification of wider economic benefits in Australia is still under development.

The project would encourage more people to use the rail network instead of driving, which would result in lower vehicle operating costs, crashes and emissions for people who switch modes, and also for people who continue to use the road network (because of lower traffic volumes). However, the cost-benefit analysis attributes a significant proportion of these benefits to commercial vehicles, because of reduced congestion and less vehicle kilometres travelled. This implies that a large number of commercial vehicles are choosing different routes, which is not a typical outcome of public transport projects. Adjusting the commercial vehicle proportion of these benefits would slightly reduce the benefit-cost ratio for the project.

The estimated capital cost of the project includes the procurement cost savings from combining the Thornlie-Cockburn Link with the Yanchep Rail Extension. However, the proponent has submitted separate business cases for the two projects. On this basis, each project has been assessed individually on its merits, rather than as part of a program (which would include any cost savings and shared benefits).

The proposed medium-term configuration of rolling stock on the Thornlie-Cockburn Link is longer than some of the stations along the Armadale Line¹. A number of options are under consideration to address this issue including platform lengthening, operating shorter trains at higher frequencies and selective door opening (i.e. the doors on carriages extending beyond the platform length will not open). The business case has assumed selective door opening would be used and has accounted for this in the transport modelling by reducing the capacity of trains, thereby capturing the disbenefit as increased crowding on trains. In reality, the alighting of passengers may cause delays if they still use these carriages and take longer to leave the train. If platform extensions are required, this would increase project costs and reduce the benefit-cost ratio of the project.

The proponent has included benefits from a travel behaviour change program which encourages people near the link to use public transport. While we support programs which promote public transport use, there is insufficient evidence in the business case to support the size of the benefits claimed in the economic appraisal.

Taking these limitations into account, Infrastructure Australia considers the strategic case for the project to be strong as it encourages better long-term land use outcomes, but that the benefits of the project are expected to be close to the costs.

A breakdown of the proponent's reported capital costs and funding is presented in the table below.

Capital costs and funding

Total capital cost	Pending (see endnote)
Proponent's proposed Australian Government funding contribution	80% of the project capital costs
Other funding (source / amount / cash flow) (nominal, undiscounted)	The Western Australian Government is funding the balance of the project.

¹ Including Beckenham, Cannington, Queens Park, Welshpool, Oats Street, Carlisle, Victoria Park, Burswood, Claisebrook and Perth stations

The following table presents the proponent's stated benefits and costs of the project.

Benefits and costs breakdown by the proponent

Proponent's stated benefits and costs		Present value (\$m, 2017/18) @ 7% real discount rate	% of total
Public transport user benefits			
	Public transport travel time savings	\$336	35%
	Increase in public transport fare revenue	\$63	7%
	Crowding benefit ¹	-\$13	-1%
	Improved public transport station and vehicle amenity	\$33	3%
	Improved reliability	\$55	6%
	Improved network resilience	\$28	3%
	Benefit of travel demand management	\$12	1%
Road user benefits			
	Road user travel time savings	\$268	28%
	Reduction in unperceived road vehicle operating costs	\$80	8%
	Road crash cost savings	\$3	0%
Community and broader benefits			
	Other externality cost savings (air pollution, noise, etc.)	\$17	2%
	Residual capital value	\$5	1%
Land use intensification benefits			
	2 nd round transport benefits	\$83	9%
Total benefits²		\$969 (A)	100%
Total capital and operating costs		\$818 (B)	100%
Core results	Net benefits - net present value (NPV)³	\$151 (C)	n/a
	Benefit–cost ratio (BCR)⁴	1.2 (D)	n/a
Results including Wider Economic Benefits	Wider Economic Benefits (WEBs)	\$440 (E)	n/a
	Net benefits – NPV with WEBs⁵	\$591 (F)	n/a
	BCR with WEBs⁶	1.7 (G)	n/a

Source: Proponent's Business Case

Notes:

(1) A negative crowding benefit denotes an increase in crowding. In other words, the project leads to additional crowding on the public transport network due to increased patronage.

(2) Totals may not sum due to rounding.

(3) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A – B).

(4) The benefit–cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

(5) The net present value with WEBs (F) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) – B)

(6) The benefit–cost ratio with WEBs (G) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) ÷ B)

7. Deliverability

The proponent has developed a delivery strategy for the project. The proponent's 'Project Definition Plan' recommends:

- Bundling the main project works for Thornlie-Cockburn Link with Yanchep Rail Extension in a single Competitive Alliance contract to create a combined contract value of approximately \$1 billion
- Design and Construct contracts to procure forward works on each site
- Procuring professional services using the Public Transport Authority Long Form of Consultancy Contract with the option to include additional projects based on performance.

If the projects are not jointly delivered under a single competitive alliance contract, capital costs could increase due to forgone synergies. The capital cost estimates exclude costs for rolling stock (assumed to be delivered under the METRONET program) and for stabling and maintenance facilities (to be addressed through a network-wide route utilisation strategy under development). However, it is generally best-practice to include all project related costs and benefits within the project business case.

The capital cost estimates (including risk contingency) have been reviewed on behalf of the Department of Infrastructure, Regional Development and Cities. The review estimated a most likely total outturn capital cost that was 6.6% lower than the original estimate (for both P50 and P90 cost estimates). This provides Infrastructure Australia with a relatively high degree of confidence in the rates and contingency in the capital cost estimates.

Planning and delivery of the project would be in accordance with the METRONET Governance Framework. The State Government's proposed joint land development agency (combining the Metropolitan Redevelopment Authority and LandCorp) and/or the Western Australian Planning Commission would be responsible for working in collaboration with local government, communities and stakeholders to establish detailed planning frameworks for each new station precinct.

A number of potential funding sources for the project have been identified by the proponent, including fare box revenue, value capture around new station precincts (developer contributions), federal funding and state funding. However, Infrastructure Australia has not been provided with a financial model for the project which demonstrates the viability gap and the impact of different delivery options or funding solutions, and strongly recommends that this be completed before the project proceeds.

A risk assessment has been completed in accordance with the METRONET Risk Management Framework, PTA's Risk Management Procedures, which includes assigning risk owners responsibility for identifying mitigation strategies and monitoring completion of these strategies, and probabilistic quantification of risks in capital cost estimates. The most significant project risks have been identified and include systemic variations risk, and uncertainties relating to stations, platforms, retaining walls, track progress, signalling, communications, earthworks scope, track and material cost. Overall, the risk assessment and mitigation approach is appropriate.

The rail line would be constructed in an existing freight corridor, as per an existing lease agreement between the State Government and the freight rail lessee. This reduces capital costs for the project as the land is already owned by the State Government. However, there will need to be ongoing work to mitigate the impacts on the freight rail operations during the construction and operational phases. An aviation fuel pipeline also runs through the corridor, and it is necessary to partially or fully protect and/or relocate a section(s) of this pipeline (currently in negotiations). Infrastructure Australia strongly recommends that these issues are resolved before the project proceeds.

A Benefits Management Plan has been developed for the project, which includes a framework for benefits management for transport, land use and wider economic benefits, but does not define specific benefit owners or key performance indicators for measurement. Infrastructure Australia strongly recommends that this be completed before the project proceeds, and that if the project does proceed, a post-completion review is undertaken to understand how the costs and benefits of the project compare to the business case.

This evaluation summary was considered by the Infrastructure Australia Board in November 2018.

Following Infrastructure Australia's process of fact and sensitivity checking the summary with the proponent prior to publication, the summary was amended to exclude the capital cost (nominal, undiscounted) pending the Western Australian Government's clearance for publication.