Sydney Metro West EIS submission

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Part 1 Submissions process

This submission is in three parts:
1) This part
2) Planning and approvals
3) The 'Concept' for the CBD

Following the public submission period, the DPIE will prepare an assessment report for the Minister for Planning and Public Spaces who may grant approval and specify conditions.

As per the Western Harbour Tunnel EIS, it is assumed 'the design and construction approach presented in this environmental impact statement is at planning stage and is indicative only.' TfNSW may alter its preferred infrastructure plan in response to submissions.

Katrina Smallwood, Bachelor of Applied Science and referred to as a project manager in parts of the EIS, employed by Jacobs/Arcadis, certifies that she has:

> "prepared the contents of the Environmental Impact Statement in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000 and the Secretary's Environmental Assessment Requirements dated 11 December 2019, and that, to the best of my knowledge the information contained in the Environmental Impact Statement is not false or misleading".

In doing so, Smallwood has relied on information from TfNSW that is indeed very misleading – particularly the comparisons between the Sydney Trains network and the Sydney Metro lines.

The EIS is certified as complying with the NSW EP&A Act of 1979 and associated regulation. Smallwood has not certified that the EIS complies with:
A) Disability Discrimination Act 1992 (DDA),
B) Australia Consumer Law,
C) Australian Rail Safety National Law (NSW).
D) Other relevant law.

Compliance with laws is addressed in Part 2.

Part 2 Planning and approvals process

2.1 EIS assessment stages

The EIS Executive Summary Overview advises:

> The planning approvals and environmental impact assessment for Sydney Metro West will be broken down into a number of stages recognising the size of the project. This includes:
>
> • Sydney Metro West at a Concept level
>
> • Stage 1 – All major civil construction works between Westmead and The Bays including station excavation and tunnelling
>
> • Stage 2 – All stations, depots and rail systems between Westmead and The Bays.
>
> • Stage 3 – All major civil construction works including station excavation, tunnels, stations, depots and rail systems between The Bays and the Sydney CBD Station, and operation of the line.
>
> This Environmental Impact Statement covers the Concept and Stage 1 comprising all major civil construction works between Westmead and The Bays including station excavation and tunnelling.
>
> Sydney Metro's **program** of work is shown in Figure E-1 and includes the Metro North West Line (which opened in May 2019), Sydney Metro City & Southwest (which is currently under construction and due to open in 2024), Sydney Metro West (this project) and Sydney Metro Greater West (which is currently in the final stages of planning).
>
> Key features of the Concept Sydney Metro West (the Concept) would involve the construction and operation of a metro rail line, around 24 kilometres long, between Westmead and Sydney CBD (refer to Figure E-2).

Figures E-1 and E-2 are appended (Appendix 1) for reference.

This submission also covers the "Concept", particularly its Sydney CBD end where there are options, not explored by government, to link with existing services and offer a more integrated transport service.

2.2 Compliance with laws

2.2.1 Passenger capacity

In EIS Figure 2.9, the aggregate figures used require 60 Metro services per hour to carry 92,160 passengers in 8-car trains - 1539 passengers per train. While there are 506 seats on these trains, only the fixed seats are counted as occupied. The folding seats that allow people in wheelchairs to ride safely, are allocated to standing room. The 1539 passengers includes about 480 seated passengers with the rest standing (~1060 standing passengers per train). Allowing space for the seated passengers (0.5 sq.m per side-facing seated person), the standing passengers have approximately 230 square metres – an average of 4.6 passengers per square metre.

In EIS section 2.4.1, the ultimate capacity is stated as "more than 40,000 people an hour". This is a figure long used by the state government, and is based on 30 services each way per hour – more than 1333 people per train. Again, about 480 are regarded as seated with more than 853 standing. The more than 853 people have the same 230 square metres – over 3.7 people per square metre.

Rail vehicle manufacturers have a policy of stating capacity at 'seats plus 4, 6 or 8 passengers per square metre of remaining space in the passenger cabin'. As engineered vehicles they must perform and be safe at all times. In western countries like Australia, the industry generally quotes capacity based on 4 standing passengers per square metre. In uncontrolled loading events, which can occur before and after major events if not well managed, the industry has ensured it will not be a mass casualty event, though many people will experience extreme discomfort. Thus the Alstom capacity for the metro trains with be approximately 480 seated plus 920 standing – 1400 per train – 175 per carriage. The rail industry would give the comparable figure for a Waratah train of ~870 seated plus ~890 standing for a total of 1760 passengers – 220 per carriage (26% more).

EIS Figure 2.9 data results in average passenger loads for the Sydney Trains Fleet of 1160 and 1166 per train equate closely to the long-established operational capacity of 1214 for suburban double-deckers and an all-seated capacity of about 800 per Intercity train. The New Intercity Fleet (NIF) which can operate as 10-car trains are assumed. They are 4-and 6-car trains joined together much like the Sydney CBD trams. Their capacity has not been stated by TfNSW, but has been estimated from videos on the TfNSW website. Sydney Trains regards its 8-car suburban double-decker trains as having a standing capacity of 320. These 320 people have ~210 sq.m of standing room – giving a standing density of 1.542 people per square metre. The Waratah trains have 894 seats for a total capacity of 1214. At this capacity, the Waratah trains are fully compliant with the laws listed above.

The state government has recently allowed public transport to operate at "half capacity" due to our low numbers of Covid-19 positive people. The Covid-19 'half capacities' were given as 68 for a Waratah carriage and 65 for a Metro carriage. These figures, when multiplied by 16 for full 8-car train capacity, are 1088 for a Waratah and 1040 for a Metro train.

1040 passengers for a Metro train is well below the 1333 and 1539 passengers for an 8-car Metro train in the EIS.

On the same operational, law compliant basis, as the Waratah trains, an 8-car Metro train can carry 506 seated and ~330 standing – for a total of ~836 per train.

Operation at Metro 30 trains per hour per line has not been proven safe as required by the Australian Rail Safety National Law (NSW). If we assume it will be proved safe in the future, the Metro capacity could be said to be 25,080 passengers per hour.

At present, the Metro line operates at 15 services per hour with 6-car trains (9,405 passengers per hour), and may have been proven safe for 24 trains per hour service – at which the service capacity would be 20,064 passengers per hour (24 x 836).

The present operational capacity of the Sydney Trains suburban service is 24,280 passengers hour (20 x 1214).

When the signalling system upgrade being implemented by Sydney Trains is complete, 24 trains per hour will likely be regarded as safe for a capacity of 29,136 passengers per hour.

A fully automated signalling system will likely deliver a capacity of 25 Waratah trains per hour for a line capacity of 30,350 passengers per hour – 5,270 more passengers per hour than the single-deck Metro train service.

However, it is preferable to increase the length of train rather than increase the number of services per hour above about 85% of operational capacity to allow for service recovery from disruptions in a reasonable timeframe.

For the information of the Sydney Metro team and DPIE assessors, seating densities for Sydney public transport vehicles are:
--- Row seating buses: 3.0 passengers per square metre
--- Reversible row seating suburban trains: 2.5 pass/sq.m – a lower figure due to thicker seat backs
--- Fixed forward/rear-facing seats over the bogie in trams: 2.0 pass/sq.m
--- Side facing seating all vehicles: 2.0 pass/sq.m - allowing for leg space.
--- Intercity train and bus services: Seated capacity only.

It is notable that the only vehicle capacities that are allowed to exceed seated capacity is metropolitan commuter public transport vehicles. For many years, a limit of 20 minutes was placed of the time a seat was not available to a passenger. But no means of measuring the requirement was developed. I believe it has been abandoned. Today, it would be measurable via the mobile phone network data used to estimate train loads.

2.2.2 Disability Discrimination Act 1992 (DDA),

The Australian Human Rights Commission advises*:

> Disability discrimination occurs when a person is treated less favourably, or not given the same opportunities as others in a similar situation because of their disability.
>
> The Disability Discrimination Act 1992 (DDA) makes it unlawful to discriminate against a person, in many areas of public life, including employment, education, getting or using services, renting or buying a house or unit, and accessing public places, because of their disability.
>
> The DDA covers people who have temporary and permanent disabilities; physical, intellectual, sensory, neurological, learning and psychosocial disabilities, diseases or illnesses, physical disfigurement, medical conditions, and work-related injuries.
>
> It extends to disabilities that people have had in the past and potential future disabilities, as well as disabilities that people are assumed to have.
>
> The DDA protects people with disabilities who may be discriminated against because they are accompanied by an assistant, interpreter or reader; they are accompanied by a trained animal, such as a guide, hearing or assistance dog; or they use equipment or an aid, such as a wheelchair or a hearing aid.

The capacity of Metro trains relied on by the state government, TfNSW and this EIS, has no allowance for compliance with the DDA in that all space designated for wheelchairs is allocated to standing passengers in determining capacity.

* https://humanrights.gov.au/our-work/employers/disability-discrimination

2.2.3 Australia Consumer Law

The ACCC advises*:
--- services come with automatic guarantees that they will work and do what you asked for
--- Businesses must guarantee products and services they sell, hire or lease for under $40,000.

Since 1 January 2011, the following consumer guarantees on services apply:
--- be provided with acceptable care and skill or technical knowledge and taking all necessary steps to avoid loss and damage
--- be fit for the purpose or give the results that you and the business had agreed to
--- be delivered within a reasonable time when there is no agreed end date.

The state government has been particularly keen to demonstrate Metro train services with images of sparsely occupied Metro trains. No images, or diagrams, have been provided with vehicles filled

to the densities quoted by the government, TfNSW and this EIS. At best, the standing crowd limits applicable to the double-deck commuter trains can be said to be the "fit for purpose" as Sydney train commuters have long experience with them. Thus the "fit for purpose" limits for a Metro train, due to slightly greater standing area, is approximately 41.5 standing passage per carriage – slightly more than the average 40 standing passengers allowed in a Waratah carriage at operating capacity.

* https://www.accc.gov.au/consumers/consumer-rights-guarantees/consumer-guarantees

2.2.4 Australian Rail Safety National Law (NSW)

All rail operations in New South Wales (NSW) are governed by the Australian Rail Safety National Law (NSW) No 82a. This states that a duty of a rail transport operator is "… to ensure, so far as is reasonably practical, the safety of the operator's railway operations." 4.1.2 It requires train operating companies to have a safety management system and that risks from the safety of rail operations are managed to 'So Far as is Reasonably Practicable' (SFARIP). Safety has to be demonstrated. Sydney Metro has never attempted to demonstrate Metro trains are safe at crowding levels greater than for the Sydney Trains fleet. It cannot legally claim safe operation at higher crowding levels.

2.3 City Shaping Network 2056

The Sydney Metro Authority works program is not based on a study of options to serve the Sydney metropolitan area like the Sydney Area Transportation Study (SATS) carried out by the Askin government in 1974.

However, Metro West is a recommendation of the SATS study, but the SATS study appears to have played no role in Metro West's inclusion in the Sydney Metro Authority plan.

The City-shaping Network 2056 – Future Transport 2056 strategy (EIS Figure 2-12, included in Appendix 1) has no analysis basis. It is simply a representation of the current network with additional lines added at the behest of politicians and senior bureaucrats with the intent of conforming to the "30-minute" goal.

In the EIS, 30 minutes is referred to as "in-vehicle" time. It does not include walking or waiting times. Thus, the long walks and wait times to interchange at Westmead, Parramatta and North Strathfield. The great depth of Metro line adds to travel times that may otherwise appear short.

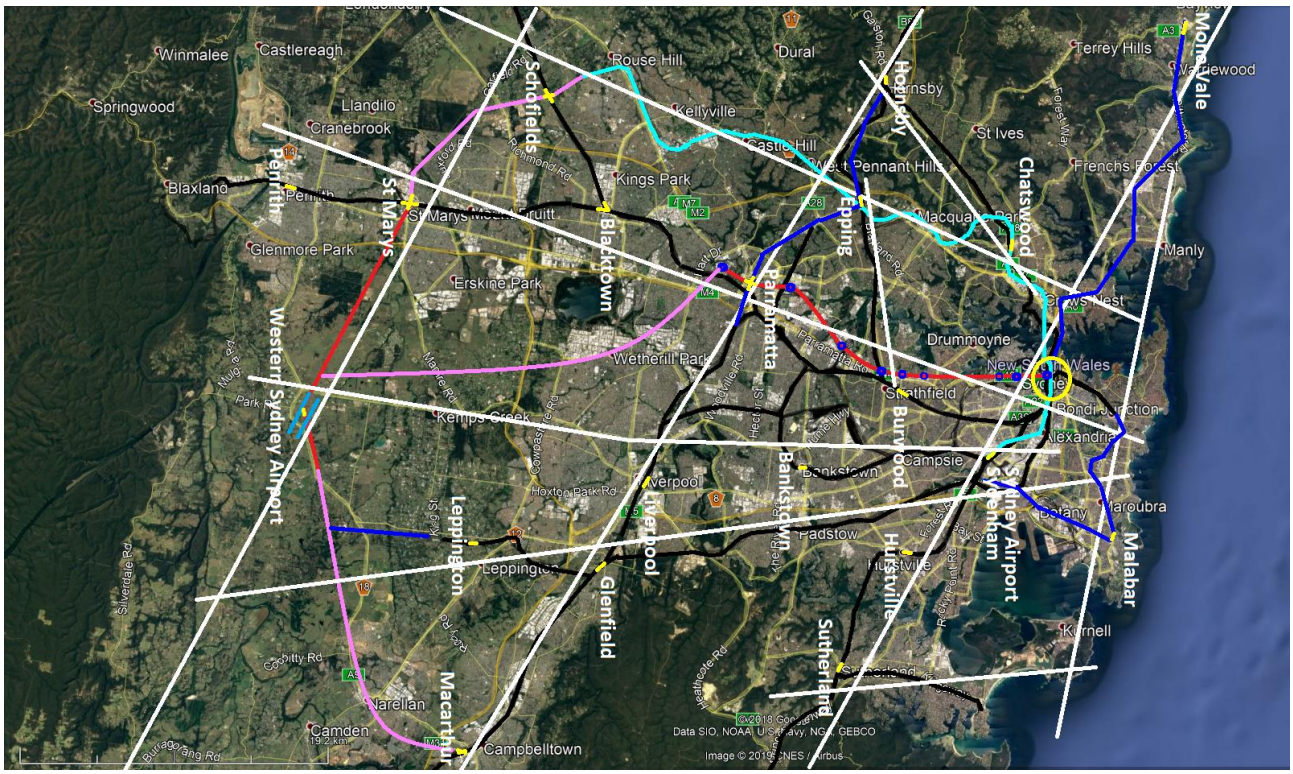
Effectively, a bus network strategy (based on average bus speeds) is being applied to much faster rail services to the detriment of the city as a whole. Rail has the capability, as demonstrated by the newer lines in western Sydney, for cross-metropolitan rail travel in 30-minutes.

The Sydney Orbital Motorway has integrated the metropolitan area from the perspective of access to fobs and for businesses to deliver goods and services. This integration is threatened as the metropolitan area is divided into three zones for access purposes.

The Sydney Metro strategy, with its division of the metropolitan area is very much anti-migrant, anti-poor, as people who cannot afford to live in the "Eastern Harbour City" with its better paying jobs, are shut out of it by extended cross metropolitan public transport travel difficulties.

Ultimately, the "three cities" strategy is a strategy for a less wealthy, less socially integrated city than one that fully utilizes rail's capabilities.

To fully utilize rail capabilities, a metropolitan scale rail grid is required. Figure 2-1 provides an example of such a rail grid applied to Sydney.



--- **WHITE** - a grid applied to the metropolitan rail network to determine service coverage gaps.
--- **BLACK** - Sydney Trains lines
--- **ACQUA** - Sydney Metro – north west Sydney to Sydenham
--- **RED** - An early version of the Metro West route and the Western Sydney Airport Access Line.
--- **PINK** - rail lines in the Sydney Metro future works program
--- **BLUE** - Rail lines to strengthen the grid structure are shown in blue.

Figure 2-1 – A rail grid for an economically and socially integrated metropolitan area

Along with Western Sydney Airport access, the highest priority rail line is a northern extension of the South Line to Merrylands, Parramatta, Epping, Hornsby Line (tunnel). This new line will allow 20 services per hour between Macarthur and Hornsby. It links this north-south line to:
--- Central Coast-Newcastle line
--- Northern Line
--- Sydney Metro
--- Western Line
--- Inner West Line
--- Sydney Airport Line
--- South-West Line which should be extended from Leppington to the Western Airport Line.
--- Southern Highlands Line

This line will free up more train paths from Parramatta to the City and west. There would be no need for the Cumberland Line. The accessibility to other lines will do far more for the people of Paramatta and others living long the line, them Metro West will do for the people using it.

2.4 Assertions made in the EIS not supported by evidence

2.4.1. EIS section 3.33 Transport mode alternatives

The EIS 3.33, in part, advises the following (indented) with authors comments using full page width:

> Buses and light rail are complementary to mass transit modes, bringing customers to and dispersing them from the major transport hubs served by the Sydney Trains suburban rail network and metro rail services.

Light rail is an expensive, redundant system lacking flexibility and speed. With just 1.5 metres between its wheels, compared to 2.5 metres for buses, light rail speed is limited due to over-turning moment. It is also limited by the ease at which a minor object on the track can detail a tram. A tram cannot move around obstructions. Battery powered articulated buses have far more

advantages, including removing pollution from cities, and capacity at least equal to a tram. As demonstrated by the Harbour bridge bus lane, it can carry almost as many passengers per hour as a heavy rail line but at slower speed.

> Buses can also potentially provide a flexible response to local demand pressures and light rail can offer medium capacity solutions for major transport corridors, replacing lower capacity bus services.

Sydney experience demonstrates buses offer a higher capacity solution.

> However, these modes would not provide sufficient mass transit capacity to address Sydney's transport bottlenecks in the Greater Parramatta to Sydney CBD corridor.

The Western Line corridor, if upgraded to six tracks between Grandville and Homebush would allow a 50% increase in capacity from 24 trains per hour to 36 trains per hour without affecting Inner West and Northern Line services. This 8.8 km corridor can be upgraded for well under $1 bn and offers a capacity increase far greater than the EIS forecast demand increase over the next 30 years.

> Ferry services tend to be slower and less reliable than rail services. Ferry travel times between Parramatta and the Sydney CBD are also impacted by speed restrictions on the Parramatta River, and natural low tides between Rydalmere and Parramatta reduces service reliability.

Ferry services are slower and less reliable on the Parramatta service due to vessel type. Hovercraft are able to operate in all conditions and lack the wake requiring speed restrictions. Hovercraft should be part of the transport services between Parramatta and Sydney.

> The NSW Government is currently investing in projects to improve transport and land use outcomes in the Greater Parramatta to Sydney CBD corridor. These include the future Parramatta Light Rail (Stage 1) and planned Parramatta Light Rail (Stage 2), the Parramatta Road Corridor Urban Transformation Strategy and road projects such as WestConnex.

As noted above, Battery powered buses offer far greater service advantages than trams at a 90% lower cost.

> The current and planned light rail network would largely serve local demand focused on the Parramatta and Sydney CBDs and provide feeder services to mass transit spines (currently the Sydney Trains network), rather than providing connectivity across the entire corridor.
>
> While current committed and future initiatives are important to service key precincts within the corridor, these projects on their own cannot wholly support the large hourly commuter movements required in and out of the Parramatta and Sydney CBDs which requires a mass transit system such as that provided by metro rail.

Current government initiative, including Metro West cannot meet demand requirement likely to emerge

2.4.2 EIS section 3.34 Rail network alternatives

The EIS 3.34 advises the following (indented) with authors comments using full page width:

> The NSW Government is currently investing in improvements to the Sydney Trains suburban rail network, through the More Trains, More Services Program which includes extra rail services, new trains on the suburban network and upgraded rail infrastructure.
>
> As part of the program, in late 2017, an extra four express services were provided between Parramatta and Sydney CBD in both the morning and afternoon peaks, increasing the service to 20 trains per hour.

The service pattern has remained 20 trains per hour with 16 T1 Western Line services and 4 Blue Mountains services. All services take 25 minutes for the Parramatta-Central journey. Express services mean the train travels slower serving less stations.

Two Cumberland Line services also operate through Parramatta linking Sydney's West and South-West.

> While the More Trains, More Services Program is important to accommodate customer growth and continually increase demand across the existing Sydney Trains suburban rail network, an additional solution is required to meet demand for rail services between the Parramatta and Sydney CBDs in the long term. So that joint objectives are achieved, the More Trains, More Services program would need to be integrated with Sydney Metro West.

More Trains, More Services is a rolling stock and signalling system program. It is not a new track program. A take-over of the program by the Metro authority is one of gaining access to another source of Metro funding, not improving the Sydney Trains service.

> Additionally, these improvements to the existing Sydney Trains suburban rail network are unable to support opportunities related to housing growth and the development of new areas. Without the provision of new stations, these improvements will not provide services to new rail catchments and key precincts currently not serviced by rail, including The Bays and direct services to Sydney Olympic Park.

The Sydney Trains service needs additional track:

--- An extra pair of tracks in the wide Grandville-Homebush track corridor (8.8 km) would allow a 50% increase in services between Parramatta and the Sydney CBD from 24 services per hour to 36 services per hour as the Central Terminal Station is under utilized with just 11 services arriving in the AM peak one-hour (4 Blue Mountains, 4 Central Coast Newcastle and 3 South Coast.

--- A pair of tunnels from Merrylands to Parramatta, Epping and Hornsby (with additional stations between Parramatta and Hornsby. This will have the benefits described in Part 2.3 above. As part of this project, all stations on the South Line would get four platforms to allow Express Trains to pass All Stops trains at stations. Trains move at a similar speed between stations.

--- The Illawarra Line between Erskineville and Sutherland needs an extra pair of tracks to allow Express and All Shops services to operate in the samer corridor. In the first instance, extra platforms should be built at the stations to allow Express trains to pass All Stops trains.

--- The Northern Line between Strathfield and Hornsby need track quadruplication completed. In the first instance, all in-between stations need 4 platforms to allow Express Trains to pass All Stops trains.

--- The Illawarra line needs a 21 km tunnel (1% grade) from Waterfall to Thirroul to reduce the Wollongong-Central journey from 90 minutes to 60 minutes.

--- The Central Coast-Newcastle Line needs a tunnel from Hornsby Station to Point Claire to cut 30 minutes from the Hornsby-Gosford services. Along with other measures, Newcastle-Central services can be reduced from 2.5 hours to 90 minutes.

--- Lengthen platforms from 8 to 12 carriages for a 50% increase in network capacity. For aboveground stations, this is a relatively simple excise in conjunction with the signalling system upgrade. In the Sydney CBD, platform lengthening can be accompanied by improved access to Stations. The small cost of platform lengthening to support the 10-car intercity trains is evidence that a 50% network capacity increase via platform lengthening is far cheaper than any Metro line.

--- There are hundreds of stations on the Sydney Trains network. Most are capable of supporting a large increase in development in suburbs served.

> Other longer-term future transport initiatives identified for investigation in Future Transport Strategy 2056 include:
> • Parramatta to Bankstown to Hurstville/Kogarah Mass Transit/Train Link
> • Parramatta to Epping Mass Transit/Train Link
> • Parramatta to Norwest Mass Transit/Train Link
> • Macquarie Park to Hurstville Mass Transit/Train Link.

Of these lines only a Parramatta-Epping Waratah train line has significant value and then only as part of as Merrylands-Hornsby line.

> These future transport initiatives do not fundamentally service the Greater Parramatta to Sydney CBD corridor, and in many instances would be complementary to Sydney Metro West.

Of course not. They are the other Sydney Metro projects radiating out of Parramatta. As presented they are not Sydney Trains projects.

It is hard to believe an employee of Jacobs could certify this part of the EIS as not misleading.

2.4.2 EIS 3.4 Travel time between Parramatta and the Sydney CBD

The EIS advises the following (indented) with authors comments using full page width:

> A guiding principle for Sydney Metro West is to offer a faster trip than would be possible on the existing T1 Western Line between Parramatta and the Sydney CBD. The fastest travel time between Parramatta and Wynyard Station on the existing Sydney Trains suburban rail network is 31 to 33 minutes. Travel time between the two cities is important to support both the '30-minute city' concept and to facilitate improved customer, transport and land use outcomes.
>
> This principle has influenced further development of Sydney Metro West, including alignment and station options. Key considerations in determining an optimum travel time between Parramatta and the Sydney CBD are detailed below.

The EIS is assuming the Sydney CBD starts at Wynyard. Services to Central are scheduled to take 25 minutes. 20 minutes is possible if extra tracks are installed between Granville and Hornsby to allow service differentiation by track.

Metro West will have only one station in the Sydney CBD. Significant effort will be required to access locations not close to Martin Place/Hunter St.

2.4.3 EIS 3.4.3 Optimum travel time between the two cities

The EIS advises the following (indented) with authors comments using full page width:

> The optimum travel time between Parramatta and the Sydney CBD is about 20 minutes. A travel time of about 20 minutes delivers a range of combined benefits for customers within the Sydney Metro West corridor, as well as for Greater Sydney

There is no 'optimum' time. Travel time budgets vary widely. Many people accept a one-hour journey to work. Others prefer no more than 10 minutes. Twenty minutes has been selected above as it corresponds to the Metro journey time.

2.4.3 EIS 1.1 Overview

The EIS advises the following (indented) with authors comments using full page width:

> Sydney Metro West would:
>
> • Provide a direct, fast, reliable and frequent connection between Greater Parramatta and the Sydney CBD, linking communities along the way that have previously not been serviced by rail

The new communities to be served by rail are at Silverwater, Burwood North, Five Dock, The Bays and Pyrmont. Sydney Olympic Park's metro service is in addition to its current service. It will be many decades before these communities provide significant demand.

> • Relieve the congested T1 Western Line, T9 Northern Line (previously T1 Northern Line) and T2 Inner West and Leppington Line

The relief is likely to be very small. Few people will give up a forward-facing seat on the world's best commuter train, to spend 10 minutes making the large vertical and horizontal transition (with waiting time) only to stand on a Metro train, or possibly sit facing sideways and bumping into a neighbouring passenger every time the Metro train accelerates or brakes. Not even people who would have to change trains at Central would likely swap to the Metro. 5 minutes standing on the Sydney metro to go downtown at the end of a Waratah/Intercity journey is far preferable to interchanging in Sydney's West.

This EIS has failed to consider the option of passengers using the Sydney Metro as part of their journey. Central will provide a far better train interchange facility.

> • Double the existing rail capacity between the Parramatta and Sydney CBDs

Current capacity is 20 suburban services (1214) + 4 Intercity (~800) = 27,480 passengers

As noted earlier, an 8-car Metro service is unlikely to comply with relevant laws with more than 836 passengers. This figure is comparable to the 1214 passenger capacity of a Waratah commuter train.

An 8-car Metro service at the same frequency as the existing Metro services has a capacity of 15 x 836 = 12,540 passengers per hour each way

Allowing 20 services per hour 20 x 836 = 16,720 passengers

Allowing 24 services per hour 24 x 836 = 20,064 passengers

Allowing 30 services per hour (for which compliance with rail safety law will be difficult to establish) 30 x 836 = 25,080 – less than the current service. Potentially, metro offers a 91% capacity increase.

A 50% increase in Waratah and Intercity services permitted by increasing the tracks between Granville and Homebush from 4 to 6 (while maintaining a separate freight track), offers a 13,740 passenger per hour increase. It also offers a 20-minute service by separating service types (1 stop, few stops, all stops) by track. The forecast T1 demand increase over the next 30 years is 54%. Based on the EIS forecast, a Granville-Homebush project would meet demand for the next 30 years at a fraction of the cost.

A compounding 50% capacity increase can be provided by extending all platforms by 50%, not just those used by Intercity services.

Extra tracks and platform lengthening can increase Western line capacity by 125% to 2.25 times existing capacity – a greater increase than claimed for the Metro.

> • Significantly boost economic opportunities for Greater Parramatta

Far greater opportunities arise from both the rail link to Western Sydney Airport, and an extension of the South Line from Merrylands to Parramatta, North Parramatta, Carlingford, Epping, Thornleigh industrial area and Hornsby.

> • Support new residential and employment zones along the Greater Parramatta to Sydney CBD corridor, including at Sydney Olympic Park and The Bays – providing improved transport for the additional 420,000 new residents and 300,000 new workers forecast to be located within the corridor over the next 20 years

Only Silverwater, Burwood North, Five Dock, The Bays and Pyrmont and Sydney Olympic Park are the new locations being serviced. It is unlikely they would see a total 50,000 new residents in the next 20 years. 85% of new residents and workers will be in areas served by the existing rail network.

> • Allow customers fast and easy transfers with the T1 Western Line at Westmead, T9 Northern Line at North Strathfield, and the Sydney Trains suburban rail network and Sydney Metro in the Sydney CBD

As noted above, few passengers are likely to transfer from a faster, better quality Waratah train to a Metro train given the likelihood of a 10-minute interchange and the need to stand on the Metro.

> • Allow for transfers with the future Parramatta Light Rail (Stage 1) at Westmead and Parramatta, as well as the planned Parramatta Light Rail (Stage 2) at Sydney Olympic Park

They can just as easily transfer to the better quality Waratah trains

> • Create an anticipated 10,000 direct and 70,000 indirect jobs during construction (based on Sydney Metro analysis).

The jobs are a result of spending money. Spending the money on more valuable projects gives the same construction job boost and a better outcome for the wider economy.

2.4.4 – EIS 2.3.2 Transport capacity, accessibility and reliability

The EIS advises the following (indented) with authors comments using full page width:

> Analysis undertaken by Sydney Metro showed that in 2017, the T1 Western Line moved around 19,100 people each morning in the one-hour AM peak (8am-9am). Around 43,700 people in the one-hour AM peak travelled from Parramatta to the Sydney CBD on all lines

(T1 Western Line, T9 Northern Line, T2 Inner West and Leppington Line, and intercity services), which collectively operated at about 85 per cent total capacity.

Greater Parramatta has been defined to include the Northern Line and Concord West, Strathfield North and Strathfield Stations. It is stretch saying Greater Parramatta crosses the A3 arterial road. Including the Northern Line is just finding a way to increase 19,100 people by more than double (to 43,700 people). Many of the 43,000 have no association with Parramatta. The statistic adds no analysis value.

The reliability and capacity of the Sydney Trains suburban rail network, particularly in the Greater Parramatta to Sydney CBD Corridor, is currently constrained by a number of factors, which include:

• The large number of lines which converge in the western rail corridor between Greater Parramatta and the Sydney CBD, including the T1 Western Line, T9 Northern Line and T2 Inner West and Leppington Line. This limits the capacity to increase rail services between Parramatta and the Sydney CBD

This would be resolved by either of an extra pair of rail lines between Granville and Homebush or by lengthening platforms by 50%. Note – Intercity platforms are presently being extended to 200 metres for 10-car intercity trains. An extension for 12-car trains has very little extra cost.

• Train timetables that require trains with different service patterns to share the same track, which can result in slower trains delaying all services (including fast and express trains) and requires customer journey trade-offs or further investment in the track network

An extra pair of rail lines between Granville and Homebush would resolve this issue.

• Crowded trains with two doors, double decks and 3 + 2 seating arrangements, which are slow to load and unload, resulting in long ‘dwell times’ (the time a train needs to stop in a station for customers to board and alight). Longer dwell times challenges on-time running of services, and leads to fewer services operating in a given time period

Dwell time is only an issue at Central, Town Hall and Wynyard stations. It can be addressed at Central by a couple of additional platforms (on top of the Metro platforms), and by modifications to Town Hall and Wynyard Stations to allow alighting from one side and boarding from the other in peak hours.

• Crowded CBD stations that rely on stairs instead of escalators as the principal means of accessing platforms and concourse levels

CBD stations need an upgrade after 90 years of service to include escalator access. This could be implemented in conjunction with a platform extension and double-sided entry program at CBD stations other than Museum and Circular Quay.

• Sharing of rail infrastructure with freight services, which impacts suburban rail services.

This needs to be addressed via the four-track program on the Northern Line. West of Strathfield, freight trains have their own track. The Western Freight Line project will clear commuter lines of freight trains as far west as St Marys. Tunnels under the Blue Mountains are needed for separation west of Penrith.

Part 3 Sydney CBD Concept

3.1 Sydney CBD investigation area and integrated transport

EIS Figure 1-2 (Figure 3.1 below) identifies the Sydney CBD as an area for investigation for a station. Previous documents have included a station at the Hunter St-Elizabeth St intersection – concentrating rail capacity in the eastern Martin Place 'precinct'. The next station on the line is proposed for Zetland.

Figure 3.1 EIS Figure 1-2: Sydney Metro West

Consultation with other government agencies is a matter of discovering impediments and conflicts with a proposal. It is not about seeking their views as to the service that should be offered. Consultation with the community and agencies is seen as, and has the purpose of, public relations. True consultation is with the minister responsible as he (Andrew Constance) is the only person with power to alter an agency plan.

The NSW transport agencies are as siloed as ever due to the creation of agencies with boards to deliver and run motorways and Metro lines. The Sydney CBD needs an integrated transport approach that cannot be delivered by the current agency structure. In this section an integrated public transport, pedestrian, cycle and road plan will be put forward.

Metro West will have far few passengers than expected, due to the time to interchange between trains. Few people can be expected to interchange at Westmead, Parramatta and North Strathfield as the Metro trains are slower than the Waratah trains, and the vertical and horizontal distance between Metro and Sydney Trains platforms will mean a typical interchange will take 10 minutes (including average wait time. Like the Sydney Metro Line to Chatswood, Metro West will be poorly utilized for many years – likely decades. It is notable that the current busy section of the Metro is the former Chatswood-Epping line which developed patronage over two decades.

Metro West will create more value if it links with an existing rail line like the current Metro line. The Eastern Suburbs Line at Martin Place is the obvious candidate. The Illawarra Line at Town Hall would then be diverted to link with the former rail tunnels at Wynyard, used by trams from 1932 to 1958, as part of the first stage of a Northern Beaches Railway.

The former rail corridor to Milsons Point on the eastern side of the Harbour Bridge can be inexpensively revived. The Western Harbour Tunnel will provide additional cross-harbour road capacity to allow the Harbour Bridge Cahill Expressway lanes to be converted back to rail use. From Milsons Point, the 'Northern Beaches' line would be extended via a 'dive' under High St to an underground station at the Alfred St-Mount St intersection (east side of motorway). From Mount St, the tunnels would be extended under the motorway to a large bus-train interchange at the Neutral Bay block bounded by Falcon St, Merlin St, Military Rd and Tramway Lane. Commuter buses crossing the harbour would be directed to rail stations on the Northern Beaches Line, Sydney Metro and North Shore Line.

As noted later in Part 3, there is sufficient commuters crossing the harbour to justify three rail lines across the harbour.

The Covid-19 crisis has also shown the need to address pedestrian and cycle access as part of an integrated plan.

3.2 Rail transport planning history

3.2.1 SATS

The only post-WW2 planning study for railways that seriously addressed options was the Askin government's Sydney Area Transportation Study 1974 (SATS) with a study team made up of experts from government departments, universities and the private sector for specific expertise. The Study Team was supervised by the Cabinet Transport sub-committee.

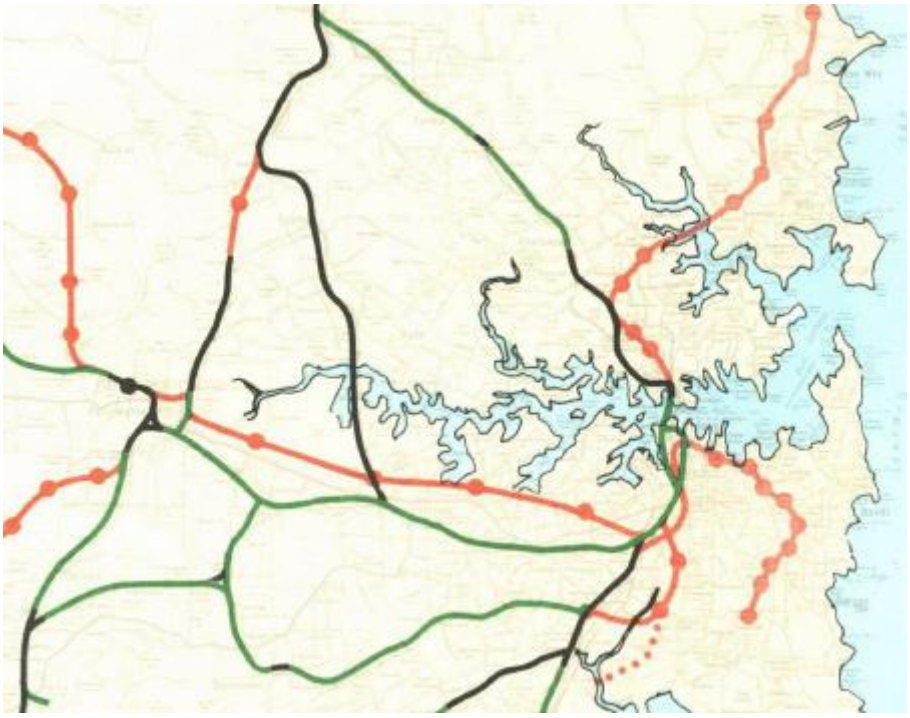
The composition and supervision of the study teams for the County of Cumberland plan, the Sydney Region Outline Plan and SATS ensured a level of rigor missing in planning today despite the creation of the Greater Sydney Commission – an orphan in the NSW bureaucracies. Today, the appearance is traffic modelling comes after project selection, not vice versa.

The previous emphasis on broad government engagement, outside expertise, and lack of today's political filters, allowed the development of plans that have stood the test of time.

The SATS undertook extensive modelling of road and public transport options to inform recommendations which retained the Northern, Warringah Gore Hill highways of Cumberland Plan.

The SATS rail recommendation (Figure 3.2 & 3.3) contains some elements of the current government's Sydney Metro rail plan.

Later rail studies addressed access to South West and North West Sydney and extra capacity in existing corridors, but none were as comprehensive as SATS.



--- The SATS railway plan Included here as the Sydney Harbour Bridge has both road and rail capability. Based on volumes carried as presented below, and freight route alternatives, the highest and best use of Harbour Bridge Lanes is public transport.

--- The Bridge's ten 'lanes' can carry road traffic, or its four outer lanes can carry trains.

--- 4 rail lines, a southbound bus lane, and 5 general traffic lanes serving the northern CBD is likely highest and best use of the Harbour bridge.

--- The current 7 general traffic lanes each carry the traffic noted in section 3.3.

--- EIS figures for motorway exits and their surrounds show 'private' vehicle passengers are only 7.5% of 'private' vehicle trips. Excluding buses, general traffic lanes vehicle volumes virtually equals people carried.

--- The EIS reports the Sydney Harbour Bridge bus lane carries 30,000 passengers in the AM peak two hours, and 57,500 passengers per day.

--- The North Shore Rail Line can carry 24,000 passengers per track per hour in comfort (1,200 per train). It presently carries passengers as noted in section 3.3.

--- The SATS plan includes a version of Metro West between Parramatta and Sydney (Central).

--- The current Metro West plan has the line going directly to a station in Hunter St, Sydney.

--- The Metro West plan could be modified to reduce costs and provide more cross-harbour rail capacity:

- --- Metro West could connect to the Eastern Suburbs Line at Martin Place Station.
- --- The Illawarra Line from Town Hall would then connect to the first stage of a Northern Beaches Metro at Wynyard's disused rail tunnels (presently a carpark).
- --- The Northern Beaches Metro would use the eastern rail corridor across the Harbour Bridge to Milsons Point (presently the Cahill Expressway and Bus Lane). The rail station structure is presently used for toll gates.
- --- As built for the Harbour Bridge opening, the eastern tracks crossed the road lanes to North Sydney Rail Station from where Bradfield made provision for a Northern Beaches Rail Line to start.
- --- Due to the Sydney Metro connecting Chatswood to North Sydney and the Sydney CBD, it would be better for a Northern Beaches Metro to go underground to a rail station at Alfred St-Mount St North Sydney (east side of motorway), and follow the motorway to another station (interchange) under the block bounded by Falcon St, Merlin St, Military Rd and Tramway Lane Neutral Bay (near the motorway).

Figure 3.2 – Sydney Area Transportation Study (SATS) 1974 - Figure 1.14 Recommended Railway Systems 2000 – extract

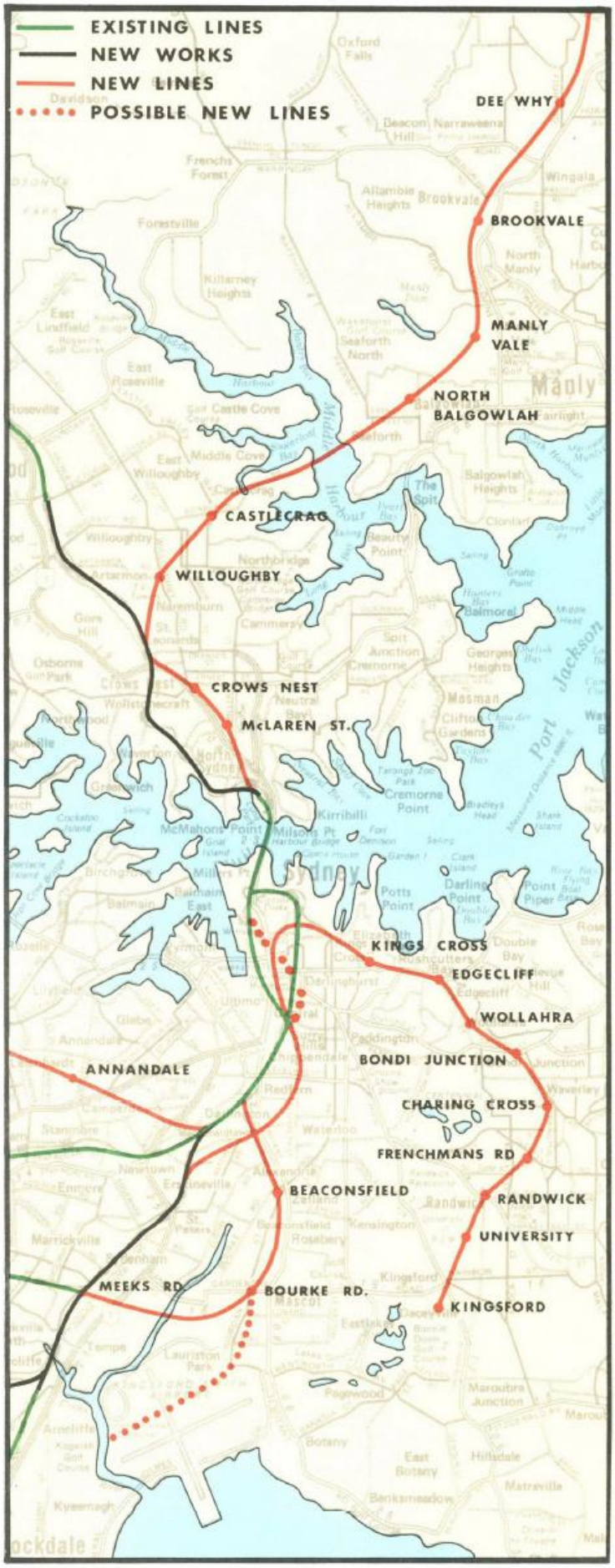


FIGURE 1·15 RECOMMENDED RAILWAY SYSTEMS
SYDNEY-NORTH SYDNEY- 2000

--- Figure included for the implied use of the Sydney Harbour Bridge for more rail services.

Figure 3.3 – Sydney Area Transportation Study 1974 - Figure 1.15 Recommended Railway Systems, Sydney - North Sydney - 2000 - extract

3.2.2 Cost effectiveness

In 2013 Chi-Hong (Patrick) Tsai and Professor Corinne Mulley of Institute of Transport and Logistics Studies, Business School, The University of Sydney published a paper – How does the efficiency performance of Sydney CityRail compare with international urban rail systems.

Tsai and Mulley found in part:

> This paper compares the operational performance of Sydney CityRail with 11 international urban rail systems using a Data Envelopment Analysis approach. The operating performance is examined using cost-efficiency and cost-effectiveness measures to understand the extent service inputs are efficiently used to generate service outputs, in terms of car-km operated and passengers carried. This research finds the operation of CityRail is efficient in terms of car-km operated, but the cost-effectiveness score is the lowest of the 12 systems being compared.

In fact, Tsai and Mulley found cities with urban sprawl ranked lowest in cost-effectiveness. Generally, sprawl is reflective of a radial network structure where trains travel large distances only to fill near the city centre. A radial structure is only effective in taking people to single centre.

A rectangular grid structure allows people to travel in every direction across a metropolitan area in reasonable time. A majority of trains do not pass through a single large centre, allowing service capacity to reflect demand away from the city centre. With a rectangular grid structure, railways can be cost effective, despite urban sprawl. Needless to say, the radial structure of the Metro lines will ensure Metro services are not cost effective, and the cost-effectiveness of rail in Sydney will decline further.

3.2.3 Three cities plan

The current government's "three cities" (Sydney, Parramatta, Aerotropolis) policy with 30-minute access is a walking back of the very successful Sydney Region Outline Plan (1968), and the 30 to 40 regional centres that evolved under it. These centres give our present 10-minute access to goods, services and jobs only available in the central CBD of many other cities.

As part of the "Three Cities" plan, the Sydney CBD is growing internally, and expanding down its Western side to Redfern. Due to its ocean and harbour moderated climate, and rainfall twice that of Penrith, the Sydney CBD will remain the preferred development location in the Sydney metropolitan area.

However, both the capital and operating cost of bringing people from the broader metropolitan area to the Sydney CBD is far higher than a metropolitan area with regional CBDs on the nodes of a rail grid – a Public Transport Oriented Development Strategy (PTODS). Public transport, as with all other transport, should make a seat available to all passengers for comfort and safety reasons.

The growth of our cities is supported by a large and successful migration program ensuring population growth that requires continued transport investment and reduces the financial risk to government of such investment.

The composition and supervision of the study teams for the County of Cumberland plan, the Sydney Region Outline Plan, and SATS ensured a level of rigor missing in planning today despite the creation of the Greater Sydney Commission – an orphan in the NSW bureaucracies. Modelling came before the recommendations.

The 1970s emphasis on broad government engagement, outside expertise and lack of today's political filters, allowed the development of plans that have stood the test of time.

3.2.4 Impact of technology development on rail service capabilities

Technology development favours that public transport being:
--- high-seating density double-deck commuter trains with more single-deck space on commuter trains serving airports. The Waratah trains comply with this principle except for airport services, where a train constructed to the layout of the Bombardier Regio 2N (double-deck carriages separated by single-deck carriages such that two-thirds of the train length is single-deck),
--- high-seating density electric buses. Sydney's bus fleet has high-density seating, but virtually all of it is powered by internal combustion engines that heavily pollute Sydney City.

3.3 Integrated CBD travel planning - Capacity and demand for cross-harbour road travel

3.3.1 Population growth

The Western Harbour Tunnel EIS (Appendix U Tables 4.1 & 4.2) reports a different figure for Sydney population growth as per Table 3.3.1.1

Table 3.3.4.1 – Population growth

		growth % p.a.	
	Population	**2011-16**	**2016-36**
--- Greater Sydney* including Central Coast	5,021,350	1.8	1.6
--- ABS Sydney, end June 2019	5,312,163	1.7	
--- ABS Melbourne, end June 2019	5,078,193	2.3	
--- ABS Brisbane, end June 2019	2,514,184	2.1	
--- ABS Australia, end Sept 2019	25,464,116	1.5	
* comprises Sydney Metropolitan local government areas and Central Coast local government area.			

Population growth is a function of natural growth, migration, planning and the relative success of state governments in addressing housing affordability. Sydney population growth is suppressed relative to Victoria, in particular, by the housing affordability issue.

The declining growth projects of the ABS reflected in the Metro West EIS, assume no government action to address growth and social issues over the next 40 years. A most unlikely scenario. Policy is directed at maintaining current population growth under pressure from business and other community groups.

The over 5% per annum growth in public transport travel before the Covid-19 crisis reflects a mode shift to public transport as it is far greater than population growth. Once the crisis passes, our economy can only continue to grow if the mode shift continues.

3.3.2 Three cities strategy

The “three cities” strategy will likely see 90% of the three-city focus on the Sydney/North Sydney CBDs due to the relative sizes of the other two “cities”, Parramatta and the Aerotropolis. The latter being in the planning phase. Also, Sydney CBD growth is supported by its better climate moderated by the harbour, Botany Bay and the ocean, and its many globally attractive features.

The previous ‘forty regional and specialised centres’ strategy would have reduced Sydney CBD growth and reduced the need for cross-metropolitan travel.

The Sydney CBD long ago reached its private vehicle limit. Bus and Light Rail corridors have expanded in the CBD, but their capacity to grow is limited.

Private vehicle travel to Sydney CBD should further decline, while all growth in travel to Sydney/North Sydney should be via public transport.

Given the dual mode capability (road or rail) of four of the Sydney Harbour Bridge ‘lanes’ and possibly six of the lanes, cross-harbour capacity should address both private and public transport travel.

TfNSW should not allocate eight Harbour Bridge ‘lanes’ to road use without a strategy to address public transport demand.

The EIS expects some cross-harbour traffic growth in the east over the next 17 years reflective of long term traffic growth and induced traffic growth, but is not reflective of current decline of private vehicle travel in the east, and growth in public transport, which was 7.4% p.a. Sydney-wide over the five years to June 2019. While public transport growth is unlikely to continue well ahead of population growth, the present situation of private vehicle travel demand decline and public transport increase is likely to continue.

Likely, high tolls will supress traffic to a greater degree than the rise in toll from $0.20 to $1.00 in 1987 to fund the Sydney Harbour Tunnel which stabilised Sydney Harbour Bridge traffic to at least 1992 when the tunnel opened (Appendix 4A).

3.3.3 Cross-harbour capacity

The Sydney Harbour Bridge (A4, T1) has 'lanes' capable of either road or rail transport. In addition to outside pedestrian-cycle lanes:
--- it could have 10 general traffic lanes,
--- it initially had 4 general traffic lanes and 4 rail tracks,
--- it presently has 7 general traffic lanes, a Bus Lane and 2 rail tracks
--- travel demand, in the context of additional road harbour-crossing capacity, would suggest 4 rail tracks, a southbound Bus Lane and 5 general traffic lanes
--- the Bridge could probably carry 6 commuter rail tracks and 4 road lanes

Table 3.3.3.1 sets out the cross-harbour 'lanes', existing and under construction, east of Parramatta. Road and rail are included as the Sydney Harbour Bridge has four lanes capable of either rail or road 'lanes'. With the Sydney Metro opened through the Sydney CBD, there will be 6 rail tracks and 36 road lanes from James Ruse Drive east. These could be rebalanced 8 rail tracks and 34 road lanes.

Table 3.3.3.1 – Cross-harbour lanes, existing and under construction, east of Parramatta

Crossing	Route	'lanes'	location west of SHT
--- Sydney Harbour Tunnel	M1,	4 road	–
--- Sydney Harbour Bridge	A4, T1	as above	0.3 km
--- Sydney Metro tunnel	M	2 track	0.9 km
--- Gladesville Bridge	A40,	7 road	6.2 km
--- Ryde Bridge	A3,	7 road	11.5km
--- John Whitton Bridge	T9,	2 track**	12.1 km
--- Silverwater Bridge	A6,	4 road	15.3 km
--- James Ruse Drive (Parramatta bypass)		6 road	18.2 km
--- Church St, Parramatta		N/A	20.0 km
--- TOTAL excluding SHB	–	4 rail, 28 road	
--- TOTAL with SHB	–	6 rail, 36 road	
--- **TOTAL with SHB and rail maximised**		**8 rail, 34 road**	

** Bridge has piers in place for an extra 2-track wide deck.
Gladesville Bridge deck is 88 feet (26.8 m) wide. Lanes are 3.1 metres wide. It could be converted from 7 to 8 road lanes with wider pedestrian-cycle paths:
--- 8x3.1 m lanes, 24.8 metres
--- a tall median strip, 0.5 metres
--- leaving 2x0.75 metres of deck width for attachment of vehicle barrier and overhanging footpaths with security fences.

The WHT project will increase road lanes to 42 – equivalent to 4 rail tracks in peak-hour capacity.

Public transport lanes carry far more people in peak hour and thus are more valuable than general road traffic lanes given the flexibility of route for general traffic.

The Harbour Bridge Bus Lane carries 20,000 passengers in 400 buses in the AM peak hour.

The North Shore Rail Line can carry 24,000 people per hour per lane (track).

A road lane can carry 2,000 private vehicles per hour which is 2,200 people per hour at the passenger rate of around 10%.

Peak-hour capacity of public transport 'lanes' is 10 times a general traffic lane not used for public transport.

Cross-harbour public transport demand should be a major feature of the WHT analysis as any constraints on conversion of Harbour Bridge road lanes to rail tracks imposes additional costs on rail infrastructure – when it is cheaper to provide new roads.

Time for driver and passenger in a private vehicle is not as productive as that for a train or bus due to the driving task and more 'jerky' motion of the vehicle which leads to discomfort and motion sickness if not focusing on the horizon.

3.3.4 Cross-harbour private travel demand 2006 onwards

See Section 3.3.5 for public transport demand.

Table 3.3.4.1 shows cross-harbour road traffic at North Sydney is stable or declining, while demand grows more rapidly the closer to Parramatta.

Table 3.3.4.2 is missing key data as TfNSW/RMS has failed to record Sydney Harbour Bridge average daily traffic data for the years 2017 to 2019 and for other roads where we should expect data.

Average daily traffic on the Sydney Harbour Bridge/Sydney Harbour Tunnel (~245,000 in 2016) and likely declining, is now matched by traffic on Concord Rd/Silverwater Rd/James Ruse Drive.

The Sydney Harbour Tunnel reached a peak in 2016-2017 and has declined since.

Gladesville Bridge also has missing data. Data available suggests demand reached a peak in 2014.

Gladesville Bridge remains at about half its expected daily volume due to poor connections to the north and south.

Gladesville Bridge is the pivot point between rising traffic to the west and declining traffic to the east.

The Western Distributor and the Cahill Expressway at Circular Quay both reached a peak in 2015. As these roads represent 76.5% of harbour Bridge traffic between 2010 and 2016, it is likely the Harbour Bridge would show decline for the years 2017 to 2019.

Between 2010 and 2016 the Western Distributor averaged 51.8% (79,930), the Cahill Expressway at Circular Quay 24.7% (38,070) and the northern CBD 23.5% (36,330) of the 154,330 vehicles per day.

It is notable that this total vehicle per day average is only 85.7% of the daily average traffic that crossed Harbour Bridge in the lead up to the opening of the Harbour Tunnel in 1992. 1987 to 1992 had a static traffic volume when the toll was raised from $0.20 to $1.00 in 1987 (Appendix 4A).

The screenline of the Harbour Bridge, Harbour Tunnel and Gladesville Bridge averaged 325,750 vehicles per day between 2010 and 2016, with a high of 330,710 in 2013 and a low of 320,460 in 2010 at the tail end of the “great financial crisis”. The latest year (2016) figure is 326,700 – just 0.3% more than the average.

In contrast, the further west harbour crossings had ten-year growth of:
--- Concord Rd A3 (6.5%),
--- Silverwater Rd A6 (13.7%), and
--- James Ruse Drive 9.3% in 5 years to 2013 and possibly 18% in 10 years.
The closer to Parramatta, the greater the rise.

In the last year for which all three had their traffic volumes measured:
--- the harbour Bridges 8 lanes averaged 19,360 vehicles per lane.day,
--- the Sydney Harbour Tunnel 22,470 vehicles per lane.day, and
--- the Gladesville Bridge 11,760 vehicles per lane.day reflecting its poor connections to its north and south as a piece of the intermittently constructed motorway.

In their last year of measurement:
--- Concord Rd (A3) averaged 14,124 vehicles per lane.day,
--- Silverwater Rd (A6) averaged 16,942 vehicles per lane.day
--- James Ruse Drive* averaged 11,806 vehicles per lane.day.
* The crossing is not part of a numbered road.

Table 3.3.4.1 – RMS Traffic volume viewer - key roads Average Daily Traffic counts

https://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=14&lat=-33.867917023987054&lon=151.22176445410156

Year	SHB ~47.5% south 5 Sth, 3 Nth in AM peak	Western Distrib ~46.5% rising 6-lane	Cahill CQ 53.3% south 4-lane	SHT ~46.5% south decline 4-lane	ANZAC Bridge 8-lane	Glades-ville Br ~53.5% south rising 3-lane N 4-lane S	Figtree Bridge 4-lane	Victoia Rd Huntley Point 4-Gen 2 Bus	M2 + Epp Rd Lane Cove Rr 4-lane E 5-laneW	Concord Rd (A3) 3-lane N 4-lane S	Silver-water Rd (A6) 4-lane	James Ruse Drive 6-lane
10-yr grwth	Insuffici ent data	2.8% to 2017	1.6%	4%	-0.15%	3.8% to 2016	2.2%	-2.9% E	2.2%	6.45%	13.7% to 2018	9.3% 2008-2013
Veh/ lane	19,360 2016	13,564 2017	9,616 2019	**22,210 2019**	16,990 2019	11,761 2016	10,450 2019	12,855 2019	11,535 2019	14,124 2019	16,940 2018	11,806 2013
2019	---	---	38,463	88,842	135,924	---	41,806	51,418	103,823	98,871	---	---
2018	---	40,477 North	20,802 South	88,033	135,860	---	36,670	28,207 E	100,132	98,995	67,766	----
2017	---	81.382	21,496 South	89,902	136,837	---	43,028	29,684 E	53,246 Epp Rd	97,071	65,742	---
2016	154,876	80,330	36,175	89,878	---	82,327	42,273	28,868 E	52,715 Epp Rd	99.003	55,172	---
2015	152,433	83,719	39,253	89,380	132,707	81,950	41,130	---	120,728	98,402	57,523	---
2014	152,865	76,702	38,797	88,137	132,007	82,118	40,228	---	115,182	96,157	59,416	---
2013	157,945	79,469	38,536	88,731	135,818	84,030	40,699	---	111,372	97,556	59,757	70,837
2012	158,275	78,719	37,838	88,128	135,103	83,338	39,330	---	107,810	96,202	57,856	70,280
2011	152,952	79,581	38,167	87,955	136,540	43,650 South	40,010	---	108,485	95,036	57,881	69,126
2010	149,652	79,606	37,764	87,870	136,885	82,934	40,489	22,222 E	107,810	95,171	57,891	68,108
2009	---	78,159	37,868	85,403	136,116	78,838	40,915	28,062 E	104,164	92,879	60,344	65,840
2008	---	79,000	40,408	83,296	134,839	83,139	39,684	29,044 E	98,222	---	59,611	64,799
2007	---	79,187	41,187	84,429	134,969	78,835	40,428	---	52,839 Epp Rd	---	59,108	---
2006	---	77,317	41,827	80,757	132,624	79,323	40,899	---	---	---	58,135	---
1987-1992	180,000											

Table 3.3.4.2 – WHT Appendix F, Table 6-1 & 6-2 Modelled 'Do minimum' peak hour traffic demands at key locations (SMPM)-modified with extra data

Road	Location	Di-rec-tion	2016 Daily vehicles	2016 Daily heavy vehicles	2016 (veh)/ lanes	2016 per lane	2027 (veh)/ lanes	2027 per lane	2037 (veh)/ lanes	2037 per lane
Morning										
SHB	Brad Hwy	**North**	90,500	4,600	4850/3	1617	5500/3	1833	6000/3	**2000**
		South	52,500	2,100	5500/3	1833	6050/3	**2017**	6600/3	**2200**
		Combined	143,000	6,700	10,350/6	**1725**	11,550/6	1925	12,600/6	**2100**
SHB	Cahill E'way	South	39,000	600	2600/2	1300	2900/2	1450	3200/2	1600
SHT	Syd Har	**North**	55,000	2,400	3950/2	**1975**	4200/2	**2100**	4450/2	**2225**
		South	48,500	2,300	3700/2	1850	4100/2	**2050**	4350/2	**2175**
		Combined	103,500	4,700	7650/4	**1913**	8300/4	**2075**	8800/4	**2200**
		Combined SHB + SHT	**285,500**		**20,600/12**	**1717**	22750/12	**1896**	24,600/12	**2050**
		1987-92 SHB 8-lane $1 toll south	**180,000***							
Glade Br	Parra Rr	**North**	51,000	2,000	3050/3	**1017**	3800/3	**1267**	4150/3	**1383**
		South	43,000	2,200	3650/4	**913**	4050/4	**1013**	4300/4	**1075**
		Combined	94,000	4,200	6700/7	**957**	7850/7	**1121**	8450/7	**1207**
Syd Harb screenline		**North**	**196,500**	**9,000**	**11,850/8**	1481	**13,500/8**	1688	**14,600/8**	1825
		South	**183,000**	**7,200**	**15,450/11**	1405	**17,100/11**	1555	**18,450/11**	1677
		Combined	**379,500**	**16,200**	**27,300/19**	1437	**30,600/19**	1611	**33,050/19**	**1740**
ANZAC Br	Pyr	East	75,500	3,200	5100/4	1275	6250/4	1563	6600/4	1650
		West	63,000	3,000	3000/4	750	3850/4	963	3900/4	975
		Combined	138,500	6,200	8100/8	1013	10,100/8	1263	10,500/8	1313
WD	Syd CBD	North	52,500	3,400	2550/3	850	3050/3	1017	3300/3	1100
		South	42,000	2,300	2800/3	933	3100/3	1033	3350/3	1117
		Combined	94,500	5,700	5350/6	892	6150/6	1025	6650/6	1108
Evening										
SHB	Brad Hwy	North			6150/4	1538	6650/4	1663	7200/4	1800
		South			3150/2	1575	3450/2	1725	3750/2	1875
		Combined			9300/6	1550	10,100/6	1683	10,950/6	1825
SHB	Cahill E'way	South			2500/2	1250	2650/2	1325	2850/2	1425
SHT	Syd Har	North			3850/2	1925	3900/2	1950	4100/2	**2050**
		South			2850/2	1425	3400/2	1700	3800/2	1900
		Combined			6700/4	1675	7300/4	1825	7900/4	1975
		Combined SHB+SHT			**18,500/12**	**1542**	**20,050/12**	**1671**	**21,700/12**	**1808**
Glade Br	Parra Rr	North			3750/3	**1250**	4050/3	**1350**	4250/3	**1417**
		South			2900/4	**725**	3250/4	**813**	3550/4	**888**
		Combined			6650/7	**950**	7300/7	**1043**	7800/7	**1114**
Syd Har screenline		**North**			**13,750/8**	1719	**14,600/8**	1825	**15,550/8**	**1944**
		South			**11,400/11**	1036	**12,750/11**	1159	**13,950/11**	1268
		Combined			**25,150/19**	1324	**27,350/19**	1440	**29,500/19**	1553
ANZAC Br	Pyr	East			4200/4	1050	5300/4	1325	5450/4	1362
		West			4250/4	1063	5850/4	1463	6200/4	1550
		Combined			8450/8	1056	11,150/8	1394	11,650/8	1456
WD	Syd CBD	North			3200/3	1067	3750/3	1250	4000/3	1333
		South			1850/3	617	2150/3	717	2300/3	767
		Combined			5050/6	842	5900/6	983	6300/6	1050
* Quail and West – see end of section 4.										

Growth from SHT (1992 before SHT open) to Combined SHB + SHT 2016 – 285,500/180,000 is 58.6%, **1.94% p.a.** growth over 24 years – slightly ahead of Sydney population growth. Pre 1992 data is from the extract below.

Sydney Harbour Screenline combined:
--- total AM peak hour traffic growth 33,050/27,300.05/27.3 = 21% growth in 21 years 2016-2037, **0.914% p.a**. over 21 years,
--- total PM peak hour traffic growth 29,500/25,150 = 17.3% growth in 21 years 2016-2037**, 0.763% p.a.** over 21 years,
--- Heavy vehicle (over 4.5 tonne) portion of total traffic 2016 – 16,200/379,500, **4.27%.**

However, the evidence of the Table 3.3.4.1 is that traffic has declined a little since the middle of the 2010s and future growth should not be expected.
Primary reasons for this include:
--- improvements in the quality of buses and trains,
--- mobile devices and telecom capacity for productive journeys using public transport free of the driving task and motion sickness in passengers not watching the horizon during personal vehicle acceleration.
--- a desire to contribute less to air pollution and the impact of greenhouse gas emissions on climate.

Extract - PROCEEDINGS 16th ARRB CONFERENCE, PART 5 pages 263-285, 9-13 Nov 1992

THE SYDNEY HARBOUR BRIDGE BUS LANE – extracts with additional calculations

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1987-1992 - ~180,000 vehicles/day with $1.00 toll. 22,500/lane
31 Aug 1992, SHT and Bus Lane opened and toll to $2/trip south.
Bus services from areas north of the harbour to Wynyard in Sydney's Central Business District:
--- STA
    --- >720 buses southbound/day
    --- >200 out of service southbound PM peak (~22% out of service)
    --- 713 services/day operate on the return trips
    --- >200 out of service northbound AM peak
--- Private bus services non-STA areas
    --- small number (50??) both directions
--- Total ~1,000 buses/day each way

Catchment area – north to Palm Beach Warringah Peninsula, Chatswood North Shore, Epping North West

12-hour period starting at 7 am – 7 pm, 42 bus routes 20,000 people to city, 17,000 people out of city.

AM peak hour, STA operates ~165 trips to CBD via Harbour Bridge carrying >7000 passengers. ~43 pax/bus
This equates to a modal split for all southbound people trips across the Bridge of:

--- bus,	22%	>7,000 pax (~165 buses at ~42.5 passengers each)
--- train,	33%	>10,500 pax (10 trains/1050 passengers each??, 12 trains/875 pax each??)
--- public trans	55%	>17,500 pax
--- car,	44%	>14,000 pax App B, car occupancy 1.12 - >12,500 cars
--- Total	99%	>31,500 pax/hour

--- Total car-equivalent vehicles ~13,000/6 = 2167 vehicles/lane prior to Bus Lane
--- Taxis – up to 350 per hour

--- less than 40% of people crossing the Bridge in the peak period travel in a motor car (include pedestrians and cyclists)
((Submission note: 'Bus lane' permitted vehicles other than scheduled buses include – tourist coaches, taxis, hire cars, motorcycles, and emergency vehicles.))

A survey of buses travelling between Falcon Street, Neutral Bay (north of the Bridge) and the city before the opening of the Harbour Tunnel showed a wide variation in bus travel times.

DELAYS TO BUSES DUE TO TRAFFIC CONGESTION
The results of the survey show travel times ranging from:
--- 4 minutes in the off peak,
--- 9-11 minutes in the morning peak,
--- 10-23 minutes in the evening peak.

The high variability in Bus Travel Times Falcon St to City time not only seriously reduced vehicle fleet utilisation during the peak periods when the frequency of service was most critical but also had a significant effect on the reliability and regularity of the bus services using the Bridge.

'Out of service' buses travelling to the city to start operation needed to leave the depot for the city well in advance of their scheduled departure time to ensure on time departure from Wynyard.

This practice frequently resulted in an accumulation of 50 or more buses at Wynyard Park between 4.30 pm and 5.30 pm.

Although unavoidable, this mode of operation was not appreciated by the Sydney City Council because of the city space consumed. Figure 5 shows the bus congestion at Wynyard Park.

Sydney has a population of 3.7 million people and is a large and expanding metropolis. (Region has been altered since.

The bus lane would begin at Falcon Street, continue along the Warringah Freeway and across the Bridge to Grosvenor St in the city, a distance of about 5 km.

The introduction of the bus lane would be timed to coincide with the opening of the Harbour Tunnel in August 1992.

From the perspective of a transport authority, buses are a very flexible form of transport.

The service frequency, service capacity and route can all be readily altered to meet changing customer requirements.

In a similar way bus and transit lanes on existing road carriageways offer a high degree of flexibility.

They can be introduced, moved or removed at low cost, and they can be time-of-day dependent.

They can also be designated as 'bus only' or can be regulated to allow for taxis and high occupancy vehicles.

From the perspective of the community this flexibility is often equated with impermanence.

A decision to provide fixed track transport infrastructure is seen as a commitment to the long-term provision of a transport service and is one of the reasons why there is so much talk about 'light rail'.

Tram tracks removed in 1958, Cahill Expressway opened in 1959.

The construction and maintenance of the Sydney Harbour Bridge has been funded from the tolls collected since its opening.

The construction and management of the Sydney Harbour Tunnel is being funded from tolls collected on the Bridge and Tunnel

(However, general road lanes are low people density, the people carried by other lanes reduces road congestion on the general road lanes)

The spare capacity available in the bus lane is essential because it provides room for growth. There are precedents for expecting strong growth in bus numbers:
--- The number of buses using the Lincoln Tunnel doubled over a 15-year period (4.73% growth)

--- In Adelaide, Wayte (1991) reports that the introduction of the O-Bahn busway resulted in a 33% increase in bus passenger numbers in a 4-year period (7.4% p.a.)

In November 1992, it was expected that the peak one-hour usage of the bus lane would be 200 buses and 350 taxis.

Given that one bus occupies the space of two or three cars, and that the capacity of the traffic lane is around 2000 vehicles per hour the maximum traffic lane utilisation is about 40% of vehicle capacity.

If, bus is equivalent to 2.65 car/bus x 200 buses=530+350=880 car equivalents/2000=44% lane use.
If, bus is equivalent to 2.85 car/bus x 200 buses=570+350=920 car equivalents/2000=46% lane use.

Lincoln Tunnel bus lane (Home and Quelch 1991) - approximately 700 buses per hour - the bus lane could carry more people than all the other traffic lanes combined – 700x50=35,000 people

700 buses x 2.65 car equivalents = 1855 cars,
700 buses x 2.85 car equivalents = 1995 cars

Electric buses can have car like performance. However, if there are not sufficient bus stops, buses will congest in bus lanes and capacity will drop.

Table A4.1 Distribution of cross harbour lanes

Mode	**Lane allocation**			
	Before SHT 12 lanes		**With SHT 16 lanes**	
	Lanes	**% of total**	**Lanes**	**% of total**
Car/truck	7.2	60%	10.6	66.25%
Bus/Taxi (high occupancy)	0.8	6.7%	1.4	8.75%
Train	2	16.7%	2	12.5%
Bicycles	1	8.3%	1	6.25%
Pedestrians	1	8.3%	1	6.25%

Assumption: Buses/taxis consume 40% of 1 lane in direction which has no bus lane

The spare capacity available in the bus lane is essential because it provides room for growth.

APPENDIXB – ASSUMPTIONS USED IN ECONOMIC ANALYSIS
(extract from ROADS AND TRAFFIC AUTHORITY CENTRAL REGION (1991))

Authors' note: the assumptions listed below were developed by others.

1. Traffic on the cross-harbour corridor growing at 5% per annum for the first two years after the opening of the tunnel, then reverting to a growth of 1.71% per annum (based on historical trend).
2. Southbound bridge capacity is 1850 vehicles per hour per lane and southbound tunnel capacity is 1600 vehicles per hour per lane.
3. Base year (1992) southbound peak traffic demand is 12,950 vehicles per hour
4. Bus occupancy is 52 and
car occupancy is 1.12.
5. Analysis period is 10 years.
6. Analysis is limited to AM weekday peak period.
7. Bus lane operational from time of opening of tunnel.
8. Taxis valued at a total person cost of $40 per hour. Person time in cars and buses valued at $6.73 per hour.
9. Bus now in peak hour assumed at 170 per hour with a natural growth of 1.7% per annum.
10. Taxis assumed to make up 3.15% of total demand. 11. Capital cost of bus lane installation is $100,000

In NSW, there are four types of special lanes provided for public transport vehicles:
(a) 'Bus Only Lane' - buses only.
(b) 'Bus Lane' - buses, taxis, hire cars, motorcycles.
(c) 'T3 Transit Lane' - vehicles with 3 or more occupants, buses, taxis, hire cars, motorcycles.
(d) 'T2 Transit Lane' - vehicles with 2 or more occupants, buses, taxis, hire cars, motorcycles.

3.3.5 Public Transport demand

3.3.5.1 Sydney CBD

Both the Sydney Harbour Bridge and Broadway bus corridors to the Sydney CBD, and the CBD itself, are bus congested in peak hours.

The WHT EIS (section 3.2.4) advises the Warringah Freeway Bus Lane carries more than 30,000 bus passengers during the two-hour AM peak – sufficient to support a new rail line. Likely, 20,000 of these arrive in the Sydney CBD in the peak one-hour (Figure 3.3.5.1). More buses heading to the Sydney CBD streets in peak hour is of limited value.

Despite the expected traffic reduction on the Harbour Bridge, a bus layover is retained at Cammeray, albeit of smaller capacity, and another added at the former Cahill Expressway toll gates (former Milsons Point train/tram stop).

In PM peak, 200 buses travel empty across the Harbour Bridge to begin services in the Sydney CBD due demand differences between the peak and counter peak directions. A similar number return empty across the Harbour Bridge in the AM peak.

The Sydney CBD reached its vehicle capacity decades ago. The Sydney CBD has five length-of-CBD roads:
--- Macquarie-College-Wentworth,
--- Elizabeth-Phillip,
--- Pitt,
--- George, and
--- Sussex-Hickson.

The CBD light rail-George St pedestrianisation project effectively removed George St from this list.

The tram service is equivalent to just 60 buses per hour – 3,000 passengers per hour per direction. Tram capacity is not significant in terms of the peak-hour public transport task.

Increased floorspace in the CBD under the “three cities” policy will require more commercial vehicle traffic to service buildings. Personal vehicle travel in the CBD will be further restricted.

3.3.5.2 Public Transport travel demand

The WHT EIS defers to other government programs to address public transport demand. While generally appropriate, the dual mode capability (road/rail) of the Sydney Harbour Bridge lanes demands an integrated approach to private vehicle and public transport demand in this instance.

Table 3.3.5.2.1 gives aggregate public transport data reported in the Sydney Morning Herald (Feb 2020).

Table 3.3.5.2.1 – Aggregate public transport data to 30 June 2019

--- Sydney bus passengers	350 million p.a.
--- Five-year growth	9.3% p.a.
--- Train passengers	424 million p.a.
--- Five-year growth	5.9% p.a.
--- combined bus and train	774 million p.a.
--- Five-year growth	7.4% per annum
--- Opal 2019:	
--- 308 million bus passengers, and	
--- 405 million train passengers.	
--- Opal October 2019	
--- North Shore Rail Line total passengers, 175,000 passengers per day.	
--- Sydney Metro, 71,000/day – assume 50% cross-harbour*	
--- North Shore Rail Line passengers crossing the Harbour Bridge, 140,000/day (EIS)	
* Opal data doesn’t record integrated event tickets, concession entitlement cards, fare evaders.	
** Based on train frequency before the Epping-Chatswood line closure for Metro conversion.	

The Sydney population grew at 1.8% for the five years to 2016, and 1.7% for 2018-19.

While growth rates far higher than population growth are unsustainable long term, implicit in the above figures is a mode shift from private vehicles to public transport fuelled by better quality

vehicles and personal electronic devices that allow people to productively fill their travel time. It should continue with more efforts to improve network structure and capacity.

Table 3.3.5.2.2 gathers public and private transport data for the Harbour Bridge.

Table 3.3.5.2.2 – Harbour bridge crossing data for public and private transport

--- 30,000 bus passengers in the Bus Lane in the 2-hour AM peak requiring 600 buses.
--- 20,000 passengers in 400 buses during the peak hour (source Figure 8.1).
--- 115,000 bus passengers each day requiring around 3,000 bus trips per day
--- 200 buses cross empty in each of the AM & PM peaks due to lower demand in the counter-peak direction.
--- 140,000 North Shore train passengers.
--- 152,000 private vehicles carry around 167,000 people (1.1 people/vehicle**).
--- 60% (255,000) of 422,000 daily people crossings are via public transport using the equivalent of three bridge lanes – two rail tracks and half of two road lanes (Bus Lanes carry a range of vehicles).
--- Public transport moves 85,000 people per 'lane' per day,
--- Private vehicles move 17,000 per lane per day.

(**On a daily basis, public transport is five times more efficient in the use of Harbour Bridge 'lanes' compared to private vehicles.)**

--- The North Shore Rail Line can carry 24,000 people per hour per lane (track).
--- A road lane can carry 2,000 private vehicles per hour which is 2,200 people per hour at the passenger rate of around 10%.

(**On a peak-hour basis, public transport is ten times more efficient in use of Harbour Bridge 'lanes' compared to private vehicles.)**

** (The EIS reported an average of 1 passenger to 13 vehicles (7.5%) for three areas neighbouring the project. A 1992 paper (Section 4, by Quail, etc) reported 12% of vehicles carried a passenger.)

Table 3.3.5.2.3 presents growth in cross-harbour public transport traffic to 2037 at different rates due to the recent growth rates reported in Table 1.

Table 3.3.5.2.3 2037 daily cross-harbour public transport demand at various growth rates

Passenger growth to 2037 (18 years away) applied to 255,000 passengers/day	
--- 5% per annum growth	240% increase to 612,000 passengers/day.
--- 4% p.a.	200% increase to 510,000 passengers/day.
--- 3% p.a.	170% increase to 433,000 passengers/day*

*very similar to the number TfNSW expects to cross the harbour in private vehicles using the SHB, SHT, WHT and Gladesville Bridge.

For buses alone, a 3% p.a. increase to 2037 (18 years) results in a growth from 115,000 passengers to 196,000 passengers per weekday. Requires over 6,000 bus trips with driver per day including about 680 buses in service in one-direction only across the Harbour Bridge.

2037 bus congestion and labour demand will be huge compared to the alternative of at least two automated rail lines.

Even at 3% growth, the AM peak two-hours will see 51,000 citybound passengers, requiring 1,000 to 1200 buses to use the bus lane in a two-hour period.

The number of people in private vehicles in the CBD is unlikely to grow due to CBD road congestion and the conversion George St to light rail.

Three times current North Shore Line passengers is 420,000 passengers. Even at low growth of 3%, public transport growth will fill three cross-harbour rail lines in 2037.

Three rail lines would remove the need for around 800 buses (15% of the metropolitan Sydney bus fleet) in the AM peak in the late 2030s.

3.3.5.3 Cross-harbour rail capacity additional to Sydney Metro

As noted earlier, cross-harbour general traffic in the east is declining, while public transport demand growth far exceeds population growth.

Additional cross-harbour road capacity near the Sydney CBD is an opportunity to rededicate the Cahill Expressway lanes on the bridge to rail transport.

The Sydney Area Transportation Study1974 recommended a Northern Beaches Railway, provision for which was made in the 1920s Bradfield supervised Sydney Harbour Bridge project. The rail infrastructure was completed from Wynyard to North Sydney, but used by trams.

The Northern Beaches Railway corridor was utilised by trams between 1932 and 1958 where upon it was converted to road lanes (Figures 3.3.5.6 to 3.3.5.9).

The former rail (tram) corridor from Wynyard to Milson's Point can be revived for a Northern Beaches Railway and extended underground, partially under the Warringah Freeway (beside the WHT tunnels if necessary), to serve stations at:
--- Wynyard,
--- Observatory Hill under the Bradfield Hwy (a new station that also serves the North Shore Line),
--- the Milson's Point station (first used by trams, then toll booths, and now road toll gantries),
--- a North Sydney station under the properties on the east side of Alfred St opposite Mount St,
--- a Neutral Bay interchange station under block bounded by Merlin St, Military Rd, Tramway Lane and Falcon St.

A revised Sydney CBD network diagram is presented in Figure 3.3.5.11.

See Figures 3.3.5.3 to 3.3.5.5 and 3.3.5.10 to 3.3.5 14 for station locations.

If Metro West were to connect to the Eastern Suburbs Line at Martin Place, the Illawarra Line could link to a Northern Beaches Line at Wynyard (Figures 3.3.5.12 to 3.3.5.14).

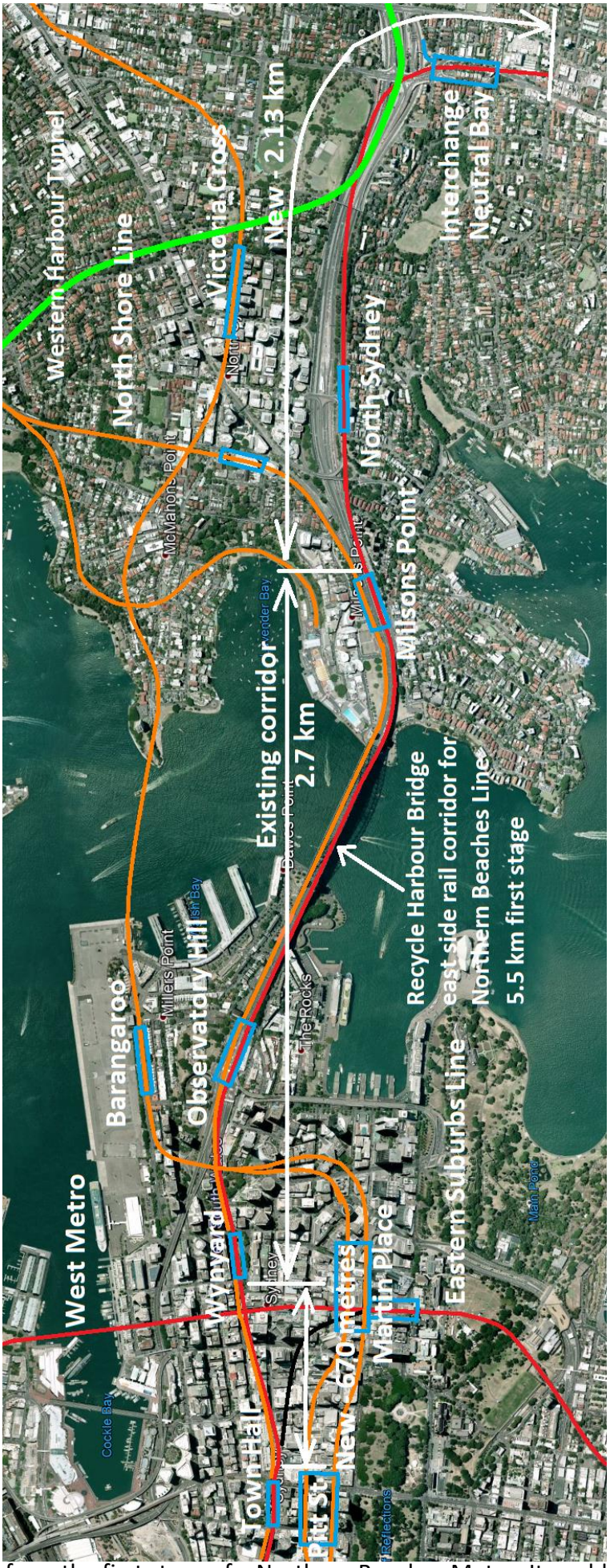
Figure 8.4 indicates the existing 2.7 km corridor would require 2.8 km of tunnel works to form the first stage of the Northern Beaches Railway.

Between the North Shore Line, Sydney Metro and Northern Beaches Line, there will be sufficient rail capacity (72,000 passengers per hour) to meet cross-harbour public transport demand for decades to come.

It would thus support CBD growth for decades to come, while significantly reducing the NSW public Transport bus fleet requirements and reducing CBD bus congestion.

--- This chart is from the Sydney City Access Strategy (~2012) and is bus service data for 2011

Figure 3.3.5.1 – 2011 buses crossing harbour Bridge in AM peak hour (379 buses), and proposed diversion to Cahill Expressway (55 buses)



--- This rail corridor would form the first stage of a Northern Beaches Metro. It enables diversion of all North Shore citybound buses to a railway station for a fast peakhour journey to the city.

Figure 3.3.5.2 – Six-lane WHT permits rededication to rail of the former Harbour Bridge rail (tram) corridor from Wynyard to Milsons Point with an underground extension to Neutral Bay

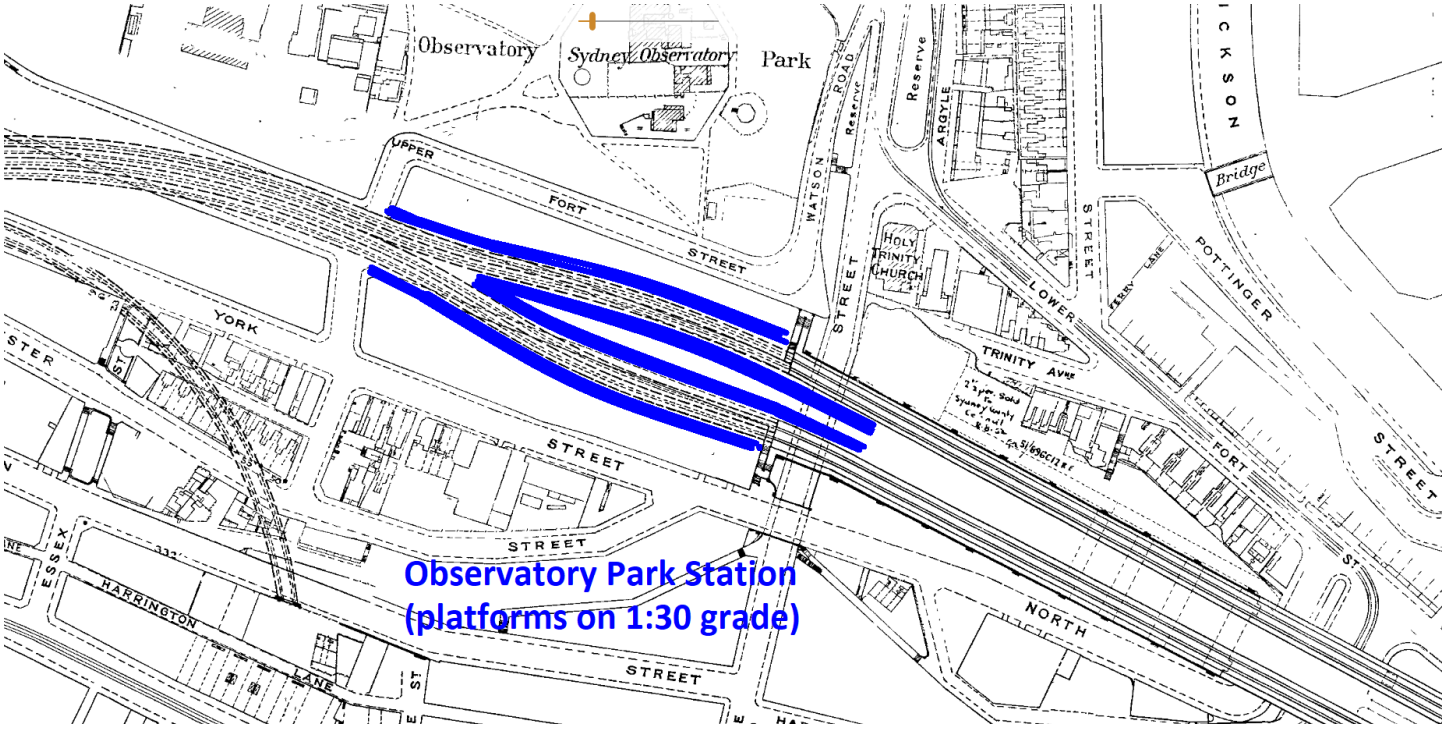
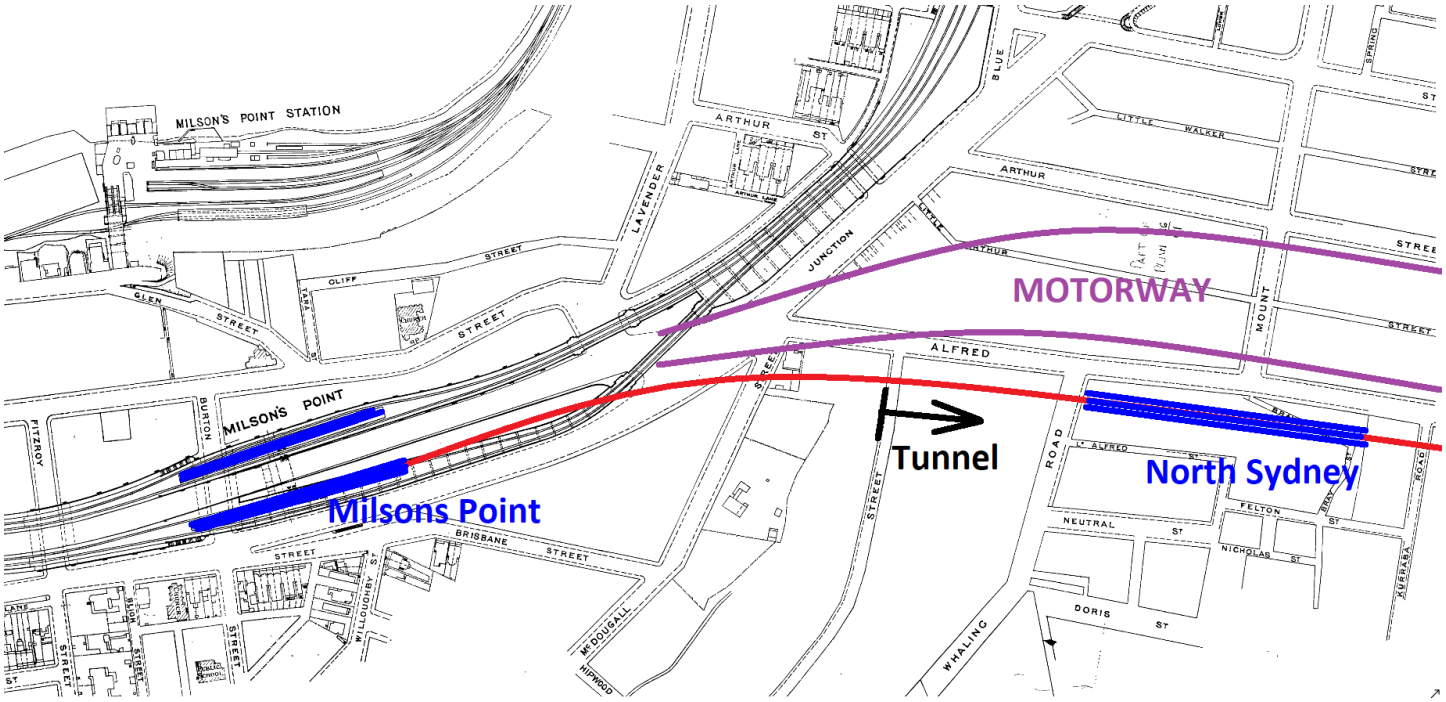
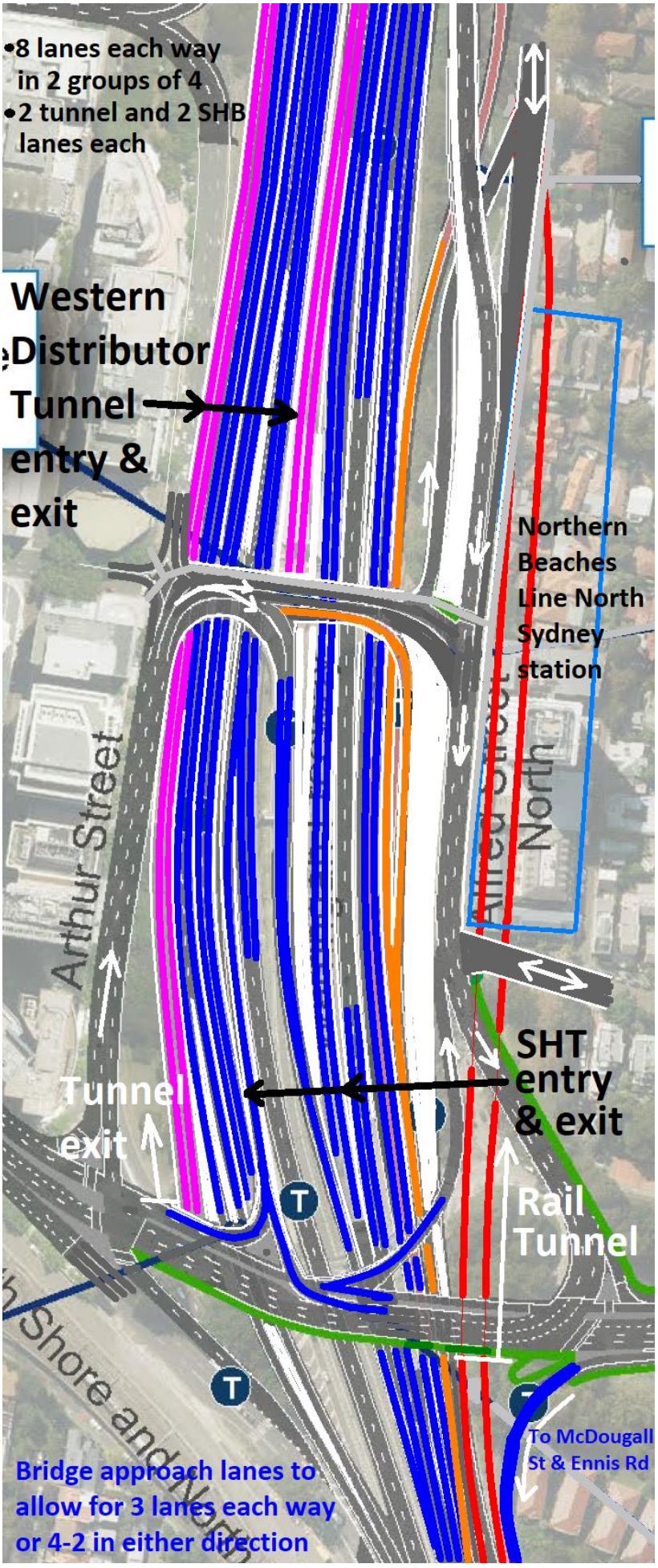


Figure 3.3.5.3 – Proposed Observatory Hill station on North Shore and Northern Beaches lines superimposed on 1930 map of 1920s rail works



--- Warringah Freeway indicated in purple, but motorway junctions not shown

Figure 3.3.5.4 – Proposed Northern Beaches line superimposed on 1930 map of 1920s rail works



--- The Cahill Expressway lanes are converted back to rail use.

Figure 3.3.5.5 – Proposed Northern Beaches line in relation to the Warringah Freeway and planned and possible changes to the motorway

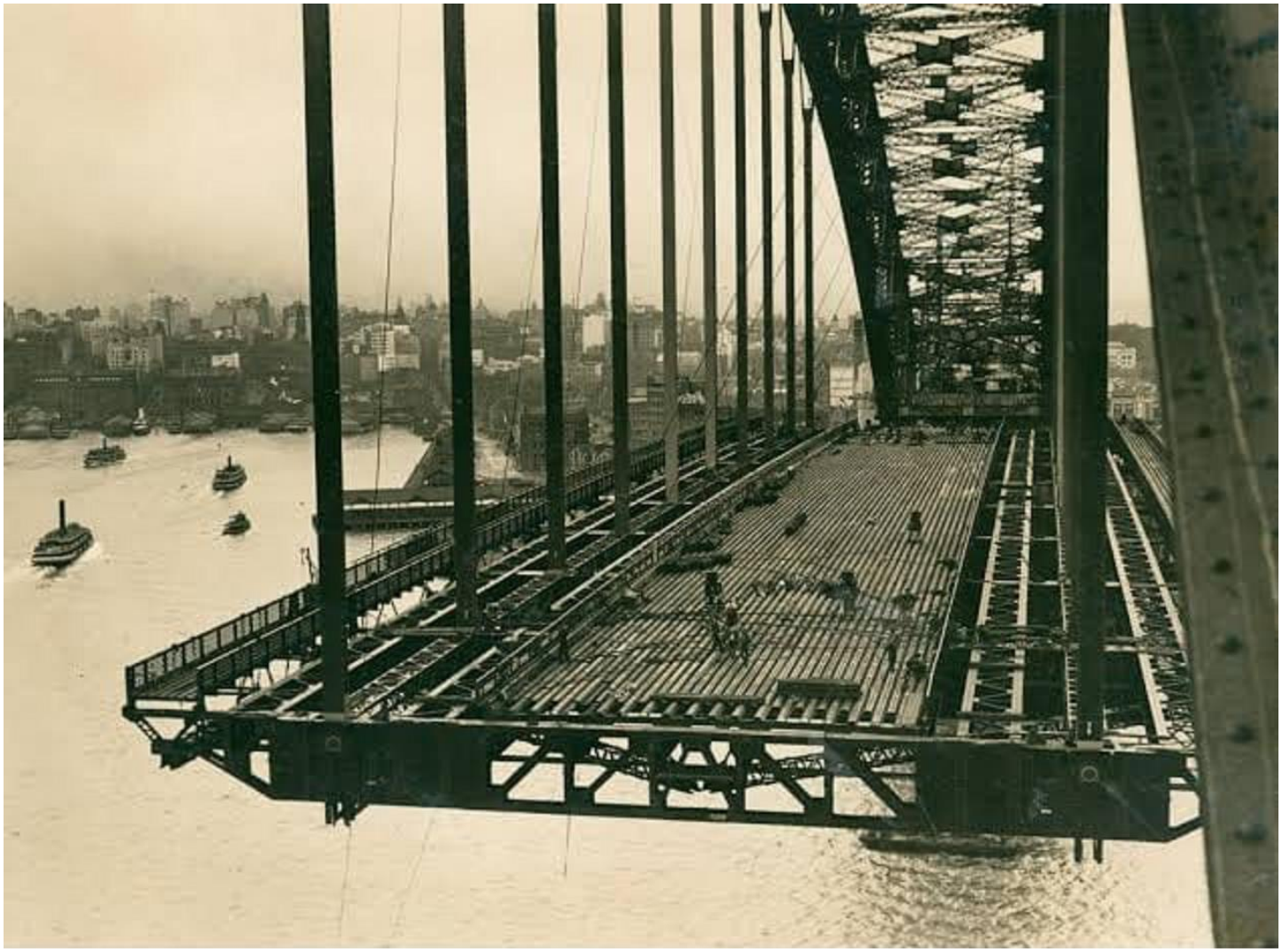


Figure 3.3.5.6 – Harbour bridge heavy trusses to support trains both sides

Figure 3.3.5.7 – Eastern rail tracks Sydney Harbour Bridge 5 February 1932

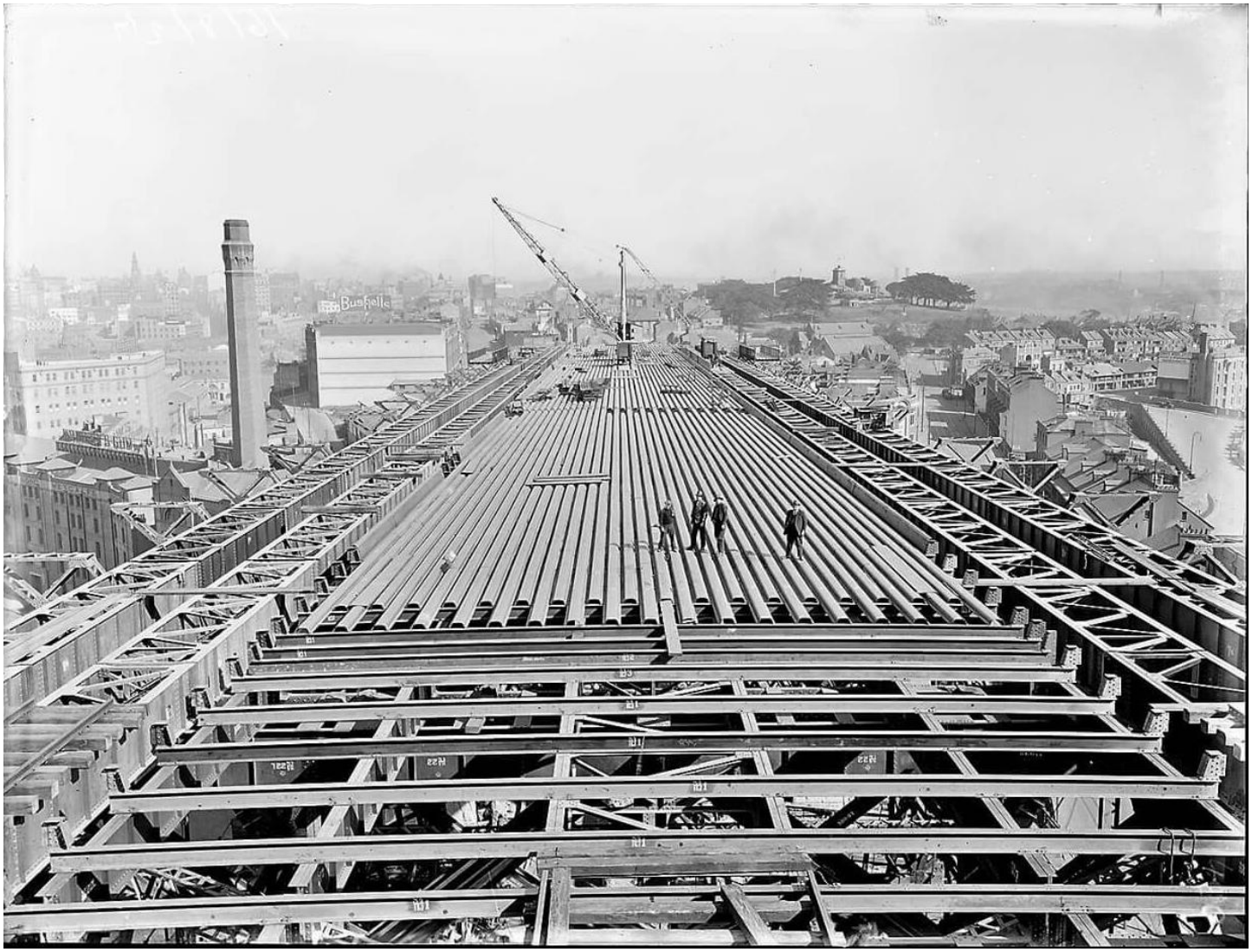


Figure 3.3.5.8 – Harbour Bridge heavy trusses on approach spans to support trains

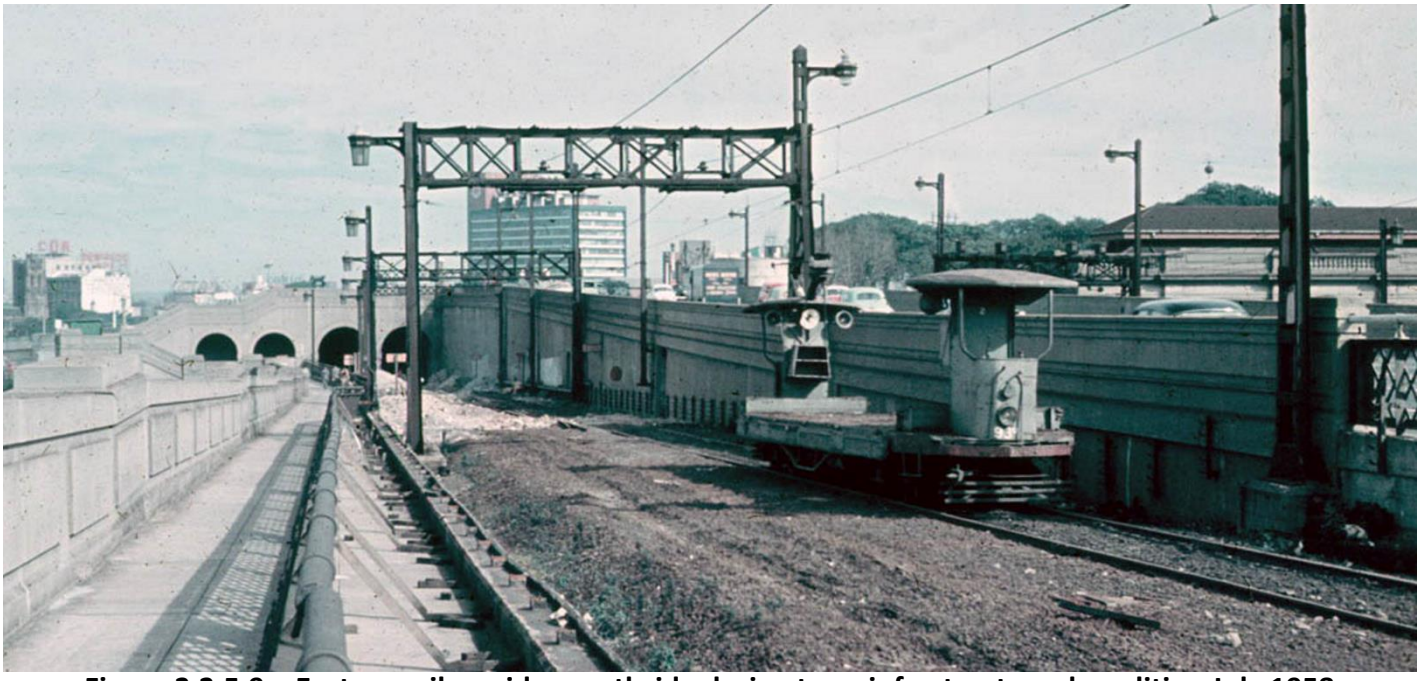
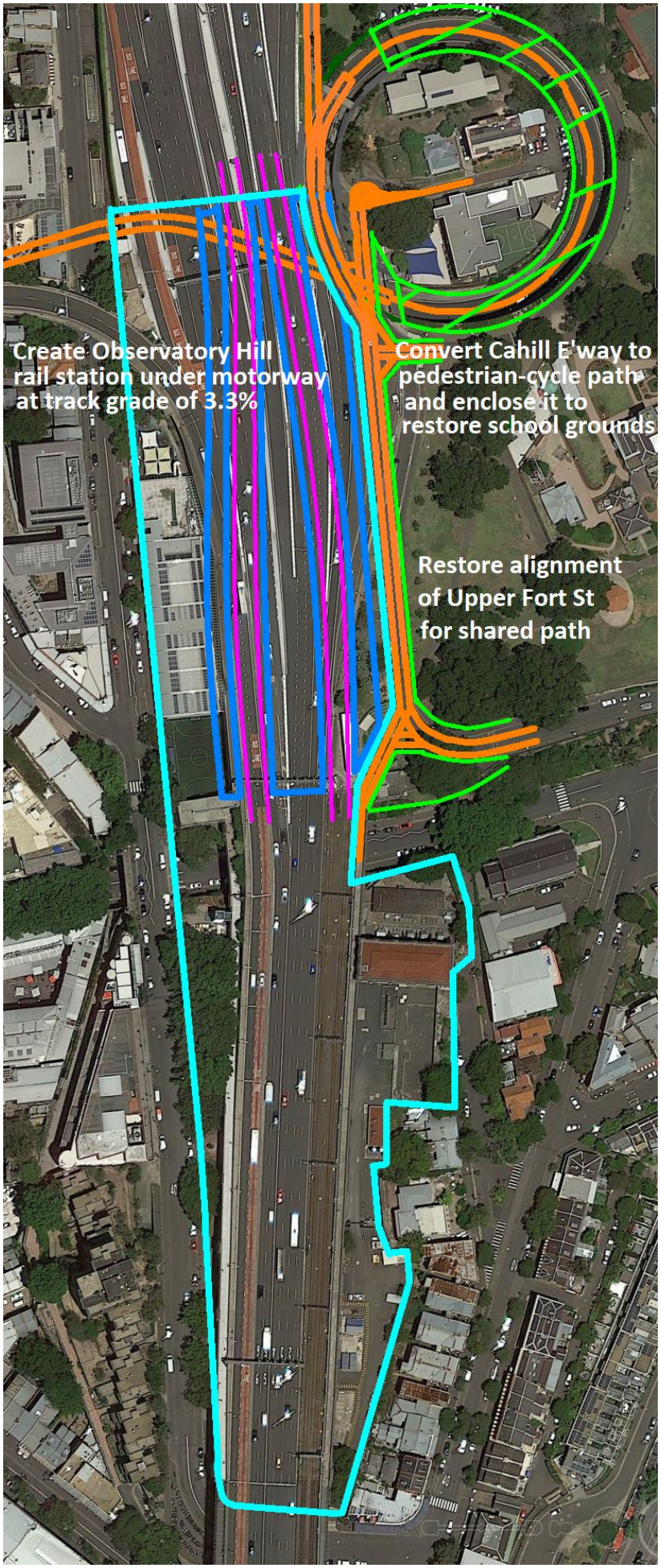


Figure 3.3.5.9 – Eastern rail corridor southside during tram infrastructure demolition July 1958

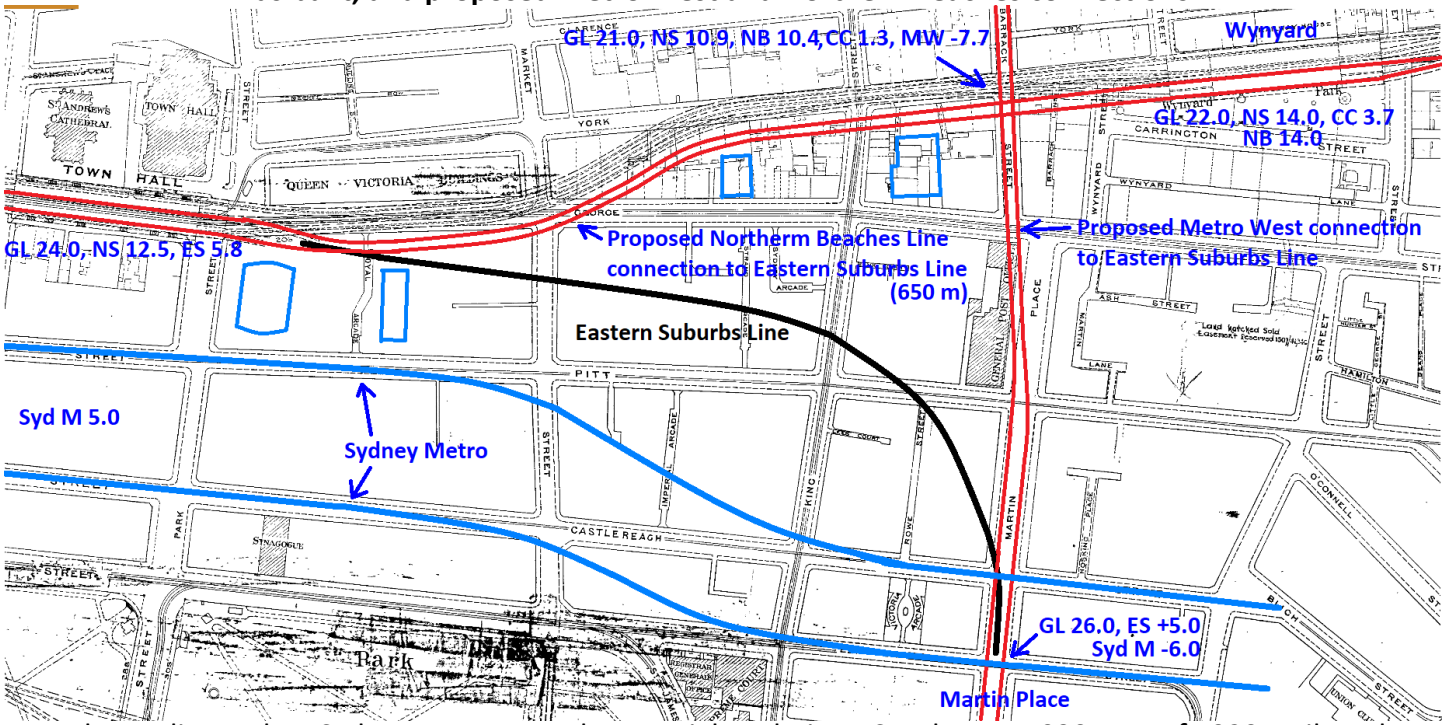


--- See active transport proposal for use of the Cahill Expressway loop.
--- The station could utilise all the TfNSW controlled space outlined in very light blue.

Figure 3.3.5.10 – proposed Observatory Hill station serving the northern CBD with platforms for both North Shore and Northern Beaches Lines

--- **Red, grey, green** – as built. **Yellow & blue** not built except for St James junction and Wynyard to north.
--- **Pink** – proposed Metro West and Northern Beaches line connections

Figure 3.3.5.11 – Schematic of Bradfield rail plan modified for Eastern Suburbs Line as built, and proposed Metro West and Northern Beaches connections



--- Red: new lines; Blue: Sydney Metro; Numbers: Height relative NSW datum. 1930 map of 1920s rail works.

Figure 3.3.5.12 – Proposed Metro West and Northern Beaches Line links to existing infrastructure

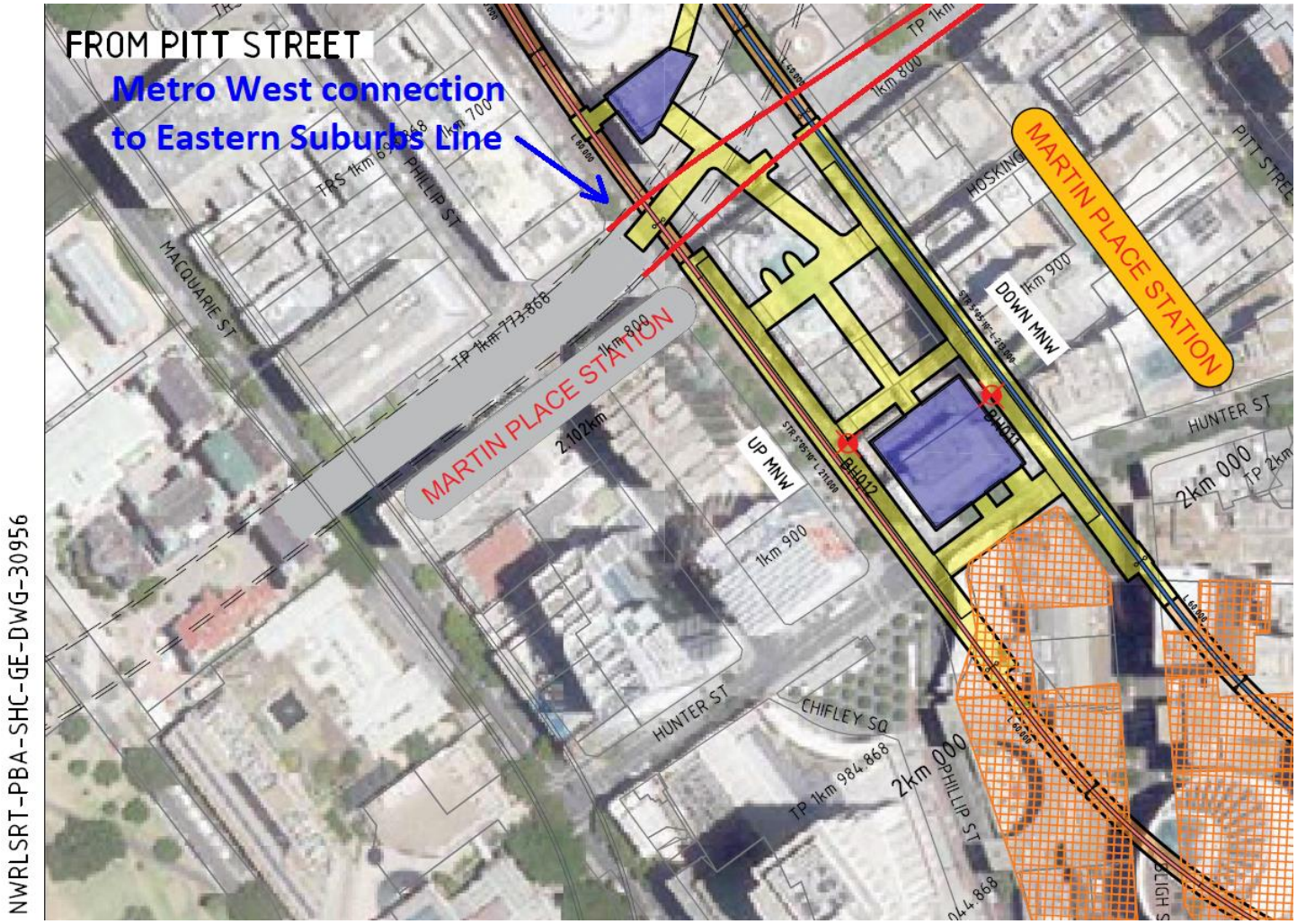


Figure 3.3.5.13 – Proposed Metro West connection (red) to Eastern Suburbs line superimposed on Sydney Metro EIS geological plan of Martin Place station

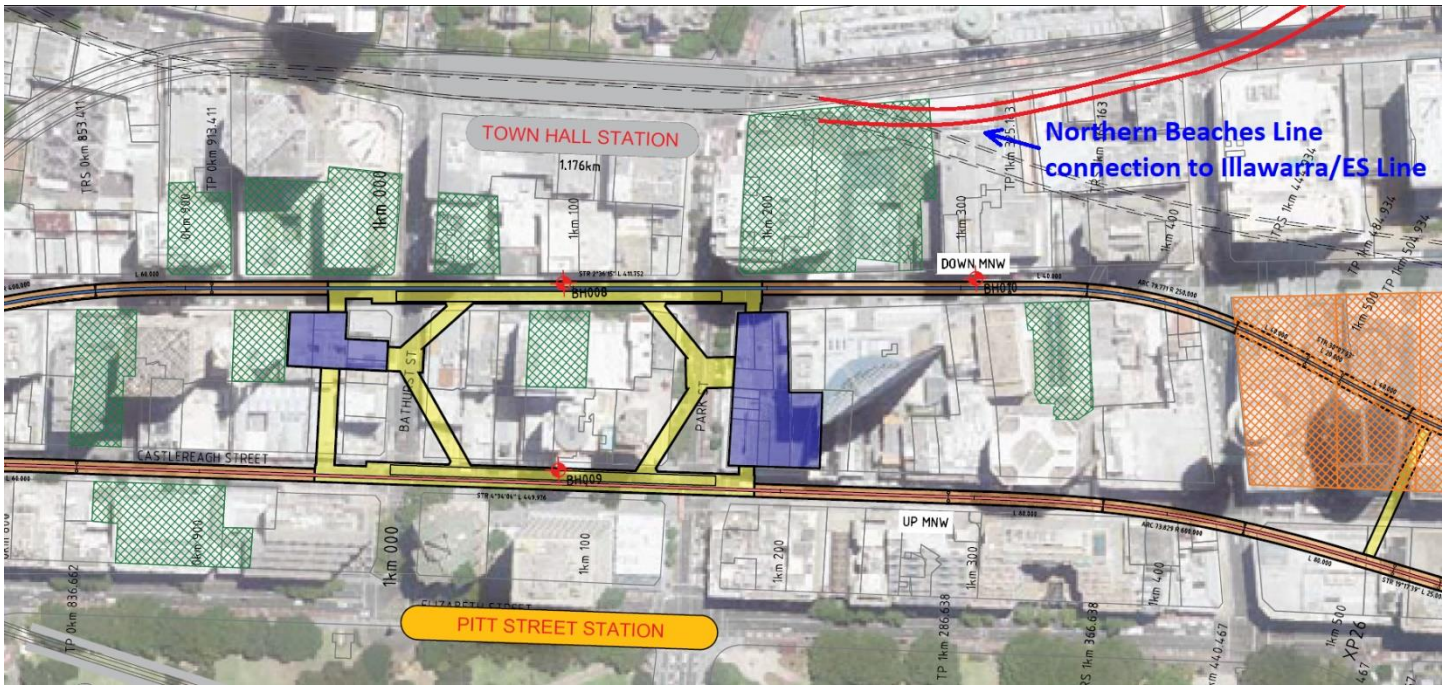


Figure 3.3.5.14 – Proposed Northern Beaches line connection (red) to Illawarra/ES line at Town Hall superimposed on Sydney Metro EIS geological plan of Pitt St/Town Hall stations

3.3.6 Active transport to and from the northern Sydney CBD

The City Circle Rail Line and Cahill Expressway form a significant barrier between the Sydney CBD and Circular Quay. The Bradfield Highway is a significant barrier between the Northern CBD, Observatory Hill, Millers Point and Barangaroo.

Additional cross-harbour road capacity that draws traffic away from the Sydney Harbour Tunnel and Cahill Expressway makes the road viaduct across Circular Quay unnecessary.

Pedestrian-cycle access to the Harbour Bridge and northern CBD is poor.

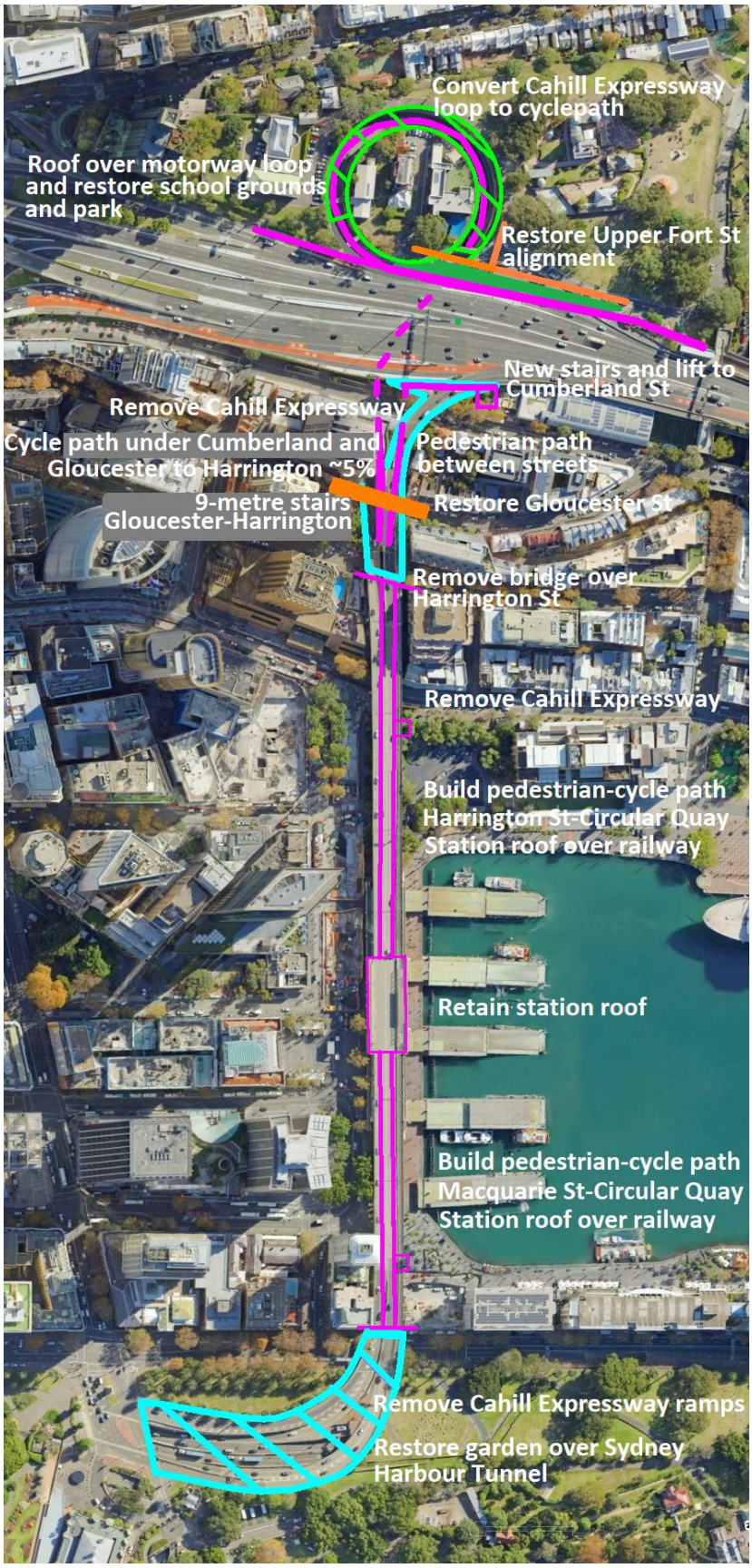
The Cahill Expressway corridor provides great opportunities for pedestrian and cycle connections between the northern CBD and the bridge.

The roof of Circular Quay railway Station is one of Sydney's great viewpoints, but it is dominated by road focused vehicle traffic that destroys the amenity currently available to pedestrians.

A conversion of the Cahill Expressway corridor to use by pedestrians and cyclists, and as a destination for Sydney visitors, is outlined in Figures 3.3.6.1 to 3.3.6.6. A major element of the conversion is the replacement of the road viaducts between:
--- the Bradfield Highway and the Circular Quay Railway Station roof, and
--- the Botanic Gardens M1 motorway ramps and the Circular Quay Railway Station roof.

The road viaducts are replaced by pedestrian-cycle viaducts between:
--- Harrington St and the Circular Quay Railway Station roof, and
--- Macquarie St and the Circular Quay Railway Station roof.

For both demand and safety reasons, the new pedestrian-cycle viaduct will need to cover the full width of the rail track corridor which is ~10 metres wide compared to ~19 metres for the road.



On western side of Quay:

--- Convert Cahill Expressway loop to cycle path and roof over to restore Fort St High School grounds.

--- Bring pedestrian and cycle paths to ground level at Harrington St. At 5% grade to Harrington St, cyclepath will pass under a restored Gloucester St.

--- Expressway removal by very large cranes includes 455 metres of 20-metre wide composite steel-concrete bridge deck across the Quay, and 42 metres of concrete bridge deck over Cumberland and Macquarie St.

--- Road is replaced by slimline, but wide pedestrian-cycle path that covers the rail track and platforms.

Figure 3.3.6.1 – Remove Cahill Expressway links to roof of Circular Quay Railway Station and replace with pedestrian cycle paths from Macquarie St and Harrington St to the station roof

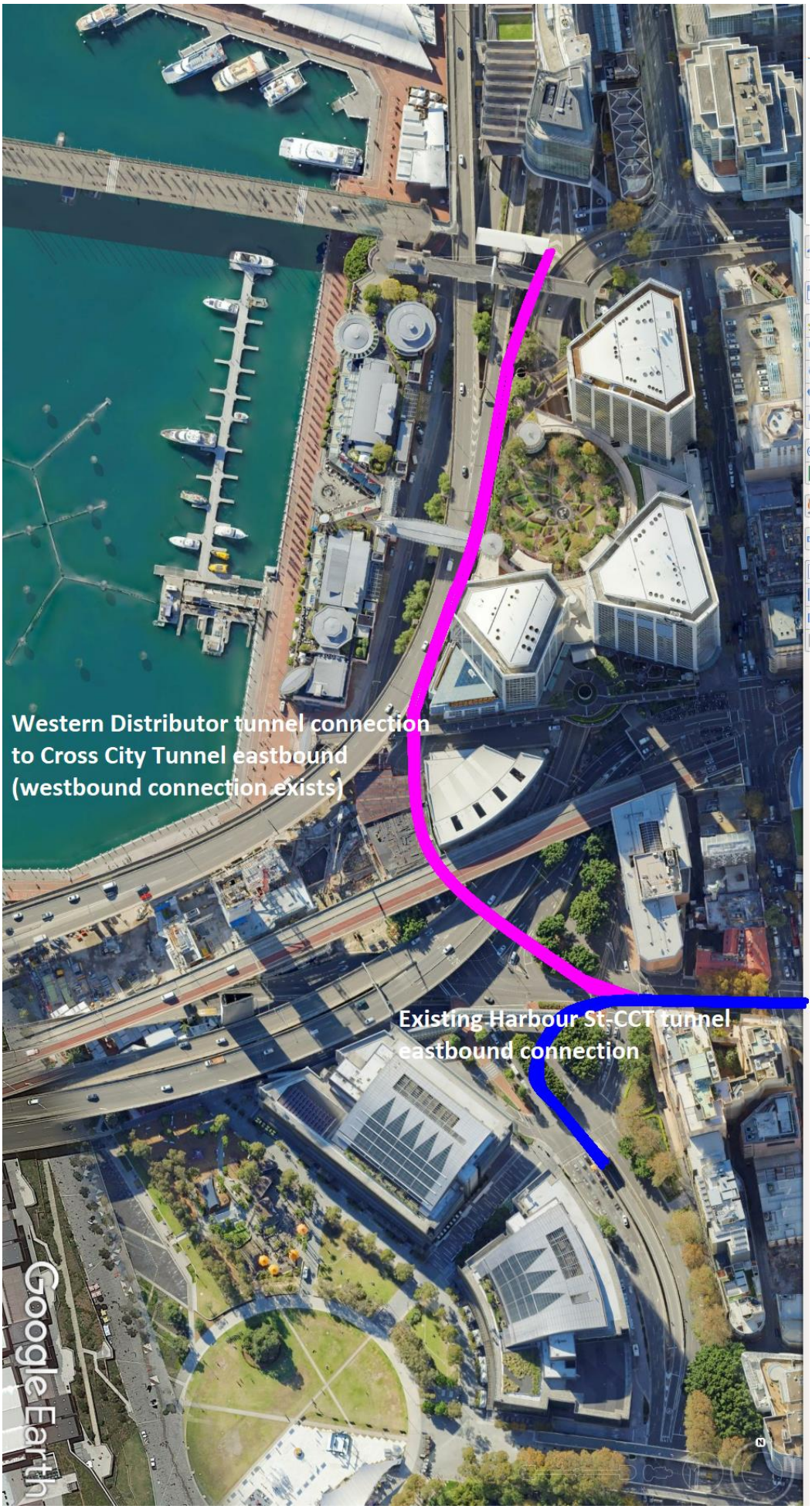
19 June 1955 photo of Cahill Expressway construction. The steel frame, and likely the concrete deck, would be retained for a pedestrian-cycle path to access the station roof. At its east and west ends, the columns are shortened to lower the steel frame to Macquarie St and Harrington St levels by use of connectors to change the angle at which the east-west beams meet the north-south.

Figure 3.3.6.2 – Conversion of Cahill Expressway at Circular Quay to a pedestrian-cycle path

--- Add left turn tunnel from Western Distributor southbound to CCT eastbound (pink)
--- Add tunnel connection between CCT eastbound and northbound exit to Sir John Young Crescent (pink)
--- Existing CCT westbound connection to Western Distributor via Harbour St intersection (blue)

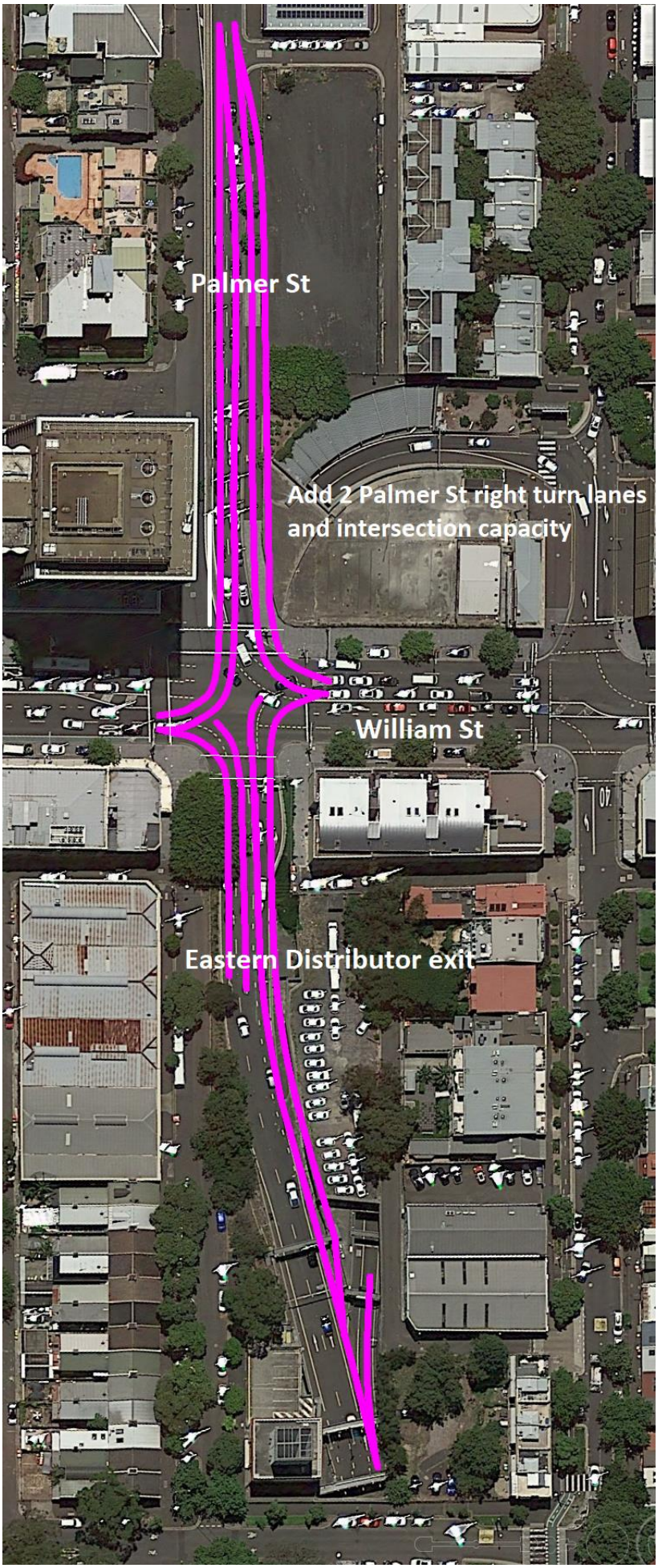
Figure 3.3.6.3 – Replace lost northern CBD connectivity (Cahill E'way Circular Quay) with mid-town connectivity

Figure 3.3.6.4 – Add underground link between Cross City Tunnel eastbound to CCT westbound exit to Sir John Young Crescent



--- Eastbound from Cross City Tunnel to Western Distributor is via Harbour St intersection.

Figure 3.3.6.5 – Add eastbound tunnel link from Western Distributor to Cross City Tunnel (~300 metres long)



--- 2 right and 2 left hand turn lanes from Palmer to William St.
--- 2 left and 2 right run lanes from Eastern Distributor to William St.

Figure 3.3.6.6 – Add Palmer St southbound right turn at William St and extra intersection capacity

Appendix 1 – Plans in the EIS by TfNSW being pursued by the Sydney Metro Authority

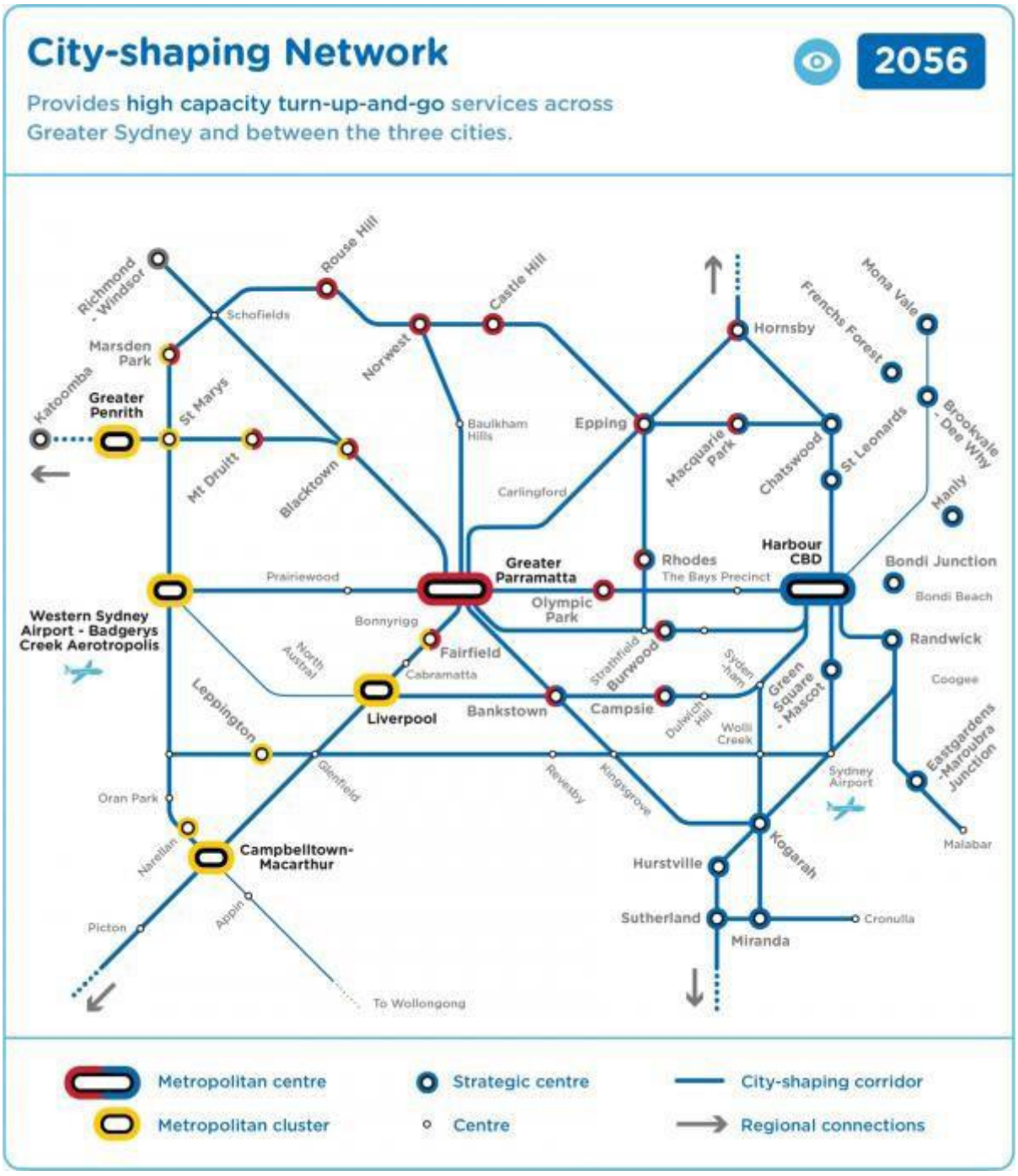


Figure 2-12- City-shaping Network 2056 – Future Transport 2056 strategy

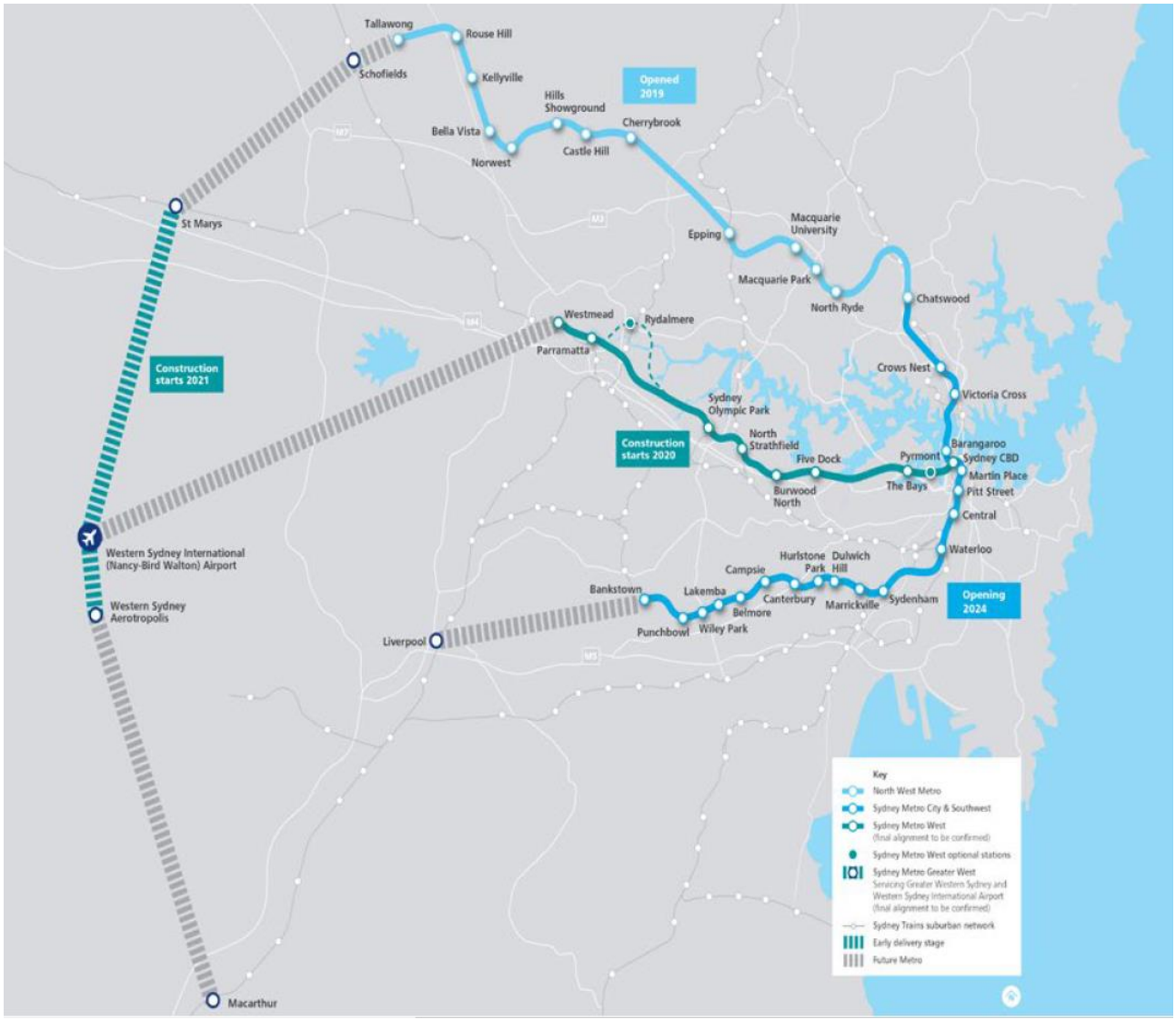


Figure E-1: The Sydney Metro network

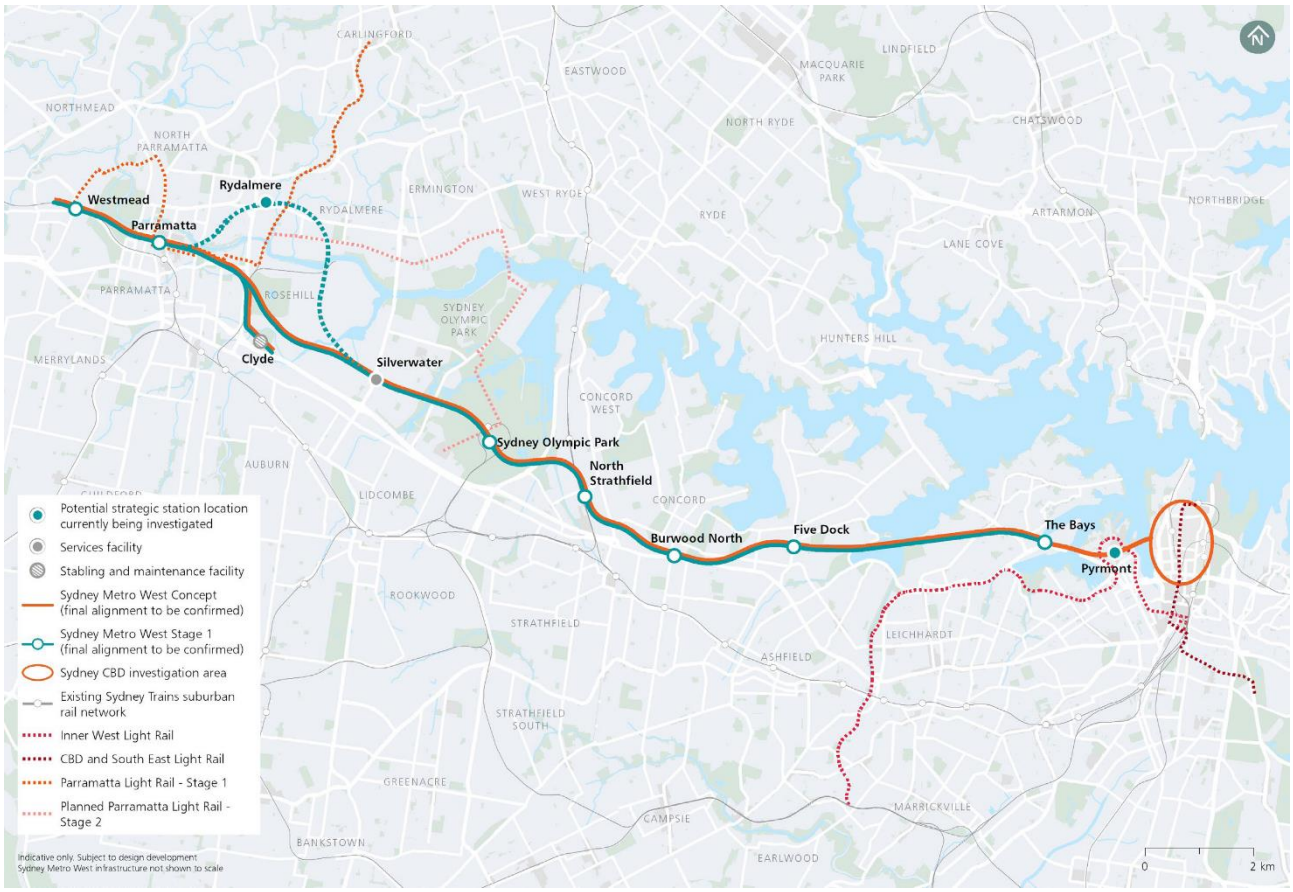


Figure E-2: Overview of the Concept