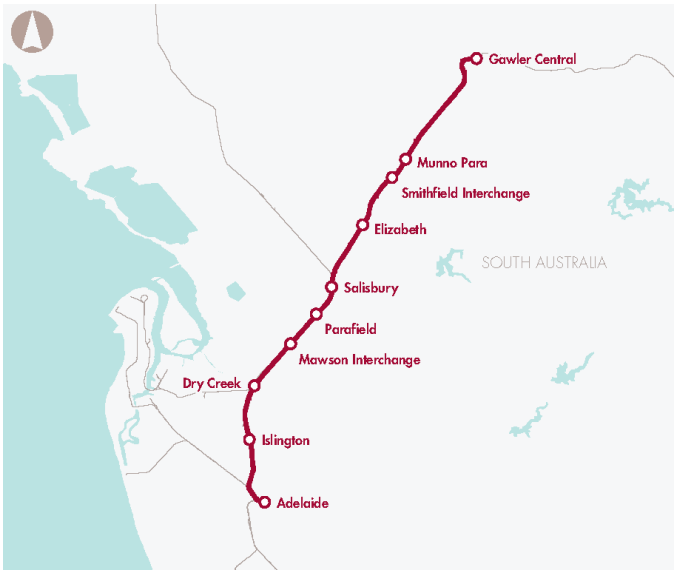
Project Evaluation Summary
Gawler Rail Line Electrification and Modernisation Project

Proponent South Australian Government
Evaluation date 30 August 2018



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1. Summary

Infrastructure Australia has added the **Gawler Rail Line Electrification and Modernisation Project** to the Infrastructure Priority List as a **Priority Project**.

The Gawler rail line provides a mix of express and all-stop passenger rail services between Adelaide's CBD and northern suburbs using a diesel fleet. It also provides access to the regional centres of Mawson Lakes, Salisbury, Elizabeth and Gawler. Patronage along the Gawler rail line grew by 30 per cent in the decade to 2016 to become the most patronised passenger rail route in Adelaide. Currently, passengers are using 75 percent of train capacity during the morning peak along the busiest sections of the rail line.

The Australian Infrastructure Audit (2015) identified that, owing to the current and predicted population growth in northern Adelaide, rail demand between Gawler and Adelaide is expected to almost double by 2031. As a result, the line could reach capacity within five to ten years. The *Gawler line rail upgrade* is currently listed as a High Priority Initiative on the Infrastructure Priority List and has progressed to Priority Project status.

The scope of the project includes electrifying the Gawler rail line, replacing the diesel fleet with electric train cars, replacing signalling equipment and systems, upgrades to 20 stations on the line, and extension or modification to 12 platforms. Replacing high polluting diesel motor units with electric motor units will reduce greenhouse gas emissions, noise and vibration. Rail users will benefit from faster journey times and increased service frequencies between Adelaide and Gawler Central.

The proponent's stated benefit-cost ratio (BCR) for the project is 1.1, with a net present value (NPV) of $44 million (using a 7% real discount rate and P90 cost estimate). Infrastructure Australia considers that the benefits of the project are likely to outweigh its costs, and that the project addresses broader strategic objectives by improving the accessibility and sustainability of transport to and from the northern suburbs of Adelaide.

2. Strategic context

The majority of the population growth projected for Greater Metropolitan Adelaide to 2061 will occur in Adelaide's northern suburbs along the Gawler rail line. Over the 50-year period to 2061, Greater Adelaide's population is expected to increase by approximately 650,000. This will be an increase of more than 50% over 2011 levels. Of this, nearly a fifth (100,000) will live in the City of Playford, which is serviced by the Gawler rail line and by Munno Para Station. Between Gawler and Broadmeadows, there were nearly 35,000 dwellings and 72,000 residents living within an 800 metre radius of the existing rail corridor as of 2015. The proponent estimates that the population within this section of the corridor could increase in the short-to-medium term by 19% under current density policies, and by 91% under higher density policies.

The northern suburbs of Adelaide historically have lower educational attainment and household incomes compared with the rest of Adelaide. The value of improved public transport and, in turn, improved access to jobs and services, strongly aligns with the priorities set out in the Australian Infrastructure Audit (2015), the South Australian Government's strategic plans, and the Australian Government's objectives for improved social equity through transport accessibility.

The project supports five of the seven strategic priorities set out in the Australian Infrastructure Audit (2015):

1. Expand Australia's productive capacity
2. Increase Australia's productivity
3. Develop our cities and/or regions
4. Reduce greenhouse emissions, and
5. Improve social equity and quality of life.

At the state level, providing convenient, efficient and attractive transport to connect people to jobs and services, and supporting a growing northern Adelaide, were key tenets of South Australia's State Strategic Plan that was first released in 2004 and the Northern Economic Plan (for South Australia) that was released in 2016.

The 30-Year Plan for Greater Adelaide (called "Living Adelaide" and updated in 2017) promotes a new urban form for the future development of Adelaide. The Plan recommends infill residential development to increase residential densities in key locations such as those adjacent to the Gawler rail line. In addition, the Integrated Transport and Land Use Plan released in 2015 sets out public transport solutions for Adelaide that focus on more reliable, frequent, direct and comfortable services that connect major activity centres and areas of employment growth. The proposed project can contribute to a more sustainable increase in residential densities in the corridor, and alleviate the challenges of population growth such as road congestion and improved access to employment across the city.

3. Problem description

The need for the project is driven by:

1. **Capacity limitations** - Increased patronage on the Gawler rail line is being driven by high population growth in areas that are serviced by the line, including Gawler-Two Wells, Playford and Salisbury. Rail services along the line, particularly for two-car sets which operate on 5 out of 12 peak period services, are becoming increasingly capacity constrained. Current demand levels result in two-car sets being at capacity from Mawson Interchange to Adelaide. Forecasts for 2021 suggest capacity constraints will appear earlier into the morning peak from further north at Salisbury. By 2036, the two-car sets are forecast to be at capacity from Elizabeth. The current train capacity and performance of the diesel fleet restricts the opportunity to increase capacity or frequencies on the Gawler rail line. In addition, the current electrified rail network operates with a single power sub-station and therefore provides little resilience in the event of sub-station failure or other power distribution issues that may occur.

2. **Operational inefficiency** - Diesel trains accelerate and decelerate more slowly, causing longer journeys between stations and limiting the ability to increase service frequencies. The existing signalling system also creates operational inefficiencies in stopping and starting that can be resolved with more up-to-date signalling systems. Twenty-two electric trains operate on other sections of the Adelaide rail network and are currently serviced at the Dry Creek Maintenance Depot on the Gawler rail line. Without a fully electrified rail line, diesel trains haul the electric fleet to and from the depot.
3. **Public safety** - The Gawler rail line has 19 (or 3%) of the 710 railway crossings on public roads in metropolitan and rural South Australia, and 89 (or 25%) of the more than 360 pedestrian crossings on Adelaide's passenger rail network. The number and low quality of crossings increases safety risks, with 29% of the 660 near misses at railway crossings reported between 2011 and 2015 occurring on the Gawler rail line.
4. **Environmental and health considerations** - The operation of diesel rail cars on the Gawler rail line can expose existing and potential new residents living along this corridor to harmful diesel emissions, including carbon monoxide, oxides of nitrogen, other particulate matter and polycyclic aromatic hydrocarbons. Diesel trains also emit carbon into the atmosphere contributing to the transport related carbon emissions for Adelaide.

4. Project overview

The complete Gawler Rail Line Electrification and Modernisation Project includes:

- **Electrification infrastructure -** Including the installation of an overhead wiring system
- **Electricity sub-station -** Constructing a new power feeder sub-station and suitable traction power infrastructure required to support the new electrified services
- **A new signalling system** - From Adelaide Station to Dry Creek Maintenance Depot and Gawler Central
- **Automatic Train Protection technology** – provides additional safety benefits and more reliable services by ensuring trains operate within the permitted speed limit
- **New infrastructure at Dry Creek Maintenance Depot** - To support the electrification of the line
- **New rolling stock** - Procurement of 15 three-car sets of the 4000-class rolling stock
- **Station platforms** - Extension or modification of approximately 12 station platforms and other station upgrades for use of three-car sets and coupled six-car sets
- **Pedestrian facilities -** Improved pedestrian facilities to access stations safely across the line and other station upgrades to 20 of the stations along the line.

5. Options identification and assessment

The proponent established a long list of 11 options which responded to each of the four identified problems. These options were qualitatively assessed against their ability to resolve or reduce the impact of each of the problems. The assessment used multiple criteria that included effectiveness (in resolving the identified problems), duration (the longevity of the impact), deliverability (complexity involved in procurement and delivery), and adaptability (to choose between alternative solutions). Four options were shortlisted:

1. **Option 1: Dry Creek -** Electrification to Dry Creek Maintenance Yard – aims to address operational issues with electric rail cars being towed by diesel rail cars to the Dry Creek Maintenance Depot.
2. **Option 2: Salisbury -** Electrification and modernisation to Salisbury Station – aims to address all four problem statements (in part), focusing on the minimum capital expenditure to support population growth in the northern suburbs near Salisbury Station. Diesel rail cars would continue to operate on the line to provide services to stations north of Salisbury Station.

3. **Option 3: Elizabeth -** Electrification and modernisation to Elizabeth Station – aims to address all four problem statements (in part) and requires a larger capital investment than Option 2 to support a greater catchment of population growth in northern Adelaide with electric train services to Elizabeth Station. Diesel rail cars would continue to operate on the line for services to stations north of Elizabeth Station.
4. **Option 4: Gawler Central -** Electrification and Modernisation to Gawler Central – aims to address all four problems and provide the greatest level of service. This project option would remove all diesel rail cars from the Gawler rail line.

Through a multi-criteria analysis that included both qualitative and quantitative measures, the proponent established Option 4 as the preferred option. This analysis assessed the ability of each short-listed option to resolve the four identified problems, and calculated the benefit-cost ratio resulting from investment in these options by way of a rapid economic analysis.

This assessment showed that, when compared with all the other shortlisted options, the preferred option (Option 4) would result in:

- The highest net present value at $53 million
- The highest number of public transport boardings (1,000 AM boardings by 2021)
- The lowest number of minutes lost due to operational issues (302 minutes per year)
- The highest number of pedestrian crossings treated
- The highest number of level crossings with improved safety
- The lowest volume of greenhouse gas and other harmful emissions

The proponent concluded that Option 4 was the preferred option owing to its ability to improve customer experiences, service the growing population of the northern suburbs of Adelaide, improve capacity along the entire line, its ability to run six-car electric trains to provide for future patronage growth, improve network resilience and reliability, and reduce exposure to reliability issues with diesel trains.

6. Economic evaluation

The proponent's economic appraisal indicates that the project is expected to have a BCR of 1.1 and a NPV of $44 million using a 7% real discount rate and P90 cost estimate when evaluated over a 30-year operational period. Public transport users would be the major beneficiaries of the project, with shorter journeys[1] and wait times on the rail line, as well as improved amenity from station upgrades and the new rolling stock.

Infrastructure Australia's analysis of the economic appraisal identified some areas that may be overstated:

- **Use of annualisation factors** – The proponent used a public transport annualisation factor of 293 to convert weekday travel times and distances to annual values based on network observations. This assumption may slightly overstate the benefits of the project compared to a more typical value of 280 used in previous business cases in South Australia.
- **Growth in project benefits beyond 2036** – The economic appraisal assumes that road and public transport user benefits will grow from 2036 (the last year of traffic modelling) to 2052 at a rate of 1% per annum. The business case does not provide enough evidence to support the growth of benefits beyond 2036, particularly as network congestion is expected to increase. These benefits may be overstated.
- **Amenity benefit calculations** – Rail users are expected to enjoy amenity benefits from improved stations and new rolling stock. The business case has estimated the combined value of this benefit to be equal to a six-minute saving of in-vehicle travel time on each journey. However, rolling stock amenity improvements have been not been included in the base case, despite the purchase of new diesel rail cars in that scenario, which would also improve amenity for passengers.

[1] A travel time saving of 2 minutes per trip is expected on a typical journey that currently takes 48 minutes to complete between Gawler Central and Adelaide on an express service.

Infrastructure Australia's analysis also found that the benefits of the project for existing private and commercial car users are likely to be underestimated in the economic analysis. Specifically, the data provided by the proponent on vehicle kilometres, hours and trips show that the assumptions used by the proponent to estimate the benefits of less in-vehicle hours and reduced vehicle operating costs were conservative.

The base case in the economic analysis assumes that life-expired diesel rail cars would be replaced in the first five years of the appraisal period. Infrastructure Australia recommends a 'do-minimum' base case, which generally excludes major unfunded capital expenditure. Adjusting the base case to assume the ongoing use, or deferred replacement, of the existing diesel rail cars with higher maintenance, lower reliability and lower amenity is likely to increase the BCR of the project.

Overall, taking these issues into account has a broadly neutral impact on the net benefits of the project. Infrastructure Australia considers that the benefits of the project will outweigh its costs, and recognises the strategic merit of the project in improving the accessibility and sustainability of transport to and from the northern suburbs of Adelaide.

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

Benefits and costs breakdown

Proponent's stated benefits and costs	Present value ($m, 2017) @ 7% real discount rate		% of total
Benefits			
Public transport user benefits	$416		69%
Farebox revenue	$20		3%
Road user benefits	$95		15%
Safety benefits	$9		2%
Environmental (externality) savings	$31		5%
Residual value	$26		4%
Resource corrections	$5		1%
Rail reliability benefits	$1		1%
Total Benefits[1]	**$601**	(A)	**100%**
Costs			
Capital costs (P90)	$527		95%
Operating and maintenance costs	$29		5%
Construction disruption	$2		0%
Foregone revenue during construction	$0.5		0%
Total Costs[1]	**$557**	(B)	**100%**
Net benefits - net present value (NPV)[2]	**$44**	(C)	n/a
Benefit–cost ratio (BCR)[3]	**1.1**	(D)	n/a

Source: Proponent's Business Case

Notes:

(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).

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

Capital costs and funding

Total capital cost (P90, nominal, undiscounted)	**$765 million**
Proponent's proposed Australian Government funding contribution	$306.25 million
Other funding (source / amount / cash flow) (nominal, undiscounted)	$458.75 million (South Australian Government)

7. Deliverability

The project would be delivered by the South Australian Government in four discrete components:

- Electrification infrastructure
- Sub-station infrastructure
- Station upgrade work
- Rolling stock.

At the time of the original business case submission in June 2017, the proponent had indicated a staged delivery approach comprising seven months of procurement and 30 months of construction, with completion expected by 2022. Since the original submission, the proponent has obtained updated prices for completing the electrification infrastructure, and received advice that delivering the entire project in a single stage would be preferable to multiple stages. This would minimise the elapsed time the works would take in the corridor and hence bring forward the completion of the electrification infrastructure to Gawler Central from 2022 to 2020.

Since the original submission, the proponent has also appointed a contractor for the design and construction of the electrification infrastructure between Adelaide and Salisbury. The scope of works was then extended in July 2018 to include electrification to Gawler Central and sub-station components.

A significant residual risk for the project is compromising connectivity and accessibility to the city for northern suburb residents during construction as a result of upgrading the entire line continuously. The proponent has applied lessons learnt from the Seaford Rail Line Electrification project delivered in 2014 into the procurement and delivery considerations of this project, which found that a whole-of-system approach is more effective in constructing a multi-disciplinary railways systems project. We also recommend that a more detailed project delivery schedule be prepared to minimise impacts during construction.

Another significant risk is the delivery of an electrified signalling system on this part of the network, which is different from most of the Adelaide Metro rail network. Infrastructure Australia recommends also applying lessons learnt on the electrification of the Tonsley and Seaford rail lines in 2014 to mitigate this risk.

The proponent studied procurement options for the rolling stock in 2017, investigating procurement options for diesel and electric rail cars, considering both new and used vehicles. The proponent estimates that the procurement of rolling stock will be completed in 2021-22. On completion of delivery, the infrastructure will be owned and operated under the current model of state government ownership and operation.

Infrastructure Australia has not received a Gateway Review of this project and the shortlisted option. The Project Management Office established by the proponent would facilitate the completion of a Gateway Review in accordance with the South Australian Treasury guidelines.

The proponent has completed a benefits realisation plan for project benefits and measures of success. However, more specific timeframes for benefits realisation and measures should be used which relate more closely to the project's proposed outcomes. We also recommend that the proponent complete a post-completion review on the benefits and costs of the project to identify any lessons that could be applicable for future projects.