



WA Railcar Program

Perth's next generation of trains

PROJECT DEFINITION PLAN - SUMMARY DECEMBER 2018

Expanding public transport rail capacity
for METRONET and beyond

Contents

| | |
|--|-----------|
| EXECUTIVE SUMMARY | 2 |
| METRONET OVERVIEW | 4 |
| NEED FOR CHANGE | 6 |
| A growing city | 6 |
| Supporting a growing transport network | 6 |
| Supporting local employment | 6 |
| Supporting economic growth | 8 |
| The need in numbers | 10 |
| RAILCAR STRATEGY | 12 |
| Next generation of railcars | 12 |
| The C-series railcar features | 14 |
| Supporting the investment | 15 |
| DELIVERING THE PROJECT | 16 |
| Project benefits | 16 |
| Budget and cashflow | 18 |
| Timeline | 18 |
| Governance | 20 |

METRONET
partner agency



**Public Transport
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Executive Summary

Perth's population is expected to grow from 2.02 million in 2017 to 3.5 million by 2050 (Perth and Peel @3.5 million). The METRONET program is integral to managing this growth and meeting the city's future needs. The first stage will add approximately 72km of passenger rail and up to 18 new stations with extensions to Yanchep, Byford and Bellevue and new lines to Forrestfield, Ellenbrook and linking Thornlie and Cockburn.

Delivering the passenger rail extensions before major urban growth provides an important framework around which bus, cycle and pedestrian links can be developed. The new stations will provide residents with high-quality public transport access to other parts of the city, while creating the focus for progressive mixed-use development that will provide amenity, services and employment for growing local communities.

A growing public transport network requires more trains to service it.

The \$1.6 billion Railcar Program (including supporting infrastructure) will deliver 102 new railcars (17 six-car sets) needed for METRONET projects and 144 railcars (24 six-car sets) to replace the ageing A-series trains, which were the first electric trains on the Transperth network. It will also seek to replace the five diesel railcars that operate the twice-daily Australind service between Perth and Bunbury.

Delivery of the first 17 METRONET trains, known as the C-series, is due to begin in 2021, with the remaining 24 trains expected to enter service between 2023 and 2028.

Not only will this project allow increased capacity on the rail network to cater for boosted passenger numbers, it will improve service efficiency and reliability, as the older A-series trains are retired.

The State Government is committed to creating ongoing local jobs and this project plays a key role in meeting that objective. With a target of 50 per cent local content for the manufacturing of the new railcars, this project will stimulate development of a local railcar assembly facility and associated infrastructure, thereby bolstering our local manufacturing industry and maximising WA jobs.

A growing public transport network requires more trains to service it.



METRONET Overview

METRONET is the State Government's vision to integrate transport and land use planning and provide a framework to support sustainable growth in Perth over the next 50 to 100 years.

More than just a rail infrastructure program of works, METRONET planning goes beyond the station forecourts to shape and support development of communities within the surrounding walkable catchments.

Stage One of METRONET is proposed to deliver approximately 72km of new passenger rail and up to 18 new stations which represents the single largest investment in public transport in Perth's history. The Railcar Program will deliver 246 C-series railcars (41 six-car trains) to cater for the expanded rail network and retirement of the aging A-series trains.

METRONET will create the opportunity to transform Perth through an expanded rail network that will see urban intensification in more than 5,000 hectares of land within walking distance of the stations, supporting delivery of the State's metropolitan growth strategy *Perth and Peel @3.5 million*:

- Forrestfield-Airport Link;
- Yanchep Rail Extension;
- Thornlie-Cockburn Link;
- Morley-Ellenbrook Line;
- Byford Rail Extension;
- Karnup Station;
- Midland Station relocation and Bellevue extension;
- Level crossing removal on the Armadale and Midland lines;
- Automatic Train Control and Railcar procurement.

The Forrestfield-Airport Link is well into construction and scheduled for completion in late 2020. The Yanchep Rail Extension and Thornlie-Cockburn Link projects are in the procurement phase and the remaining projects are in early planning.

This Project Definition Plan has been prepared to document the scope and parameters of the Railcar Program. It has been prepared in consultation with the Department of Treasury and the Department of Jobs, Tourism, Science and Innovation to ensure cross-agency input and coordination.

Stage One of METRONET is proposed to deliver approximately 72km of new passenger rail and up to 18 new stations which represents the single largest investment in public transport in Perth's history.

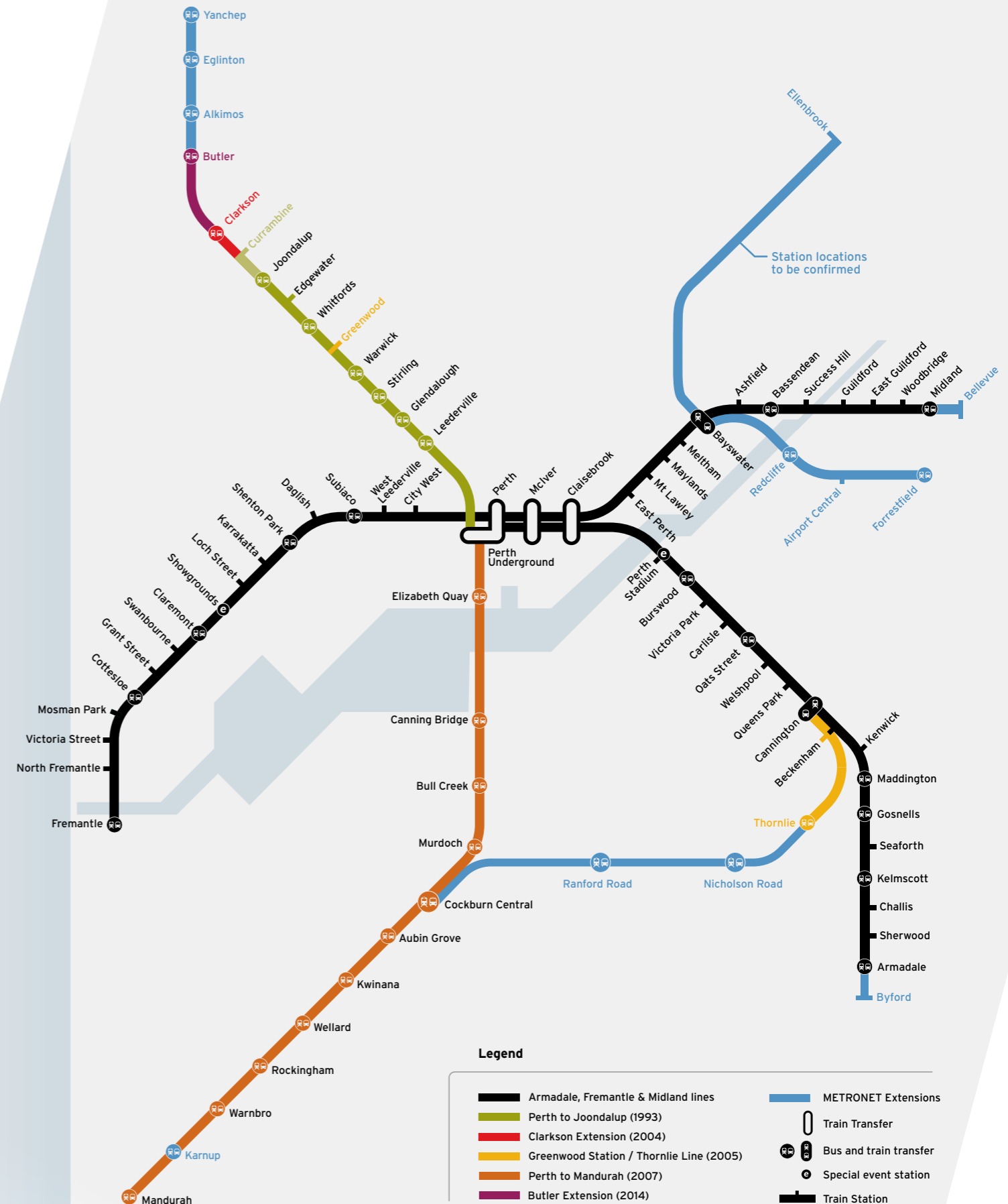


Fig 1: Existing Transperth Train Network and proposed Stage 1 METRONET Initiatives

Need For Change

Good cities grow with effective public transport. It plays a vital role in creating competitive economies, liveable, inclusive and connected communities and reducing reliance on fossil fuels.

Perth has a modern and effective public transport system, however with METRONET expanding the network, in addition to the A-series trains reaching their operational life of 30 years, a significant increase in and modernisation of the metropolitan railcar fleet is required.

A growing city

Perth's population has seen unprecedented growth over the past 20 years. At a time when the economy has experienced several transformations, the city's population has continued to grow. In fact, even in the period between 2013 and 2016, Perth's rate of population growth (approximately 0.9 per cent per year) is high when compared to the rate of population growth across other major OECD cities.

This population growth is anticipated to continue into the future. The State Government's growth strategy, *Perth and Peel @3.5 million*, considers what the city will look like in the future and how to maintain and protect the unique lifestyle and environment while accommodating projected growth. It estimates that the greater metropolitan population will increase from approximately 2 million in 2017 to 2.9 million by 2031 and 3.5 million by 2050.

The METRONET program aligns with the strategic objectives of *Perth and Peel @3.5 million* and its supporting transport strategy. Each METRONET project supports the shaping of Perth into a more compact urban form while accommodating projected population growth.

Supporting a growing transport network

Procuring the new C-series railcars is the first of a series of network development and expansion elements necessary to meet anticipated growth in public transport demand. It is part of a new framework for railway planning adopted by the Public Transport Authority (PTA), called the Route Utilisation Strategy (RUS).

This strategy is a decision-making framework that identifies the steps needed in network improvements and assists investment prioritisation by considering the implications of, and required changes to, an holistic range of network operations, systems and infrastructure, including:

- service characteristics, including train frequencies, stopping patterns and timetables;
- stations and platforms, including platform lengths to potentially accommodate longer train sets on the Midland, Fremantle and Armadale/ Thornlie lines, multi-modal access requirements including feeder buses, walking, cycling and park and ride, ticketing equipment, and the availability and capacity of lifts, escalators, and stairs at key stations; and
- potential changes required to traction power and capacity, overhead line equipment, signalling and train control systems.

Supporting local employment

METRONET will create significant job opportunities in planning, designing and building new transport infrastructure and ongoing development around each new station.

A key objective of the Railcar Program is to maximise opportunities for WA jobs, apprenticeships and small to medium enterprise participation. The project has been identified as a "project of strategic importance to the State" under the *WA Jobs Act 2017*, invoking additional requirements in relation to local job creation.

As such, a key consideration of the tender process will be the supplier's commitment to meet the target of 50 per cent local content for the manufacturing of new railcars in WA and maximise the involvement of local small to medium businesses in both the railcars' manufacture and maintenance.

METRONET is also an opportunity to achieve greater decentralisation of employment in Perth by supporting Strategic Employment Centres throughout the metropolitan region. This is aimed at allowing residents to live closer to work, encourage new and growing industries, all the while enjoying the same coastal lifestyle.



Perth's population has seen unprecedented growth over the past 20 years.

Supporting economic growth

Perth is strategically located as a key international gateway between Australia, Asia and the Indian Ocean rim. Sharing the same time zone with major international cities, including Shanghai, Singapore and Hong Kong, gives Perth a distinct advantage over Australia's other capital cities, making it an attractive option for foreign investors.

Perth contributed approximately \$150 billion to the national economy in 2015/16 corresponding to an average GDP per capita of approximately \$72,000, roughly four per cent above the Australian average. Between 1991 and 2016, Western Australia increased its Gross State Product, outperforming Australia as a whole in 20 out of these 26 years.

During the mining investment boom from 2002 to 2012, the economy grew significantly through investment activity flowing from outside the State and has seen a corresponding peak in population growth and demand for housing. At the same time there was significant investment in promoting the city's profile for retaining a globally qualified workforce, highlighted by significant investment in the city centre.

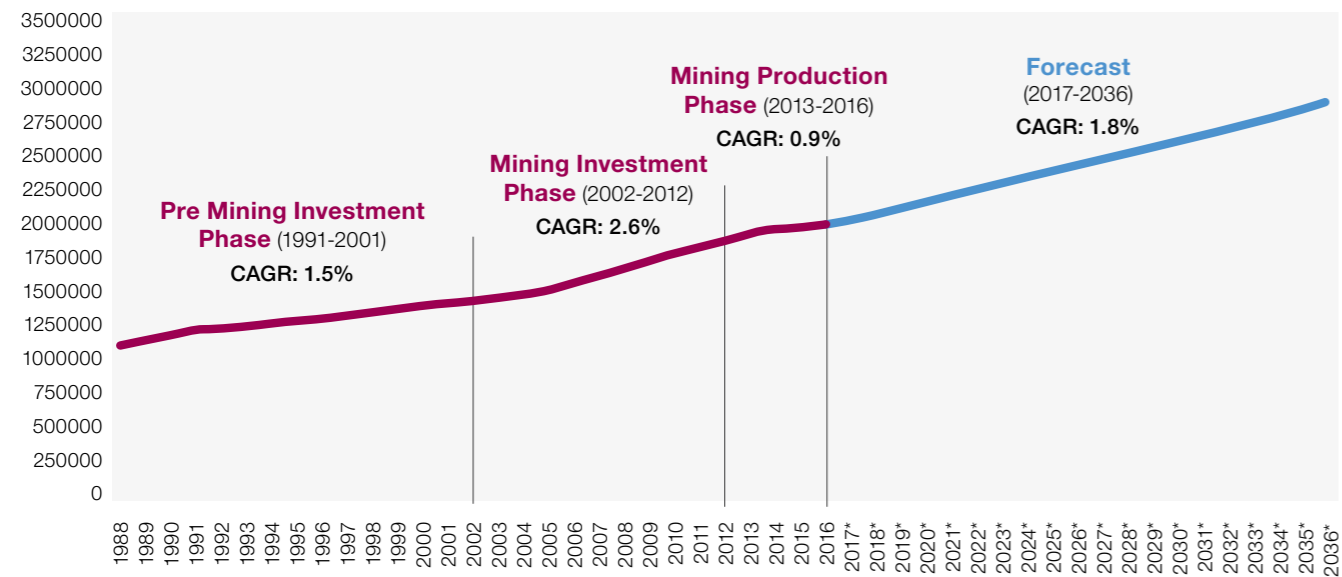
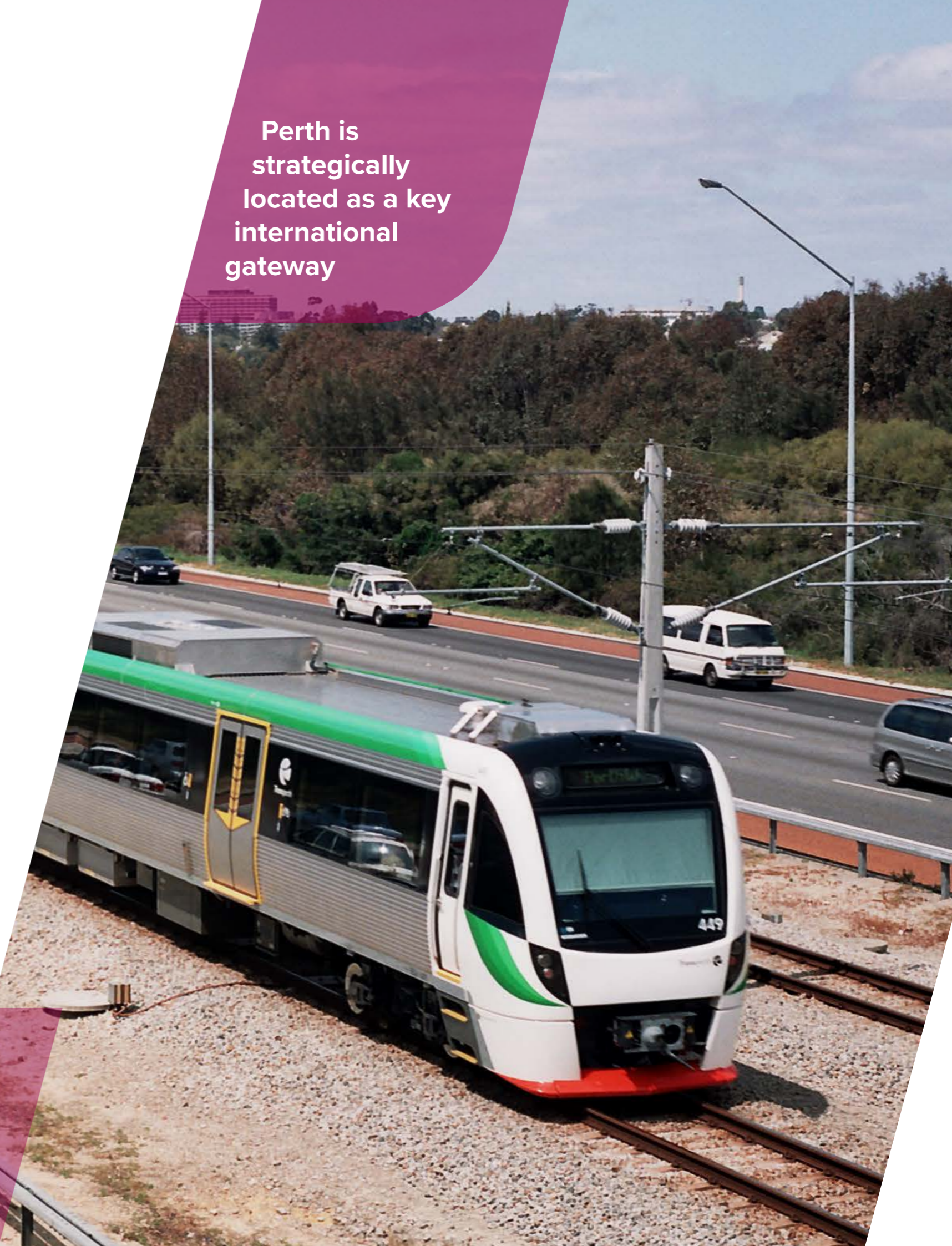


Fig 2: Perth's Population and forecasted population, 1988-2026

Source: Historical data (1988-2016) Australian Bureau of Statistics (2017) Cat No 3218.0 - Regional Population Growth, Australia, 2016, accessed 1/12/2017; Forecasts*: Based on the assumption that Perth will reach 3.5 million people by 2050 as outlined in Perth and Peel@3.5million

To remain one of Australia's leading capital cities and a key international gateway, Perth must continue to invest in essential infrastructure that supports continued economic productivity and attracts international investment.

Perth is strategically located as a key international gateway



The need in numbers

METRONET will increase rail patronage through extensions to Yanchep, Byford and Bellevue and new lines to Forrestfield, Ellenbrook and linking Thornlie and Cockburn.

In addition, Perth's passenger rail network experienced significant patronage growth between 2004 and 2012 from around 19.5 million to 40.5 million initial boardings per year¹. This was generally achieved on the back of strong economic growth and activity, and the Mandurah Line opening in December 2007. Since 2012 this growth has flattened somewhat due to a number of factors, not least of which relates to a general slowdown in population and economic growth. However, it is anticipated that local economic activity will return to trend in the medium-term and associated patronage demand return to pre-2012 trend growth.

Public transport rail patronage forecasting is derived from the Department of Transport's STEM, which models demand based on forecast assumptions for population, population distribution, land use, employment distribution and self-sufficiency, and the existing and planned transport network, including the rail network.

The PTA supplements STEM data with further analysis involving SmartRider origin-destination data to establish the peak travel demand forecasts necessary to inform decisions on planned operational capacity.

The PTA continually monitors patronage levels and reviews forecast demand. Using this data the PTA plans train timetable frequency to meet passenger numbers, focussing on the peak periods. These peak period frequency numbers helped inform the required railcar investment program.

| Line Group | Peak train frequency on busiest sections of the network | | |
|--|---|---------------|---------------|
| | current 2017 | proposed 2021 | proposed 2031 |
| Yanchep/Butler - Mandurah | 6 | 6 | 6 |
| Whitfords - Cockburn | 6 | 6 | 6 |
| Clarkson - Rockingham | - | - | 6 |
| Mandurah / Joondalup total trains per hour | 12 | 12 | 18 |
| Armadale | 8 | 8 | 8 |
| Thornlie | 4 | 4 | 4 |
| Armadale / Thornlie total trains per hour | 12 | 12 | 12 |
| Midland - Fremantle | 6 | 6 | 6 |
| Forrestfield | - | 6 | 6 |
| Midland group total trains per hour | 6 | 12 | 18 |

Note: Annual frequencies will be subject to a number of key factors, including availability of railcars and staging of platform extensions.

Operations on the proposed Morley-Ellenbrook Line are subject to ongoing planning investigations and will not be finalised until the business case and Project Definition Plan are completed. This may influence future operational outcomes for the Midland Line group.

In addition to train frequency, further capacity improvements are intended on the Joondalup/Mandurah lines with the introduction of the higher capacity six-car C-series trains, and on the Midland/Fremantle and Armadale/Thornlie lines through the future progressive introduction of six-car operations using three-car B-series trains.

Table 1: Forecast peak period frequency 2021 and 2031

A growing public transport network requires more trains to service it.



Railcar Strategy

In order to service an expanded rail network, maintain a reliable, frequent and high-capacity service on all lines and ensure alignment with longer-term requirements for operating the rail network, priority and investment must be given to:

1. Procuring new generation six-car trains in line with current international design trends capable of meeting projected demand growth and METRONET projects; and
2. Transition the Armadale, Fremantle and Midland lines to three and six-car operation using the existing B-series fleet (currently operating on the Joondalup and Mandurah lines) to meet projected demand growth and METRONET projects on these lines.

This will provide the opportunity to maintain efficient operations and transition the broader rail network to a higher-frequency and higher-capacity railway over time and optimise investment.

Next generation of railcars

The \$1.6 billion Railcar Program will deliver 41 six-car trains over an eight-year period from 2021. This new generation of trains will support the rail network's expansion through METRONET.

Railcar availability and capacity is intrinsic to the capacity of public transport services, particularly during peak periods.

The design of the current B-series three-car sets, which introduced a 60 per cent increase in planned capacity over the A-series trains, is a generation old. The original A-series two-car sets are two generations old. With only two doors per railcar per side, and space at either end of the two and three-car sets taken up by driver cabs in the A and B-series' design, both have inherent constraints that limit capacity for demand growth, such as:

- a) Overall passenger capacity of a four or six-car set is reduced by the two cabs where the two shorter sets are coupled;
- b) Passengers congregate and crowd at the two doors, not always moving along the carriage, making for less efficient loading and reduced capacity; and

- c) Time taken to load and unload passengers at stations (known as "dwell time") through the two doors has implications on operational planning.

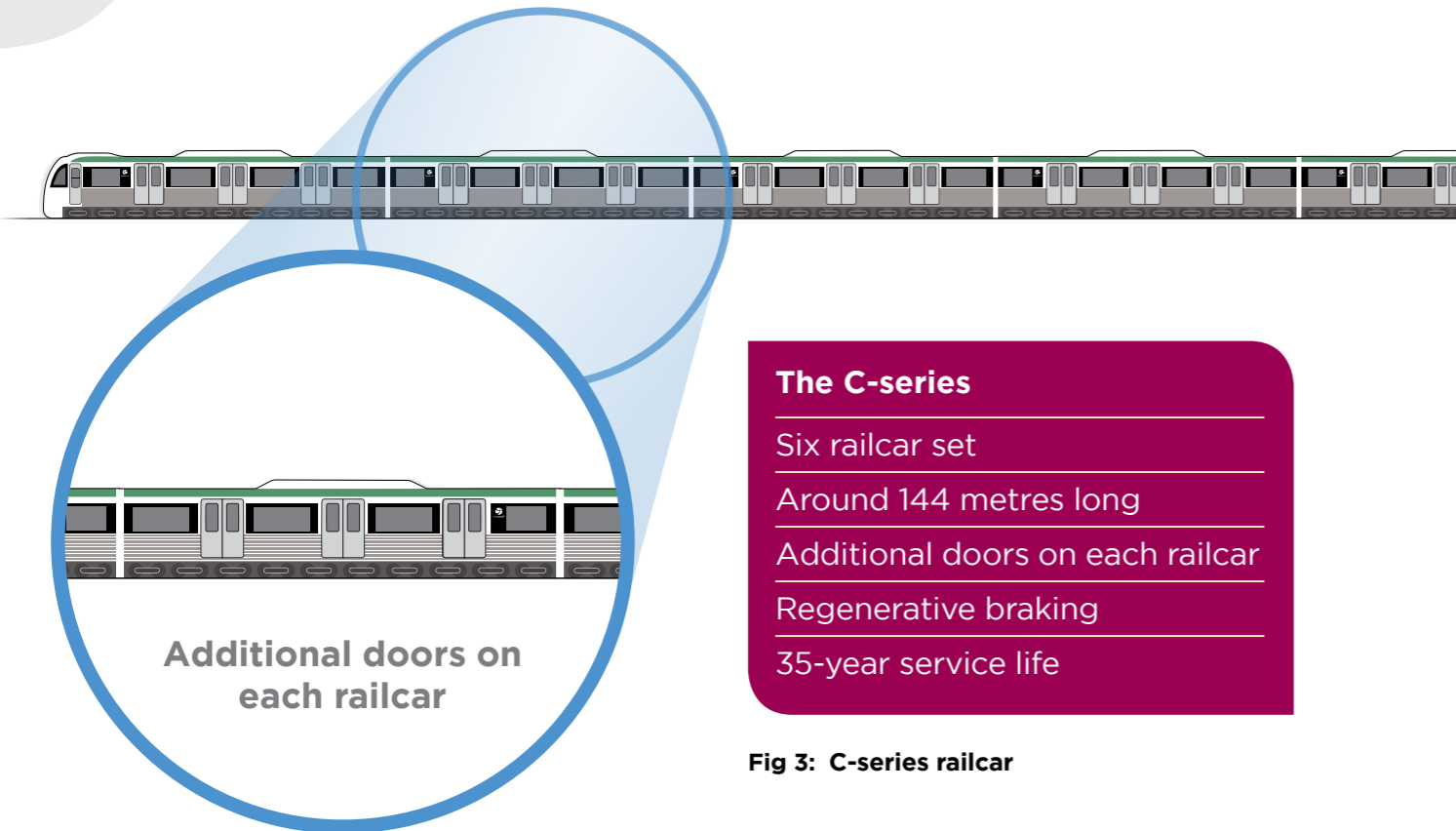
Increasing operational capacity on the Mandurah and Joondalup lines means more frequent railcars carrying more people during peak times. Current frequencies on these lines are five-minute intervals, or 12 trains per hour. This needs to be improved to around three-minute intervals, or 18 trains per hour, to meet forecast demand out to 2031 and beyond. To help achieve this, dwell time needs to be reduced. More doors per railcar, combined with a more efficient interior layout, will reduce dwell times and increase capacity.

The C-series railcar will be a modern design with higher passenger capacity than both the A-series and B-series trains. Each set will be six cars long with a driver cab at either end and additional doors on each side of the railcar to improve passenger flow and reduce station dwell times.

The new C-series trains will also provide an opportunity to cascade existing B-series sets onto the Armadale, Fremantle and Midland lines, modernising operations on these lines and enabling future transition to a six-car railway to meet with projected operational demands. Making optimum use of the B-series trains will ensure the effective ongoing use of these strategic assets, while significantly increasing the long-term capacity of these lines.

More doors per railcar combined with a more efficient interior layout will reduce dwell times and increase capacity.

The C-series railcar features



The C-series

- Six railcar set
- Around 144 metres long
- Additional doors on each railcar
- Regenerative braking
- 35-year service life

Fig 3: C-series railcar

The C-series will be a modern electric multiple unit (EMU) train configured with six railcars as a fixed set. Its primary advantages over the A and B-series design are:

- a) Additional doors on each side and improved interior layout to:
 - i. improve passenger flow;
 - ii. increase passenger distribution across the railcars; and
 - iii. minimise dwell time at stations.
- b) It will provide for a higher passenger capacity with a planned 25 per cent increase on a B-series six-car set and a 100 per cent increase on a A-series four-car set.

At 144 metres long with AC traction motors, the C-series will be the same length as two coupled B-series sets, making the new railcars compatible with the PTA infrastructure while incorporating the latest international performance standards expected of modern rail services.

It is expected the railcars will travel approximately 220,000 kilometres a year, have the ability to travel at speeds of at least 130kph and have a service life of 35 years.

The new railcar's general specification includes:

- improved energy efficiency, and greater reliability than the existing A and B-series;
- contemporary appearance to differentiate them from the existing trains;
- preferred body construction in stainless steel;
- additional doors per railcar per side for easy access, shorter passenger loading and unloading times, and better passenger distribution along the train;
- maintaining as a minimum the current levels of safety and security;
- universal access to meet Disability Standards for Accessible Public Transport;
- air-conditioning and ventilation for passenger comfort;
- modern passenger information (audio, visual, and digital) and counting systems to provide passenger loading data;
- regenerative braking to reduce energy consumption; and
- designed to accommodate future upgrades to the network, signalling, train control, and radio communication systems.

The railcars will be procured through a design/build/maintain form of contract agreement.

Supporting the investment

Procuring a new generation of railcar and supporting local industry requires consideration of the availability of local manufacturing and commissioning facilities as well as a review of existing maintenance and stabling facilities - the infrastructure required to support the manufacture and whole-of-life maintenance of the new railcars.

Should the preferred supplier not have facilities within WA to assemble the new railcars, an assembly and commissioning facility will be built at Bellevue which will subsequently be used for maintenance and overhaul of the PTA's trains.

The maintenance of the new railcars will form part of the C-series contract.

Maintenance activities for the new railcars will consist of:

- a) routine preventative maintenance and inspection;
- b) fault finding and rectification;
- c) component overhaul and replacement;
- d) provision and stocking of replacement parts;
- e) cleaning of railcars and maintenance of cleaning equipment; and
- f) maintenance of repair depot buildings and facilities.

Minor upgrade works will be required at the Nowergup train maintenance facility to accommodate maintenance on the new six-car trains. In addition, a train maintenance facility will be built at Bellevue to maintain the B-series trains cascaded from the Joondalup and Mandurah lines onto the Fremantle, Armadale and Midland lines (and currently maintained at Nowergup).

Fig 4: Railcar Program - Proposed Assembly Facility, Bellevue



Delivering The Project

The Railcar Project will help meet demand as METRONET expands the rail network and Perth grows towards a population of 2.7 million in 2031, providing a solid foundation for further system improvement and expansion beyond.

The project's objectives are to:

- maintain an efficient and effective public transport service that ensures access to and connectivity between, key activity, education and employment centres;
- maintain a safe, reliable, accessible and modern train service that meets public expectations;
- enable increased use of trains to reduce road congestion and environmental impacts;
- maximise opportunities for WA jobs, apprenticeships and small/medium enterprise (SME) participation;
- optimise the State's investment in public transport and future-proof the network for future transport demands; and
- deliver value for money for Western Australia.

The project scope and delivery will include:

- design, manufacture and commissioning of 246 new C-series railcars (or 41 six-car trains);
- maintenance of the 246 railcars for a 30-year term;
- design and manufacture of diesel railcars to replace the existing "Australind" fleet which provides the Perth-Bunbury service;
- maintenance support for the new diesel railcars;
- construction of a railcar assembly and commissioning facility, if required;
- construction of a maintenance and stabling facility in Bellevue;
- modifications to the existing Nowergup train maintenance facility to accommodate the new C-series trains;
- operation and maintenance of the railcar maintenance facilities for this fleet; and
- options to allow for additional new railcars if and when required, beyond the current scope.

Without this project, there will not be enough trains to maintain the current level of peak and off peak services on the future network expanded by METRONET projects. This means without additional trains, passenger rail services across the network would be required to be pared back either through a reduction in service frequency or a reduction in train capacity (ie. using three-car trains instead of six).

Project benefits

The key anticipated benefits of this project are:

- meeting new passenger demand due to METRONET extensions;
- replacing the existing A-series train which are coming close to – and in many cases, exceeding – their operational life of 30 years with new higher-capacity trains;
- meeting the forecast growth in passenger demand; and in doing so
- reducing the number of passengers unable to board trains during peak periods;
- achieving a higher passenger loading capacity on the new C-series railcars, as compared to the existing A-series and B-series railcars; and
- achieving target levels of satisfaction with passenger rail services as an efficient, effective, and timely alternative to private vehicle travel.

The PTA uses key performance indicators to monitor its achievement against the Government's strategic goal of results based service delivery. The KPIs relevant to the anticipated benefits of this Project are passenger numbers and satisfaction. These KPIs are monitored and reported on a daily basis and will be used to monitor the realisation of these benefits, primarily through data generated by the Transperth ticketing system and annual Passenger Satisfaction Monitor.



Fig 5: Railcar investment since 1990



Budget and cashflow

The approved budget for the project is \$1.6 billion.

The preferred railcar procurement option is for State-funded procurement, with payment made when each railcar set is accepted by the PTA as ready for passenger train operations.

| Period | 18/19 | 19/20 | 20/21 | 21/22 | Outyears |
|----------|--------|--------|--------|---------|-----------|
| Railcars | \$28.9 | \$30.5 | \$71.4 | \$195.4 | \$1,239.9 |

Table 2: Capital budget cashflow (\$million)

Timeline

Lead time for procurement of new railcars is significant.

The PTA's previous experience in railcar procurement has resulted in a plan being prepared to identify key milestones with respect to this railcar program.

The timeline below is based on the following lead time factors:

1. Procurement to secure a suitable delivery contract;
2. Design, manufacture, static commissioning, and delivery;
3. Testing/commissioning and driver training; and
4. Staged delivery to suit METRONET extension requirements and A-series retirement.

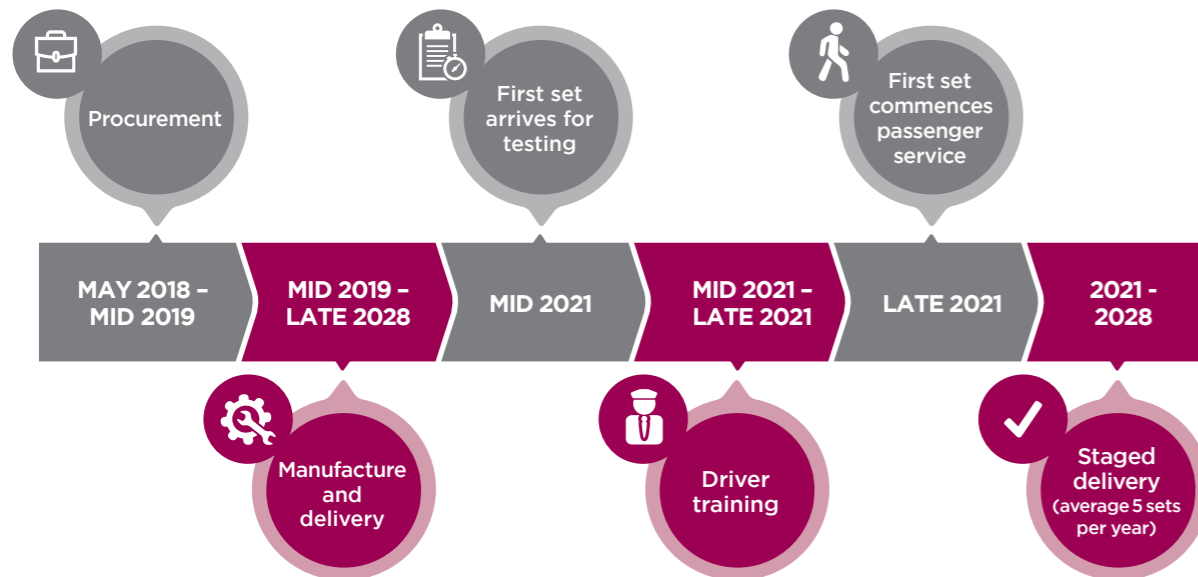


Fig 6: Key Project Stage Timeline

The approved budget for the project is \$1.6 billion.

Governance

The Railcar Program will be delivered by the PTA.

The PTA has appropriate and relevant experience in the procurement and delivery of new trains, particularly and most recently with the current order of B-series railcars.

The form of procurement proposed for the project is similar to that used successfully for the B-series railcar procurement. The finance and cost provisions of the contract will differ to reflect the preferred payment model which incentivises on-time delivery to a budget cost by linking payment to key delivery milestones. Structured appropriately, this payment method has the potential to enhance the risk allocation, improve price certainty, and introduce added financial rigour to the procurement.

Governance of the project will follow State Government and PTA procurement and strategic project management framework guidelines.





MORE INFORMATION

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