

Final Business Case

SUMMARY

October 2016



CONTENTS

Premier's message	4
Minister's message	4
Introduction	7
1. Sydney Metro overview	8
1.1 Core components	8
1.2 Transport for NSW customer outcomes	14
2. The Need For Sydney Metro	19
2.1 Meeting the challenges of growth	19
2.2 Project history	19
2.3 Strategic policy context	21
2.4 Strategic goals and objectives	22
2.5 Project objectives	24
2.6 Final Project design	24
2.7 Project benefits	27
2.8 Delivery program	28
3. Need for investment	31
3.1 A global Sydney	31
3.2 Sydney's population and employment growth	32
3.3 Challenges to continued economic growth and productivity	35
3.4 Sydney's transport network challenges	36
3.5 Sydney's rail network challenges	37
3.6 Urgency	41
4. Alternative options	43
4.1 Narrowing the options	43
4.2 Non-metro alternatives considered	43
4.3 Metro alternatives considered	45
4.4 Station options analysis	46
4.5 Sydney Harbour Metro Crossing and tunnelling options	46
5. Project definition	51
5.1 Final Project design	51
5.2 Business requirements	52
5.3 Definition Design overview	55
6. Project justification	57
6.1 Overview of high value benefits	57
6.2 Capacity benefits	58
6.3 Transport benefits	59
6.4 City-building benefits	69
6.5 Economic benefits	70
7. Delivery strategy	77
7.1 Overview	77
7.2 Stakeholder and industry engagement	78
7.3 Delivery Strategy objectives	78
8. Value sharing	83
8.1 Public transport fares	83
8.2 Over station development and other property cost recovery opportunities	85
8.3 Passive value capture from existing taxation regimes	88
9. Financial analysis	91
9.1 Financing the Project	91
9.2 Financial analysis overview	92
9.3 Project cost analysis	93
10. Project implementation	97
10.1 Program	97
10.2 Project development and procurement program	98
10.3 Sustainability	100
10.4 Conclusion	101



The completed city-bound tunnel at Castle Hill, May 2016

Premier's message



The NSW Government is transforming the way Sydney travels with the next stage of Sydney Metro, Sydney Metro City & Southwest, now fully funded and in the delivery phase. Sydney is about to move into a new era, as metro rail extends its route under

Sydney Harbour and the centre of Sydney and beyond. We are cutting travel times, reducing congestion and delivering economic and social benefits for generations to come.

We are proud to be building Australia's biggest public transport project. It will be the backbone behind a strategy to keep Sydney competitive on a global stage, helping us keep pace with the city's growth.

From government planners to engineers, tunnellers to train-manufacturers, we all have one focus – the customers who will be using this new service. We are working hard to provide a level of service never before seen in Sydney and meet the needs of tomorrow's Sydney.

A handwritten signature in black ink, appearing to read "Mike Baird".

Mike Baird MP
PREMIER OF NEW SOUTH WALES
AND MINISTER FOR WESTERN SYDNEY

Minister's message



Sydney Metro continues to progress and pass its many milestones. Fully-funded and with the formal procurement process for Sydney Metro City & Southwest underway, we are on track with our journey along

this vital and exciting pathway to build Australia's largest public transport project.

Sydney Metro will not only shape Sydney for decades, but this congestion-busting infrastructure will contribute to the growth of the NSW and Australian economies as a whole.

Sydney Metro will provide essential infrastructure support for the way we will manage our planned growth in the coming decades, ensuring Sydney maintains its status as a leading, desirable city in which to live and work.

We have listened to the community and we have placed the customer at the centre of all our planning – to deliver a 21st century railway using the best proven technologies. The state-of-the-art service will provide easy and fast connections to people and places across the city and suburbs, with an enviable, reliable and affordable service worthy of Sydney's great future.

Welcome aboard Sydney Metro.

A handwritten signature in black ink, appearing to read "Andrew Constance".

Andrew Constance MP
MINISTER FOR TRANSPORT
AND INFRASTRUCTURE





Inside Sydney's new metro train

INTRODUCTION

This publication presents a summary of the Final Business Case that was prepared to enable the NSW Government to make an informed decision on the timing, scope, funding and delivery strategy for the Sydney Metro City & Southwest project (the Project).

It demonstrates how this enabling piece of infrastructure can increase the capacity of Sydney's wider rail network, boosting Sydney's ability to contribute to the economic success of NSW and Australia.

The Sydney Metro City & Southwest Business Case summary:

- ▶ identifies the problems the Project will address
- ▶ demonstrates the feasibility of its scope
- ▶ establishes the benefits to be realised
- ▶ identifies the cost and justifies the investment of funds for development
- ▶ outlines the project implementation plan.

The Final Business Case was based on the analysis completed during the Project development phase in 2015. Further refinements will take place as the Project moves into the procurement phase. Any changes to the Project will seek to improve value for money, and reduce risk and community impacts.

This Business Case summary reflects the structure of the full Final Business Case. Some details have been amended and updated as the Project has been further refined. Figures relating to population and economic growth in this report are calculated based on NSW Government and Australian Bureau of Statistics data.

Sydney Metro City & Southwest has a cost range of \$11.5 billion to \$12.5 billion.

A benefit cost ratio (BCR) is the ratio of a project's benefits relative to its costs.

Given the Project's cost range of \$11.5 billion to \$12.5 billion, this represents an equivalent BCR range of about 1.47 to about 1.6. The BCR for the project is 1.53 at the midpoint of this cost range.

To put it more simply, the Project will deliver \$1.53 worth of benefits for each \$1 invested.

Note about redacted figures

The Sydney Metro City & Southwest project is currently in the delivery phase. A live tender process has started for the first major contract, which includes tunnelling under Sydney Harbour. See page 26 for information about redacted figures.

1. SYDNEY METRO OVERVIEW

Sydney Metro is Australia's biggest public transport project.

This 21st-century standalone railway network will deliver 31 metro stations and 66 kilometres of new metro rail for Australia's biggest city – revolutionising the way Sydney travels.

Services start in Sydney's booming north west, from Rouse Hill to Chatswood, in the first half of 2019 using Sydney's new generation of fully-automated metro trains. With a train running every four minutes during the peak, customers won't need a timetable when Sydney Metro opens – they'll just turn-up-and-go.

From Chatswood to Bankstown, metro rail will run in newly constructed tunnels under Sydney Harbour, through new underground stations in the central business district (CBD) and beyond to the southwest.

Sydney Metro services from Chatswood to Bankstown are expected to start in 2024. There will be ultimate capacity for a metro train every two minutes in each direction under the city – a level of service never before seen in Sydney that ensures we can meet the needs of customers well into the future.

Sydney's new metro railway will have an ultimate capacity of about 46,000 customers per hour, similar to other metro systems worldwide. Sydney's current suburban system can reliably carry 24,000 people an hour per line.

Sydney Metro, together with signalling and infrastructure upgrades across the existing Sydney rail network, will increase the capacity of train services entering the Sydney CBD – from about 120 an hour today to up to 200 services beyond 2024. That's an increase of up to 60 per cent capacity across the network to meet demand.

1.1 Core components

Sydney Metro has two core components:

- ▶ **Stage 1: Sydney Metro Northwest** – formerly North West Rail Link. This \$8.3 billion project is now under construction and will open in the first half of 2019 with a metro train every four minutes in the peak. Tunnelling has finished and construction of the 36-kilometre line is progressing rapidly.
- ▶ **Stage 2: Sydney Metro City & Southwest** – a new 30-kilometre metro line extending metro rail from the end of Sydney Metro Northwest at Chatswood under Sydney Harbour, through new central business district (CBD) stations and south west to Bankstown. Construction will begin in 2017 with the first tunnel boring machine (TBM) in the ground before the end of 2018. This line is due to open in 2024 with the capacity to run a metro train every two minutes each way through the centre of Sydney.

Sydney Metro City & Southwest includes new metro stations at:

- ▶ Crows Nest
- ▶ Victoria Cross (North Sydney)
- ▶ Barangaroo
- ▶ Martin Place
- ▶ Pitt Street
- ▶ Central (new underground platforms)
- ▶ Waterloo.

Sydney Metro City & Southwest (the Project) is currently in the planning approvals stage, with the Environmental Impact Statement for the Chatswood to Sydenham section exhibited in May and June 2016.

The planning process will start later this year for the conversion of the Bankstown Line between Sydenham to Bankstown to metro standards.

The twin railway tunnels between Chatswood and Sydenham will be delivered using five TBMs, including a specialised TBM under Sydney Harbour due to the rock conditions at the bottom of the harbour.

The first TBM will be in the ground before the end of 2018.

Figure 1.1 Sydney Metro alignment



1.1.1 Transforming Sydney

Sydney Metro will transform Sydney, cutting travel times, reducing congestion and delivering economic and social benefits for generations to come.

It will boost economic activity by more than \$5 billion a year, supporting major job and business growth along its 66-kilometre route with better connectivity and land development opportunities and greatly improving business logistics, especially for knowledge-based businesses.

Sydney Metro will deliver this major economic boost by:

- ▶ improving access to jobs
- ▶ changing the way people move about the city and reducing congestion
- ▶ allowing people to travel from one key centre to another in minutes
- ▶ enabling housing and employment growth along Sydney's Global Economic Corridor and west to Bankstown
- ▶ encouraging greater commercial development – and jobs – in key areas of the city and North Sydney.

Employment across metropolitan Sydney is expected to increase from 2.1 million workers today to about 3.1 million by 2036.

About 60 per cent of people will work in the Global Economic Corridor (GEC), which stretches from Norwest and Parramatta to Macquarie Park, through Chatswood, North Sydney, the Sydney CBD and on to Sydney Airport. Sydney Metro will connect people across Sydney to these jobs.

Over the next 15 years, NSW will require infrastructure to support 40 per cent more train trips, 30 per cent more car trips and 31 per cent more households. Sydney Metro is identified as a key infrastructure project as part of the NSW Government's infrastructure investment program.

The NSW Government is committed to the creation of 150,000 new jobs by 2019, one of the NSW Premier's 12 key priorities¹. Through investment in infrastructure such as Sydney Metro, new jobs and apprenticeships are being created for the construction sector, delivering huge flow-on benefits to productivity, wages and the state's overall economic performance.

1.1.2 More choices

Sydney Metro will give people more choice in their everyday lives:

- ▶ **faster travel** means new choices for jobs, education and recreation
- ▶ **less crowded** trains, stations and platforms
- ▶ **greater choice** of shopping, retail, restaurants
- ▶ **better access** to health care
- ▶ better access to and **choice of educational facilities**
- ▶ **faster transport** to growth areas
- ▶ **quick and easy access** to recreation and sports facilities.

1.1.3 The Sydney Metro experience

Sydney Metro will deliver the ultimate capacity of a metro train every two minutes in each direction under the Sydney CBD – a level of service never before seen in Sydney.

Services start in 2019 with a train every four minutes in the peak – 15 trains an hour – on the \$8.3 billion Sydney Metro Northwest, Stage 1 of Sydney Metro.

¹ **Jobs for NSW** is an innovative new body set up to drive the creation of 150,000 new jobs over the next four years and cement NSW as the engine room of the Australian economy.



Sydney Metro Northwest prototype station

1.1.4 Customer benefits

These include:

- ▶ **no timetable** – customers will just turn-up-and-go
- ▶ **Opal ticketing** – fares set and controlled by the NSW Government, the same as the rest of Sydney’s public transport
- ▶ **customer service assistants** at every station and moving through the network during the day and night
- ▶ **Australian-first platform screen doors** which keep people and objects away from the edge, improving customer safety and allowing trains to get in and out of stations much faster. These doors run the full length of all metro platforms and only open at the same time as the train doors
- ▶ **fully-accessible** stations
- ▶ **fast, safe and reliable** new-generation metro trains
- ▶ continuous **mobile phone coverage** throughout the metro network
- ▶ 98 per cent **on time** running
- ▶ **clean** platforms and trains
- ▶ two **multi-purpose areas** per train for prams, luggage and bicycles
- ▶ **wheelchair spaces**, separate priority seating and emergency intercoms inside trains
- ▶ each train has **38 security cameras** and customers can see from one end of the train to the other inside the train – a major safety benefit
- ▶ **video help points** at platforms, connecting directly with train controllers – an Australian first
- ▶ **level access** between the platform and train and three double doors per side per carriage for faster loading and unloading
- ▶ **heating and air-conditioning** in all metro trains
- ▶ on-board **real time travel information** and live electronic route maps
- ▶ **customer safety** is the number one priority of Sydney Metro, which is Australia’s first fully-automated railway. At all times, a team of expert train controllers will monitor the system, making sure everything runs smoothly.

Sydney Metro features

- ▶ **66 kilometres** of metro rail from Rouse Hill to Bankstown.
- ▶ **New generation** of fast, safe and reliable metro trains.
- ▶ **No timetable** – just turn-up-and-go.
- ▶ **Higher frequency** trains during the day and late at night.
- ▶ **Reduced travel times** for customers across the rail network.
- ▶ **More trains, more often** in the peak through the CBD, providing more options for customers and less crowding on trains, stations and platforms.
- ▶ Sydney Metro will help **reduce crowding** on the T1 Western Line and on trains from the south west, by creating extra capacity on the city circle.
- ▶ **More trains** from Sydney’s north west and south west.
- ▶ **Opal ticketing** and fares the same as for the rest of Sydney’s public transport, providing a seamless journey for customers, making it even easier to move around.
- ▶ **Fast and easy** to change to trains, buses, ferries and light rail.
- ▶ **Standalone** line operating independently of the existing rail network, not subject to wider suburban delays.
- ▶ **Connecting** Sydney’s economic centres with a boost of activity of up to \$5 billion per year.
- ▶ **New choices** for jobs, education and recreation.



Sydney Metro Northwest prototype station

1.2 Transport for NSW customer outcomes

To be effective the transport system must meet customer needs. Transport for NSW (TfNSW) is responsible for ensuring the needs of the customer are at the centre of planning and decision making for the transport system, and that all projects and services are designed and operated accordingly. This is reflected in the TfNSW mission statement: “The customer is at the centre of everything we do in transport.”

Customer experience will be a fundamental driver for the Project. The stations, trains and complete travel experience will be integral to the customer experience. A high-quality door-to-door transport product is critical to attracting and retaining customers, and also to meeting broader transport goals.

The Project provides a customer focus by addressing customer needs at all stages of the journey. This journey is represented diagrammatically in Figure 1.2.

“the **customer**
is at the **centre**
of everything we do in
transport”

The customer journey

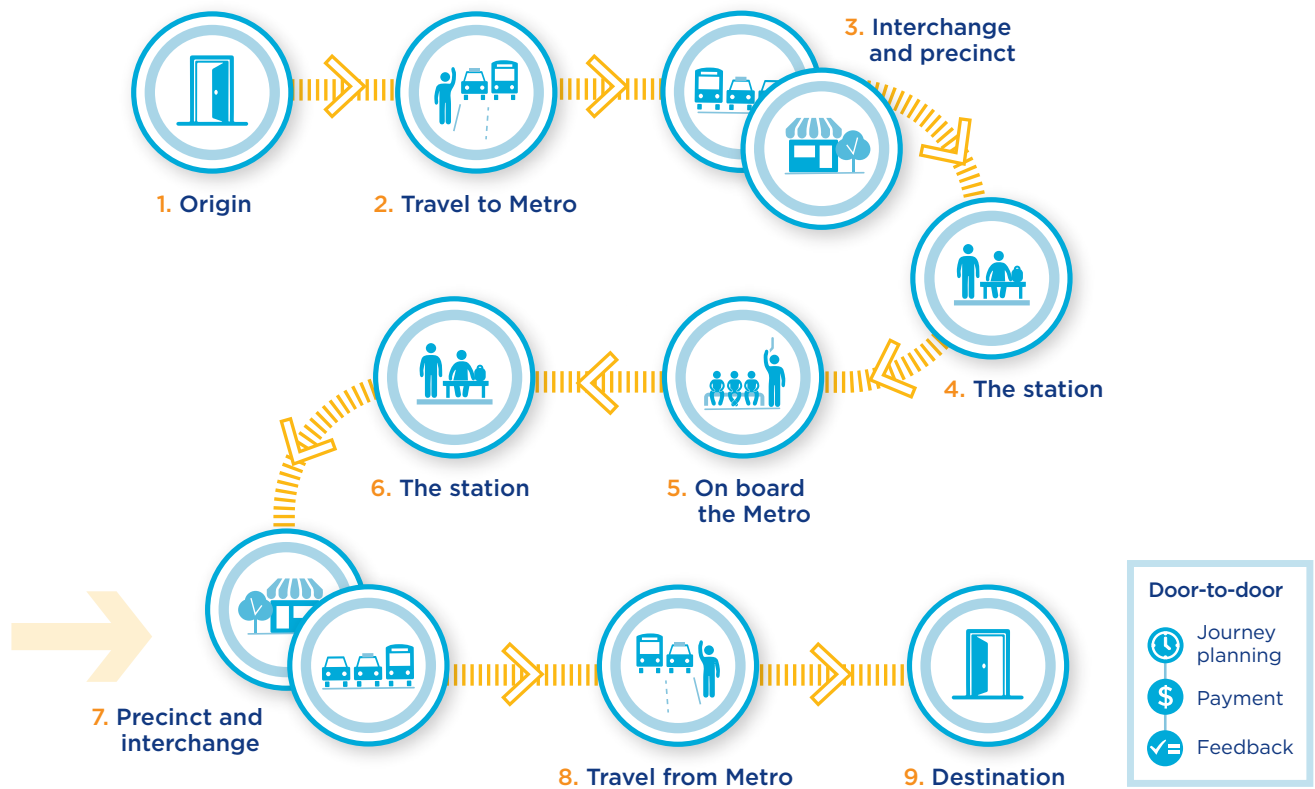


Figure 1.2 The customer transport journey

1.2.1 What customers are looking for

Customers are at the centre of Sydney Metro. Australia's biggest public transport project will deliver an easy door-to-door experience, integrating Sydney's new-generation metro trains with state-of-the-art stations and 21st century technology.

Sydney Metro will make it easy for customers to get where they need to go.

New metro services will be integrated with other transport modes, including interchanges with the existing Sydney railway network as well as buses, light rail and ferries.

Customers are at the centre of Sydney Metro's 21st century design, including the development of Sydney's new metro train, new metro railway stations, interchanges and precincts.

State-of-the-art technology will keep customers connected at all stages of their journey, from smart phone travel apps on the way to stations to real-time journey information at metro stations and on board trains.

This approach will help customers achieve their daily tasks more easily, whether it's getting to work, meetings, school or education, sport, a day out or running errands – and, of course, getting home. Making it easy for customers at each stage of their journey will be integral in the successful delivery of Sydney Metro.

Linking communities, schools, hospitals, key destinations and businesses with the new metro railway network is key in attracting and keeping customers, as well as in meeting broader transport and land use objectives.

Transport for NSW is working across government and with the community to get customers to and from new metro services easily and, when travelling on them, to ensure they are safe and comfortable.

Sydney Metro is being designed to deliver safe, clean, comfortable services that will run on time, be convenient, efficient, accessible and easy for customers to use.



Artist's impression of Waterloo Station



Waterloo

 Accessible Journey
MSU
Come to work and all passengers off the train first



Artist's Impression of Crows Nest Station

2. THE NEED FOR SYDNEY METRO

2.1 Meeting the challenges of growth

As Sydney continues to develop it faces new challenges to cater for the growth in employment, population and dwellings, ongoing economic productivity and liveability. Sydney's population is forecast to increase from 4.3 million people to 6.2 million people in 2036². Driven by population growth, employment in Sydney is expected to increase from its current level of 2.1 million workers to 3.1 million by 2036.

This employment and population growth will require increased transport capacity, to ensure continued growth in productivity and to sustain Sydney's liveability. Rail network demand is expected to increase by 41 per cent by 2026, with the growth in demand for rail travel into the CBD expected to increase by 31 per cent by 2026. The number of people travelling to the Sydney city centre each day is forecast to grow to 775,000 by 2031³.

In response to these needs, Sydney Metro City & Southwest will provide significant additional capacity to the Sydney transport network by:

- ▶ extending Sydney Metro from Chatswood through the Sydney CBD
- ▶ adding new stations at Crows Nest, Victoria Cross and Waterloo
- ▶ significantly increasing the number of CBD stations by building new Sydney Metro stations at Barangaroo, Martin Place and Pitt Street, as well as new metro platforms beneath Central Station
- ▶ providing extra connectivity and interchange capacity at Chatswood, Central Station, Martin Place, Sydenham and Bankstown
- ▶ upgrading the Bankstown Line between Sydenham and Bankstown to be part of the high capacity, high frequency Sydney Metro system.

2.2 Project history

Sydney's Rail Future (2012) identified an extension of Sydney Metro Northwest from Chatswood to Bankstown via the CBD. This involves the development of the Sydney Metro City & Southwest (the Project), including a second harbour rail crossing connecting to a new CBD rail line, and the connection to and conversion of the T3 Bankstown Line to metro operations.

In June 2014, the NSW Government announced *Rebuilding NSW*, which would provide \$20 billion from leasing the state's electricity businesses to invest in infrastructure.

In November 2014, the Premier identified Sydney Metro City & Southwest as a strategic priority for consideration in the *State Infrastructure Strategy Update 2014*, which prioritised the allocation of funds from *Rebuilding NSW*. A preliminary business case was submitted to Infrastructure NSW setting out the case for the investment, project definition, strategic options to expand the scope, project benefits, and an initial delivery strategy.

Infrastructure NSW concluded in the *State Infrastructure Strategy Update 2014* that Sydney Metro City & Southwest had strategic merit, as it would benefit Sydney Metro Northwest users by reducing transfer penalties at Chatswood interchange, and would provide significant relief for the T1 North Shore, Northern and Western Line, and City Circle, as well as to crowded CBD stations. It would also deliver significantly improved capacity and performance across the wider rail network. As a result, the NSW Government reserved an additional \$7 billion from *Rebuilding NSW* for the Sydney Metro City & Southwest in November 2014.

² *A Plan for Growing Sydney*, Department of Planning and Environment, p3; Sydney Metropolitan Fact Sheet, Department of Planning and Environment, p1; Bureau of Statistics and Analysis Small Area Employment 2014; *Sydney Metro City Shaping Opportunities Analysis*, Mecone, p6

³ Sydney City Centre Access Strategy, December 2013, p9

Modelling undertaken for Infrastructure NSW by Deloitte Access Economics demonstrated that the *Rebuilding NSW* initiative and the investment proposed in the *State Infrastructure Strategy Update 2014* could effectively increase NSW gross state product (GSP) by \$30.9 billion in 2035 – an increase of 3.6 per cent over the level of GSP that would occur without the investment – and generate about 122,000 jobs. The increase in GSP comes largely from the reinvestment of funds into productive infrastructure.

In March 2015, the Australian and NSW Governments committed to joint funding of over \$9 billion under the National Partnership Agreement on Asset Recycling, \$1.356 billion of which was allocated to the Project.

The Final Business Case (summarised in this report) was prepared to enable the NSW Government to make an informed project investment decision for the Sydney Metro City & Southwest, and to make an informed decision on the precise timing, scope, funding and delivery strategy for the Project.

The Final Business Case was independently reviewed in terms of the NSW Government’s Infrastructure Investment Assurance Framework and the panel considered that it provides a compelling and comprehensive justification for the Project and met its requirements for a Final Business Case, recommending its consideration by Government.

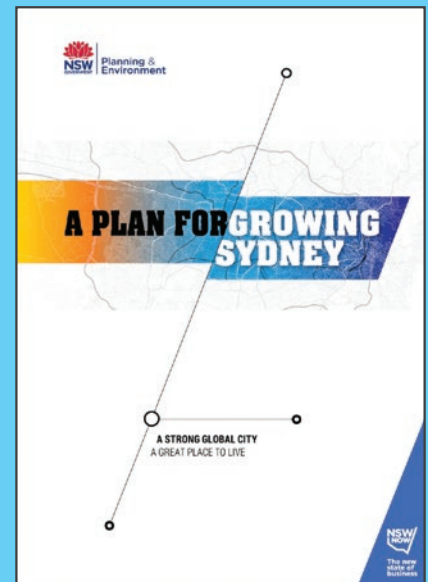
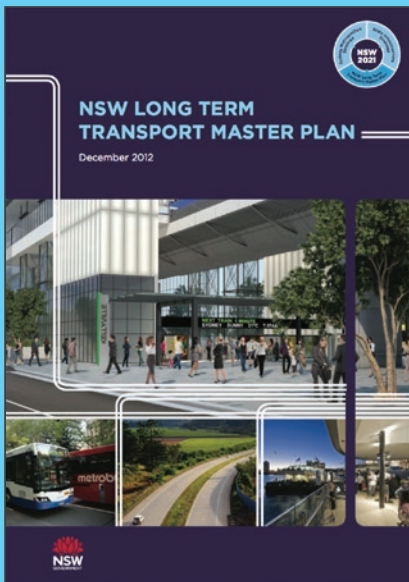


2.3 Strategic policy context

The Australian and NSW Governments have recognised the importance of maintaining the economic strength and liveability of cities, and have introduced a number of plans and reforms that support the development of Sydney.

This clear, linked and complete hierarchy of future-orientated, publicly available plans demonstrates a strategic planning framework focused on economic productivity, liveability and sustainability, supported by integrated land use, transport and infrastructure development.

- ▶ The Project addresses Infrastructure Australia's strategic infrastructure priorities.
- ▶ The Project has been developed to address the NSW Government strategic directions and objectives set out in *NSW 2021*, *NSW State Plan*, *State Infrastructure Strategy Update 2014*, the *NSW Long Term Transport Master Plan*, *A Plan for Growing Sydney* and the TfNSW corporate objectives.



2.4 Strategic goals and objectives

The priorities from the government strategies relevant to this Project are summarised and grouped according to the three themes of productivity, liveability and sustainability and shown in Table 2.1.

The Australian and NSW governments’ strategic priorities demonstrate that effective integrated transport and land use planning, and the resultant infrastructure development, will drive strong productivity, liveability and sustainability outcomes for Sydney, with significant benefits flowing to the state and the nation.

Table 2.1 Key goals and objectives, by strategy

National	State and city		Transport	
Infrastructure Australia’s strategic priorities	NSW State Plan – <i>Making it Happen</i>	<i>A Plan for Growing Sydney</i>	<i>NSW Long Term Transport Master Plan</i>	TfNSW Corporate Objectives
Productivity				
<ul style="list-style-type: none"> ▶ Expand Australia’s productive capacity ▶ Increase Australia’s productivity ▶ Diversify Australia’s economic capabilities ▶ Build on Australia’s global competitive advantages 	<ul style="list-style-type: none"> ▶ Create jobs ▶ Encourage business investment ▶ Boost apprenticeships 	<ul style="list-style-type: none"> ▶ Grow a more competitive Sydney CBD ▶ Grow high-skilled jobs in the Global Economic Corridor by expanding employment opportunities and mixed-use activities ▶ Invest to improve infrastructure and remove bottlenecks to grow economic activity ▶ Invest in strategic centres across Sydney to grow jobs and housing and create vibrant hubs of activity 	<ul style="list-style-type: none"> ▶ Support economic growth and productivity ▶ Support regional development 	<ul style="list-style-type: none"> ▶ Enable the transport system to support the economic development of the state ▶ Achieve greater efficiency

National	State and city		Transport	
Infrastructure Australia's strategic priorities	NSW State Plan - <i>Making it Happen</i>	<i>A Plan for Growing Sydney</i>	<i>NSW Long Term Transport Master Plan</i>	TfNSW Corporate Objectives
Liveability				
<ul style="list-style-type: none"> ▶ Develop Australia's cities and regions ▶ Improve social equity and quality of life in our cities and regions 	<ul style="list-style-type: none"> ▶ Increase housing supply ▶ Improve road travel reliability ▶ Reduce road fatalities ▶ Ensure on-time running for public transport ▶ Improve government services 	<ul style="list-style-type: none"> ▶ Undertake urban renewal in transport corridors, which are being transformed by investment and around strategic centres ▶ Revitalise existing suburbs ▶ Diversify the CBD by enhancing the cultural ribbon, which connects new and revitalised precincts including Barangaroo 	<ul style="list-style-type: none"> ▶ Improve liveability ▶ Improve quality of service ▶ Improve safety and security 	<ul style="list-style-type: none"> ▶ Put the customer first, and design the transport system around the needs and expectations of the customer ▶ Focus on performance and service delivery, based on a strong purchaser-provider model with clear accountabilities for outcomes ▶ Provide safe transport services in accordance with a safety regulatory framework
Sustainability				
<ul style="list-style-type: none"> ▶ Reduce greenhouse emissions 	<ul style="list-style-type: none"> ▶ Build infrastructure 	<ul style="list-style-type: none"> ▶ Preserve future transport corridors to support future growth 	<ul style="list-style-type: none"> ▶ Reduce social disadvantage ▶ Improve sustainability 	<ul style="list-style-type: none"> ▶ Promote the delivery of transport services in an environmentally sustainable manner ▶ Contribute to the delivery of social benefits for customers

2.5 Project objectives

Sydney Metro City & Southwest has been developed to help meet the Australian and NSW Governments' strategic planning and policy goals. These objectives will ensure that the Project addresses critical national and state priorities. They also underpinned the evaluation process and will help shape the development of the metro network during future stages of development.

The Project objectives are to:

- ▶ improve the quality of the transport experience for customers
- ▶ provide a transport system that is able to satisfy long-term demand
- ▶ grow public transport patronage and mode share
- ▶ support the productivity of the Global Economic Corridor
- ▶ serve and stimulate urban development
- ▶ improve the resilience of the transport network
- ▶ improve the efficiency and cost effectiveness of the public transport system
- ▶ implement a feasible solution recognising impacts, constraints and delivery risk.

Key stakeholders in the process included the Department of Premier and Cabinet, Treasury, Infrastructure NSW, the Department of Planning and Environment, TfNSW divisions, Sydney Trains, NSW Trains, and Roads and Maritime Services. External stakeholders included local governments, local businesses, special interest groups, infrastructure development organisations and the general community.

2.6 Final Project design

All Sydney Metro trains will operate initially as six-car trains, with a design capacity for 1,152 customers. Train capacity can be increased through the extension to eight-car sets with a design capacity of 1,539, providing a maximum capacity of 46,170 passengers per hour per direction (ultimate capacity frequency of 30 trains per hour in each direction).

The operation of the Sydney Metro between Cudgegong Road (Rouse Hill) and Bankstown will require at least 59 six-car trains, enabling services to initially (2024) operate at least every four minutes during peak periods, or 15 trains per hour in each direction.

The metro network will be equipped and integrated with Communications Based Train Control, which will continually monitor and manage the reliable and safe movement of all trains.

The Sydney Metro Trains Facility at Tallawong Road will be expanded for the maintenance of the additional fleet and stabling of trains required for the project. Additional stabling would also need to be provided at a location to be determined.

Peak hour services are planned to initially operate at 15 trains per hour (every four minutes) in each direction between Cudgegong Road (Rouse Hill) and Bankstown. Off-peak services will operate every 10 minutes (six trains per hour per direction). This will be supplemented with additional trains between Sydenham and Chatswood during the weekday inter-peak period (Monday to Saturday from approximately 9.30 am–3 pm). Services will operate for 21 to 22 hours a day.

The NSW Government will retain control of fares and timetable requirements (frequency and span of hours), with fares consistent with the Opal system.



Artist's impression of Barangaroo Station entry from Barangaroo Reserve

2.7 Project benefits

Sydney Metro City & Southwest will provide a range of high-value benefits to Sydney and NSW.

2.7.1 Transport benefits

- ▶ Enables the longer-term development of the Sydney rail network through increasing rail network capacity.
- ▶ Supports forecast growth in rail patronage from 168,400 to 288,000 trips in the one-hour AM peak by 2036.
- ▶ Increases total rail network capacity available on the network by 60 per cent (through the addition of ultimately 60 high-capacity metro train paths each hour allowing more passengers to be carried).
- ▶ Delivers 31 per cent more train services in 2024 (40 additional services in 2024) than if the project is not implemented.
- ▶ Transfers 20,000 private car trips to rail in 2036 in the 3.5 hour AM peak, reducing road congestion.
- ▶ Provides customers with significant travel time savings and increased reliability and comfort.
- ▶ Reduces train crowding and crowding at key stations, including Central, Town Hall, Wynyard and North Sydney.
- ▶ Reduces traffic and bus congestion across Sydney Harbour and into the CBD.
- ▶ Improves transport network resilience on the lower North Shore and through the CBD.
- ▶ Enhances customer satisfaction for those travelling within the Global Economic Corridor and on the T3 Bankstown Line.
- ▶ Enhanced safety features.

2.7.2 Key city building benefits

- ▶ Peak additional employment during the construction period of 6,233 workers.

- ▶ \$8,562 million per annum additional value add in 2036, from increased co-location and productivity of businesses and workers in the corridor.
- ▶ Stimulates 44,245 additional jobs in the corridor by 2036.
- ▶ Between \$721 and \$1,761 savings per annum in 2036 for households through reduced cost of living (medium- or high-density dwellings in transit-oriented developments have a lower average consumption profile of electricity, gas and water).

2.7.3 Key economic benefits

- ▶ Total economic benefits of \$62,120 million (real), \$12,988 million (present value).
- ▶ Transport economic benefits of \$9,118 million (present value).
- ▶ Productivity or wider economic benefits of \$2,713 million (present value).
- ▶ City building or land use benefits of \$1,157 million (present value).

Net present value is the value in the present (30 June 2015) of a sum of money, compared to its future value if invested with compound interest. For example, \$110 due in one year's time has a net present value of \$100 if invested at an annual rate of 10 per cent.

NPV of the Project is █████.

A **benefit cost ratio** (BCR) is the ratio of a Project's benefits relative to its costs. The BCR for the Project is 1.████, or, to put it more simply, the Project will deliver \$1.████ worth of benefits for each \$1 invested.

Note: Due to the live tendering process currently underway, the final BCR has been redacted to ensure value-for-money for NSW Government in the procurement process. This redaction will be removed once the procurement process is complete.

However, given the Project's cost range of \$11.5 billion to \$12.5 billion, this represents an equivalent BCR range of about 1.47 to about 1.6. The BCR for the project is 1.53 at the midpoint of this cost range.



Showground Station, March 2015

2.8 Delivery program

Initial industry engagement has included an industry briefing and a market sounding process, to inform the Delivery Strategy. The Delivery Strategy will continue to evolve as a result of the further development and definition of the Project, the receipt of more detailed feedback from industry through further industry engagement (including a second round

of industry engagement that has recently been undertaken), and through proposed pre-augmentation discussions with NRT.

The Project is expected to open in 2024. The critical path for the Project includes the acquisition and vacant possession of land, and the award of the Tunnelling and Station Excavation (TSE) contract, both of which are planned to be completed by the middle of 2017.

Table 2.2 Reference contract packaging approach

Package	Overview of scope	Form of contract
TSOM: Trains, Systems, Operations and Maintenance	Rolling stock Signalling system Central control Communications and other systems Depot (including stabling) and Operations Control Centre Systems integration, testing and commissioning Operations and maintenance	Augmentation of the existing Sydney Metro Northwest Operations, Trains and Systems (OTS) PPP contract with Northwest Rapid Transit (subject to value for money)*
Line-wide Contracts	Station control systems Lifts and escalators Tunnel ventilation Track including tunnel services (drainage, lighting, fire systems, LV supplies), stabling, combined services cable brackets High voltage power supply Overhead line and traction supply Radio communications Platform screen doors, platform edge barriers, mechanical gap fillers	The form of contract will be tailored for each Line-wide Contract (e.g. supply only, supply and install with through life support)
STME: Stations, Mechanical and Electrical Works	Excavation of remaining station shafts (to extent not undertaken by TSE Contractor) Station structure up to podium level (excluding Barangaroo and Central Station) Station fitout, including mechanical and electrical (all underground stations excluding Central Station)	Design and Construct

* Potential for incorporating private financing to be considered as part of augmentation discussions with Northwest Rapid Transit.

Package	Overview of scope	Form of contract
TSE: Tunnels and Station Excavation Works	Demolition and site preparation (via novation to TSE Contractor) Tunnel boring and lining Cavern mining and lining Excavation of station shafts (extent varies at different station locations) Station structure at Barangaroo only	Design and Construct
CSM: Central Station Main Works	Customer continuity works Services relocation Temporary decommissioning of platforms and reinstatement Metro box excavation Station structure and fitout Potential additional works in the vicinity	Design and Construct, with government retaining some risks (via Early Contractor Involvement tender process)
SSC: Southwest Station and Corridor Works	Bridge and non-station civil works Station works (including demolition, upgrades) Services buildings and facilities Electrical works (low voltage) Cable and services routing Track and other rail infrastructure	Design and Construct, with government retaining some risks (via Early Contractor Involvement tender process)
Early and Enabling Works	Investigation Early design Demolition and site preparation (to be novated to the TSE Contractor) Sydney Trains enabling works Sydney Yard Access Bridge Northern corridor brownfield works Pacific Highway works High voltage construction power Utility relocations and protection Mobile phone tower relocations	The form of contract will be tailored for each component of the enabling works (e.g. managing contractor, schedule of rates) Several scope components to be delivered via managing contractor approach
OSD: Over Station Development	The development of integrated property developments in connection with metro stations The development of surplus land which is no longer required after the construction phase	OSD Project Development Agreements



Artist's Impression of Martin Place Station

3. NEED FOR INVESTMENT

3.1 A global Sydney

Sydney is Australia's only global city – as shown by its economic and cultural influences, engagement with international trade and finance, strong liveability, and attractiveness to globally mobile workers and visitors. Sydney's economy represents one-fifth of Australia's gross domestic product.

Sydney makes up over 60 per cent of the State's total population, with 4.3 million residents⁴, and generates over 70 per cent of NSW's gross state product.

The city's key employment and economic areas are clustered in a corridor that extends from the CBD north to Macquarie Park and Norwest and south to Sydney Airport. Known as the Global Economic Corridor, this is home to high-value service industries, including finance, insurance, technology, health and tourism, and generates over 41 per cent of NSW's gross state product⁵.

Sydney's population is forecast to increase from 4.3 million people to 6.2 million people by 2036⁶. Driven by population growth, employment in Sydney is expected to increase from its current level of 2.1 million workers to 3.1 million by 2036.

The Australian and NSW Governments have developed national and city building policies to support the continued growth and development of Sydney's economy and sustainability. Further investment in transport infrastructure is a key requirement to achieve these policy objectives.

Growth in employment and population size calls for increased transport capacity to ensure continued productivity growth and to sustain Sydney's liveability. The number of people travelling to the city centre each day is forecast to grow to 775,000 by 2031. This is an extra 145,000 trips every day⁷.

The current transport system cannot provide the capacity required. The road and bus networks are already heavily constrained and cannot effectively be augmented into the CBD. Sydney's rail network is complex and becoming more crowded and unreliable. With the expected rate of population growth, Sydney is fast outgrowing its existing heavy rail network.

There is an urgent need to progress Sydney Metro City & Southwest. Delay will result in impacts such as \$2 billion of lost economic benefits a year on average; 3,535 jobs lost every year in the Global Economic Corridor; lost worker productivity and wages growth; and higher costs of living.

⁴ *State Infrastructure Strategy Update 2014*, p10; and *A Plan for Growing Sydney*, Department of Planning and Environment, p3

⁵ *A Plan for Growing Sydney*, Department of Planning and Environment, p44

⁶ *A Plan for Growing Sydney*, Department of Planning and Environment, p3; *Sydney Metropolitan Fact Sheet*, Department of Planning and Environment, p1; *Bureau of Statistics and Analysis Small Area Employment 2014*; *Sydney Metro City Shaping Opportunities Analysis*, Mecone, p6

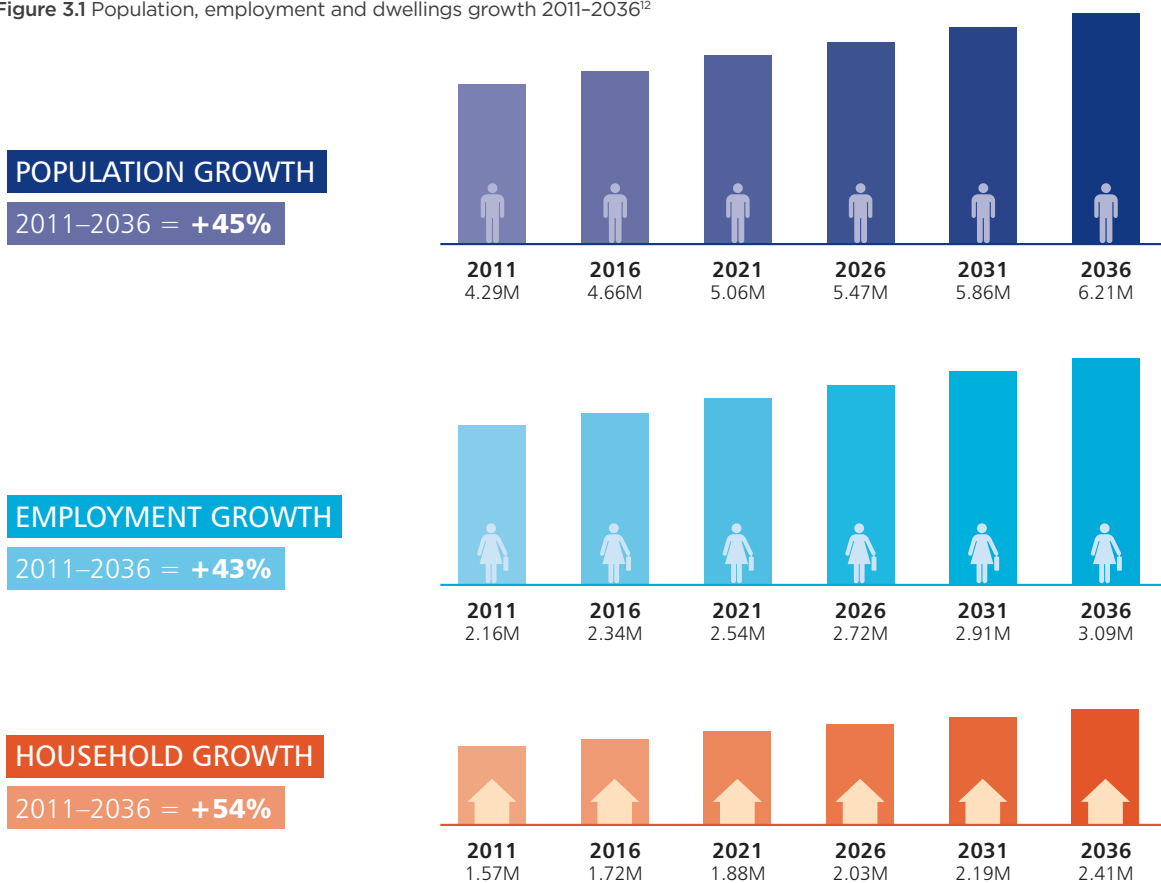
⁷ *Sydney City Centre Access Strategy*, December 2013, p9

3.2 Sydney's population and employment growth

As Australia's global city, Sydney generates more than one-fifth of Australia's gross domestic product, competing with other international cities in the region such as Singapore and Hong Kong as a home for global investment. Sydney also generates over 70 per cent of NSW's total gross state product⁸. The city is one of the most liveable cities in the world, and is home to 4.3 million residents and 451,000 businesses⁹.

A sign of Sydney's prosperity is that its economic output and population are growing. Close to 200,000 jobs have been added to the NSW economy over the past five years¹⁰. By 2031 Sydney's economic output will almost double to \$565 billion a year and there will be 689,000 new jobs (based on a study undertaken in 2014). In the next 20 years, Sydney's population will grow by 1.6 million people¹¹.

Figure 3.1 Population, employment and dwellings growth 2011-2036¹²



⁸ State Infrastructure Strategy Update 2014, Infrastructure NSW, p17 and p10

⁹ A Plan for Growing Sydney, Department of Planning and Environment, p3

¹⁰ State Infrastructure Strategy Update 2014, Infrastructure NSW, p6

¹¹ A Plan for Growing Sydney, Department of Planning and Environment, p4

¹² A Plan for Growing Sydney, Department of Planning and Environment, p3; Sydney Metropolitan Fact Sheet, Department of Planning and Environment, p1; and Bureau of Statistics and Analysis, Sydney Metro City Shaping Opportunities Analysis, Mecone, p6

As Sydney continues to develop it faces new challenges to cater for growth in employment, population and dwellings, ongoing economic productivity and liveability. It needs highly efficient economic centres to support growth in jobs and productivity.

Sydney's knowledge jobs are heavily concentrated within the Global Economic Corridor (see Figure 3.2), and are in sectors such as education, finance and other business services, communications, high-tech manufacturing, and emerging industries such as biotechnology. These sectors are at the forefront of innovation in Sydney's economy¹³.

The Global Economic Corridor generates over 41 per cent of the NSW gross state product. This economic cluster is unique in Australia due to the extent, diversity and concentration of globally competitive industries¹⁴. By clustering these jobs into the Global Economic Corridor they have become more productive as they interact with a larger pool of employees, customers, suppliers, competitors and partners.

It is imperative that the Sydney CBD continues to be Australia's premier commercial district and build on its strengths. The Sydney CBD has 10 times the number of jobs than any other centre in Sydney, and generates 28 per cent of the city's gross domestic product¹⁵. Barangaroo, Sydney's newest precinct, will provide a hub for Sydney's financial and professional services, and will further enhance the city's appeal for international investment and skilled workers¹⁶.

To continue to grow and develop, the Global Economic Corridor, including Sydney CBD and Barangaroo, will require high-quality transit amenity to remain an attractive place to do business and to work.

To support Sydney's projected population growth, the rate of development of new dwellings will also need to increase, with 664,000 dwellings needed over the next 20 years¹⁷. To maintain liveability and support continued growth in productivity, these homes will need to be located with high-quality transit amenity to employment areas, enabling residents to actively participate in Sydney's growing economy.

¹⁵ *A Plan for Growing Sydney*, Department of Planning and Environment, p44

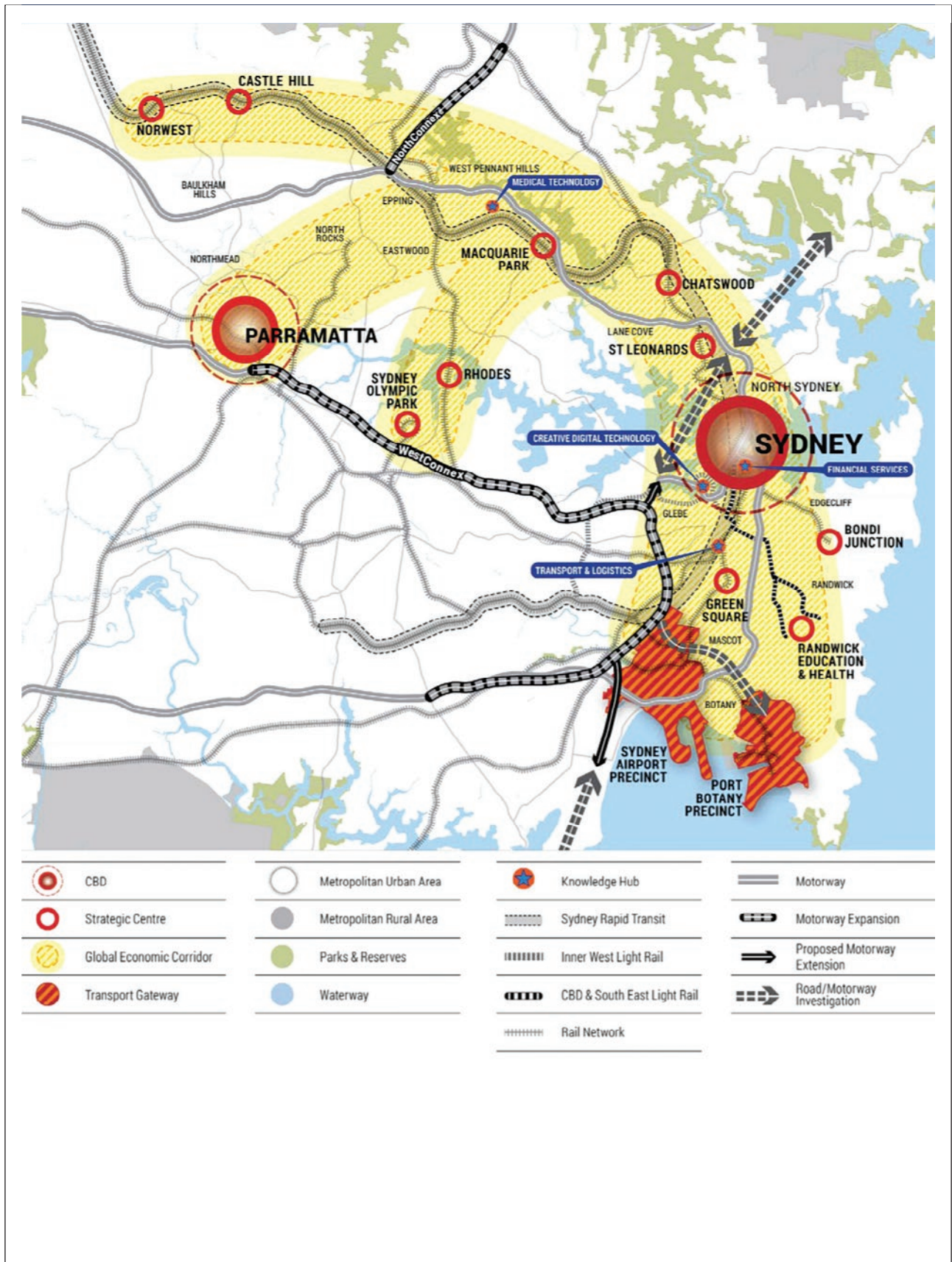
¹⁶ *A Plan for Growing Sydney*, Department of Planning and Environment, p44

¹⁷ *A Plan for Growing Sydney*, Department of Planning and Environment, p24

¹⁶ *A Plan for Growing Sydney*, Department of Planning and Environment, p24

¹⁷ *A Plan for Growing Sydney*, Department of Planning and Environment, p64

Figure 3.2 Map of Sydney's Global Economic Corridor¹⁸



¹⁸ A Plan for Growing Sydney, Department of Planning and Environment, p47

3.3 Challenges to continued economic growth and productivity

For Sydney to continue to be one of the most economically productive and liveable areas in Australia, its growth will need to be managed.

To maintain the liveability of the city, transport capacity is required to enable the development of new, affordable housing and to enable people to move around the city to enjoy their daily lives.

Demand for transport is forecast to grow by more than 30 per cent by 2031¹⁹. While there is significant investment planned for the road network, cars and buses cannot provide the mass transit capacity of the heavy rail network.

Rail network demand is expected to increase by 41 per cent by 2026, with the growth in demand for rail travel into the CBD expected to increase by 31 per cent by 2026²⁰.

The current suburban rail network has a number of significant constraints. Most of the Sydney rail network was built more than 100 years ago and is complex compared to networks elsewhere. It is made more complex by having many branch lines converge into six inbound tracks through the CBD. The funnelling of up to 15 branch lines into this limited CBD capacity constrains the utilisation of each branch, but also creates a more complex rail operation.

3.3.1 Challenges to accommodating population growth

There is a need to provide 664,000 new dwellings in Sydney over the next 20 years²¹, which is an average of over 33,000 dwellings per annum. These dwellings will need to be well connected to jobs and services, high quality, affordable, within the walking catchments of larger centres, and serviced by transport infrastructure. Over the past five years, new housing has grown from around 13,300 dwellings per annum to around 22,800 dwellings per annum, the highest level since 2002.

To support the new housing requirements the following 10 priority precincts have been identified – North Ryde Station, Epping Town Centre, Wentworth Point, Carter Street Lidcombe, Herring Road Macquarie Park, Showground Station, Bella Vista Station, Kellyville Station, Banksia and Arncliffe²².

The *Sydenham to Bankstown Urban Renewal Corridor Strategy*, released by the NSW Department of Planning and Environment, identifies opportunities for additional housing and jobs within walking distance of the 11 train stations along the existing Sydney Trains T3 Bankstown Line (the Sydenham to Bankstown Upgrade component of the Project). The strategy forecasts that approximately 36,000 additional dwellings could be built within the corridor by 2036. St Leonards and Crows Nest have also recently been identified for investigation as priority precincts.

¹⁹ TfNSW figures. Figures relating to population and economic growth in this report are calculated based on NSW Government and Australian Bureau of Statistics data.

²⁰ TfNSW figures. Figures relating to population and economic growth in this report are calculated based on NSW Government and Australian Bureau of Statistics data.

²¹ *A Plan for Growing Sydney*, Department of Planning and Environment, p64

²² *A Plan for Growing Sydney*, Department of Planning and Environment, p67

3.3.2 Challenge of addressing equity of access across the city

By 2038 it is projected that the population of western Sydney will exceed that of eastern Sydney.

Yet the majority of jobs will continue to be in the east, resulting in a continued imbalance between where people live and work. By 2041 it is projected that there will be 680,000 more jobs in the east compared to the west.

There are strong links between transit amenity and access to employment (and hence household income) and public services including education. The socio-economic index for areas (SEIFA) provides a ranking of the welfare of Sydney residents in terms of their access to material and social resources and their ability to participate in society. There is a real challenge to provide additional transit amenity to the north west and south west of Sydney.

3.4 Sydney's transport network challenges

3.4.1 Increasing public transport demand

Sydney's transport network is congested. As demand on the transport network grows, public transport will no longer be able to meet its key service requirements. The Sydney Business Chamber has noted that Sydney scores poorly on the quality of its public infrastructure, particularly its transport networks, and that this is impacting productivity²³.

The number of trips for all modes of travel is expected to increase by 24 per cent in 2026 and by 40 per cent by 2036²⁴. Motor vehicle transport is expected to reduce as a percentage of total travel modes from 79 per cent in 2014 to 76 per cent in 2036. This is due to;

- ▶ intensification of land-use at public transport hubs (for example, Epping will see a 28 per cent increase in the population within walking distance of the station by 2019);
- ▶ investment in public transport including Sydney Metro Northwest and the CBD and South East Light Rail, and more buses, trains and ferries;
- ▶ and increased road congestion.

Sydney will require increased transportation capability to support employment and population growth. Of the three primary transportation modes, it is projected that travel by rail will experience the highest growth in demand, more than double that of buses and over a third more than that of car trips²⁵.

3.4.2 Road network congestion

Sydney's roads are already some of the most congested in Australia. As transport demand grows there is limited ability to augment the road network to increase capacity and reduce congestion.

²³ Referred to in *State Infrastructure Strategy 2012-2032*, INSW, p4

²⁴ TfNSW figures. Figures relating to population and economic growth in this report are calculated based on NSW Government and Australian Bureau of Statistics data.

²⁵ *State Infrastructure Strategy 2012-2032*, p38

3.5 Sydney's rail network challenges

Sydney's rail network is the backbone of the city's public transport system. On a typical workday, customers take approximately one million journeys on the rail network, one-third of which occur between 6am and 9.30am. With the expected rate of population growth, Sydney is fast outgrowing its rail network. Growth in population and employment is forecast to increase rail network demand by 41 per cent by 2026 and 61 per cent by 2036²⁶.

With the implementation of planned rail service enhancements to coincide with the opening of Sydney Metro Northwest, passenger demand into the CBD is expected to increase by 31 per cent by 2026. Passenger growth on services into the CBD will vary considerably on a line-by-line basis.



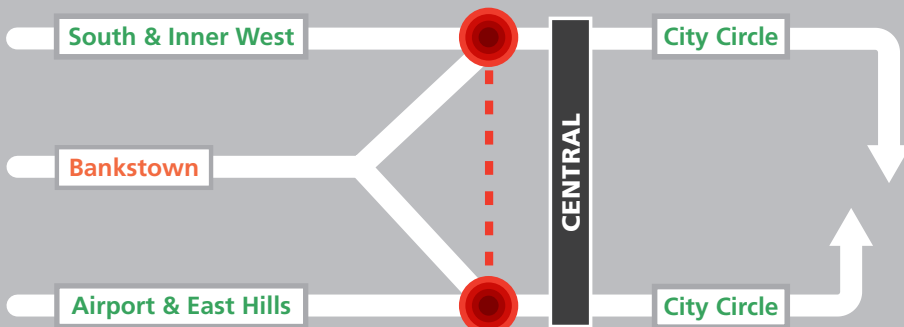
TBM1 Elizabeth factory acceptance testing, June 2014

²⁶ TfNSW figures. Figures relating to population and economic growth in this report are calculated based on NSW Government and Australian Bureau of Statistics data.

Figure 3.3 Congestion on Sydney's current heavy rail network



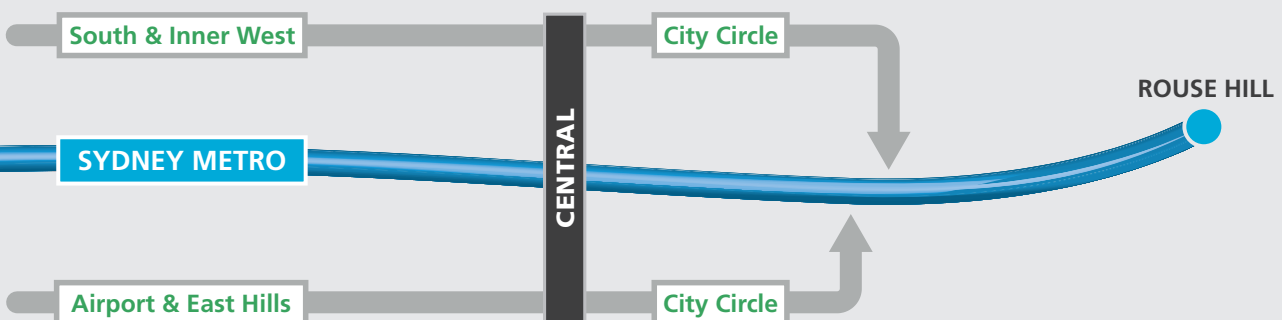
CURRENT Before Sydney Metro



- The Bankstown Line adds to Sydney's big rail bottleneck
- It funnels trains on to the East Hills and Inner West lines outside Central
- Queuing trains make delays worse, causing backlogs in the west and south west

6 CBD TRACKS

FUTURE With Sydney Metro - busting congestion



- Removes the Bankstown Line bottleneck by putting the line on Sydney's new stand-alone metro system
- Suburban trains from the Bankstown Line allocated to other lines
- Clearing the funnel means more trains and more reliable services

There are only two lines through the city (T1 North Shore, Northern and Western Line and T4 Eastern Suburbs and Illawarra Line) and two lines that share the City Circle loop (T2 Airport, Inner West and South Line and T3 Bankstown Line). A number of services are required to terminate at Central Station.

Other key infrastructure constraints, such as Town Hall Station where there is considerable crowding, further limit the capacity of the network.

The implementation of the 2013 rail timetable has acted to significantly reduce network complexity, particularly on the T1 Western Line. Once Sydney Metro Northwest opens in 2019, the T3 Bankstown Line and T2 Airport, Inner West and South Line will remain as the most complex operations in the network. The T3 Bankstown Line and T2 Airport, Inner West and South Line use the City Circle to traverse the Sydney CBD, with some services on the city inner track (counter-clockwise) and some on the city outer track (clockwise). Figure 3.4 shows how the 20 per hour per direction services are allocated on the City Circle.

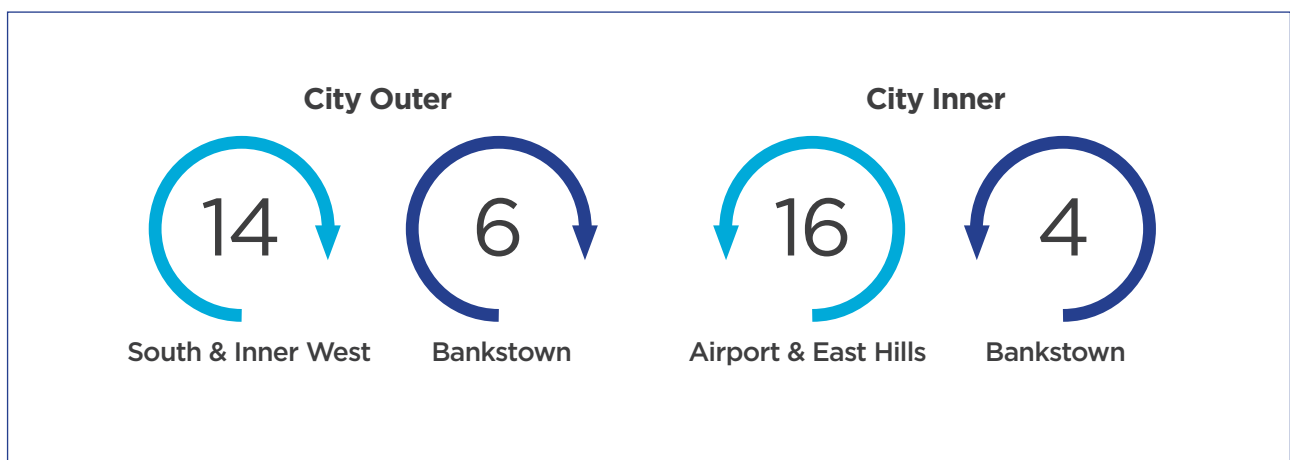
The limited network capacity restricts the number of services that can be provided, resulting in increased crowding on trains and platforms, and decreased reliability of services.

Without an increase to the network capacity, by 2026 demand will exceed capacity on the T1 North Shore, T1 Northern, T2 Inner West and South, and T3 Bankstown Lines, and demand will be approaching capacity on T2 Airport and South Line.

By 2036 demand on the T2 Inner West and South Line and the T3 Bankstown Line will exceed capacity, to the extent that some customers will not be able to board the trains and there will be major impacts to the reliability of these services. Demand will exceed capacity on the T1 Northern Line, T1 North Shore Line and T2 Airport and South Line services, and will have a material impact on service reliability. By 2036, demand for rail services will be at 108 per cent of capacity, leading to widespread crowding and decreases in reliability.

A key challenge will be to provide additional capacity to these areas before 2026.

Figure 3.4 City Circle train allocations, based on 20 per hour per direction services



3.6 Urgency

Employment and population growth require increased transport capacity, to ensure continued growth in productivity and to sustain Sydney's liveability.

Rail is predicted to experience the highest growth in travel demand with the number of people travelling to Sydney's CBD during the morning and evening peaks forecast to grow.

Many parts of the rail system are constrained by network capacity limitations.

Without the creation of additional rail capacity, crowding levels on the network will continue to increase.

Once complete, Sydney Metro City & Southwest would deliver a major increase in the capacity of Sydney's rail network, with the capacity to run up to 30 trains per hour through the Sydney CBD in each direction.

This provides the foundation for delivering a 60 per cent increase in the number of trains operating on Sydney's rail network in peak periods, which would cater for an extra 100,000 customers per hour across CBD rail line.

Analysis shows that Sydney Metro City & Southwest is required to be implemented by 2024. The impacts of a delay in implementing Sydney Metro City & Southwest are:

- ▶ **Sydney's transport network problems** – Additional public transport travel time (12.7 million weighted passenger hours per annum in 2036), 20,000 additional road network peak hour trips (AM peak, 2036), and a cost of road congestion equivalent to 5.9 million weighted driver and passenger hours per annum in 2036. 'Weighted driver and passenger hours' refer to the hours lost because people (both drivers and their passengers) are stuck in traffic.
- ▶ **Sydney's rail network problems** – Increased rail demand to CBD of 6,733 trips (AM peak) in 2026, six additional train services a year needed to meet demand in 2026, increased train crowding of 3.3 million weighted passenger hours in 2026, increased station crowding of 8.4 million weighted passenger hours in 2026, and reduced reliability of 5.1 million weighted passenger hours in 2026.
- ▶ **Nation and city building problems** – Lost economic benefits (an average of \$2.0 billion per annum), lost economic value add, lost productivity per worker, lost jobs, lost cost of living savings, reduced wages and reduced competitiveness.



Artist's impression of Victoria Cross Station

4. ALTERNATIVE OPTIONS

This chapter looks at some of the options considered as part of the planning processes for the Project. By reviewing the main transport options against objectives, it shows how the chosen option achieves all strategic policy goals and objectives and is the most appropriate long-term mass transit solution.

4.1 Narrowing the options

The number of people travelling to the Sydney city centre each day is forecast to grow to 775,000 by 2031. This amounts to an extra 145,000 trips every day – equivalent to 116,000 more cars driving into the Sydney CBD every day, which is comparable to the daily traffic volume on the six-lane M4 motorway. Put another way, it equates to 2,685 more buses driving into the Sydney CBD every day, which is almost three times as many buses as currently access the city in the morning peak. Suburban rail must continue to be the ‘heavy lifter’ and carry the largest share of growing demand.

To ensure construction of a metro line from Chatswood to Bankstown was the best solution a number of alternative options were assessed during the development of the *NSW Long Term Transport Master Plan* and *Sydney’s Rail Future* including:

- ▶ regulatory, governance and better-use reforms
- ▶ road, bus and light rail alternatives
- ▶ rail network efficiency options
- ▶ *Sydney’s Rail Future* network options.

While regulatory, governance and better-use reforms are important, and partially address the Project objectives, they are not enough on their own. A number of road and bus options are being implemented, but these are also insufficient to address the forecast growth in travel demand.

All five stages of *Sydney’s Rail Future* are required to meet the long-term capacity challenges facing the transport network. While Stages 1 to 3 are being implemented,

they fall well short of achieving the strategic policy goals and objectives over the longer term without the addition of Stages 4 and 5.

An alternative to implementing Stages 4 and 5 is to increase capacity on the T1 North Shore, Northern and Western Line to 24 trains per hour. While this would help to achieve some of the strategic policy goals and objectives in the short term, it has significant cost and risk, and only provides an incremental capacity increase while forcing more passengers through Town Hall, Wynyard and North Sydney stations.

Implementing Stages 4 and 5 of *Sydney’s Rail Future* (Sydney Metro Northwest and Sydney Metro City & Southwest) is the preferred network option. It achieves all strategic policy goals and objectives and is the most appropriate long-term mass transit solution.

4.2 Non-metro alternatives considered

As an alternative to further investment in Sydney Metro, the NSW Government considered a range of regulatory, governance and better-use reforms. The reforms could include:

- ▶ regulatory reform (including review of passenger transport legislation to allow for more flexible transport services)
- ▶ governance reform (including centralising transport planning and policy functions within Transport for NSW and integrating land use and transport planning, including for major growth corridors)
- ▶ better-use reform (including continued implementation of the integrated electronic ticketing system; a bus priority system;

- ▶ interchange upgrades; and improvements, expansion and modernisation of train and bus fleets).

While these reforms are vital to meeting the government’s policy objectives and are already being implemented, additional investment in transport infrastructure will also be required to ensure Sydney’s transport network meets future demand.

Table 4.1 compares the various options considered against the Project objectives. In conclusion:

- ▶ regulatory, governance and better-use reforms are important and partially address the Project objectives, but are not sufficient on their own
- ▶ road and bus alternatives are not appropriate given these solutions have limited capacity to adequately service the forecast growth in passenger demand

Table 4.1 Assessment of alternative options against Project objectives

Alternative options	Project objectives							
	Improve the quality of the transport experience	Provide a system that is able to satisfy long-term demand	Grow public transport patronage and mode share	Support the productivity of the Global Economic Corridor	Serve and stimulate urban development	Improve the resilience of the transport network	Improve the efficiency and cost effectiveness of the public transport system	Implement a feasible solution recognising impacts, constraints and delivery risk
Regulatory, governance and better-use reforms	●	●	●	○	●	●	○	●
Road and bus alternatives	■	■	●	●	■	●	●	■
Network efficiency (up to 20 trains per hour)	●	■	●	■	■	○	○	○
Network efficiency (up to 24 trains per hour)	●	■	●	●	●	■	○	■
<i>Sydney’s Rail Future preferred network option</i>	○	○	○	○	○	○	○	○

KEY

■ Weak support for objective

● Medium support for objective

○ Strong support for objective

- ▶ network efficiency improvements (Stages 1 to 3 of *Sydney's Rail Future*) are necessary but fall well short of achieving the Project objectives
- ▶ increasing to 24 trains per hour may achieve some Project objectives in the short-term but involves significant cost and risk and has minimal impact over the longer term
- ▶ the *Sydney's Rail Future* preferred network option achieves all Project objectives and is clearly the most appropriate long-term mass transit solution.

4.3 Metro alternatives considered

Many options were considered and evaluated during the development of the Project. The outcomes of the option development processes were confirmed through government and project governance arrangements.

Key stakeholders in the process included the Department of Premier and Cabinet, Treasury, Infrastructure NSW, the Department of Planning and Environment, TfNSW divisions, Sydney Trains, NSW Trains, and Roads and Maritime Services. External stakeholders included local governments, local businesses, special interest groups, infrastructure development organisations and the general community.

The analysis identified and assessed 41 station location options, including strategic options to incorporate additional stations. The preferred station locations between Chatswood and Sydenham are Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Central and Waterloo.

The analysis also identified and assessed a number of harbour crossing options, including the option of using the Sydney Harbour Bridge. The preferred option is to use a specifically designed tunnel boring machine (TBM) launched from Barangaroo, which best addresses cost, impact management, program and ground condition issues.

The assessment considered a number of existing lines in the southern sector of the Sydney Trains network for conversion to metro operations, with the preferred conversion option being the T3 Bankstown Line between Sydenham and Bankstown. The preferred option best provided increased capacity, growth, reduced station crowding, enhanced reliability and simpler conversion.

Converting the T3 Bankstown Line between Sydenham and Bankstown into a dedicated metro line would improve rail network reliability by reducing the number of rail lines sharing the same existing tracks and would facilitate much needed capacity increase from the west and south west. The Sydenham to Bankstown upgrade would unlock capacity at Central Station platforms and enable the relocation of train paths on the City Circle. It would also significantly reduce platform and train crowding. The T3 Bankstown Line does not share operations with other lines or rail freight. It would therefore be less complex to convert and segregate from the existing rail network when compared with other lines. The T3 Bankstown line would require less infrastructure work to convert to a metro service when compared with other lines, such as the T2 South Line and T4 Illawarra Line, which would require additional tunnels and tracks, significant enabling works such as alternative freight routes and a new train stabling and maintenance facility for Sydney Trains. The decision to proceed with a conversion of the T3 Bankstown Line to a metro service led to the alignment of the project from south of Central Station to just north of Sydenham Station.

A number of scope options for the Sydenham to Bankstown Upgrade were also assessed. The preferred scope option included ensuring *Disability Standards for Accessible Public Transport 2002* requirements are met, with some straightening of platforms, engineering solutions and platform screen doors, to meet business requirements and provide a value-for-money outcome.

Northern Corridor (Chatswood to the northern tunnel dive) options analysis included consideration of alternative surface or tunnel works options (by locating the northern tunnel dive at St Leonards or Chatswood). The preferred option is tunnel works, as this provides reduced impacts, less complexity through shared corridor interface with Sydney Trains, reduced impacts to Artarmon Station and Artarmon Reserve, reduced construction time and reduced cost.

Alternative operating strategies assessed included developing Sydney Metro as two separate lines, and alternative peak and inter-peak service plans. The preferred option is to develop Sydney Metro as one line, to better manage cost and transport outcomes, with an initial 20 six-car services an hour in the peak period using the Sydney Metro Northwest rolling stock configuration.

4.4 Station options analysis

The station options evaluation process – used to determine preferred station locations – involved a number of stages, each with an increasing level of detailed analysis. The analysis for the short list of station options are shown in figures 4.1 and 4.2. The Project objectives underpinned the evaluation criteria used in the options evaluation process.

4.5 Sydney Harbour Metro Crossing and tunnelling options

Aboveground and underground options were considered for crossing Sydney Harbour. These included:

- ▶ a new carriageway beneath the Sydney Harbour Bridge
- ▶ a new rail viaduct above lanes seven and eight of the Sydney Harbour Bridge
- ▶ conversion of lanes seven and eight of the Sydney Harbour Bridge to accommodate metro rail

- ▶ an immersed tube tunnel resting on the seabed
- ▶ bored tunnels below the seabed through rock
- ▶ bored tunnel below the seabed through rock and sediments.

4.5.1 Aboveground options

Options to install a new carriageway beneath the Sydney Harbour Bridge or to install a new viaduct above lanes seven and eight were found to have a number of constraints, such as impacts on (reductions to) shipping heights and/or substantial modification to the Sydney Harbour Bridge, which is a major landmark and a listed place on the National Heritage List. These options would also have broader network impacts during construction and operation (particularly in terms of access to the Sydney CBD for other transport modes). Consequently, these options were not progressed further.

The conversion of lanes seven and eight to accommodate the metro network would require connections to metro tunnel alignments to the north and south of the Harbour Bridge. Unlike the tunnel option (see below), use of the Sydney Harbour Bridge would require the use of existing suburban rail stations and platforms at North Sydney and Wynyard. The use of existing infrastructure for the project would largely result in replication of the existing T1 North Shore Line and would not provide additional rail services to new areas. Further, using existing infrastructure would have operational limitations; in particular, this option could not meet long-term capacity requirements (that is, there would be less than 30 trains per hour) and would result in longer journey times than a new tunnel. In addition, using the Sydney Harbour Bridge is estimated to cost substantially more than the preferred bored tunnel option (by over \$400 million).

4.5.2 Underground options

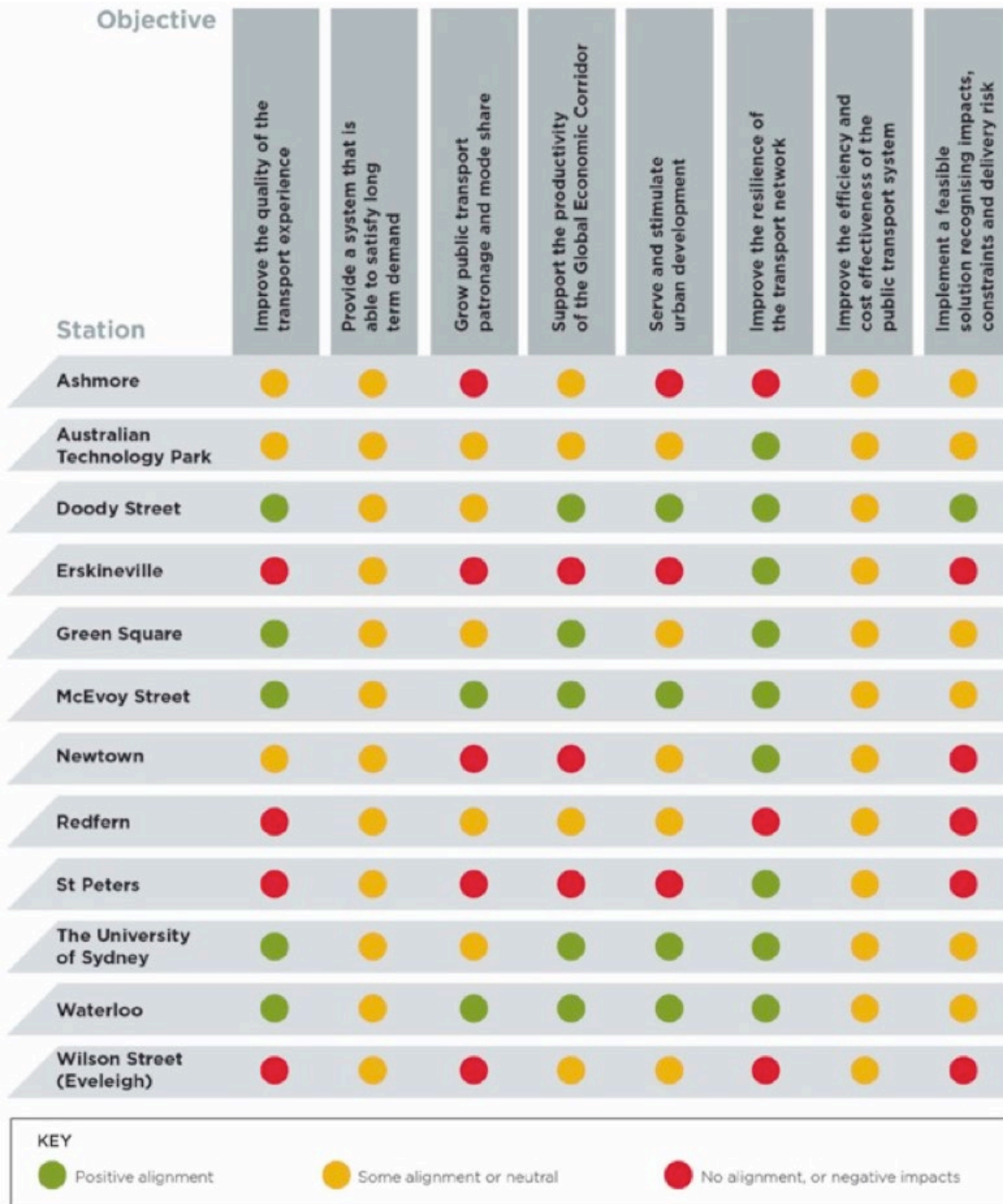
Options investigated for underground crossing of Sydney Harbour included an immersed tube tunnel, bored tunnels through the bedrock and

bored tunnel through a combination of bedrock and sediments. These options are shown on Figure 4-8.74 in *Sydney Metro | Chatswood to Sydenham EIS*.

Figure 4.1 Performance of each station option against the Project objectives



Figure 4.2 Performance of station options between Central and Sydenham against the Project objectives



- ▶ a comparative assessment was carried out for these options. It found that:
- ▶ an immersed tube option is a favourable option in terms of station depth and tunnel gradient, but the likely environmental impacts associated with dredging and cofferdam construction in the harbour would be considerable, as compared with the tunnel boring machine options. Costs are also likely to be significantly higher than the bored tunnel options
- ▶ given the depth to rock below the harbour, a tunnel bored entirely through rock would result in unacceptable station depths at Barangaroo and at Victoria Cross and / or unacceptable tunnel gradients
- ▶ keeping the tunnel alignment wholly within rock would still likely require a specialised tunnel boring machine for the harbour crossing due to the anticipated poor rock quality and high water pressure
- ▶ a shallower tunnel involving tunnelling through rock and sediments would result in acceptable station depths. Whilst there would be some construction risks associated with tunnelling through sediments and transition zones from rock to sediment, they are considered to be manageable.

Given these factors, a bored tunnel through a combination of bedrock and sediments was selected as the preferred option for crossing Sydney Harbour.

4.5.3 Tunnelling strategy options

Following review of the geotechnical data, a number of tunnelling options for the Sydney Harbour Metro Crossing were considered as mitigation to the soft sediment on the harbour floor at the preferred location and high water pressure.

The optimal alignment for the tunnels, which keep both Barangaroo and Victoria stations at a reasonable depth, includes a short section of tunnel, of approximately 150 metres, through the sediments, which are mainly comprised of stiff clays.

The original tunnelling strategy was to launch two TBMs from the Northern Dive site, which would drive south and be extracted in the city, and two TBMs from the Southern Dive site, which would drive north and similarly would be extracted in the city. This strategy was devised on the assumption that the tunnelling would be through good quality rock all the way, including under the harbour.

Taking account of these issues has resulted in the adoption of a reference tunnelling strategy using a fifth TBM specifically designed for the harbour crossing section.



Artist's impression of Barangaroo Station

5. PROJECT DEFINITION

This chapter provides an overview of the definition of the Project including product strategy, design overview and guiding principles.

5.1 Final Project design

After careful review and evaluation of different transport and project alternatives and options, as discussed in the previous chapter, the project team developed the Project design described in this chapter. It used a comprehensive collection of data, research, analytics, strategic and implementation metrics to formulate the Project design.

All Sydney Metro trains will operate initially as six-car trains, with a design capacity for 1,152 customers, including 378 seats, providing an initial line capacity of 23,040 passengers per hour per direction (at an expected 20 trains per hour 2024). Train capacity can be increased through the extension to eight-car trains with a design capacity of 1,539 customers, and increasing the running frequency to ultimately 30 trains per hour providing a maximum capacity of 46,170 passengers per hour per direction.

The system will be designed to provide a minimum of two-minute headways between trains, which will allow an ultimate line service level maximum of 30 trains per hour.

The operation of the Sydney Metro between Cudgegong Road (Rouse Hill) and Bankstown will require at least 59 six-car trains, enabling services to initially operate in 2024 at least every four minutes during peak periods.

The metro network will be equipped and integrated with Communications Based Train Control, which will continually monitor and manage the reliable and safe movement of all trains.

The Sydney Metro Train Facility at Tallawong Road will be expanded for the maintenance of the fleet and stabling of trains. Additional stabling would also need to be provided.

The ultimate capacity of Sydney Metro allows for a train every two minutes in each direction under the CBD. Services will operate for 21 to 22 hours a day.

The NSW Government will retain control of fares and timetable requirements (frequency and span of hours), with fares consistent with the Opal system.

The Project's business requirements and the Definition Design that meets those requirements, together provide the Project definition for the Sydney Metro City & Southwest.

The Preliminary Design has been used to develop the whole-of-life cost estimate of the Project, as well as informing transport, city building, economic and funding requirements analysis, and the development of the implementation plan. It takes into account the following key elements of the definition of the Project:

- ▶ business requirements
- ▶ Definition Design overview
- ▶ Chatswood to Sydenham alignment
- ▶ tunnel and associated infrastructure
- ▶ underground station design
- ▶ Sydenham to Bankstown Upgrade alignment and works
- ▶ rail systems
- ▶ rolling stock
- ▶ stabling and maintenance facilities
- ▶ operations and safety.

5.2 Business requirements

5.2.1 Overview

The requirements for the Project can be represented as a ‘pyramid’ that progressively develops from Project objectives to contract requirements as the Project transitions from the definition to the procurement phase, as shown in Figure 5.1.

Figure 5.1 Sydney Metro requirements pyramid
 Source: *Business Requirements Specification v2.0*, 24 Sept. 2015

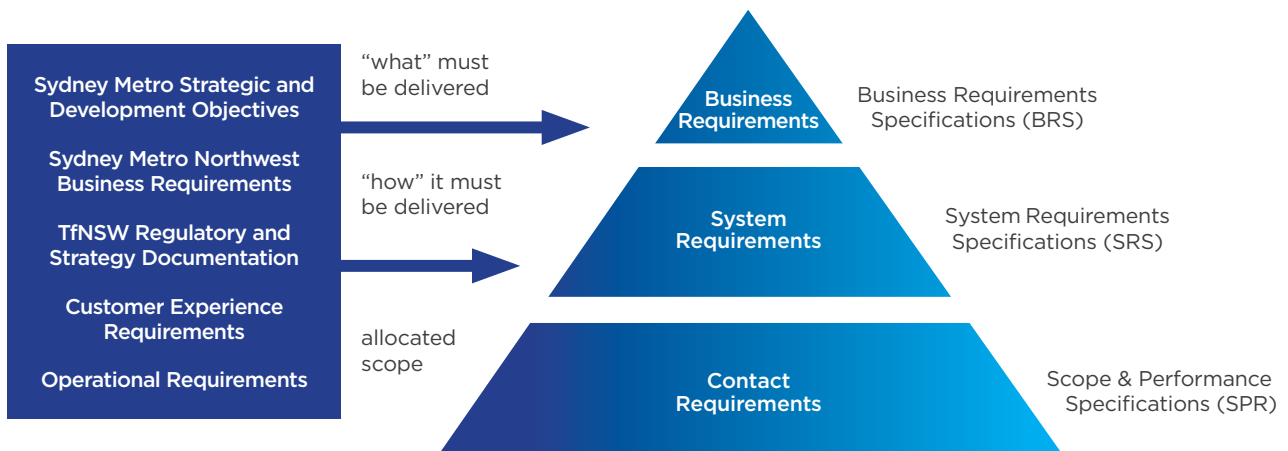


Table 5.1 Sydney Metro City & Southwest Project objectives and guiding principles

Objectives	Guiding principles
<p>Improve the quality of the transport experience for customers.</p>	<p>Timeliness and reliability – Customers should be provided with minimised transit times in addition to a normal pattern of frequent and reliable services with minimum delays and disruptions.</p>
	<p>Customer experience – Customers and staff should experience clean, comfortable and pleasant conditions throughout all hours of operations both on the train, and at the stations and precincts. Customers should experience a fully accessible system.</p>
	<p>Customer comfort – Trains should be clean, temperature-controlled, well-lit and maintained, with sufficient personal space for all customers.</p>
	<p>Customer information – Clear and accurate information should be provided in a timely manner through mobile and web-based applications and throughout the system at interchanges, stations and on the train, including information for network wide services.</p>
	<p>Customer service – Customers should have access to polite, knowledgeable customer service with prompt and effective responses to service requests and feedback.</p>
	<p>Wayfinding and signage – Station precincts and trains should provide clear, unambiguous, intuitive wayfinding, aided by signage or navigational aids as required.</p>

Objectives	Guiding principles
<p>Improve the quality of the transport experience for customers.</p>	<p>Access to integrated ticketing – Customers should be provided with convenient, easy-to-access, secure and well-maintained ticket facilities.</p> <p>Technology access – Customers should be provided with connectivity for modern mobile communications (including mobile phones and internet access).</p> <p>Personal safety and security – Customers should be provided with active, well-lit stations and precincts that offer surveillance, help points, and other safety and security measures.</p> <p>Place making – Interchanges and stations should be key focal points with good quality design of public places and high levels of safety.</p>
<p>Provide a transport system that is able to satisfy long-term demand.</p> <p>Support the productivity of the Global Economic Corridor.</p>	<p>Achieving greater productivity – Linkages between the areas of high population growth and economic activity, both within and to the Global Economic Corridor, should be strengthened.</p> <p>Access to workforce – The pool of available workers for businesses located in the Global Economic Corridor should be increased, while providing workers with a reliable, consistent means of transport to access jobs.</p> <p>Designing for future growth – The design should allow for construction of the identified future extensions to the network.</p> <p>Future growth – The needs of an increasing population should be met and flexibility in operations provided.</p>
<p>Grow public transport patronage and mode share.</p>	<p>Meeting customer needs – Interchanges and stations should optimise the provision of additional functions and amenities to serve customers' needs, allowing customers to meet their everyday needs locally while providing activation of public spaces.</p> <p>Transport integration – High levels of service integration should be provided with other transport modes, including the bus network, cycle and pedestrian paths, and other rail services.</p> <p>Priority of access – Facilities should be provided for all modes of transport, with priority of access being pedestrians first, then bicycles, buses, taxis, kiss and ride, and park and ride.</p>
<p>Serve and stimulate urban development.</p>	<p>Community building – The health, growth and development of communities should be promoted.</p> <p>City shaping – Opportunities to accommodate and increase the proportion of Sydney's population and jobs in the corridor should be promoted.</p> <p>Optimising land requirements – The use of the land acquired should be optimised and the contribution that the acquired land can make to the urban environment maximised.</p> <p>High quality design – High quality design outcomes should be delivered to contribute toward positive urban and environmental outcomes.</p>

Objectives	Guiding principles
Improve resilience of the transport network.	Maintainability – Maintenance access at interchanges, stations, facilities and along the rail corridor should be provided to minimise disruptions to customers and services.
	Degraded operations – Customers should be provided with safe and continuous operation and, in the event of an incident or failure, with safe recovery from the event.
Improve the efficiency and cost effectiveness of the public transport system.	Rail operations and maintenance – The design and construction should allow for effective operation and maintenance.
Implement a feasible solution recognising impacts constraints and delivery risk.	Climate responsibility – Greenhouse gas emissions should be minimised and the Project developed so that it is resilient to future changes in climate.
	Environmental responsibility – The delivery and operation should occur in an environmentally responsible manner, respecting the natural environment, and reducing resource use, noise and pollution.
	Protecting biodiversity and heritage – The biodiversity and heritage values of the region should be preserved and protected.
	Social responsibility – The planning, delivery and operation should recognise and respond to the social changes that may arise as a result of the Project.

5.2.2 Key business requirements

The business requirements for Sydney Metro City & Southwest are grouped in the following categories:

- ▶ **Customer experience** – What must be delivered to reflect the customer-centred design approach for Sydney Metro. The customer experience requirements are structured around nine customer experience drivers identified through customer insight research – timeliness, safety and security, ticketing, convenience, accessibility, comfort, cleanliness, information and customer service.
- ▶ **Operations** – The high-level requirements for the expected operations of Sydney Metro that support the customer related business requirements and TfNSW project objectives. The operations will be defined in the Concept of Operations that will need to be consistent with requirements outlined here.
- ▶ **Safety and assurance** – Sydney Metro shall establish the highest level of safety that achieves the safety requirements under the NSW regulatory framework, and sets a quantitative safety limit to provide a measure of safety performance that is comparable with or exceeding other international metro operations. This level of safety reflects the need for Sydney Metro to demonstrate leadership in transport for delivering safe, high quality, reliable and affordable metro train systems for Sydney.
- ▶ **Sustainability and environment** – Sydney Metro has a clear vision to achieve new benchmarks in sustainable infrastructure delivery. The sustainability business requirements are based upon the *North West Rail Link (Sydney Metro Northwest) Sustainability Strategy October 2012*. For sustainability, environment and urban planning, Sydney Metro is seeking to achieve a higher level of achievement than those set out in codes of practice or standards. The business requirements in this area therefore reflect the need to be at the forefront of best practice.

They include:

- ▶ **place making** – Active precincts, urban design and expression of local identity.
- ▶ **transport integration** – Access hierarchy, operational management and maintenance, and transport integration coordination.
- ▶ **asset management** – High quality and best practice design, and asset management requirements.

5.3 Definition Design overview

The Definition Design for Sydney Metro City & Southwest includes the following two components:

- ▶ **Chatswood to Sydenham** – a 17.1-kilometre extension, predominantly in tunnel, from Chatswood, under North Sydney, Sydney Harbour, Sydney CBD and Central Station, to Sydenham Station.
- ▶ **Sydenham to Bankstown Upgrade** – a 13.4-kilometre extension, converting the existing Bankstown rail line from Sydenham Station to Bankstown Station to metro operations.

An overview of the alignment is provided in Figure 5.2.

Figure 5.2 Sydney Metro City & Southwest





Barge working in Sydney Harbour

6. PROJECT JUSTIFICATION

This chapter provides an overview of the key transport, city building and economic benefits of the Project.

As outlined in the previous section, Sydney Metro City & Southwest provides a range of high value benefits to Sydney and NSW:

- 1. Transport benefits** – including enabling the transport network to better cater for growth, travel time savings, increased network capacity, decreased train and station crowding, increased reliability of the rail network, enhanced customer satisfaction on the use of public transport, and improvements in customer safety.
- 2. City-building benefits** – including increased economic activity, economic productivity, jobs, worker income, savings in infrastructure provision, lower cost of living, sustainability benefits, health benefits, more choice of housing and more affordable housing, more access to services, and greater social equity.
- 3. Economic benefits** – including valuation of transport, land-use and wider economic benefits, and an economic appraisal.

6.1 Overview of high value benefits

Sydney Metro City & Southwest is a city-shaping Project that delivers significant benefits.

6.1.1 Transport benefits

The Project:

- ▶ enables the longer-term development of the Sydney rail network
- ▶ supports growth in rail patronage from 168,400 to 288,000 trips in the one-hour AM peak by 2036 (growth of 71 per cent)
- ▶ increases total rail network capacity by 60 per cent (through the addition of 60 high-capacity metro train paths each hour)
- ▶ delivers 31 per cent more train services in 2024 (40 additional services in 2024)
- ▶ attracts 16,300 more rail customers in 2036 in the one-hour AM peak, reducing road congestion
- ▶ provides customers with travel time savings of up to 21 minutes
- ▶ reduces train crowding and reduces crowding at key stations, including Town Hall, Wynyard and North Sydney

- ▶ reduces traffic and bus congestion across Sydney Harbour and into the CBD
- ▶ improves transport network resilience on the lower North Shore and through the CBD
- ▶ enhances customer satisfaction for those travelling within the Global Economic Corridor and on the Bankstown Line
- ▶ delivers a significant improvement in rail safety.

6.1.2 Key city building benefits

The Project provides:

- ▶ peak additional employment during the construction period of 6,233 workers
- ▶ \$8,562 million per annum additional value add in 2036, from increased co-location and productivity of businesses and workers in the corridor
- ▶ stimulates 44,245 additional jobs in the corridor by 2036
- ▶ between \$142 and \$322 additional income per annum for workers in 2036
- ▶ between \$721 and \$1,761 savings per annum for households through reduced cost of living in 2036.

6.1.3 Key economic benefits

The Project offers:

- ▶ total economic benefits of \$62,120 million (real), \$12,988 million (present value)
- ▶ transport economic benefits \$9,118 million (present value)
- ▶ productivity or wider economic benefits of \$2,713 million (present value)
- ▶ city building or land use benefits of \$1,157 million (present value).

6.2 Capacity benefits

Sydney Metro City & Southwest will provide significant additional transit capability to the Sydney transport network by:

- ▶ extending Sydney Metro from Chatswood through the Sydney CBD and beyond
- ▶ adding new stations at Crows Nest, Victoria Cross and Waterloo
- ▶ considerably increasing the number of primary CBD stations by building new Sydney Metro stations at Barangaroo, Martin Place and Pitt Street
- ▶ providing extra connectivity and interchange capacity at Chatswood, Central Station, Martin Place, Sydenham and Bankstown
- ▶ upgrading the Bankstown Line between Sydenham and Bankstown to be part of the high capacity, high frequency Sydney Metro system.



Isabelle Andersen, 4, after whom tunnel boring machine 3 Isabelle was named after on Sydney Metro North West

6.3 Transport benefits

Sydney Metro will deliver a step-change in the capacity and customer experience of Sydney's rail network by providing a fully automated metro rail system across Sydney – an Australian first. Sydney Metro will deliver a brand new tier for Sydney's rail network, supporting high-demand sections of the rail network with a high-capacity, turn-up-and-go service.

Sydney Metro will complement the wider suburban and intercity rail network by:

- ▶ strengthening connections and access across Sydney, particularly within the Global Economic Corridor
- ▶ providing dedicated turn-up-and-go services, delivering more trains, more often along key corridors, with multiple destinations and interchanges with the wider transport network
- ▶ delivering a significant step-change in rail capacity through the Sydney CBD – the core of Sydney's rail network – by providing major congestion relief on key existing corridors on the Sydney Trains network
- ▶ strengthening the overall transport network by allowing other modes such as buses to be deployed to more efficient routes and to provide stronger regional connections.

By connecting Sydney Metro Northwest to the CBD, Sydney Metro City & Southwest will enable a progressive development of a broader Sydney Metro network.

This network will complement the suburban and intercity networks, providing a 60 per cent increase in network capacity when fully implemented (30 per cent increase in 2024 with the initial service plan), and will amplify network and operational efficiency initiatives being progressed under Stages 1 and 2 of *Sydney's Rail Future*.

Sydney Metro City & Southwest will provide a number of transport benefits to users from the opening date of the Project (Day One benefits), while other transport benefits would be earned over time as the metro is established and demand grows. Table 6.1 outlines a summary of transport benefits delivered by the Project.

Table 6.1 Transport benefits delivered by Sydney Metro City & Southwest

Benefit category	How the benefits are enabled
Catering for growth in demand	Increased rail accessibility, number of services, reliability and rail catchment; reduced train and station crowding; and travel time savings, etc. will enable rail system to cater for growth in demand.
Increasing the reach of the rail network (Day One benefit)	<p>New stations at Crows Nest, Victoria Cross, Barangaroo and Waterloo will directly increase rail catchment areas.</p> <p>More direct connections to high-capacity CBD stations at Martin Place and Pitt Street will increase CBD rail catchment areas.</p> <p>Additional interchange capability at Central Station, Martin Place, Pitt Street, Sydenham and Bankstown.</p>
Increased accessibility and trip diversity (Day One benefit)	Improved frequency of services and interchange with other modes and connections to key destinations will increase accessibility (for example, to major commercial, industrial, shop and residential areas) and trip diversity (for example, journey to work, education, CBD distributor, local service trips and work related trips).
Reduced network complexity (Day One benefit)	Removes the T3 Bankstown Line from its current requirement to merge and diverge with the T2 Airport, Inner West and South Line at flat junctions, as these lines converge into the constrained City Circle. This in turn will allow the City Circle to be dedicated to the T2 Airport, Inner West and South Line in a simplified operation.
Increased rail network capacity (Day One benefit)	<p>Additional tracks through the CBD – two additional tracks enabling an extra 30 high-capacity metro services per hour through the CBD in each direction.</p> <p>Additional tracks from Chatswood to CBD – two additional tracks providing additional capacity from the north.</p> <p>Sydenham to Bankstown Upgrade – upgrade of T3 Bankstown Line to high capacity metro services.</p> <p>Removal of T3 Bankstown Line services from the City Circle, enabling other lines to use this capacity.</p>
Travel time savings (Day One benefit)	<p>Sydney Metro Northwest, T1 North Shore Line and T3 Bankstown Line customers, will have access to more direct Sydney Metro services to key activity areas in the Global Economic Corridor.</p> <p>North Shore and North Sydney customers will have direct rail access to key destinations in the Global Economic Corridor such as Martin Place and Norwest Business Park.</p> <p>Eastern suburbs customers will have more direct access to key destinations in the Global Economic Corridor, interchanging to direct services at Martin Place Station instead of the crowded Town Hall Station.</p>
Decreased train crowding (Day One benefit)	<p>Sydney Metro services – 20 new high frequency metro services each hour will reduce crowding on the T1 North Shore and T3 Bankstown Lines.</p> <p>Sydney Trains services – potential for additional services each hour on the T2 Airport, Inner West and South Line, made possible by the Project releasing additional capacity on the City Circle by removing the T3 Bankstown Line services from the City Circle.</p>

Benefit category	How the benefits are enabled
Decreased station crowding (Day One benefit)	New CBD stations and platforms provided at Barangaroo, Martin Place, Pitt Street and Central spreads station loading and decreases crowding at Wynyard and Town Hall Stations, and platforms 16 and 17 at Central.
Increased reliability	Reduced train and station crowding will increase reliability of T1 North Shore, Northern and Western Line, and T2 Airport, Inner West and South Line suburban and intercity services.
Improved network resilience (Day One benefit)	Public transport access through the CBD and across Sydney Harbour is currently limited to a few key pieces of infrastructure. The Project will provide an additional, high-capacity public transport link through the CBD and across the harbour. The Project provides an alternative option for customers during unplanned and planned events, which may force closure of other CBD and harbour links.
Improved transport integration (Day One benefit)	Improved interchange with bus, light rail, pedestrian and cycling networks, provision of taxi and kiss and ride at key stations, and improved linkages to park and ride facilities at outer stations.
Rail safety benefits (Day One benefit)	Safety targets for Sydney Metro to be demonstrably world class when compared to other modern metros. Rail safety is enhanced through a reduction in crowding on stations and the introduction of new technologies and design, such as communication based train protection system, platform screen doors, platform edge barriers, modern ventilation systems, emergency arrangements in the tunnelling environment, intrusion detection technologies along the shared corridor, and extensive CCTV coverage on board and at stations.
Customer satisfaction benefits	Increased customer satisfaction through improvement in train frequencies, reduced crowding, and the provision of new or upgraded station facilities, new trains, and improved interchange and connectivity.
Bus network benefits (Day One benefit)	Freeing of bus services by bus customers transferring to rail, enabling some opportunity to redeploy bus services from the north and northwest. Less demand for Sydney Harbour Bridge bus services, freeing capacity over the bridge.
Road network benefits	Reduced road congestion by road users transferring to rail. Less congestion on key road corridors including the Harbour Bridge, Harbour Tunnel and Eastern Distributor. A reduction in 20,000 private vehicle trips across Sydney in 2036 during the 3.5-hour AM peak.
Enabling longer term development of Sydney rail network	Enables realisation of benefits of Stages 1 and 2 of <i>Sydney's Rail Future</i> . Enables fulfilment of Stages 3, 4 and 5 of <i>Sydney's Rail Future</i> . Facilitates development of the rail network beyond <i>Sydney's Rail Future</i> , including continued development of the Sydney Metro and Sydney Trains networks.

The main benefits categories are discussed in detail in the following sections.

6.3.1 Catering for growth in demand

Demand for rail services is projected to grow by 119,600 trips in the one-hour AM peak by 2036. The development of Sydney Metro City & Southwest will enable the Sydney rail network to effectively cater for growth and will also provide a mode shift from road-based transport to rail of 20,000 trips during the AM peak (2036).

With full utilisation, Sydney Metro City & Southwest can provide 60 high-capacity services during any one hour. This is a fundamental, step-change in network capacity, enabling the ability to cater for a 60 per cent increase in passenger demand.

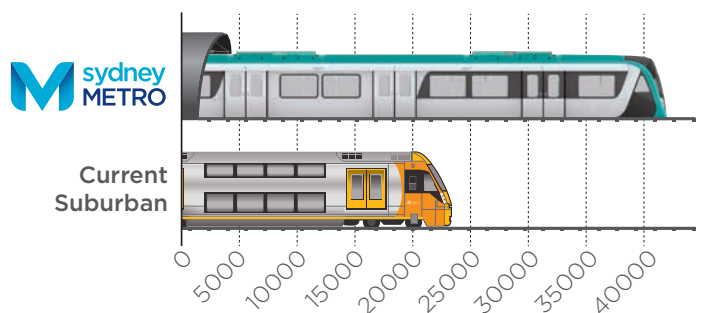
Figure 6.1 shows the large increase in capacity when Sydney Metro is added to Sydney Trains.

6.3.2 Increasing the reach of the rail network and catering for trip diversity

Sydney Metro City & Southwest will also increase the reach of the network, providing new stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo, and additional platforms at Central Station.

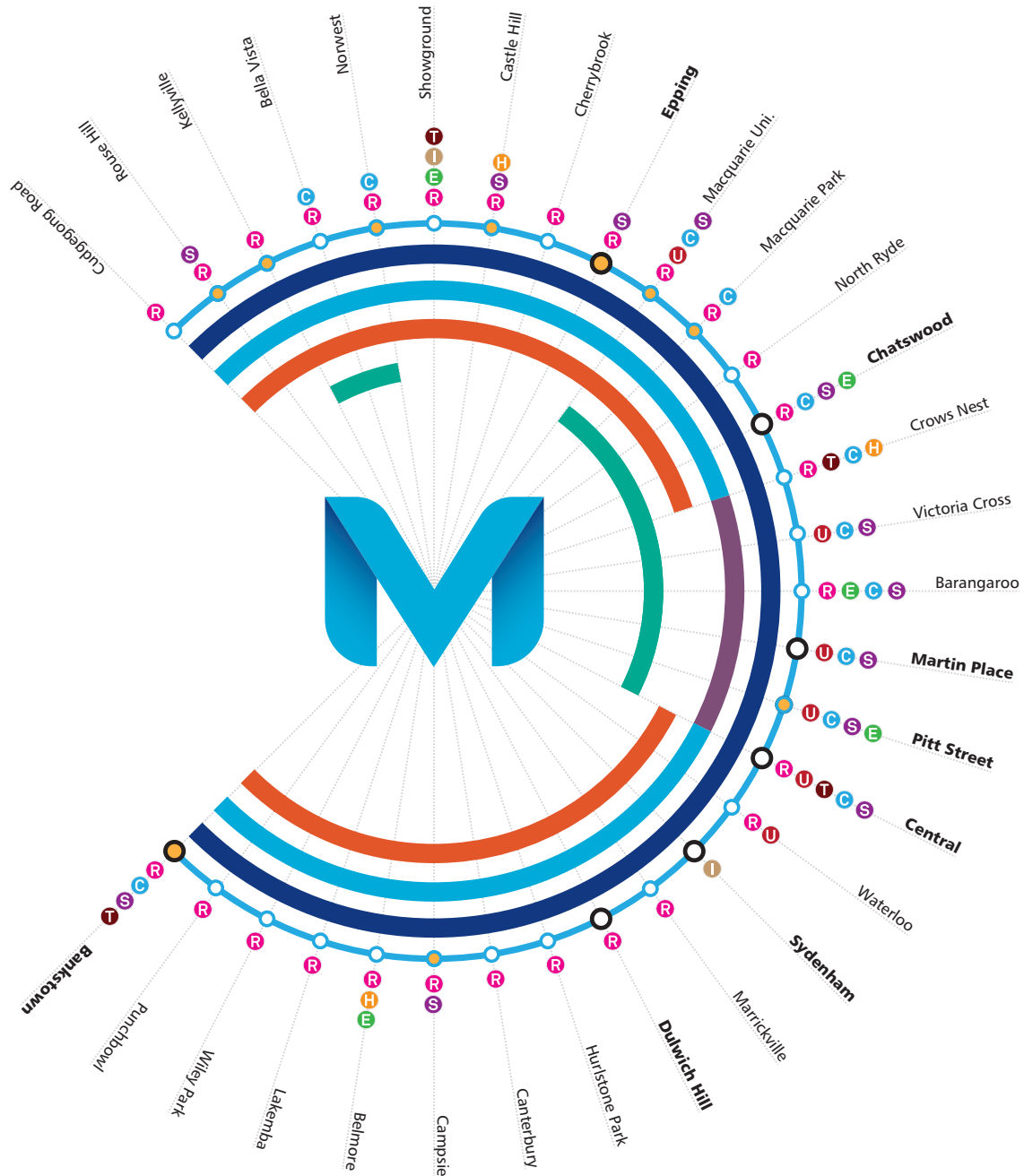
By increasing the reach of the network, and providing high-frequency services, interchanges with other modes and connections to key destinations, Sydney Metro City & Southwest will increase the diversity of trips undertaken on the network and more trips will be taken in non-peak periods. Figure 6.2 provides an overview of increased trip diversity made possible by the Project.

Figure 6.1 Ultimate hourly network capacity



Maximum Sydney train customers per hour per line

Figure 6.2 Increased usability and trip diversity



LEGEND

Metro uses

- Access to universities
- Journey to work
- CBD distributor
- Local service and shopping trips
- Local core employment area trips

Land uses

- C Major commercial
- I Major industrial
- S Major shops
- R Residential growth area

Facilities

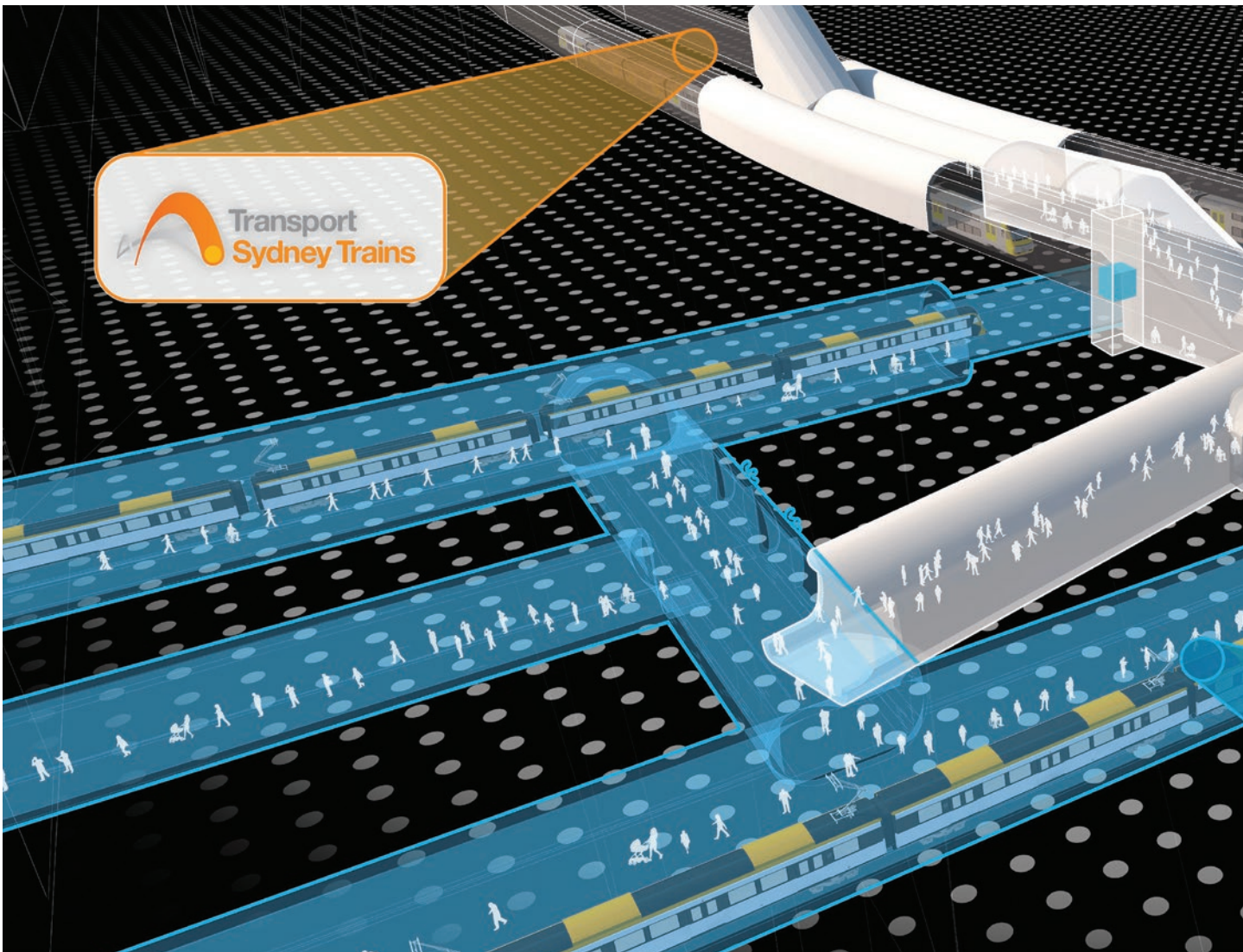
- Light rail / suburban interchange
- Bus interchange
- Rail and bus interchange
- E Recreation
- H Major hospital
- T TAFE
- U University

6.3.3 Saving travel time

Sydney Metro City & Southwest will provide a significant opportunity to improve travel times by providing:

- ▶ more direct routes to destinations provided by metro services
- ▶ more direct routes on Sydney Trains and NSW Trains services due to additional capacity provided by the introduction of Sydney Metro City & Southwest
- ▶ reduced train crowding and station crowding, leading to improved service reliability.

The Project will substantially improve travel times for customers. The largest travel time savings will be experienced by customers travelling from new stations (such as Crows Nest), or where the Project provides a more direct route of travel (such as Victoria Cross to Martin Place).



6.3.4 Reduced rail network complexity

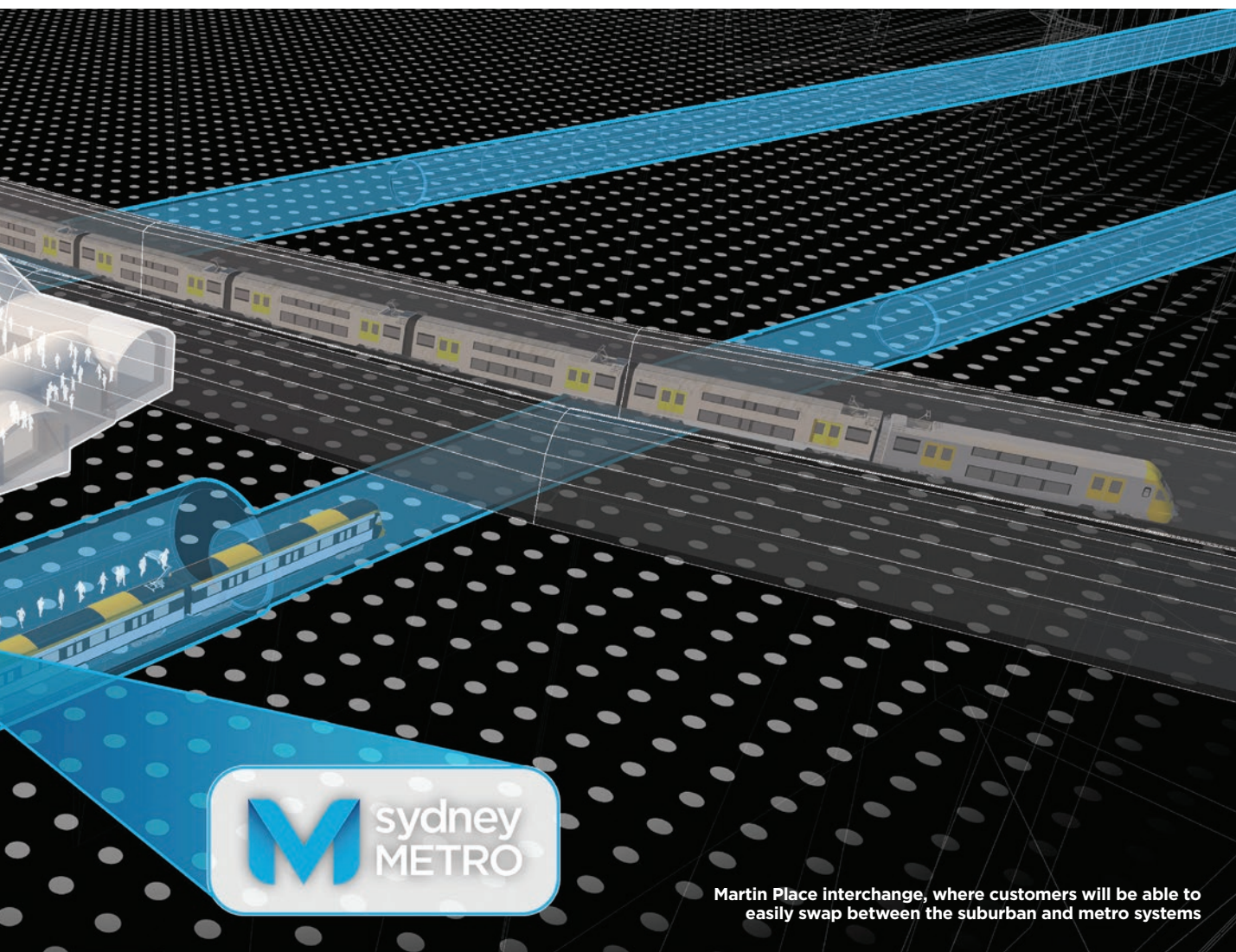
The section of the Sydney Trains network between Sydenham and the CBD is one of the most complex parts of the rail network, with the current requirement for services to merge and diverge at flat junctions into the constrained City Circle. Converting the T3 Bankstown Line to metro will remove this line from this complex arrangement. This in turn will allow the City Circle to be dedicated to the T2 Airport, Inner West and South Line in a simplified pattern of operation for up to 20 trains per hour in each direction.

6.3.5 Reduced train crowding

By enabling additional train services, Sydney Metro City & Southwest will fundamentally reduce crowding on the Sydney Trains network.

During periods of heavy train congestion, the following impacts can arise:

- ▶ services begin to become unreliable as passengers crowd on to trains and dwell times at stations are more difficult to manage
- ▶ passengers need to board a following train
- ▶ passengers may seek to use another form of transport, travel at a different time or will not travel.



Martin Place interchange, where customers will be able to easily swap between the suburban and metro systems

By enabling additional train services on the rest of the suburban rail network and diverting passengers from existing services, Sydney Metro would significantly reduce train crowding on the T1 North Shore Line, T1 Western Line, and the T2 Airport, Inner West and South Line.



Figure 6.5 platform screen doors in use overseas

6.3.6 Reduced station crowding

Currently station crowding occurs at key CBD stations during peak periods.

With passenger travel demand to the CBD forecast to increase, additional constraints will be placed on CBD and key interchange stations, particularly crowding on platforms and vertical transport such as lifts. This will result in excessive delays to platform and station clearance times.

By providing eight additional high-capacity platforms at key city destinations, Sydney Metro City & Southwest enables a considerable dispersal of customers to new and enhanced locations throughout the city. This significantly reduces the loading at key stations such as Wynyard and Town Hall. By 2036, over 25,000 customers will choose to use the new, more convenient, Sydney Metro stations at Barangaroo, Martin Place and Pitt Street rather than Wynyard Station or Town Hall Station. Connecting Sydney Metro to Central Station will increase passenger movements from 55,900 to 62,200 in 2036, however the provision of two new high-capacity platforms will reduce overall platform crowding.

6.3.7 Increased reliability

The Project will improve network reliability through the provision of automated trains on the Sydney Metro system, and by the reduction of train and station crowding at Sydney Trains stations.

By reducing train and station crowding, reliability will be improved on other lines, including T1 North Shore, Northern and Western Line services, and T2 Airport, Inner West and South Line suburban and intercity services.

6.3.8 Enhanced safety

Sydney Metro provides an opportunity to

Table 6.2 Enhanced safety benefits

Category	Features	Comment
Signalling	Automatic Train Protection	<p>Sydney Metro will introduce Communication Based Train Control (CBTC) System, Gate Automation 4, which is broadly similar to European Train Control System (ETCS) Level 2 that is being planned to be installed in the Sydney Trains network.</p> <p>Automatic train protection systems are safer than traditional train control systems as they virtually eliminate over-speed and signals passed danger risks, which are the key contributing factors to train derailment and collisions.</p>
Station	Platform screen doors, CCTV coverage, intrusion detection and monitoring	<p>Platform screen doors prevent passengers falling off platforms onto the tracks. They are also effective at reducing trespass into the rail corridor and the opportunity for passengers to throw objects onto trains or tracks from the platform. Platform screen doors also serve as an effective physical barrier, preventing smoke from entering underground station environments in the event of a fire in a tunnel.</p> <p>Stations will be designed with modern crime prevention through environmental design principles together with closed circuit television (CCTV) coverage and emergency alarm and help points.</p>
Rail corridor	Intrusion prevention and detection technologies	<p>The Project will incorporate a number of intrusion prevention and detection systems, including barriers between Sydney Metro and Sydney Trains lines where they occur in the same rail corridor (such as on portions of the T3 Bankstown Line), trackside intruder detection system and trackside CCTV systems.</p> <p>This will provide an increased ability for controllers to detect any unauthorised access to the Sydney Metro corridor and to take appropriate response actions.</p>
Tunnel	Ventilation and egress	<p>Sydney Metro specifies world-best fire and life safety requirements for the tunnel environment.</p> <p>Should a fire occur inside a tunnel, the operator can pump air into the tunnel and force the smoke out through the ventilation system.</p> <p>Egress is also provided where customers can get off the train and access another tunnel in a short distance through an emergency door.</p> <p>Emergency phones are provided along the tunnel and they are all operated as duplicated lines.</p>
Rolling stock	Full CCTV coverage	Sydney Metro trains incorporate full CCTV coverage. Any irregular and unsafe behaviour can be detected in real time and a response implemented immediately.
	Fire and life safety	Sydney Metro trains are built using fire resistant materials reducing the likelihood and consequence of any fire.

deliver an enhanced safety environment for passengers and operators by adopting business requirements that exceed minimum safety standards.

As part of Sydney Metro's commitment to achieving the highest levels of safety performance for metro operations, Sydney Metro has set safety targets based on international benchmarking studies of metro operations. These targets allow Sydney Metro to be 'demonstrably world class when compared to other modern metros'.

6.3.9 Bus network benefits

The implementation of the Project will provide increased connectivity to passengers through increases in bus services to support connection to the metro, and will also reduce the number of buses required on the congested Sydney Harbour Bridge.

Under a 'do-minimum' network change approach, the introduction of Sydney Metro City & Southwest will allow 18 southbound and 17 northbound bus services to be removed from the congested Harbour Bridge during the one-hour AM peak. It will also remove an additional 12 inbound buses along other key locations on the M2 corridor.

6.3.10 Road network benefits

By encouraging mode shift to the rail network, Sydney Metro City & Southwest will reduce the number of trips that will otherwise be made on the road network. This is particularly the case for sections of the road network that are constrained, such as the Harbour Bridge, where the Project will provide a high-quality transport alternative. The Project will reduce the number of private vehicle road trips in the 3.5-hour AM peak by more than 20,000 in 2036, and remove 500 vehicles using the Sydney Harbour Bridge and tunnel during the 7–9 AM peak in 2036.

6.3.11 Improved transport network resilience

The introduction of a technically and geographically separated second harbour rail crossing and metro line through the CBD provides a higher level of public transport resilience and disaster recovery. The metro system will be technically separated from the heavy rail network, with its own power, stations, control infrastructure, track and trains, and will operate independently from the current heavy rail network.

For any adverse events that could impact the current heavy rail system, including power outages, severe weather events, or train or track incidents, Sydney Metro will provide a high-capacity transport alternative in the CBD and across Sydney Harbour that will not be affected by the incident. Sydney Metro City & Southwest will also provide a rapid harbour crossing as an alternative for bus and road users crossing the Harbour Bridge or accessing the CBD in the event of accidents, natural events, traffic congestion or incidents impacting travel time.

6.4 City-building benefits

Sydney Metro City & Southwest will provide a significant increase in transit amenity, which will enable increased economic productivity and land use efficiency.

Sydney is the most urbanised area within Australia. The density of population and economic activity in its centres are major drivers of national productivity.

Sydney Metro City & Southwest will enable businesses to become effectively closer together, by reducing travel times between major economic centres, and between economic centres and potential employees. The closer businesses are to each other, and to a deep pool of skilled labour, the higher their productivity, with greater specialisation, more intensive knowledge transfer, and employees who are better matched to their organisation²⁷.

Sydney Metro City & Southwest will also enable a higher intensity of land use. By providing new stations at Crows Nest, Victoria Cross and Waterloo, and by converting the Bankstown Line between Sydenham and Bankstown to high-capacity Sydney Metro operations, Sydney Metro City & Southwest will enable a higher and more intense use of the surrounding precincts.

Higher density residential areas can offer more affordable housing options with better access to services and employment, and support more liveable, vibrant communities. Successful development of international cities is a 'virtuous cycle', where higher living standards draw global talent, attract global businesses and investment, and boost international trade opportunities²⁸.

Higher density employment areas support further productivity gains, enabling more businesses to co-locate in those areas than previously, and connecting those areas to existing economic areas and employees. They also reduce urban sprawl, contributing to the development of a more sustainable city, characterised by shorter journey distances and greater public transport mode share.

6.4.1 Increased land use efficiency – changes in job and population density

Sydney Metro City & Southwest will play a significant role in delivering land use change. New and improved public transport access offers opportunities for transit orientated development, encourages urban renewal, and allows more efficient use of land within station catchments.

Planning along the Sydney Metro City & Southwest alignment supports the following²⁹:

- ▶ Global Economic Corridor – approximately 650,000 jobs within 800-metre station catchments in the core employment area and 774,000 along the entire metro line by 2036
- ▶ an urban renewal corridor along the full length of the metro line – approximately 514,000 people within 800-metre station catchments of the metro line by 2036
- ▶ the Central to Eveleigh Urban Transformation program, including the redevelopment of Waterloo
- ▶ possible future priority precincts emerging from the current investigation between Bankstown and Sydenham
- ▶ 460,000 jobs and 67,000 residents at Barangaroo, Martin Place, Pitt Street and Central.

²⁷ *National Infrastructure Plan*, June 2013, Infrastructure Australia, p30

²⁸ *National Infrastructure Plan*, June 2013, Infrastructure Australia, p30

²⁹ *Sydney Metro: City Shaping Opportunities Analysis*, Mecone, Oct 15, pp49 and 58

6.5 Economic benefits

The economic gain from Sydney Metro City & Southwest is a result of transport, city-shaping and productivity benefits. These are outlined in

Table 6.3, along with their respective values and share of total benefits.

Table 6.3 Economic benefits and costs (present value)

Benefit	Overview	Value	
		PV \$m	PV %
Transport		9,118	70
Public transport users	Savings in the perceived cost of travel for public transport users, including travel time, reliability, train de-crowding, station de-crowding and amenity.	6,337	49
Public transport travel time benefits	Travel time savings are generated through increased accessibility between particular origins and destinations as a direct result of Sydney Metro City & Southwest.	1,863	14
Train reliability improvements	The reduction in unexpected wait time for customers as a result of reducing train crowding and station dwell times at Central, Wynyard and Town Hall Stations.	990	8
Rapid transit all day patronage	Higher patronage levels in future years as a result of higher density land uses around the Sydney Metro City & Southwest stations and more frequent turn-up-and-go travel behaviours throughout the day.	576	4
Reduction in train crowding	Reduction in crowding on trains as a result of Sydney Metro City & Southwest. Train de-crowding benefits mainly accrue to customers travelling on Sydney Trains lines that will benefit from increased capacity as a result of Sydney Metro City & Southwest. Customers travelling on metro services are expected to experience some crowding dis-benefit as trains will be configured to accommodate a higher ratio of standing to seated passengers.	723	6
Reduction in station crowding	Reduction in crowding on stations as a result of Sydney Metro City & Southwest. Station de-crowding benefits will accrue to customers travelling on Sydney Trains lines that will benefit from increased capacity as well as customers that switch their travel from a Sydney Trains to Sydney Metro services. The higher frequency of Sydney Metro trains and better designed stations is expected to reduce station crowding.	1,511	12
Reduction in displaced trips	Related to the benefit of reduced crowding is the reduction in the number of displaced trips. At a critical point, crowding not only causes service delays but also prevents customers from boarding, otherwise known as trip displacement. The reduction in crowding associated with the introduction of Sydney Metro City & Southwest therefore delivers a secondary benefit of a reduction in displaced trips on Sydney's most congested railway lines, including the T1 North Shore, Northern and Western Line, T2 Airport, Inner West and South Line.	498	4

Benefit	Overview	Value	
		PV \$m	PV %
Improvement in amenity of Bankstown Line stations	Conversion of the T3 Bankstown Line in order to accommodate metro trains and associated upgrade of stations is expected to improve the travelling experience for customers, reduce the perceived cost of waiting, and improve station accessibility.	190	1
Impact on customers during Bankstown Line upgrade	Dis-benefit of Bankstown Line customers travelling on replacement bus services during the upgrade of the line from heavy rail to metro.	(14)	-
Road users	Savings in the perceived cost of travel for road users, including travel time and vehicle operating costs.	1,749	13
Improvements in road user travel times	Perceived travel savings for road users based on changes to in-vehicle time and mode shift to public transport.	1,399	11
Reduction in vehicle costs for road users	The cost of operating vehicles based on changes to in-vehicle time and vehicle kilometres travelled at various speeds from reduced congestion.	350	3
Resource corrections	Other transport benefits, including those where perceived costs are adjusted to account for actual resource costs.	1,032	8
Road user externalities	The value of environmental benefits from the reduction in road trips that are not fully perceived in the above categories. These include reductions in noise, air and water pollution, greenhouse gas emissions, urban amenity impacts and accidents.	241	2
Increase in public transport fare revenue	Additional fare revenue across the entire public transport network as a result of the Project being implemented.	285	2
Rail safety improvements	Economic savings from a reduction in the average number of safety incidents per rail journey as a result of the Project having additional safety features, such as platform screen doors.	221	2
Additional value from the project assets after 30 years	Additional value that the Project's assets will generate beyond the 30-year operational period in the analysis. Known as residual value, it is a proxy measure for the remaining benefits in long-term infrastructure projects.	285	2

Benefit	Overview	Value	
		PV \$m	PV %
City shaping		1,157	9
'Second round' transport positive impacts	Increase in the value of the above transport benefits as a result of more residents and businesses locating along the transport corridor.	906	7
Public transport travel time benefits	The increase in travel time savings as a result of the city-shaping benefits of Sydney Metro City & Southwest is linked to the increase in patronage from more people living and working along the corridor.	28	0
Metro all day patronage	With more people living and working along the corridor, more people also benefit from the faster journey times that a turn-up-and-go metro service offers during the day.	5	0
Public transport travel time benefits	The increase in travel time savings as a result of the city-shaping benefits of Sydney Metro City & Southwest is linked to the increase in patronage from more people living and working along the corridor.	28	0
Metro all day patronage	With more people living and working along the corridor, more people also benefit from the faster journey times that a turn-up-and-go metro service offers during the day.	5	0
De-crowding	More people living and working along the corridor means more benefit from an overall reduction in station de-crowding as a result of metro services operating more frequently than Sydney Trains services. Offsetting this benefit to some extent is additional train crowding on metro services.	173	1
Improvements in road user travel times	The increase in people expected to live and work along the Sydney Metro City & Southwest corridor is forecast to increase travel time savings for road users in Sydney. This is because people living and working along the corridor are expected to walk and use public transport more than people living in parts of Sydney with less public transport options.	319	2
Reduction in vehicle costs for road users	The uplift in this benefit relates to the reduction in road trips from more people living in and working along the Sydney Metro City & Southwest corridor.	178	1
Road user externalities	With people living and working along the metro corridor making fewer road trips, there is a further reduction in externalities, including noise, air and water pollution, greenhouse gas emissions, urban amenity impacts, accidents and road maintenance.	125	1
Increase in public transport fare revenue	With more people living and working along the transport corridor, it is expected that there will be a further increase in public transport revenue.	107	1
Rail safety	The increase in patronage on metro services from more people living and working along the corridor increases the average number of potential safety incidents each year (on an average basis). This is therefore a dis-benefit generated by the city-shaping impact of the Project.	(30)	0

Benefit	Overview	Value	
		PV \$m	PV %
Land use impacts	More efficient land use in terms of infrastructure savings, health and sustainability benefits for with more residents and businesses locating along the transport corridor.	252	2
Savings in public infrastructure provision	The opportunities of high- or medium-density infill development associated with more people wanting to live and work along the Sydney Metro City & Southwest corridor will provide substantial savings in infrastructure provision for government. This includes infrastructure such as roads, sewers, electricity and communication systems, and basic community services such as health care facilities, schools and public transport.	110	1
Savings in greenhouse gas emissions	Households that choose to move to new high- or medium-density housing along the Sydney Metro City & Southwest corridor are expected to accrue reductions in their consumption of energy and water. This is accounted for in terms of a reduction in emissions from power, and gas and water production, treatment, distribution and consumption.	0.4	0
Active travel benefits (walking)	The attraction of living along the metro corridor is expected to generate higher-density communities. This is expected to lead to an increase in active travel, particularly walking, with data supporting the relationship between active travel and urban density.	27	0
Active travel benefits (cycling)	Similar to walking, higher-density living also encourages an increase in cycling journeys, generating similar benefits to those outlined above.	0.3	0
Higher value land use for Waterloo	Higher land value generated through greater density enabled by Sydney Metro City & Southwest.	114	1
Productivity		2,713	21
Transport productivity	Agglomeration value of the increase in business-to-business and workforce-to-business connections using the transport network as a result of the Project (known as effective density).	1,663	13
	Imperfect competition benefits from increased output.	152	1
	Labour supply benefits of increased tax from additional workers.	82	1
Land use productivity	Agglomeration value of the benefit of more residents and businesses locating in higher-density areas along the transport corridor (known as land use density).	816	6

6.5.1 Increased economic activity during the Delivery Phase

A net total of over 6,200 achievable jobs is expected to be supported by the Project at the peak of construction in 2017/18. The majority of these jobs will be in the construction (46 per cent) and professional, scientific and technical services (26 per cent) sectors, where project expenditure will be focused. Other sectors that are expected to see a significant increase in jobs in 2017/18 include retail trade and hospitality, making up 11 per cent and 6 per cent of net achievable jobs respectively. These are sectors that benefit from flow-on consumer spending from the Project.

The increase in supported jobs, along with associated investment and spending, will generate an uplift in economic output for the state during the construction phase of \$2,848 million in value added to the NSW economy.

6.5.2 Increased economic activity during the Operating Phase

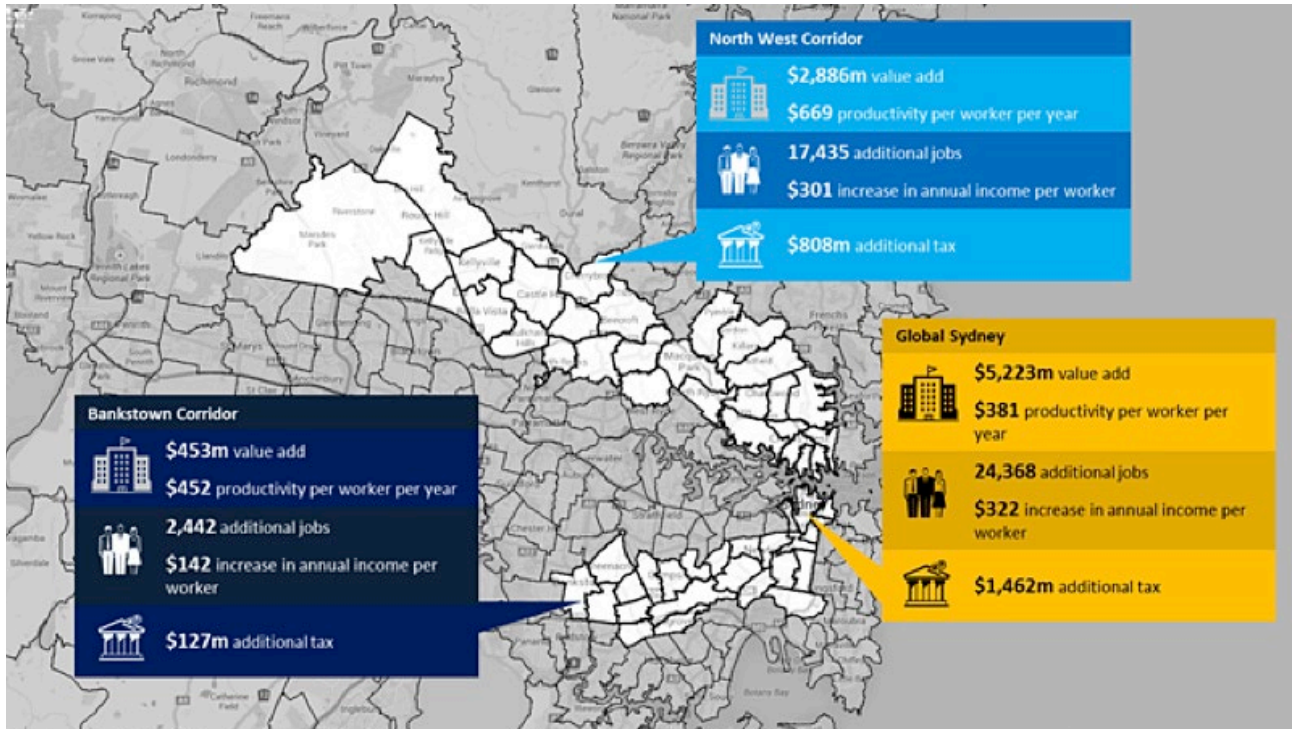
Improving accessibility to, from and within Sydney is not just about travel time and cost savings. By 2036, it is expected that, without the Project, train services to the CBD will be so crowded in the morning peak that this may act as a travel deterrent to workers and as a constraint on the ability of business to operate efficiently.

By improving accessibility and journey experiences for users, Sydney Metro will improve economic outcomes for workers, households, businesses and government. It will stimulate additional economic activity along the Sydney Metro City & Southwest corridor, including value add, productivity, additional jobs and income.

Figure 6.6 summarises some flow-on economic benefits from improved transit amenity provided by implementing Sydney Metro City & Southwest including:

- ▶ **increased value add** – ‘Value add’ is the value of output produced in the Global Economic Corridor, minus the costs in producing that output. Sydney Metro will result in higher value add per year by attracting more businesses and workers into the corridor, and by existing businesses and workers becoming more productive
- ▶ **enhanced productivity per worker** – ‘Productivity per worker’ is value add per worker per year. Sydney Metro enables workers in the corridor to be more productive as their economic outcomes improve, and because of agglomeration and other wider economic benefits
- ▶ **employment** – Enhanced access in and around the corridor as a result of Sydney Metro City & Southwest will attract additional workers into the corridor from outside
- ▶ **income per worker** – ‘Income per worker’ reflects the additional output that is produced in the corridor and the enhanced productivity of its workers, measured on a per year basis. The increase in income per worker reflects the share of the productivity gains that fall to a worker’s labour income
- ▶ **additional tax** – ‘Additional tax’ is obtained from the corridor through increased corporate tax, labour and consumption tax intake. This results from the additional economic value and incomes generated by the increased economic activity in the corridors.

Figure 6.6 Sydney Metro flow-on economic benefits in 2036 (\$2015)





Sydney Metro City & Southwest will also deliver benefits in the areas of land use, sustainability, infrastructure provision savings, household savings, health, housing affordability improvements, social equity and service access improvements.

At the global Sydney level, Sydney Metro City & Southwest will provide an overall productivity increase per worker of \$381 per year in 2036, as shown in Table 6.4.

Sydney Metro City & Southwest will play a significant role in supporting the NSW economy, particularly along the Sydney Metro network corridor. The Project is expected to provide business with access to an additional eight per cent of the Sydney metropolitan labour force. The gross value add to the state in 2036 alone is expected to be \$8,562 million.

Table 6.4 Economic activity and productivity outcomes of Sydney Metro in 2036

Metric	North west corridor	North west corridor	South west corridor	Global Sydney (Sydney CBD and North Sydney)	Total
 Value add (\$ million)		2,886	453	5,223	8,562
Productivity per worker (\$)		669	452	381	-
 Additional jobs (number)		17,435	2,442	24,368	44,245
Income per worker (\$)		301	142	322	-



A tunnel under construction on Sydney Metro Northwest (mid-2015)

7. DELIVERY STRATEGY

Initial industry engagement has included an industry briefing and a market sounding process, to inform the Delivery Strategy. The Delivery Strategy will continue to evolve as a result of the further development and definition of the Project, the receipt of more detailed feedback from industry through further industry engagement (including a second round of industry engagement which has recently been undertaken), and through proposed pre-augmentation discussions with NRT.

Any augmentation of the existing Sydney Metro North West Operations, Trains and Systems (OTS) PPP contract with Northwest Rapid Transit will be subject to achieving value for money.

7.1 Overview

The Delivery Strategy was confirmed in April 2016 following industry consultation.

In the development of this strategy, these factors were taken into account:

- ▶ commercial risk assessment, including detailed assessment of potential risks and potential mitigations from a Delivery Strategy perspective, and development of a commercial risk register
- ▶ detailed review of the Project packaging, including consideration of cost, program, constructability, interface and contracting issues (with alternative packaging arrangements)
- ▶ confirmation of TfNSW's business requirements
- ▶ detailed consideration of the potential role of Northwest Rapid Transit³⁰ (NRT)
- ▶ input from a number of commercial advisors, other advisors to the Project (including financial and legal advisors), and various members of the broader Sydney Metro Delivery Office and Delivery Strategy Working Group

- ▶ undertaking an industry engagement process, with detailed market sounding, to obtain feedback from industry in relation to the Project, including how the Project might potentially be delivered
- ▶ initial conceptual and qualitative assessments of potential opportunities for privately financing elements of the Project
- ▶ consideration of property development opportunities above stations and at other locations, and development of a strategy to deliver over station development opportunities
- ▶ identification of a revised Reference Delivery Strategy for delivering the various elements of the Project, including proposed packaging.

The Delivery Strategy developed for Sydney Metro City & Southwest includes delivering the infrastructure required for Sydney Metro City & Southwest and the strategy for undertaking integrated operations and maintenance across the entire Sydney Metro network (Sydney Metro Northwest and Sydney Metro City & Southwest). This may include an augmentation of the existing Sydney Metro Northwest concession with NRT. Any augmentation of the existing Sydney Metro Northwest Operations, Trains and Systems (OTS) PPP contract with Northwest Rapid Transit will be subject to assessment value for money.

³⁰ The Northwest Rapid Transit (NRT) consortium includes: NRT Pty Ltd (the Project company), Hong Kong's MTR Corporation – with John Holland and UGL Rail Services – which will operate and maintain Sydney Metro Northwest upon completion; John Holland, Leighton Contractors, MTR and UGL Rail Services – a four way joint venture to deliver the infrastructure and rail systems; and other equity providers including Plenary Group – the financial sponsor and capital arranger.

7.2 Stakeholder and industry engagement

Sydney Metro developed the Delivery Strategy in close consultation with NSW Treasury, and external commercial, financial and legal advisors. Industry was also engaged and the two key elements of the industry engagement process were:

- ▶ an initial industry briefing, to introduce the Project and provide a brief overview of the Sydney Metro City & Southwest to industry
- ▶ a market sounding process, which included engagement with industry to obtain written feedback on the Project in response to a questionnaire, in addition to a series of one-on-one meetings with a representative sample of selected industry participants from key market sectors.

A second stage industry engagement was also undertaken to obtain industry feedback on the reference delivery strategy.

7.3 Delivery Strategy objectives

Through consultation with stakeholders and assessment of the Project objectives, the following objectives were adopted for the Delivery Strategy:

- ▶ achieve value for money for government
- ▶ have a similar vertical integration outcome as that achieved on Sydney Metro Northwest, where a single entity is responsible for both operations and maintenance, with the aim of avoiding disputes over fault attribution that would be likely to arise where responsibility for operations and maintenance is split between separate entities

- ▶ preserve the reliability requirements, key performance indicator regime and other key risk allocation factors as for Sydney Metro Northwest (to the extent possible).
- ▶ minimise delivery risk, including by minimising interface risks; for example, through consolidation of works scope into fewer packages, where this is appropriate and results in a better value for money outcome
- ▶ ensure the Project does not disrupt the successful delivery and operation of Sydney Metro Northwest
- ▶ ensure that the Delivery Strategy is effective and able to be implemented
- ▶ preserve future flexibility, to the extent reasonable and consistent with the other objectives.

7.3.1 Reference packaging and contracting approach

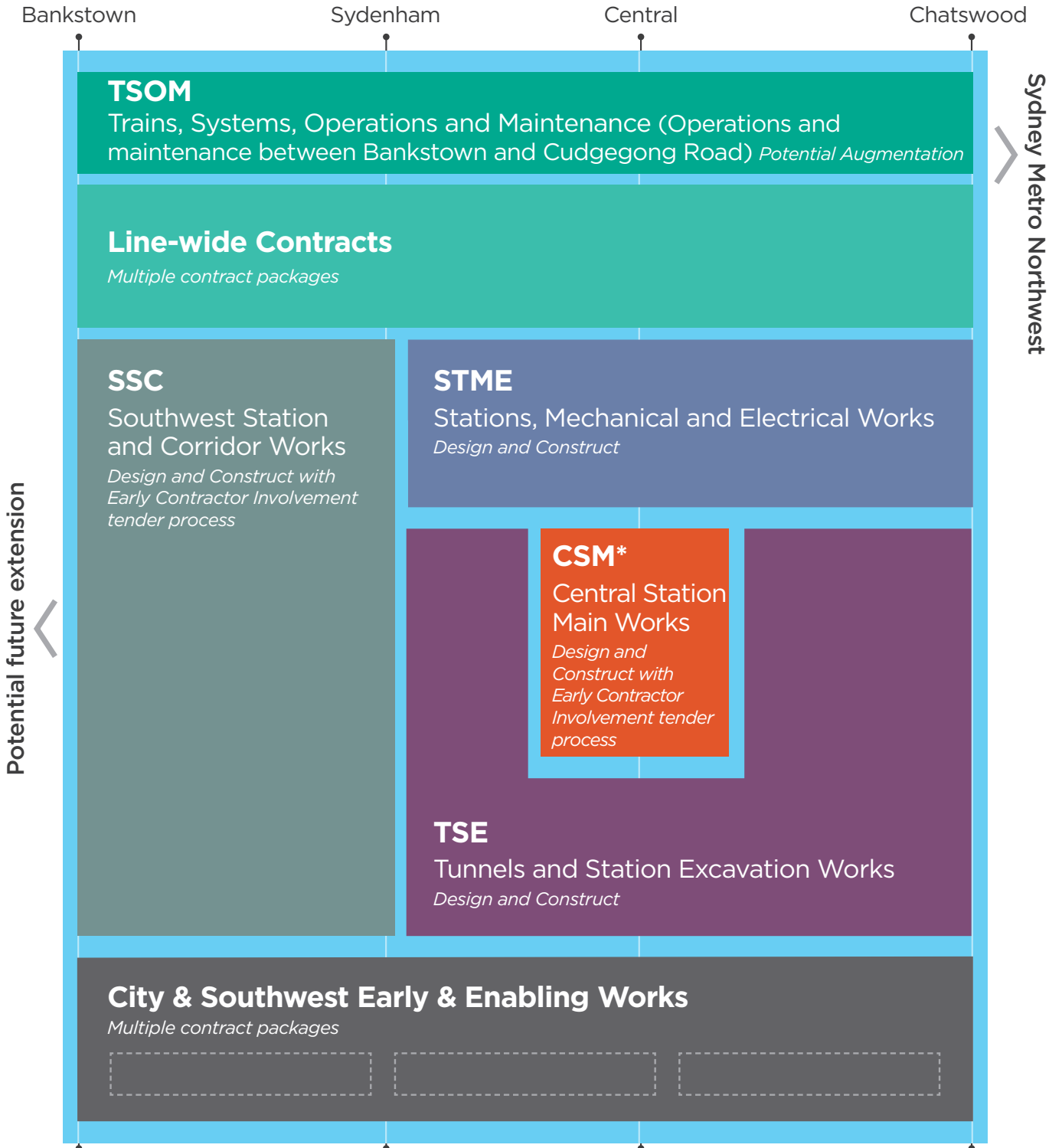
The outcome of the assessment and consultation process is the following packaging and contracting approach, as outlined in Figure 7.1 and Table 2.2. Since the business case was finalised the contract packaging was updated following further industry consultation through a second round of market sounding (which included consultation on a reference contract packaging strategy). Figure 7.1 reflects the contract packaging as presented at the April 2016 industry briefing.

Refer to Table 2.2 (page 28) which sets out in more detail the scope that is included in each of the packages.

Further refinements may be made based on future feedback.

Figure 7.1 April 2016 reference packaging and contracting approach

Project Delivery Strategy



*Central Station Main Works scope is subject to confirmation.

**Over station development is additional to above contract packages.



Following the first break-through, TBM Elizabeth traverses the Norwest Station site, February 2015

7.3.2 Over station development rights disposal approach

Five over station development rights disposal options were developed, outlining potential approaches for the government delivery of the over station developments. Customer experience is paramount – it is important to ensure that the customer experience in the stations is easy while the development above is world-class. This approaches ensure that any impacts on the metro are minimised and the value the government receives in relation to property development opportunities is maximised.

The preferred approach provides the optimum risk/reward for government. Government would obtain the Stage 1 planning approval and obtain the value uplift associated with the over station development. To obtain Stage 1 planning approval and ensure that substantial station design is undertaken before award of the Tunnelling and Station Excavation (TSE) contract, substantial design work will be required to inform the over station development design. During this process, government can obtain private sector input through a number of mechanisms; for example, early involvement of developers or an expert panel of technical advisors to provide a sounding board for the over station development design and Stage 1 planning approval.

In addition to over station development significant value add would also be created for surplus land, through its consolidation and the government obtaining Stage 1 development approval. This value add could be used to offset project costs.



Artist's Impression of Waterloo Station

8. VALUE SHARING

Value sharing (or value capture) seeks to identify the beneficiaries of an infrastructure project and to provide opportunities to enable them to contribute to the cost of developing the project.

Sydney Metro City & Southwest generates additional value through:

- ▶ additional service provision
- ▶ increase in transit amenity, which in turn increases land value
- ▶ increase in transit amenity, which in turn increases economic productivity and activity.

Sydney Metro City & Southwest will provide increased transit amenity to public transport users, land holders and businesses along the Sydney Metro corridor. It also supports increased transit amenity more broadly in Sydney by freeing capacity in the Sydney Trains, bus and road networks.

Nineteen value sharing and funding opportunities were assessed to support the affordability of the Project, including detailed analysis of:

- ▶ public transport fares
- ▶ sale of surplus property and over station development rights
- ▶ Barangaroo and Waterloo Station opportunities resulting from the construction of a metro station at these locations
- ▶ passive value capture from existing taxation regimes (stamp duty, land tax and capital gains tax)
- ▶ active value capture opportunities (Special Infrastructure Contribution – SIC)
- ▶ alternative funding opportunities.

This summary identifies potential opportunities for value sharing and an initial analysis of the financial impact. If government decides to pursue these opportunities, further detailed analysis will be undertaken.

8.1 Public transport fares

Opal ticketing will work on Sydney Metro and provide a seamless connection to other transport modes for customers. Fares will be set on the same basis as for Sydney Trains and controlled by the NSW Government. TfNSW will perform fare enforcement, ticketing equipment operation and maintenance. To assist with fare enforcement all new underground stations will be closed gate stations.

Net public transport fare analysis includes an assessment of the impact of the Project on the Sydney Metro, Sydney Trains, NSW Trains, light rail, bus and ferry networks. Overall the Project increases total public transport patronage and public transport fare revenue. It is forecast that there will be a considerable diversion of patronage from Sydney Trains and NSW Trains to Sydney Metro, and relatively minor diversions from light rail, ferry and bus services.

The total incremental fare revenue for 2026 and 2036 is outlined in Table 8.1.

Table 8.1 Annual incremental public transport fare revenue (real \$m 2015)

Fare type	2026	2036
Sydney Trains and NSW Trains	██████	██████
Sydney Metro	██████	██████
Light rail	██████	██████
Ferry	██████	██████
Bus	██████	██████
Total public transport fares	██████	██████

Offsetting the increase in revenue from metro operations of ██████ in 2026 and ██████ in 2036 is the decrease in non-metro transport modes of ██████ in 2026 and ██████ in 2036. The total incremental fare revenue for the Project over the assessment period is interpolated between 2026 and 2036, with zero growth assumed thereafter. (See page 26 for explanatory note re redacted figures.)

The net profit/loss generated by Sydney Metro City & Southwest is shown in Table 8.2.

Table 8.2 Net profit/loss from metro operations (real \$m 2015)

Fare type	2026	2036
Incremental Sydney Metro revenue	██████	██████
Incremental annual operating costs	██████	██████
Net profit from metro operations	██████	██████
Change in revenue for non-metro modes	██████	██████
Net profit/(loss)	██████	██████

Key outcomes of this analysis include:

- ▶ the annual incremental public transport fare revenue would cover nearly 61 per cent of the incremental operating cost in 2026 and more than the operating cost in 2036
- ▶ the additional fare revenue on Sydney Metro services would more than cover the incremental operating costs of these services (net profit of ██████ in 2026 and ██████ in 2036).

Additional analysis is provided in Chapter 9, Financial analysis.

8.2 Over station development and other property cost recovery opportunities

8.2.1 Introduction

A considerable portion of the total cost of the Project is for property acquisition to support the development of the Project, including property for the southern and northern tunnel portal sites, tunnel services sites, underground stations and construction compounds.

There is an opportunity to recover a portion of project costs through the sale of surplus property following construction or over station development rights.

An assessment of the value of these opportunities has been undertaken, including analysis of value sharing through the sale of surplus property and the maximising of opportunities for over station development during the station design and construction phase.

Assessment process

To estimate the value of the proposed property recovery on the stations, tunnel portals and construction sites, the following approach was adopted:

- ▶ identification of possible sites
- ▶ assessment of potential development opportunities on property left after construction or over stations, including an assessment of the residential and commercial property market, and the scope and scale of development that may be able to be achieved on each site (see the following sections in this chapter)

- ▶ options for sale of property or over station development rights
- ▶ estimated value of property including contingency analysis.

8.2.2 Property development analysis

To assess the potential value of property and over station development rights, a detailed assessment of potential property development outcomes for each site was undertaken by consultants, town planners and architects employed by the Project, in consultation with the Project design team.

The assessment took into consideration:

- ▶ the areas likely to be available for development
- ▶ the physical constraints that may be placed on each site, such as height limitations, floor space ratios and permitted use
- ▶ what type of development may be permitted and the likely scale of the proposed development.

8.2.3 Sale of surplus property and over station development rights estimate

A detailed estimate of the value of each site was developed, taking into consideration a number of factors such as site area, possible gross floor area, floor space ratio, highest and best use, car parking availability, construction costs, development period and development financing costs.

A detailed probabilistic risk and opportunity assessment was undertaken, including consideration of contingent and inherent risks such as changes in construction costs and changes in gross floor area achieved.

The risk and opportunity assessment identified that there is considerable opportunity to achieve a higher value compared to the point estimate and that a value of up to █████ (P90, 2015\$) may be able to be achieved, with a most likely value of █████ (P50, 2015\$) being achieved, with the most likely value being adopted for the purpose of financial and funding analysis. See Chapter 9, Financial analysis.

Analysis of stations indicated that over station developments would require additional station infrastructure to be incorporated in the station to accommodate the over station development.

Table 8.3 provides a summary of the total value of property and over station development rights, after taking into consideration opportunity and risk, escalation and the cost of additional station costs to support over station developments.

Table 8.3 Estimate of value of surplus property and over station development rights (P50 nominal \$)

Station	Site	Area (m ²)	Estimated OSD value (\$m)	Additional station infrastructure (\$m)	Net benefit (\$m)
Northern Dive site	Northern Dive site	24,000	████████	████████	████
Chatswood Refuge	Chatswood Refuge	Unknown	████████	████████	████
Crows Nest	North	3,871	████████	████████	████
	South	1,871	████████	████████	████
	Clarke St	608	████████	████████	████
Victoria Cross	196 Miller St	790	████████	████████	████
	Victoria Cross	4,789	████████	████████	████
Martin Place	North	2,615	████████	████████	████
	South	1,884	████████	████████	████
Pitt Street	North	3,141	████████	████████	████
	South	1,708	████████	████████	████
Southern Dive site	Southern Dive site	31,511	████████	████████	████
Sub-total			████████	████████	████
Contingency - P50 for OSD and P90 for future proofing			████████	████████	████
Escalation			████████	████████	████
Total including contingency and escalation			████████	████████	████

8.3 Passive value capture from existing taxation regimes

8.3.1 Increase in transit amenity, property value and existing property taxes

There is an increased awareness within government and the community that investment in infrastructure, and transport infrastructure in particular, leads to a range of economic, social and environmental benefits. In particular, investment in transport infrastructure results in a range of direct and indirect benefits, including:

- ▶ direct transport benefits, such as travel time savings, reduced accidents and enhanced reliability
- ▶ economic benefits, such as agglomeration impacts, enhanced productivity and increased land value
- ▶ environmental benefits, including reduced fuel consumption, pollution and emissions
- ▶ social benefits, including enhanced accessibility to jobs and centres, and improved liveability.

Increases in accessibility, and the subsequent reductions of transportation externalities produced from the investment in transportation infrastructure, are effectively financially monetised into the infrastructure's land market values.

This represents a 'willingness to pay' for a reduction in this economic cost. The increase in the willingness to pay for transportation accessibility is a land market response and reflects where residents, businesses and developers are willing to pay increased land and property costs for a commensurate reduction in transportation costs.

8.3.2 Analysis results

A financial model was developed to assess the impact of an increase in accessibility, changes in land use re-zoning, and increased land use (larger floor space ratios) made possible by the Project. The impacts of these measures were quantified through increases in land tax, stamp duty and capital gains tax. The inner city stations – Barangaroo, Pitt Street, Martin Place and Central – were excluded as these centres were already well serviced by public transport, and as such the impact of the Project on the land markets was indeterminable. Waterloo Station was also excluded, as it formed part of a separate study by UrbanGrowth NSW. The modelling of the financial impact of the Project on existing passive taxes is based on an assessment of the current land and property development within the corridor and the proposed development within the corridor bought about by the Project. The figures in Table 8.4 reflect the impact of the Project on passive taxes from the financial modelling.

Table 8.4 Estimated impact of the Project on passive taxes (\$m)

Description	NPV
Passive taxes excluding the Project	62,848
Passive taxes including the Project	70,176
Project induced tax benefit	7,328

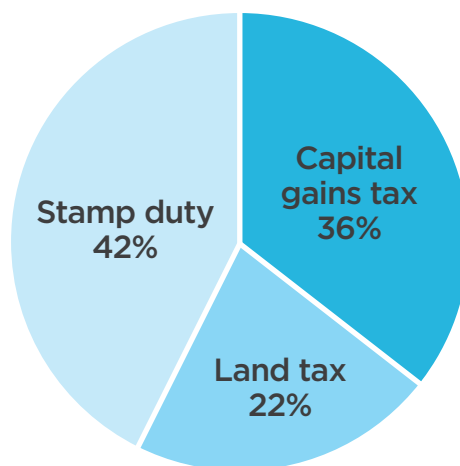
Table 8.5 provides an overview of the outcomes of the analysis of the impact on the different taxes by the additional development stimulated by the Project.

Table 8.5 Impact on capital gains tax, land tax and stamp duty – NPV (\$m)

Passive tax	NPV
Capital gains tax	2,606
Land tax	1,603
Stamp duty	3,119
Total	7,328

Figure 8.1 provides a summary of the collection of passive taxes on a percentage basis.

Figure 8.1 Increase in passive taxes





Artist's impression of Pitt Street Station

9. FINANCIAL ANALYSIS

This chapter summarises the whole-of-life financial analysis and Project cost analysis. It looks at funding and financing, and considers opportunities to improve affordability, including value sharing.

9.1 Financing the Project

Financial analysis was performed on the Definition Design. The financial analysis covers 38.5 years and includes a delivery phase of 8.5 years and an operating phase of 30 years.

Total Delivery Phase net project cost is █████ (nominal), inclusive of the sale of the rights for over station development (█████). (See page 26 for explanatory note re redacted figures.)

The Delivery Phase is now fully funded. At the time the Business Case was prepared, it was 91 per cent funded with █████ additional funding required. Funding included Total Asset Management (TAM) funding of █████, Rebuilding NSW funding of █████, and contributions from UrbanGrowth NSW and LAHC of █████.

Operating costs have been calculated on an incremental basis with the operations of Sydney Metro City & Southwest added to the existing operations of Sydney Metro Northwest.

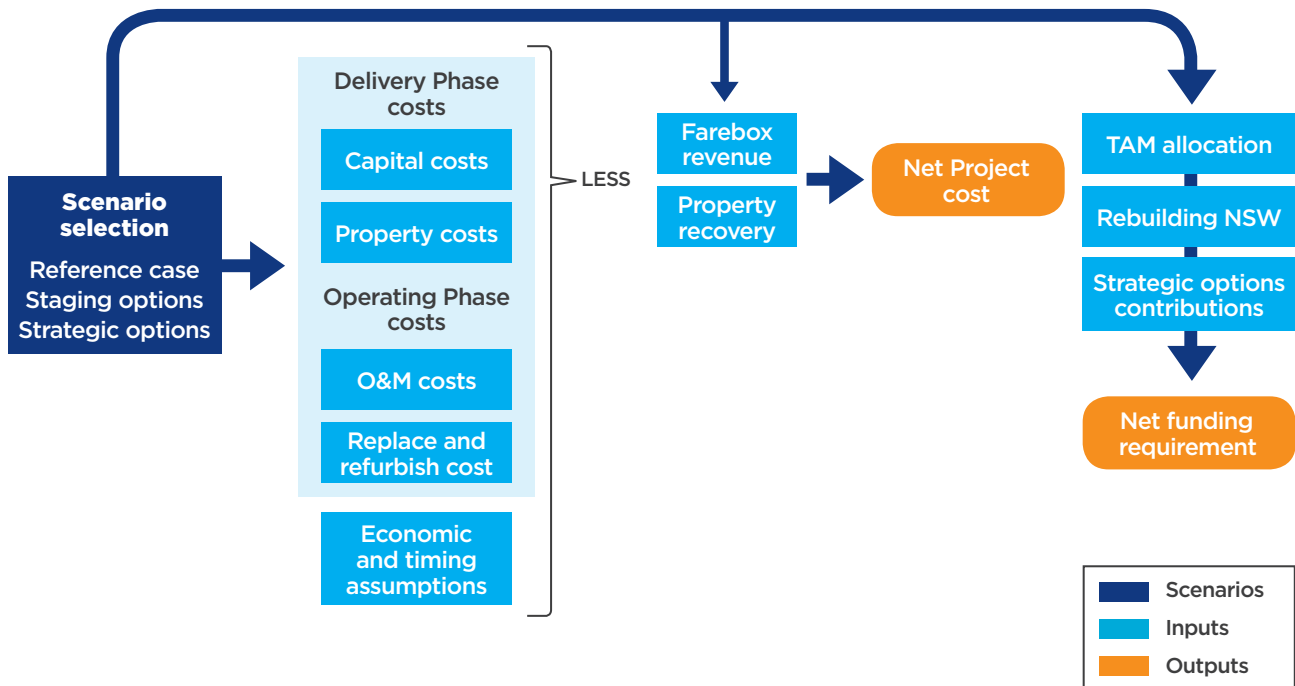
Operating costs are expected to increase on average by █████ per annum (real) over the assessment period. However, after taking into account the additional fare revenue earned through the implementation of the Project of █████, the net operational funding requirement is █████ per annum (real).

9.2 Financial analysis overview

In order to assess the financial impact of the Project and consider funding requirements, a financial model was developed to combine Delivery Phase costs, Operating Phase costs, revenue and property recoveries to calculate the net project cost. The affordability analysis considers the funding streams available to fund the Project and calculates the net funding requirements for the Project. All calculations are done in real, nominal and discounted cash flow basis. The methodology used for the financial analysis and affordability assessment is shown in Figure 9.1.

In addition, the financial model was used to carry out analysis on the private financing options for the Project identified in Chapter 8. The financial model includes proxy PPP calculations and considers the value for money of the private financing options by comparing the Preliminary Public Sector Comparator (Preliminary PSC) to the proxy PPP.

Figure 9.1 Financial analysis methodology



9.3 Project cost analysis

9.3.1 Delivery Phase costs

The estimated cost of delivering the Sydney Metro City & Southwest in nominal terms is █████. Table 9.1 sets out the P90 net costs for the Project during the Delivery Phase in real, nominal and NPV terms.

Table 9.1 Delivery Phase net Project costs (\$m) – P90

Passive tax	Real ³¹	Nominal	NPV ³²
Net Project cost	█████	█████	█████

9.3.2 Operating Phase costs

The Operating Phase costs for the Project are based on the incremental increase in services and assets from the Sydney Metro Northwest, and operating risks attached to the Sydney Metro City & Southwest. Table 9.2 sets of the Operating Phase costs over 30 years by element in real, nominal and NPV terms on a P90 basis.

Table 9.2 Operating Phase costs by element (\$m) – P90

	Average annual (real)	Real ³³	Nominal	NPV ³⁴
Incremental Operating Phase costs	█████	█████	█████	█████

The fare revenue is calculated on an incremental public transport basis, considers the impact of the Project on the entire transport network and includes change from other transport modes (including Sydney Trains, light rail, bus, and road) to Sydney Metro. The net profit/loss generated by Sydney Metro City & Southwest is shown in Table 8.2.

9.3.3 Key outcomes

Key outcomes of this analysis include:

- ▶ the additional fare revenue on Sydney Metro services would more than cover the incremental operating costs of these services
- ▶ the annual incremental public transport fare revenue would cover nearly 61 per cent of the incremental operating cost in 2026 and more than the operating cost in 2036.

³¹ 30 June 2015

³² 30 June 2015 base date discounted at 4.75 per cent

³³ 30 June 2015

³⁴ 30 June 2015 base date discounted at 4.75 per cent

9.3.4 Whole-of-life financial analysis

Table 9.4 sets out the P90 net cost for the Project over the entire evaluation period in real, nominal and NPV terms. The evaluation period is for 38.5 years and includes a Delivery Phase of 8.5 years and an Operating Phase of 30 years.

Table 9.4 Whole-of-life net project costs (\$m) – P90

Passive tax	Real ³⁵	Nominal	NPV
Net project cost	████████	████████	████████

Operating Phase

Funding post-Project construction would be provided from the additional farebox revenue generated by the Project.

The net funding requirement calculation for the Operating Phase is shown in Table 9.6.

The analysis reveals that 60.6 per cent of the operating costs (nominal) are funded through the additional farebox revenue generated by the Project and that the unfunded portion is ██████ per year.

Table 9.6 Operating Phase costs (\$m)

Passive tax	Real	Nominal	NPV
Operating Phase costs (including Bankstown Line savings)	████████	████████	████████
Less revenue	████████	████████	████████
Total cost to be funded	████████	████████	████████

³⁵ 30 June 2015



Mother and son Robin and Robert Baird, who worked together on tunnelling on Sydney Metro Northwest



Breakthrough of TBM4 Maria at Epping, October 2015

10. PROJECT IMPLEMENTATION

The Project is expected to open in 2024. The critical path for the Project includes the acquisition and vacant possession of land, and the award of the Tunnelling and Station Excavation (TSE) contract, both of which are planned by June 2017.

The Sydney Metro Delivery Office is delivering Sydney Metro City & Southwest and Sydney Metro Northwest. The Delivery Office is part of TfNSW, but with a unique separation and set of governance arrangements that are appropriate for the scale, significance and inter-relationship of the two Sydney Metro projects.

Under the charter of TfNSW's Asset Standards Authority (ASA), Sydney Metro has been authorised as an Authorised Engineering Organisation (AEO) for the feasibility and concept design phases of the asset life cycle.

Core risk management strategies have been adopted to identify and quantify risk, and put in place appropriate risk mitigation strategies.

Industry and community consultations conducted to date have been supportive of the Project, including station locations and changes to extend tunnelling to Chatswood.

The operation and maintenance of the assets is proposed to be performed by the TSOM contractor on behalf of TfNSW.

10.1 Program

The Sydney Metro City & Southwest program will be delivered over the next eight years as outlined in Figure 10.1.

The project development activities have been undertaken throughout 2014 and 2015, and concluded when the Final Business Case was approved in April 2016 and procurement activities commenced.



Figure 10.1 Development and delivery program

10.2 Project development and procurement program

The major activities for 2016 include the following.

Delivery Strategy and Final Business Case development	Stakeholder engagement and communications	Site investigations and enabling works	Design
<ul style="list-style-type: none"> ▶ Further develop the commercial principles for each of the procurement packages and preparation of the procurement documentation to go to market. ▶ Engage in a second round of market sounding to seek feedback on reference packing and constructing approach. ▶ Finalise the Delivery Strategy, in light of findings from the industry engagement activities and other work streams. ▶ Commence a formal engagement process with NRT to potentially augment the current Sydney Metro Northwest contract, subject to value for money assessment. 	<ul style="list-style-type: none"> ▶ Ongoing stakeholder and community consultation. ▶ Engagement with the proponents of the Barangaroo and Waterloo strategic options, including legal agreements with both. ▶ Required stakeholder consultation and agreements are in place by the completion of procurement tender documents and tender issue. ▶ Community consultation in relation to the planning approvals process, including exhibition of the Environmental Impact Statements. 	<ul style="list-style-type: none"> ▶ Land survey works are to be carried out to assess spatial, site and service constraints on the sites, and will inform the enabling works program for the Project. ▶ Enabling works, including site demolition, service relocation, and road works, will commence for the various sections to enable the start of tunnel excavation and station construction. 	<ul style="list-style-type: none"> ▶ The Definition Design will be further refined and a Reference Design will be produced to support the development of technical documents for tendering. ▶ Configuration changes to the Configuration Management and Asset Assurance Committee (CMAAC) submitted for Gate 1 approval.

Environmental approvals	Property	Procurement
<ul style="list-style-type: none"> ▶ Prepare and submit a State Significant Infrastructure (SSI) application in accordance with the <i>Environmental Planning and Assessment Act 1979</i> for the Sydenham to Bankstown Upgrade. ▶ Prepare and exhibit Environmental Impact Statements for Chatswood to Sydenham and start the planning approvals process for the Sydenham to Bankstown upgrade. ▶ Develop a detailed over station development and surplus land disposal strategy, undertake community and stakeholder consultation, and obtain Significant State Development (SSD) approval for the various sites. 	<ul style="list-style-type: none"> ▶ Continue the land acquisition process. This includes consultation with property owners and commercial negotiations for properties to ensure critical timelines are met. 	<p>Team development for the project procurement and Delivery Phase:</p> <ul style="list-style-type: none"> ▶ procurement of transaction management services ▶ procurement of enabling works managing contractor services ▶ procurement of service providers for power supply to tunnel boring machine (TBM) sites ▶ development of Expression of Interest (EOI) and contract documents to support procurement of packages for delivery.

10.3 Sustainability

The environmental and social sustainability program for the Project is aligned with TfNSW policy and is aimed at delivering best practice outcomes, building on the achievements and lessons learned from Sydney Metro Northwest. The environmental sustainability objectives for the Project relate to pollution reduction, minimising use of materials, energy and water, climate change resilience, biodiversity and heritage conservation, and reducing greenhouse gas emissions. Workforce development is a key component of the social sustainability agenda for the Project. Priority areas for workforce development include:

- ▶ increasing opportunities for employment of local people, participation of local businesses, and participation of small and medium enterprises
- ▶ enabling targeted and transferable skills development that resolves local and national skills shortages, supports industry to compete in domestic and global markets, and embeds a health and safety culture within all induction and training activities, promoting continuous improvement
- ▶ increasing workforce diversity and inclusion, targeting Indigenous workers and businesses, female representation in non-traditional trades, and long-term unemployed



Laying the first track on Sydney Metro, June 2016

- ▶ inspiring future talent and developing capacity in the sector, engaging young people through education and work experience, collaborating with higher education institutions to provide programs responding to metro and other infrastructure requirements, and supporting vocational career development through apprenticeships and traineeships.

10.4 Conclusion

Further refinements to Project implementation plans will continue to take place as the Project moves into the procurement phase.

Any changes to the Project will seek to improve value for money, and reduce risk and community impacts.





25 metres under Castle Hill in the city bound tunnel, May 2016



Further information

Web sydneymetro.info | Phone **1800 171 386** | Email sydneymetro@transport.nsw.gov.au

Information in this document has been prepared in good faith and is correct at the time of printing, September 2016.

© Sydney Metro 2016



Find us on Facebook



Printed on environmentally responsible paper manufactured using Elemental Chlorine Free (ECF) pulp sourced from certified, well managed forests.