Australian Government | Infrastructure Australia

Project business case evaluation summary

Perth Level Crossing Removals – Inner Armadale Line

Location
Perth, Western Australia

Geography
Fast-growing cities

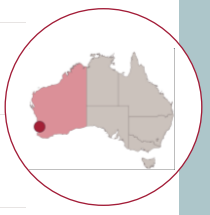
Category
Urban congestion

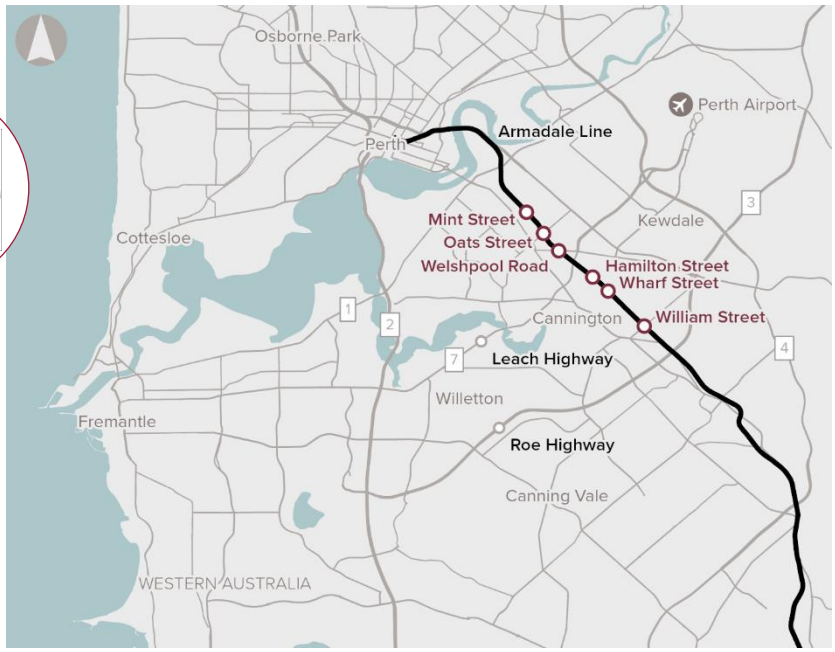
Capital cost
Pending (see endnote)

Indicative timeframe
Construction Start: 2021
Project completion by: 2023

Proponent
WA Government

Evaluation date
8 December 2020





1. Evaluation Summary

Level crossings on the Inner Armadale Line are causing significant problems, including vehicle and pedestrian safety issues and traffic delays.

Addressing the problems would contribute to the objectives of the METRONET rail program, which are to support sustainable population growth in Perth while supporting economic growth, connectivity between communities and businesses, and accessible travel and lifestyle options.

The business case proposes six grade separations between Mint Street and William Street (comprised of two groups of three level-crossing removals). The proposed works also include reconstructing stations, and extending station platforms to accommodate longer trains that are planned to be deployed onto the Armadale Line in 2031.

The proponent's business case reports that the costs of the project will significantly outweigh the social, economic and environmental benefits, with a benefit-cost ratio (BCR) of 0.36 and a net present value (NPV) of -$569 million. The proponent also considered the two groups of level-crossing removals individually, identifying a net present value of -$241.4 million for Group 1 and -$215.9 million for Group 2. Both groups had individual benefit-cost ratios of 0.5, using a 7% real discount rate and P50 capital cost estimates.

Our review found that the stated benefits of the project are likely to be underestimated. However, with the scope proposed, our analysis found that the project is unlikely to deliver a productivity benefit to the economy. There is also limited evidence that the grade separations are the most cost-effective solution for addressing the identified problems.

On the balance of our assessment, the Perth Level Crossing Removals – Inner Armadale Line project has not been added to the Infrastructure Priority List as a project at this time.

2. Context

The business case notes that there are 30 level crossings on the Armadale, Midland and Fremantle lines. These lines were constructed in the late 1800's and are referred to as the 'Heritage' lines.

Increased population and high car-use rates have resulted in traffic delays on road corridors adjacent to the Armadale Line where level crossings are in place. As traffic increases, congestion for vehicles at level crossings and conflicts between rail and road users and pedestrians will increase. Without intervention, the main problems are:

- Increased interactions between rail and road users creating safety risks, leading to near-misses, accidents and fatalities.
- As the frequency of rail services increase, road users face travel delays due to longer boom-gate closures, particularly during peak periods.
- Longer boom-gate closures can create community severance and reduce amenity.

METRONET is an overarching program to sustainably support population growth, including by enabling economic growth, housing and employment choice throughout Perth. Strategic METRONET objectives include:

- Supporting economic growth with better connected businesses and greater access to jobs
- Delivering infrastructure that promotes easy and accessible travel and lifestyle options
- Creating communities that have a sense of belonging and support Perth's growth and prosperity.

This project would remove six level crossings along the inner section of the Armadale Line through an elevated rail line for the first group of three stations (removing the Mint Street, Oats Street and Welshpool Road level crossings), and two raised sections for the second group of stations (removing the Hamilton Street, Wharf Street and William Street level crossings). There are also station upgrades that create opportunities for land use changes, generating benefits such as amenity from new open public space, reduced urban heat island effects, and recreational benefits.

This project has been designated by the WA Government as a 'project under acceleration' as part of its commitment to economic recovery in the wake of the COVID-19 pandemic, and outlined in the State Government's WA Recovery Plan.

Perth Rail Network Capacity is a Priority Initiative on the Infrastructure Priority List. This Initiative recognises that investments are required to improve Perth's rail capacity, including higher capacity rolling stock, longer train station platforms, and signal upgrades. Investments in rolling stock are funded and committed, with higher capacity trains expected to come into service on the Armadale line by 2031.

3. Problem description

Perth is home to 2 million people and is expected to grow by 1.5 million to reach 3.5 million people by 2050. Population growth is the root cause for increased road traffic congestion at level crossings. Increasing passenger rail patronage will require more train capacity to meet demand.

With the level crossings in place, this will lead to more frequent and longer boom-gate closures and travel time delays for road users. More train services, pedestrians and traffic congestion around level crossings may also result in an increased number of near-misses and collisions as road users take risks to reduce travel times.

The proponent has identified three main problems:

1. Boom-gate closures constrain road capacity, causing travel delays and unreliable travel times, especially in peak periods: Boom gates on the inner Armadale Line can be closed for up to 25 minutes per hour during peak times currently. The Oats Street and William Street boom gates are forecast to be closed for over 45 minutes per hour in the AM peak by 2041. This causes road congestion and increases travel time, vehicle operating costs and emissions.

2. The conflict between trains, vehicles and pedestrians at level crossings creates a significant safety risk: There is a history of collisions and near-misses at Perth's level crossings. Seven incidents and 80 near-misses were recorded across the project's six level crossings from 2015 to 2019. Only reported near-misses are accounted for in these statistics. Incidents can cause injuries/fatalities, equipment damage, and service disruptions. Near-misses create reporting and evaluation costs, and in some cases service disruption costs, and trauma to drivers and pedestrians.
3. Level crossings with lengthy boom-gate closures reinforce community severance and reduce amenity.

The proponent has also identified an opportunity to improve land use outcomes through the project. Raising the rail line would open areas within the rail corridor that are not currently accessible to the public, which could be used for community, recreational, open space, and green space uses. Raising the rail line could also improve at-grade connectivity across the rail corridor. These amenity improvements could also attract new residential and commercial developments close to Perth's CBD.

4. Options identification and assessment

The options identification and assessment process included four steps:

1. Prioritise level crossings for removal
2. Identify the best type of solution (capital, non-capital)
3. Group the level crossings and identify the viable rail and road separation options
4. Identify the preferred road and rail separation option for each level crossing group

A quantitative multi-criteria analysis (MCA) was used to prioritise the 16 Armadale Line level crossings for removal. The six inner-section level crossings scored highest on the quantitative MCA. The Inner Armadale line was identified as the highest priority line-section on the basis that the vehicle delays are currently highest at these six level crossings and are forecast to be highest in the future.

The proponent considered regulatory solutions (such as restricting vehicle access), asset reform solutions (such as bus rapid transit), and capital investments (such as underground rail, light rail, and level crossing removals) for addressing the problem. These were assessed qualitatively against four strategic objectives (safety, congestion, rail capacity growth and local communities). Non-capital options were not considered viable as they did not address the identified problems nor meet the strategic objectives of the project.

The crossings were grouped into two groups based on their impact and proximity to each other. Once grouped, different grade separation solutions were assessed for each group with two solutions shortlisted. The shortlisted options were assessed using a rapid cost-benefit analysis (CBA) and a qualitative MCA. A fully elevated rail option for Group 1 and a two-viaduct option for Group 2 were identified as the preferred options.

Our review of the analysis found that the fourth appraisal step could have been strengthened by including more quantitative information.

The preferred option includes the most expensive solutions across the two groups, adding $143.5 million of capital and operating costs to the final project lifecycle cost. Given the lack of differentiation from a transport modelling perspective, the selection of these options would have benefitted from more quantified justification. The proponent also assessed delivering each group separately and found that each individual group generated net present values and benefit-cost ratios higher than the combined option.

We support the proponent's commitment to conducting a value engineering exercise to explore options to improve the project's value for money.

5. Proposal

The proposed project would remove six level crossings along at the inner section of the Armadale Line through an elevated rail line for the Group 1 stations, and two raised sections for the Group 2 stations:

- Group 1: Mint Street, Oats Street and Welshpool Road: a 1.6 km elevated rail line will be constructed over Mint Street and Oats street. Carlisle and Oats Street stations will be reconstructed as elevated stations. Welshpool Road station will be closed. 3.8 hectares of rail corridor will be converted into public open space.
- Group 2: Hamilton Street, Wharf Street and William Street: a 900-metre elevated rail line will cross Hamilton and Wharf Street. Queens Park and Beckenham Stations will be reconstructed as elevated stations.

Removing the level crossings allows road traffic to cross under the rail line without stopping or queueing for boom-gate closures. Separating the rail line and the road also removes the potential for incidents and near-misses between pedestrians and road users with trains.

The new stations will be able to service longer trains which are planned to be introduced by 2031 as part of the Public Transport Authority's (PTA) Network Concept Train Operating Plan (2018). The area underneath the raised rail line will be transformed into public open space and will facilitate active transport connectivity.

6. Strategic fit

Removing level crossings from Perth's transport network aligns with the objectives of the METRONET program to support sustainable population growth in Perth while supporting economic growth, connectivity between communities and businesses and accessible travel and lifestyle options.

The level crossing removal project also promotes greater community amenity from transforming the rail line to open public spaces. This amenity benefit aligns with the METRONET objective of creating communities that have a sense of belonging. This community amenity was not monetised by the proponent.

In addition to METRONET, the project aligns with state and local policies and plans, including:

- Perth and Peel @ 3.5 Million – the Transport Network: this plan sets out WA Government's vision for Perth's future transport network. This project aligns with the plan by reducing congestion and making public transport more attractive by facilitating higher capacity trains and constructing more accessible stations.
- City of Canning Integrated Transport Strategy: The Group 2 stations are in Canning. The City of Canning Integrated Transport Strategy recognises the congestion and safety issues at the level crossings within its jurisdiction.
- Office of the National Rail Safety Regulator - Railway Crossings Policy: This policy primary objective is to encourage safe rail operations. Removing the level crossings on the Armadale line will reduce the chance of incidents occurring, which aligns with the regulator's policy.

7. Economic, social and environmental value

The proponent's business case considered the quantified social, economic and environmental costs and benefits of Group 1 options and Group 2 options separately, and as a combined option.

The proponent's analysis found that the project's quantified social, economic and environmental benefits are lower than its costs for both groups, with a net present value of -$241.4 million for Group 1 and -$215.9 million for Group 2. Both groups had individual benefit-cost ratios of 0.5, using a 7% real discount rate and P50 capital cost estimates. The proponent also considered a 4% discount rate, which reported a benefit-cost ratio of approximately 0.9 for each group.

The proponent's business case found that delivering both Group 1 and Group 2 would result in a net present value of -$569.0 million and a benefit-cost ratio of 0.36, using a 7% real discount rate and P50 capital cost estimates. The proponent also considered a 4% discount rate for the

combined option, which reported a benefit-cost ratio of 0.6 and a net present value of -$410.7 million.

The proponent's quantified public transport user benefits (travel time and fare revenue benefits), road user benefits (travel time saving, vehicle operating costs savings, crash savings), and externality benefits were estimated using the strategic transport evaluation model (STEM). The level crossing incident savings were estimated through separate analysis outside of STEM.

The proponent assumed benefits would grow at 2.8% beyond 2041 (the final transport modelling year), based on the long-term patronage on the Perth public transport network. Where benefits are extrapolated beyond the final model year, proponents should demonstrate that the network has sufficient capacity to accommodate the forecast growth. Our sensitivity tests using forecast volume/capacity ratios for the two traffic corridors near the Armadale Line (Graham Farmer Freeway/Orrong Road and Albany Highway) indicates this growth rate may not be realisable without additional capacity.

The project evaluation found that the social cost-benefit analysis does not fully align with Australian Transport Assessment and Planning guidelines and the Infrastructure Australia Assessment Framework in the following areas:

- Strategic transport model: The business case uses the STEM to estimate most of the impacts of the project. However, STEM does not consider individual vehicle trips and is not detailed enough to differentiate between the economic benefits of the project sub-options for each group of level crossings. ATAP guidelines note that strategic models are appropriate for strategic planning purposes, and that the selected modelling tool needs to be sensitive to the relevant issues of a project. Given the project cost and primary driver to alleviate road congestion, Infrastructure Australia considers that a more detailed microscopic model would have provided a more accurate estimate of the economic benefits of the project.
- Safety benefits: the business case assumes that a near-miss costs society half as much as an actual level crossing incident. This assumption is based on a case study in a superseded Transport for New South Wales guidance document. Whilst we recognise that near-misses do result in some costs, there is insufficient evidence to support the proposed approach.

Our review acknowledged that some benefits have not been quantified in the social cost-benefit analysis:

- Land use benefits: a key feature of the project is the potential land use benefits from transforming rail corridors into public and community spaces. This feature may generate tangible and realistic economic benefits to the local community. The proponent stated that these benefits were not monetised in the business case.
- The project supports the increase of Perth's rail capacity (higher capacity rolling stock, longer train station platforms, and signal upgrades). Not increasing rail capacity will cause passenger crowding and mode shifting. These benefits, which are enabled in part by elements of this project, have not been directly captured in this business case.

On balance, with the scope proposed, the project is unlikely to deliver a productivity benefit to the economy.

The cost estimate has been developed by a cost consultant and are probabilistic. The cost estimate reflects a concept level design standard and are identified as Class 5. The Department of Infrastructure, Regional Development, and Cities identifies a typical contingency of 30 – 100% for a Class 5 P50 cost estimate. The cost estimates for the combined option provided in the business case infer that, at P50 costs, contingencies are 18.3% of base costs.

The following table presents a breakdown of the benefits and costs stated in the business case.

Benefits and costs breakdown

Proponent's stated benefits and costs	Present value ($m,2018/19) @ 7% real discount rate		% of total
Benefits			
Road user benefits	$280.4		89.1%
Public Transport user benefits	$13.4		4.3%
Pedestrian incident savings	$7.3		2.3%
Externalities	$6.8		2.2%
Service disruption savings	$6.4		2.0%
Open Level Crossing vehicle incident savings	$0.4		0.1%
Total Benefits[1]	**$314.7**	(A)	**100%**
Total Costs[1] (see endnote)	**$883.7**	(B)	**100%**
Net benefits - Net present value (NPV)[2]	**-$569.0**	(C)	n/a
Benefit-cost ratio (BCR)[3]	**0.36**	(D)	n/a

Source: Proponent's business case

(1) Totals may not sum due to rounding.
(2) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A – B).
(3) The benefit–cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

The proponent's reported capital costs and funding is presented in the following table.

Capital costs and funding	
Total capital cost (Group 1 + Group 2)	(see endnote)
Group 1 – total estimated cost	(see endnote)
Australian Government funding contribution (committed)	$207.5 million
WA Government funding (committed)	$207.5 million
Group 2 – total estimated cost	(see endnote)
Australian Government funding contribution (proposed)	50%
WA Government funding (proposed)	50%

The existing funding commitments to Group 1 are less than the P50 outturn cost estimate. The business case states that the proponent intends to remain within the funding envelope through scope and design refinement, noting that any residual funding shortfall would be met by the WA Government.

8. Deliverability

A workshop was held between WA representatives to assess delivery options. Two shortlisted options, a competitive alliance (CA) and a design and construct with early contractor involvement (DC-ECI), were short-listed at this workshop. The stated advantages of the shortlisted options are:

- Competitive alliance: this approach drives value-for-money due to the competitive process. Other advantages include flexibility to extend other future packages. A competitive alliance is also suitable for complex projects.

- Design and Construct with early contractor involvement: this approach suits high value and complex projects as it promotes innovation from a cohesive design and construction method. Other advantages include allowing PTA to transfer the design risk to the contractor.

The proponent also confirmed that the procurement process aligns with State procurement guidelines. Furthermore, the Office of Major Transport Infrastructure Delivery has been established to resource and plan major projects. The proponent has stated that the preferred delivery option will be re-assessed and confirmed prior to initiating the project.

During the evaluation, the proponent confirmed that:

- based on current knowledge, it is unlikely that a registered aboriginal heritage site will be identified
- no matters of national environmental significance under the Environmental Protection and Biodiversity Conservation Act are significantly impacted
- a native vegetation clearing permit is not required and any tree removal is likely to be authorities through the planning approval process
- other environmental approvals (including dewatering approvals and out-of-hours works approvals) will be required and obtained by the delivery team.

The proponent's risk analysis identified three items with a high residual risk including the potential for new public open space beneath viaducts becoming blighted; loss of long-term bus and rail patronage; and delivery delays or cost increases due to market constraints. Of the remaining risks, four were classified as medium. These relate to approvals and community concerns. Mitigation measures have been proposed for managing each risk. As with all complex construction projects in the rail environment, risks associated with unexpected utility impacts and unexpected site conditions will also need to be managed as the project proceeds.

The proponent's business case includes a post completion review plan for the project. This includes key performance indicators (KPI) and related metrics/measures for each objective of the project. The post completion review plan outlines the measures, target, baseline, data source, and reporting responsibility for each KPI. The KPIs are also aligned to the objectives of stakeholders, such as with ONSR's Railway Crossings Policy.

The proponent has confirmed that governance arrangements would be considered and developed during the project, and lessons learned will be informed by the planned quality assurance reviews, gateway reviews, and post completion reviews.

Infrastructure Australia is satisfied that the post completion review plan broadly conforms with the Assessment Framework and recommends the proponent use outputs from this project to inform future business cases.

Consideration of COVID-19

The COVID-19 pandemic has significantly affected the use of infrastructure. Infrastructure Australia has been working collaboratively with the Australian Government to provide advice on a staged response for managing, and recovering from, the impacts of the COVID-19 pandemic.

One critical element of our advice is to maintain a pipeline of nationally significant infrastructure investments. Nationally significant infrastructure projects are long-term investments, typically considering a 30-year view of the project's social, environmental and economic impacts. In making this recommendation, Infrastructure Australia continues to take a long-term view and has also considered the sensitivity of key planning assumptions using the best data available to us.

As noted in the 2019 Australian Infrastructure Audit, we must continue to evolve the way we plan for Australia's infrastructure to embrace uncertainty. There are still many uncertainties regarding the long-term impact of the COVID-19 pandemic on infrastructure use.

We will continue to collaborate with industry, the community and governments at all levels to understand the impacts of the COVID-19 pandemic on infrastructure decisions in Australia.

Infrastructure Australia has redacted capital cost (nominal, undiscounted) information from this evaluation summary as the project is in active procurement.