Submission No 230

INQUIRY INTO IMPACT OF THE WESTERN HARBOUR TUNNEL AND BEACHES LINK

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Date Received: 18 June 2021

Submission by Peter Egan to:

Inquiry into the impact of the Western Harbour Tunnel and Beaches Link, including each of its constituent parts being the Warringah freeway upgrade, the Western Harbour Tunnel and the Beaches Link

Public Works Committee

Response to the terms of reference:

(a) the adequacy of the business case for the project, including the cost benefits ratio

Business cases are prepared for the selected project. Projects are nominally based on material included in future transport documents. The current document being Future Transport 2056. The is no evidence of analysis supporting this document.

Future Transport 2056, like all documents drafted and referred to in EIS documents, are a response to the Cabinet-in-Confidence Transport Strategy (referred to below as the CCTS) document agreed by the department, departmental ministers and leading ministers. The first coalition CCTS was likely commissioned by Barry O'Farrell as head of his mini-cabinet before the bulk of the cabinet was sworn in. During his time as premier, Barry dominated the transport space, with Gladys Berejiklian as the transport operations minister. I believe Barry resigned over his transport troubles more than anything else.

Mike Baird likely agreed another CCTS with the department when he took over as premier without much input from his colleagues. The current CCTS likely reflects Gladys' more collegiate style of management.

Included in the Baird CCTS would have been a single project for both Western Harbour Tunnel and Beaches Link to ensure a future government could not cancel the Beaches Link component.

Future Transport 2056 and related public documents are required references in the EIS, but play no other part in project development. There is one page of options analysis in the WHT EIS. This is likely the full extent of documented options analysis.

The planning and construction of the Western Harbour Tunnel (North Western Motorway) between WW2 and 2014 is outlined in Chapter 3 of my WHT EIS submission which is appended to this submission.

The Arterial road, Motorway and Railway plans of the state should fall out of a service analysis that supports the growth and development of Sydney and NSW more broadly. Transport (movement of people, goods, energy, data using more than human energy) exists to support specialised land use.

((Australia is fortunate to have a current and historical record of how humans can live well as hunter-gathers to see the economic difference transport makes – the social and environmental difference is highly questionable.))

Essentially, beyond local scale, roads and railways are most effective as grids. There is no evidence of an economic analysis of Greater Sydney and NSW served by various 'grid' options. The last time this was partially done was the Sydney Area Transportation Study (SATS) of 1974. The County of Cumberland Plan (first draft 1948) and the Sydney Region Outline Plan (1968) are two other studies which undertook this exercise.

Garbage-in/Garbage-out is an old adage that is applicable to Business Case and any CBRs as they are based on assumptions designed to support outcomes in the CCTS. CBRs are highest when possible future versions of our total transport network are evaluated against each other. In 1974, computers were of little assistance.

Today, we can model billions of options very quickly. But we should be basing options on well established economic and technology principles. The many transport modes have their competitive advantage which is always changing, but an advantage must be sustained over a period of time due to the time taken to constructure a significant network of a particular mode.

Every community needs a suite of transport modes to meet our needs. But the competitive advantage of a transport mode varies by size of community. Thus, in putting together suites of

transport modes for a community, we may need to expand or contract the community size as we consider each mode.

(b) the adequacy of the consideration of alternative options,

As only one page of text was produced on alternates, the consideration was totally inadequate. How the plan, as it existed from 1948 to 2014, could be implemented is outlined in chapters 11 to 13 of my appended submission.

The Rozelle to M2 option in the EIS was literally a 9 km tunnel with no intermediate connectivity – it was specifically designed as a version of previous plans that would yield a poor outcome.

The WHT-BL-WF plan as developed brings together 330,000 vehicles a day under the Falcon St motorway overpass. Traffic across Sydney Harbour is not growing, but growth of traffic across the Parramatta River increases the further one goes west. Dragging 330,000 vehicles a day to Neutral Bay is great for toll collection, but it does not reflect where people want to go and how.

(d) the consideration of the governance and structure of the project including the use of a 'development partner' model,

The 'development partner' model is designed to maximise profits for the partner – that is the sole primary objective of businesses and the duty of their directors to ensure. The role of government with our transport network is to deliver on the economic, social, health, human development and environmental goals of the community as expressed through the ballot box.

There is no more core function of government as we are all reliant on the transport system (as broadly defined) 24 hours a day, everyday of our existence.

The project as defined requires the large portion of traffic wishing to get from the M2 to the City or WestConnex to travel an extra 5.5 km over the 9 km distance envisaged by the 1948-2014 plan. The 1948-2014 plan envisaged a circle of connectivity crossing the harbour which had many more benefits than this and likely of equal value.

(f) the consultation methods and effectiveness, both with affected communities and stakeholders,

The WHT EIS advised:

--- TfNSW invites comment (on the EIS) and will prepare a submissions report to DPIE responding to issues.

--- The DPIE will prepare an assessment report for the Minister for Planning and Public Spaces who may grant approval and specify conditions.

--- Section 2.3 Next steps advises "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.

Thus the subject of the EIS is generic, not specific. The actual project will be developed by the department and government without further consultation. Only if the environmental impacts of the actual project turn out to be far different to the generic project on a regional level, as distinct from local level, will further assessment be required.

The community needs to know the project design to the same level of detail as a DA for a privately constructed building. Only then can we determine its service capabilities and likely environmental impacts.

The community is most interested in the service aspects of transport systems.

There is no requirement for the government to consult about transport services. It is only required to consult about the environmental impacts of the infrastructure it builds.

Legally, services are gift of the relevant minister for which the parliament votes money to the minister. Departments work to achieve desires of the relevant minister as expressed in the CCTS in the case of transport.

Most people, including MPs, struggle to articulate the service aspects of transport systems, or even understand whether a service is a largely self-service (road), or a largely provided service (public service).

The community needs education regarding transport services and supporting infrastructure at school and post-school. Until we have this, consultation can't be effective.

France does the best job of consulting on transport services via its Public Debate authority – Commission Nationale du Debat Public (CNDP) https://www.debatpublic.fr/en The Public Works Committee should go to France to study its methods and invite its experts to Australia to advise our community and public servants on its methods.

(i) whether the project is subject to the appropriate levels of transparency and accountability that would be expected of a project delivered by a public sector body,

All transport strategy and policy must be in the public domain for good community outcomes. The Cabinet-in-Confidence Transport Strategy (CCTS) must be in the public domain for a good outcome. It should be developed with several cycles of public input.

We have no transparency and accountability of significance about any transport project as only cabinet ministers, and perhaps only a few of them, know the context of a project.

(h) whether the NSW Government should publish the base-case financial model and benefit cost ratio for the for the project and its component parts,

The sum of the benefits of a transport system is hundreds of times greater than that of any component or sub-component. The motorway network is near useless with out the rest of the road network. Ten kilometres of motorway has many orders of magnitude less benefit-cost ratio than 100 kilometres.

The government should publish its financial models and CBRs as it will definitively show the poor quality of modelling and the poor understanding of transport systems by government.

(m) any other related matter.

Cross-harbour transport, of which the WHT-BL-WF would form part, needs to be seen in the context of other cross-harbour transport.

My EIS submission covered the subject matter under the following headings:

1 Submissions process
2 Summary
3 Seventy-year government plan for a cross-harbour circle of connectivity
4 Capacity and demand for cross-harbour road travel
5 North Shore traffic modelling and preferred solutions to traffic conflicts
6 Road pricing (taxation including tolls)
7 Freight
8 Public Transport
9 Active transport to and from the northern Sydney CBD
10 Adding much needed parks to the motorway corridor
11 WHT-BL-Warringah Freeway-Gore Hill Freeway connectivity
12 Alternative project - completion of the North Western Motorway and the cross-harbour circle of connectivity
13 Lane Cove to Sydney CBD (M1) motorway corridor upgrade

Inquiry submission appendix – WHT-Warringah Freeway EIS submission
Peter Egan

Key Points

The chronology provided in the EIS dates the Western Harbour Tunnel and Beaches Link Project to the State Infrastructure Strategy of 2014 (Baird Coalition government) which "references a harbour crossing and Beaches Link".

The project, corridor B (red) in the figure below, is a departure from the 'circle of connectivity' formed by the Sydney Harbour Bridge, Warringah Freeway, Gore Hill Freeway, North Western Motorway and Western Distributor, and first envisaged in the County of Cumberland Planning Scheme of 1948. The roads were called 'highways' in the scheme.

The North Western Motorway is corridor A (pink) in the figure below. It, and the second half of the Warringah Freeway (now called Beaches Link), have been pursued intermittently since the 1940s. The Anzac Bridge to Iron Cove section is being constructed as part of the M4-M5 Link Project.

By releasing stranded cross-harbour capacity in the Gladesville Bridge, further deconflicting traffic on the Harbour Bridge and North Shore roads, and utilizing counter-peak flows, the 'circle of connectivity' has a far greater benefit-cost ratio (BCR) than the Western Harbour Tunnel.

Traffic on the three major river crossings west of the Gladesville Bridge grows, and now equals the traffic crossing the Harbour Bridge and Harbour Tunnel, which has been declining for five years. Cross-harbour public transport demand now supports three rail crossings of the Harbour.

The Harbour Bridge has four 'lanes' capable of carrying road lanes or rail tracks. Presently, two are used for rail. In Sydney, 'Bus Lanes' and rail tracks have ten times the people carrying capacity as general traffic lanes making Harbour Bridge lanes more valuable carrying public transport.

The WHT project results in 25 road and 4 train 'lanes' at five harbour crossing points. These 'lanes' less effectively address demand than the 24 road and 6 train 'lanes' of the alternative programme.

Political desire for a continuous road project crossing Sydney Harbour and Middle Harbour has trumped a higher value transport strategy half completed.

Data collection to inform provision of cross-harbour transport capacity has been poor and warrants project delay to collect better data - particularly that for road travel.

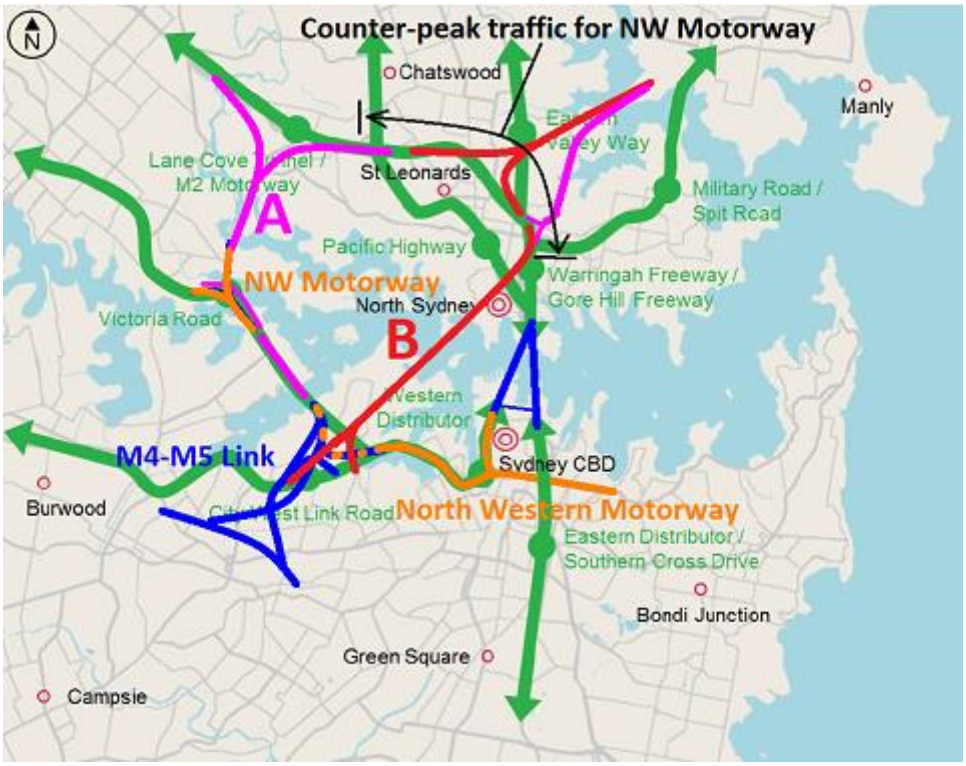

Figure K1 – Cross-harbour road options near the Sydney CBD

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5 North Shore Traffic modelling and preferred solutions to traffic conflicts

6 Road pricing (taxation including tolls)

None

7 Freight

12 Alternative project - completion of the North Western Motorway and cross-harbour circle of connectivity

13 Lane Cove to Sydney CBD (M1) motorway corridor upgrade

1 Submissions process

The Western Harbour Tunnel (WHT) – Warringah Freeway (WY) environmental impact statement (EIS) was released in January with submissions due to the Department of Planning, Industry and Environment by 12 March 2020, since extended to 30 March 2020. TfNSW invites comment and will prepare a submissions report to DPIE responding to issues.

The DPIE will prepare an assessment report for the Minister for Planning and Public Spaces who may grant approval and specify conditions.

Section 2.3 Next steps advises "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.

2 Summary

The economic shutdown due to the corona virus, its likely reduction in road traffic, and its impact on government revenue and debt, warrants delay of a decision to proceed and for project review.

A delay of several years will permit intensive collection of data on cross-harbour roads east of Parramatta (James Ruse Drive to the Harbour Tunnel) and their connecting roads. Data is missing for major roads including the Sydney Harbour bridge (since 2016), James Ruse Drive (2013), Flat Rock Drive (2008).

3 Seventy-year government plan for a cross-harbour circle of connectivity

The cross-harbour circle of connectivity (Warringah and Gore Hill Freeways, North Western Highway (motorway), and Western Distributor) was created by the County of Cumberland Planning Scheme (1948-1953 publication to road reservation), was retained in the Sydney Region Outline Plan of 1968, and again in the Sydney Area Transportation Study of 1974.

The 'circle' was still present in studies for WestConnex and Light Rail. An extension of the North Western Motorway from the ANZAC Bridge to Iron Cove forms part of the M4-M5 Link project underway.

Completion of the 'circle' would allow the Gladesville Bridge, demand presently stranded at half capacity, to be used to its full capacity.

Completion of the 'circle' allows counter-peak motorway lanes to be utilized between Falcon St and the Pacific Hwy at Lane Cove.

A 24 km journey from North Ryde to Sydney Domestic Airport Terminal would be reduced to 22.5 km by the WHT, but further reduced to 17 km by the North Western Motorway.

Completion of the North Western Motorway would cut the journey length for two-thirds of Lane Cove Tunnel traffic by 5.5 km due to the shorter path from the M2 at North Ryde to Rozelle.

The primary motivation for the Western Harbour Tunnel is a combined project with Warringah Freeway completion (Beaches Link). The combined project comes at the heavy price of reduced cross-harbour connectivity, greater mid-North Shore congestion, and additional conflict between local and regional traffic.

4 Capacity and demand for cross-harbour road travel

The Study Area should have been Sydney east of Parramatta, rather than the Gladesville Bridge to Sydney Harbour Tunnel screenline. The cross-harbour roads from James Ruse Drive to the east partially substitute for each other. Cross-harbour traffic volumes west of Gladesville Bridge equal those to the east. Volume to the west is growing, volume to the east is declining.

Travel time savings for start and end points of the project, but not for typical door-to-door cross-harbour journeys.

Critical data that would inform government decision making is missing 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. Data collection was cut after the project was announced by the Baird Government.

The limited TfNSW data (RMS traffic viewer) shows that cross-harbour travel demand near the Sydney CBD is declining likely due to the more comfortable and usable journey afforded by public transport.

The traffic growth predictions of the EIS are not justified by the available TfNSW data.

The Sydney Harbour Bridge has ten traffic 'lanes' and two overhanging pedestrian and cycle lanes. The ten traffic lanes can be configured as:
--- ten road lanes
--- eight road lanes and two train tracks (current)
--- six road lanes and four train tracks (1932 to 1958) with moderate work
--- possibly zero road lanes and ten commuter rail tracks given the four rail connection points (two each end)

The capacity of road lanes with a reasonable free flow of vehicles in 2,000 light vehicles per hour. The peakhour average is ~10% of vehicles have a passenger giving a people carrying capacity of 2200/hour.

The capacity of the North Shore Rail Line is 24,000 passengers per hour in 20 Waratah trains. This could be doubled simply by doubling the length of trains and platforms.

The Harbour Bridge Bus Lane presently carries 20,000 passengers per hour in 400 buses. Capacity is limited by the capacity to disembark them at Wynyard and turn the buses round.

Effectively, a Harbour Bridge:
--- public transport lane carries ten times the people of a general traffic lane in peak-hour,
--- public transport lane carries five times the number of people on a daily basis.

Given the cheaper cost and greater flexibility of roads, the highest and best use of the Harbour Bridge is public transport where there is demand for it.

Given the thousands of people employed to support bus services across Sydney Harbour, trains are now a more cost-effective means of cross-harbour public transport.

Transport projects near and along the Harbour Bridge-Warringah Freeway corridor should make active provision for conversion of at least the Cahill Expressway lanes to rail tracks.

Heavy Vehicle movements in Sydney are mainly confined west of the A3 arterial road except for the M5 route to the port. The steeper maximum motorway grades of previous projects, ~6.5%, can be retained for projects such as Beaches Link, where the new maximum of 4% grade leads to an extra 3.5 km of 6-lane tunnel construction.

The WHT project results in 25 road and 4 train 'lanes' at five crossing points between, and including, the Gladesville Bridge, Sydney Harbour Tunnel and Sydney Metro. These 'lanes' have less effective capacity than the 24 road and 6 train 'lanes' of the alternative programme of works.

5 North Shore traffic modelling and preferred solutions to traffic conflicts

Again, critical traffic data has not been collected for North Shore traffic. The limited data shows traffic in and out of the Willoughby LGA declining. Again, likely due to a better public transport option, and desires to reduce personal transport costs and greenhouse gas emissions.

Local and regional traffic conflicts are poorly addressed. Conflicts reduce both local and regional road utility. We do not want cross-regional traffic in local centres, or local and regional traffic mixing on roads like the Bradfield Hwy/Sydney Harbour Bridge.

The WHT project ensures traffic at the Miller St and Brook St motorway ramps cannot access the SHT, and traffic at the Falcon St, Miller St and Brook St motorway ramps cannot access the WHT. This traffic can use the Harbour Bridge/Cahill Expressway/Western Distributor to access the Eastern Distributor and WestConnex, ensuring significant conflict remains.

Local travel distance to access the motorway in the westerly direction is up to 8 km for people in the east of the Willoughby LGA. This is often travel on roads congested due to the long distance to access the motorway. Westerly direction motorway access east of the North Shore Rail Line would significantly reduce congestion in much of the LGA.

Lower north shore motorway junction spacing at 600 metres is far below the desired 2 km to 4 km due to the volume of traffic brought together on one road of 16 lanes with many access ramps. Spacing is not improved by the WHT which effectively adds four more lanes to the Warringah Freeway.

Both Willoughby Rd and Brook St have motorway access ramps while being just 350 metres apart and having four significant linking roads. It is appropriate to remove motorway access from one of these roads.

Willoughby Road is favoured by TfNSW for motorway access as this intersection is further from the harbour crossing and thus suffers less congestion. Maximised motorway traffic flow is prioritised over all local considerations.

Willoughby Road is also a district road linking Chatswood, Willoughby, Naremburn, Crows Nest and St Leonards centres. The level of conflict between local service and motorway access is high.

Brook St/Flat Rock Drive Drive/Alpha Rd is parallel to Willoughby Rd, is well connected to it but has no local centres. With just 100 to 150 dwellings impacted by noise, Brook St is the preferred motorway access point for the mid-North Shore east of the North Shore Rail Line.

TfNSW had the intent in earlier versions of the project to remove the motorway ramps from Ernest St and return it to a district access road. However, the project retains it for Sydney Harbour Tunnel access to reduce lane merging and changing of the Warringah Freeway.

6 Road pricing (taxation including tolls)

The state government intends to sell the future toll income of the Western Harbour Tunnel, Sydney Harbour Tunnel and Sydney Harbour Bridge to reduce its debt. The level of toll, and even whether it goes to government impacts demand for road travel and displacement of traffic to non-tolled roads.

While demand is inelastic to tolls in the short term, they have a large impact on travel patterns in the longer term. Some workers spend $8,000 per year on tolls to and from work, prompting the registration cashback. The raising of the harbour Bridge toll from $0.20 to $1.00 in 1987 saw an end to cross-harbour traffic growth until the Sydney Harbour Tunnel opened in 1992.

In an environment of a relative fall in vehicle costs and taxes, road tolls increases have been cemented into private tolling agreements at a minimum of the CPI, and likely twice the expected inflation rate over the next forty years. A major tool for road demand and environmental management is frozen for forty years.

The sale of taxes (toll income stream) for 40 years commits future government to compensate owners of the income streams for any action by government detrimental to the income stream, while any government action that results in an increase in income goes to the companies as a winfall gain. Australia's largest private toll collector, Transurban, has received many winfall gains as motorway network extensions have increased traffic on existing sections of motorway.

This system of winfall gain at the expense of NSW residents should be regarded as another revenue leakage warranting a downgrade in the risk rating of government bonds.

Government bonds are an efficient means of investing in the state economy of which the transport network is a prime enabler. Government collection of the reliable toll income, more reliable than property taxes, lowers the risk for bond investors.

Methods of returning tolls to government and their future collection as a tax is suggested.

7 Freight

The A6, A3, A40, Western Distributor and Eastern Distributor are lightly trafficked by heavy vehicles compared to the M2, M4, M7 and M5 – due to industry locations in the Sydney basin and poor connectivity.

The coming electrification of all vehicle types, including trucks, gives them great hill climbing performance without pollution. Grades of ~6.5% remain suitable for motorways where there are distance or environmental savings.

Hazardous freight, like fuel, is not permitted in tunnels, such as the Western Harbour Tunnel, and will continue to use aboveground routes like the Sydney Harbour Bridge and Western Distributor.

The A6 arterial road has great connections to Sydney's major freights. It is midway between the Warringah Freeway corridor and the M7. It links the M1 at both ends – in the north this is achieved by NorthConnex which is due to open mid-2020.

With Sydney freight, and expected freight growth, mainly confined west of the A3 arterial Road (except for port access via the M5), an A6 upgrade to a limited access 80 km/h road is the highest priority road freight initiative in Sydney.

An A6 upgrade should have greater priority than the F6 motorway which will direct more traffic towards the traffic constrained Sydney CBD.

8 Public Transport

The project benefit for job accessibility within 30 minutes is small compared to possible public transport options.

The triangular area that benefits most is bounded by St Leonards, Balmain, Newtown and Bondi Junction. This is the area of Australia with the highest concentration of quality public transport. The job benefits would appear small compared to those enabled by public transport.

The rates of bus passenger growth over the five years to June 2019 averaged 9.3% per annum. Trains averaged 5.9% due to poor metropolitan coverage. Trains and buses together added 7.4% per annum.

Public transport demand grows rapidly fuelled by better quality vehicles and personal electronic devices that allow people to productively fill their travel time.

While growth rates far higher than population growth are unsustainable long term, a significant mode shift to public transport will result if efforts are made to improve network structure and capacity.

There is sufficient public transport demand to support three cross-harbour rail lines: North Shore Line; Sydney Metro; and another to replace cross-harbour bus services which increased congestion with demand growth.

The Cahill Expressway should be converted back to be part of the first stage of the Northern Beaches Railway. The first stage would have stations at Wynyard, Observatory Hill (shared with North Shore Line), Milsons Point (old tram stop), North Sydney (east side of Motorway) and Falcon St Neutral Bay. It is proposed this line be linked to the Illawarra Line at Town Hall and Metro West link to the Eastern Suburbs Line at Martin Place.

Cross-harbour bus services would be diverted to one or more of the Sydney Metro, North Shore Line and Northern Beaches Line.

9 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 diminishes the need for the road viaduct across the Quay.

Pedestrian-cycle access to the Harbour Bridge is poor. The Cahill Expressway corridor does provide great opportunities for pedestrian and cycle access between the northern CBD and the bridge.

The roof of Circular Quay railway Station is one of Sydney's great view points, 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 pedestrian-cycle use, and as a destination for Sydney visitors, is outlined with images.

10 Adding much needed parks to the motorway corridor

Two-thirds of Artarmon Park (3.5 hectares bounded by the North Shore Line, Parkes Rd, Hampden Rd and Punch St) was taken for the Gore Hill Freeway. Taking advantage of the difference in motorway and surrounding land levels, the park should be restored over the motorway.

The Warringah Freeway cut Naremburn in half with the deep gash used to provide motorway ramps to Willoughby Rd. The St Leonards-Crows Nest growth precinct is 500 metres to the south of the Naremburn local centre. Level park space is virtually non-existent in Naremburn and the St Leonards-Crows Nest growth precinct. A park of 1.65 hectares can be built over the motorway between Willoughby Rd and Merrenburn Rd. A park could still be realised with the motorway access ramps retained but it would lose size and amenity.

11 WHT-BL-Warringah Freeway-Gore Hill Freeway connectivity

Connectivity is a primary service feature of roads. It is a major contributor to minimising door-to-door journey times for the greatest number of people.

A matrix of major road connectivity is presented to understand which local roads are likely to experience rat-running and congestion as a result of connectivity limitations imposed by the project. The connectivity limitations are designed to reduce traffic incidents during lane changing and merging. The Warringah Freeway-Harbour Bridge corridor averages four vehicle incidents a day requiring assistance.

Where a direct connection is missing, traffic makes the connection by way of 'rat runs'. Rat-running means using lower AUSTROADS category roads to achieve connections. Lower category roads generally have lower capacity. Arterial roads and motorways have capacities of 2,000 vehicles per lane per hour. Local roads have a capacity of around 700 vehicle per lane per hour.

Proposals to restore some missing connectivity are given:
--- Straighten eastbound Beaches Link tunnel portal to permit traffic from the Pacific Hwy and Longueville Rd to pass north of the portal to the Gore Hill Freeway.
--- Add branch of westbound portal to Reserve Rd that connects to the Pacific Hwy and Longueville Rd exit.
--- a 500-metre gap in the median strip (marked in red) between northbound SHT and Warringah Freeway lanes from Harbour Bridge.

--- Southbound tunnel connection (marked in red) between Beaches Link and Sydney Harbour Tunnel access lanes on the Warringah Freeway to permit SHT traffic to access Beaches Link, and Miller St and Brook St ramps
--- Mid-North Shore motorway access concentrated at Brook St and provided in both directions.

12 Alternative project - completion of the North Western Motorway & the cross-harbour circle of connectivity

The 'circle of connectivity' permits a significant portion of traffic to vary the harbour crossing point, at the time of travel, based on expected travel times influenced by demand, traffic incidents, maintenance, etc. Today, with a major portion of the western arc of the 'circle' missing, few motorists have route choice.

The NWM has been built intermittently since the 1960s with the latest section under construction as part of the M4-M5 Link project.

The first section (Gladesville Bridge) opened in 1964. The bridge has been stranded at about 50% of its daily crossing capacity when compared to the Sydney Harbour Tunnel (Section 4).

The WHT project results in 25 road and 4 train 'lanes' at five crossing points between, and including, the Gladesville Bridge, Sydney Harbour Tunnel and Sydney Metro. These 'lanes' have less effective capacity than the 24 road and 6 train 'lanes' of the alternative programme of works.

North Western Motorway works completed so far include:
--- The Western Distributor
--- The Cross-City Tunnel
--- The Anzac Bridge
--- The Gladesville Bridge

Under construction with the M4-M5 Link is the extension to Iron Cove. The complexity of the WHT increased the M4-M5 Link from 5 to 8 connections and requires additional works whose extra costs would half fund completion of the North Western Motorway.

To complete a North Western Motorway requires:
--- The last 750 metres of 4-lane M4-M5 Link lanes to Iron Cove upgraded to 6-lanes,
--- an extension to the M2 at North Ryde including:
    --- 2 x three-lane tunnels (total 5.5 km) under Drummoyne and Lane Cove,
    --- new bridges over Iron Cove (442 m with 52.5 m spans to match existing) and the Lane Cove River (350 m Lindley Point, 750 m North Ryde) next to existing bridges,
    --- 1 x two (or three) lane tunnel (1.4 km), including 350 m submerged tube tunnel, from Huntleys point to Drummoyne,
--- 2 x two-lane tunnels (2.8 km) from the NWM under Lane Cove to the Gore Hill Freeway and Pacific Hwy,
--- the Southerly corridor, 2 x two lane tunnels (6 km) for NorthConnex in addition to the Westerly corridor (9 km) which is nearing completion and expected to open in mid-2020).

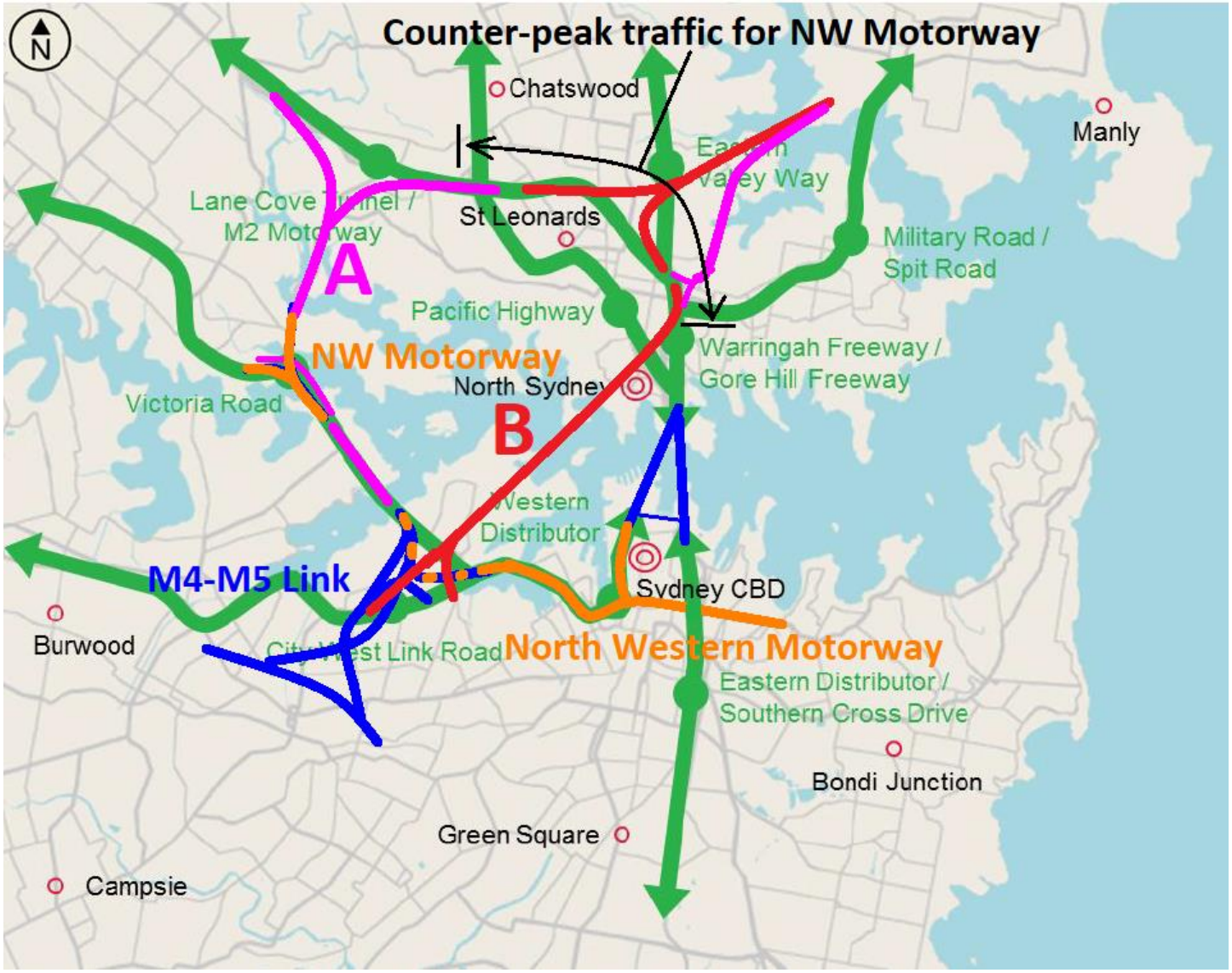
Rozelle to the M2 at North Ryde, via an NWM is 5.5 km shorter than via the WHT of this EIS – a major saving for the two-thirds of the M2 traffic crossing the Lane Cove River and a major energy and greenhouse gas saving.

With standard maximum portal grades of ~6.5%, rather the 4% maximum adopted for the Beaches Link, a direct approach to the motorway at the Cammeray Golf Course is possible. West- and south-facing ramps permits connectivity missing from the current plan. The tunnel saving is 2 x ~3.5 km.

13 Lane Cove to Sydney CBD (M1) motorway corridor upgrade

Due to changes of political priorities and intermittent construction over decades, the M1 corridor from the Pacific Hwy Lane Cove to the city has service structure issues. The growth of public transport demand is high due to better quality services and mobile phone services, while private road travel demand is falling as noted in earlier chapters.

Proposed upgrade works to address the service structure issues, drawn from WHT plans where possible, are presented in order from Lane Cove to Sydney City.



--- Green Current road corridors as identified in the EIS
--- Orange North Western Motorway built and under construction
--- Blue Sydney Harbour Bridge, Sydney Harbour Tunnel and M4-M5 Link project
--- Pink(A) North Western Motorway with separate Beaches Link option
--- Red (B) The WHT-BL project

Figure S1 – Cross-harbour road options near the Sydney CBD

3 Seventy-year government plan for a cross-harbour circle of connectivity

3.1 History

By 1945, Sydney had organically spread out along six major roads and to the Eastern Suburbs coast.

The Cumberland County Council, made up of 10 councillors elected by local governments, developed the County of Cumberland Planning Scheme (Figures 3.1 and 3.2).

The McKell, McGirr, Cahill, Heffron and Renshaw Labor governments created the Council and pursued the Scheme which introduced a five-kilometre wide greenbelt in Western Sydney (e.g., Westmead to Eastern Creek) to hem in metropolitan sprawl.

In the absence of a copy of the Cumberland Plan, Wikipedia advises “the plan reserved corridors for:
--- a north-eastern road, roughly along the alignment of the Warringah Expressway, crossing Middle Harbour and following Wakehurst Parkway and Pittwater Road to Palm Beach,
--- a northern road, roughly along the alignment of Victoria Road, the M2 Hills Motorway and the Pacific Motorway,
--- a western road, roughly along the alignment of today's M4 Western Motorway,
--- a southern road, roughly along the alignment of the F6 corridor, but passing to the west of the airport,
--- a south-western road, branching off the southern road near Tempe and roughly following the alignment of today's M5 South Western Motorway,
--- a ring-road, roughly along the alignment of the A3 ring-road between Macquarie Park in the north and Miranda in the south.”

Under the Askin Coalition government, in 1968, a review of the Main Road Development Plan 1953 was carried out by the State Planning Authority to inform the Sydney Regional Outline Plan 1970-2000 (SROP) (Figure 3.3) released that year.

The State Planning Authority replaced the Cumberland County Council and other bodies, but retained membership by the City of Sydney, the Local Government Association (Sydney Councils) and the Shires Association (other NSW Councils) ensuring planning was not just internal to state government and its agencies.

In the absence of a copy of the Sydney Region Outline Plan 1970–2000 (SROP) (Figure 3.3), Wikipedia advises the Cumberland scheme's green belt and satellite cities was abandoned and the Sydney Region Outline Plan was devised with reference to seven principles:
--- extend the city along the linear railway corridors,
--- a 'grid' of highways to reduce the dominance – and congestion – of the Sydney central business district (CBD),
--- new city centres, each with their own identity, within the larger metropolitan area,
--- phasing of development to maximise the use of existing infrastructure before opening up new areas to subdivision,
--- reserve multi-purpose utility corridors,
--- develop Sydney, Newcastle and Wollongong as "one linear urban complex",
--- create new commercial areas in the suburbs to balance employment across the metropolitan area.

The plan retained the Northern, Warringah and Gore Hill highways of Cumberland Plan.

The Askin government later undertook the 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 SATS undertook extensive modelling of road and public transport options to inform recommendations which retained the Northern, Warringah Gore Hill highways of Cumberland Plan (Figures 3.4 & 3.5).

The SATS rail recommendation (Figure 3.6 & 3.7) contains some elements of the current government's Sydney Metro rail plan – again reasons for change from previous rail plans are poorly addressed today.

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 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.

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.

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 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.

3.2 Road planning identified in the EIS

The jump from the Askin government to the current government above is reflected in the EIS Figure 4.2 Historical context timeline. It lists no metropolitan road planning studies since 1974 – 46 years ago. Key items from Figure 4.2 are:

> **1930s** Plans were developed for a new Warringah Transport Corridor, including an additional harbour crossing, to the Northern Beaches **(Stevens, Mair United Australia Party)**

(Evidence of this would be welcome. The Sydney Harbour Bridge was completed in 1932 and fostered development occurred on the North Shore despite the Great Depression. The Cahill Expressway portion of the Harbour Bridge project was not completed until 1956. The Bridge opened with four general traffic lanes which were later remarked for six lanes. The County of Cumberland Council 1945-1963 and its planning scheme was pursued by the McKell, McGirr,

Cahill, Heffron and Renshaw Labor governments. The Council was replaced by the State Planning Authority who would go on to create the Sydney Region Outline Plan)

1953 The Main Road Development Plan 1953 adopted the Warringah Transport Corridor **(Cahill Labor)**

1953 County of Cumberland Road Reservation prescribed which included an inner ring-route, a second crossing of Sydney Harbour (Greenwich-Birchgrove), and Warringah Freeway crossing Middle Harbour between Sugarloaf Point and Pickering Point (a kilometre north of the Beaches Link). **(Cahill Labor)**

1968 A review of the Main Road Development Plan 1953 carried out in the Sydney Regional Outline Plan (NSW State Planning Authority) **(Askin Coalition)**

1974 Sydney Area Transportation Study included the Warringah Freeway in the long term road network **(Askin Coalition)**

1981 Second Harbour Crossing Inquiry started and abandoned **(Wran Labor)**

1981-3 Warringah Transport Corridor Inquiry – extension to Northern Beaches would have unacceptable environmental and community impact **(Wran Labor)**

(The historical list appears to have a political bias. **1983-2012** – 29 years, no studies listed. The Greiner-Fahey **Coalition** and Carr, Iemma, Rees, Keneally **Labor** governments studies not covered.)

2012 NSW Long Term Transport Master Plan – references a new harbour crossing west of the CBD and a bus tunnel bypassing Military Rd (**O'Farrell Coalition**)

2014 NSW State Infrastructure Strategy (**Baird Coalition**) – (references a harbour crossing and Beaches Link)

2018 Greater Sydney Region Plan – A Metropolis of Three Cities (GSC) (**Berejiklian Coalition**) references WHT and BL

2018 Future Transport Strategy 2056, references WHT and BL

2018 NSW State Infrastructure Strategy 2018-2038, references WHT and BL

2018 North District Plan, references WHT and BL

2018 Eastern District Plan, references WHT and BL

The 2012 plan still featured the North Western Motorway (Figures 3.8 to 3.10).

The 2014 referenced harbour-crossing and Beaches Link (Figures 3.11 to 3.13) severely complicated Rozelle junction arrangements such that 5 connections became 8. Extra construction costs for Rozelle would go a long way towards completion of the previous plan for the North Western Motorway (Figures 3.14 to 3.16).

Planning since 2011 has accumulated proposals in support of the "Three Cities" strategy, rather than start from scratch with modelling of the various transport modes including utilities to inform transport 'grid' improvements and enhancements that best support desired land use.

Public transport planning has used extreme crush load capacities (which rely mainly on passengers standing in corridor space) for single-deck trains and trams in comparisons with the existing comfortable service capacities of double-deck trains and buses. The CBD-Eastern Suburbs light rail line is not competitive with buses in terms of capacity and service times. The transport planning process lacks rigor and appropriate governance.

3.3 Constructed and planned cross-harbour capacity west of the Harbour Bridge

The WHT, as presented in the EIS, is a major departure from the North West Motorway plan pursued in a piecemeal manner over 70 years, including with the recently approved M4-M5 Link to Victoria Rd project. Given the 70 years to reach the present state, the history of the motorway is outlined below.

AUSTROADS advises in regard to the first stage of the North Western Motorway (the Western Distributor):

> Lying entirely within the City of Sydney, the Western Distributor was not included in the County of Cumberland Planning Scheme, however the routes of the North Western, Western and Southern Expressways were all relative to a proposed western distributor, skirting the western edge of the CBD.
>
> Following the completion of the Warringah Expressway between the Bridge and Miller St, construction began on the first stage of the Western Distributor between the Harbour Bridge toll booths and Day St, to allow for reversible traffic flow during peak periods. Unfavourable topography and the close proximity of underground railway tunnels meant it wasn't practicable to carry the expressway below the street system.
>
> It would complement the Warringah Expressway by extending this improvement south of the Bridge and connect with the planned Southern and Western Expressways by an interchange at Ultimo. There will also be a link with the North Western Expressway near Druitt Street.
>
> The DMR advised: "Ultimately the Western Distributor is planned as a two-level viaduct. The top level will consist of a divided six-lane expressway provided mainly for through traffic between the Sydney Harbour Bridge and the Ultimo Interchange, which will be the commencement of the Southern and Western Expressways. The lower level will be mainly a collector-distributor road with a number of connections to the city streets. The southbound roadway on this level will commence at Margaret St and the northbound roadway will terminate at Jamison St."
>
> June 1971, "The North Western Expressway will form part of the planned expressway route between the cities of Sydney and Newcastle. It will extend from the City at Druitt St via Glebe, Balmain and Drummoyne to Huntleys Point where it will connect with the Lane Cove Valley Expressway which, in turn, will join the Sydney-Newcastle Expressway at Wahroonga."
>
> September 1972, both carriageways of the first stage were opened to traffic, followed by a temporary northbound onramp to the Distributor from Pyrmont Bridge.
>
> 1976, the State Government ended further construction of the North Western Freeway, bringing it to an abrupt halt at Harris St, Pyrmont. Major community opposition to the destruction of the closely settled communities of Rozelle, Balmain and Drummoyne was a major contributor to the decision.
>
> October 1977, the Western Freeway (Concord to City) and the Southern Freeway (St Peters to City) were cancelled - the Distributor would not be extended to Ultimo, its two-level design redundant.
>
> May 1980, the westbound viaduct from Day St to Harris St, was opened to traffic
>
> December 1995, a new high-level crossing to replace the Glebe Island Bridge and an elevated freeway to join the bridge to the Darling Harbour Viaducts opened. Known as the Glebe Island Arterial it completed the Western Distributor. The bridge is now called the Anzac Bridge.

A north-western motorway plan from the Sydney CBD to Hornsby via Rozelle and North Ryde has existed since the 1948 County of Cumberland plan.

Five kilometres of motorway was opened in stages from 1972 to 2005 in the form of the Western Distributor, Anzac Bridge and Cross City Tunnel. This road now designated part of the A4 arterial Road.

Two kilometres of the North Western motorway was previously opened in 1964 with the completion of a ‘Y’ project linking Drummoyne to Huntley’s Point, Hunters Hill and Lane Cove via the Gladesville Bridge, Tarban Creek Bridge and Fig Tree Bridge. These roads are now designated the A40 and Burns Bay Rd.

The M4-M5 Link project (M4-M5 to Rozelle), approved after an earlier EIS process, will extend the ‘northern highway’ two kilometres from the Anzac Bridge ramps to Iron Cove.

--- Cross-harbour circle of connectivity of Western Distributor, Northern Western Motorway, Gore Hill Freeway and Warringah Freeway present with a single version of a Northern Beaches Link.

Figure 3.1 – County of Cumberland Planning Scheme 8TH MARCH 1948 Extent of scheme, Sydney Harbour extract

--- Cross-harbour circle of connectivity of Western Distributor, Northern Western Motorway, Gore Hill Freeway and Warringah Freeway present with two versions of a Northern Beaches Link.

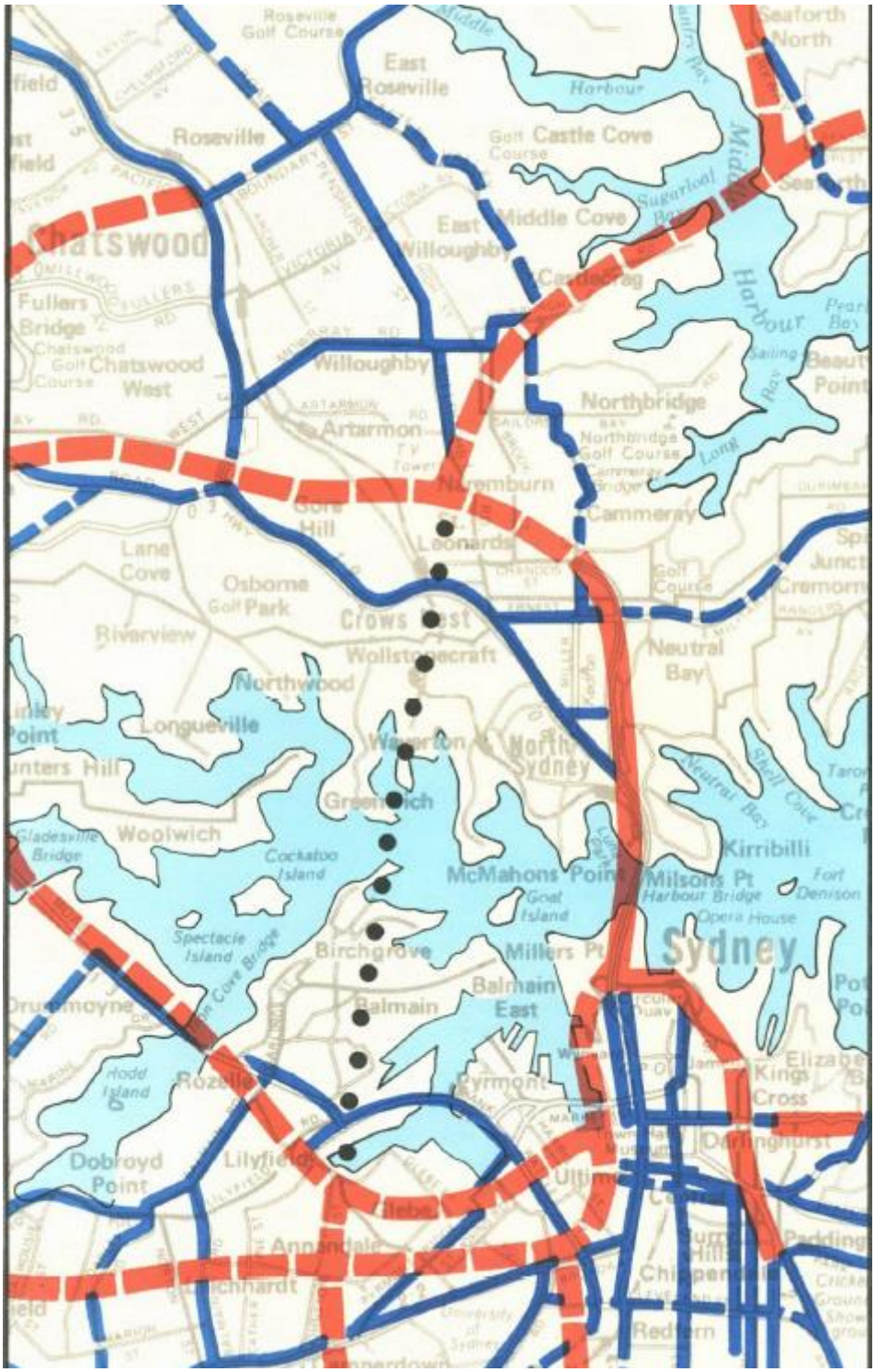
Figure 3.2 – County of Cumberland Planning Scheme as presented to J.J. Cahill, Minister for Local Government, 27th July 1948, Sydney Harbour extract

--- Cross-harbour circle of connectivity of Western Distributor, Northern Western Motorway, Gore Hill Freeway and Warringah Freeway retained.

Figure 3.3 – Sydney Region Outline Plan 1970-2000 of 1968 extract

--- Cross-harbour circle of connectivity of Western Distributor, Northern Western Motorway, Gore Hill Freeway and Warringah Freeway retained with northern version of Beaches Link.

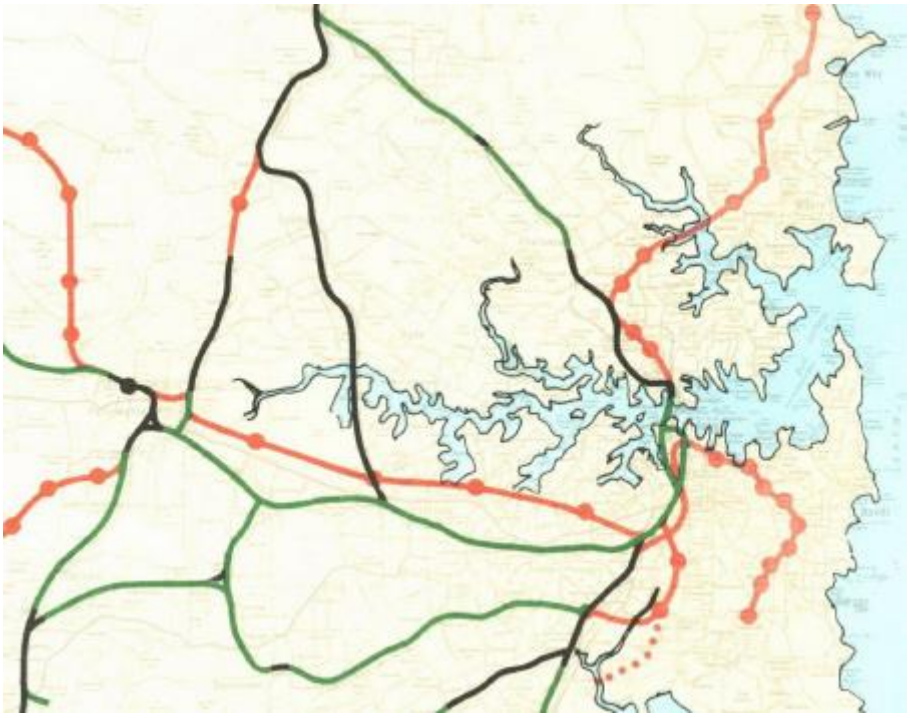
Figure 3.4 – Sydney Area Transportation Study 1974 - Figure 1.9 Recommended Highway Systems 2000 - extract



--- Cross-harbour circle of connectivity of Western Distributor, Northern Western Motorway, Gore Hill Freeway and Warringah Freeway retained with northern version of Beaches Link.

--- It also includes a possible direct link between Rozelle and the Northern Beaches Link northern option (includes a 4-way junction with the Gore Hill Freeway at Naremburn).

Figure 3.5 – Sydney Area Transportation Study 1974 - Figure 1.10 Recommended Highway Systems 2000 – extract



--- 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 900???? Vehicles per hour and ????vehicles per day.

--- 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 in the AM peak hour and ???? passengers per day.

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

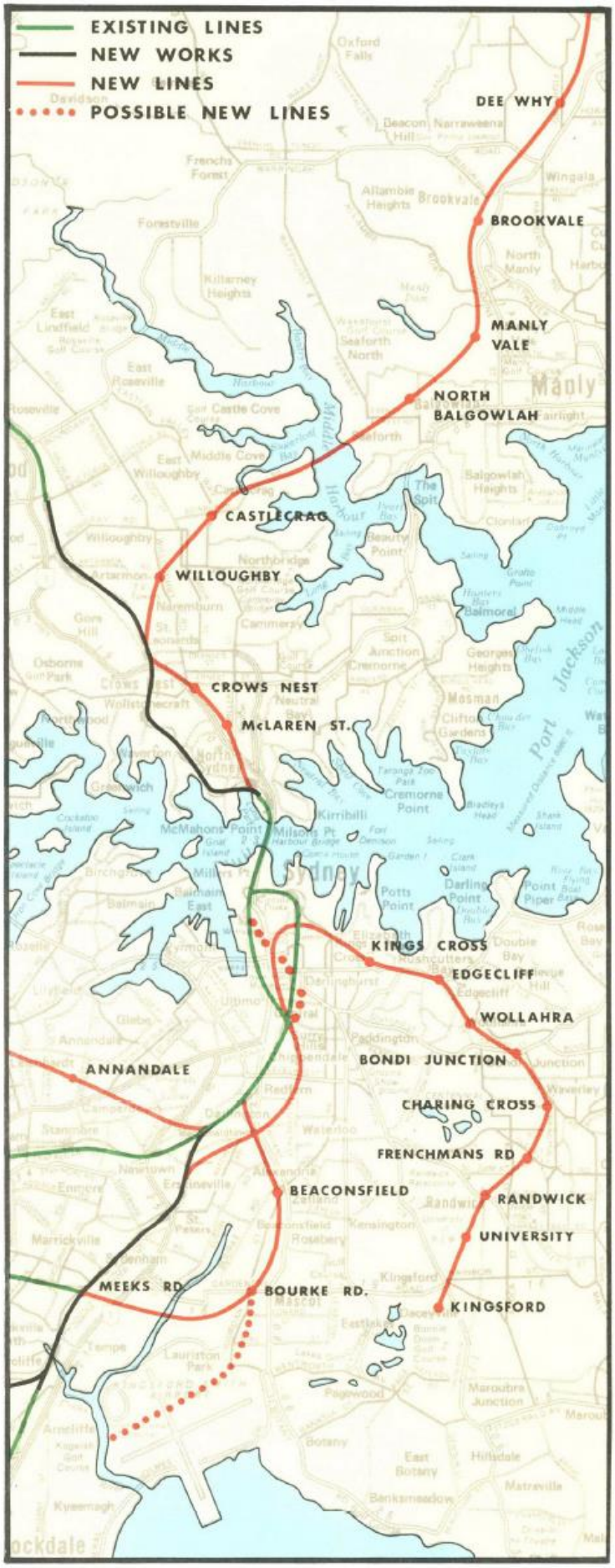
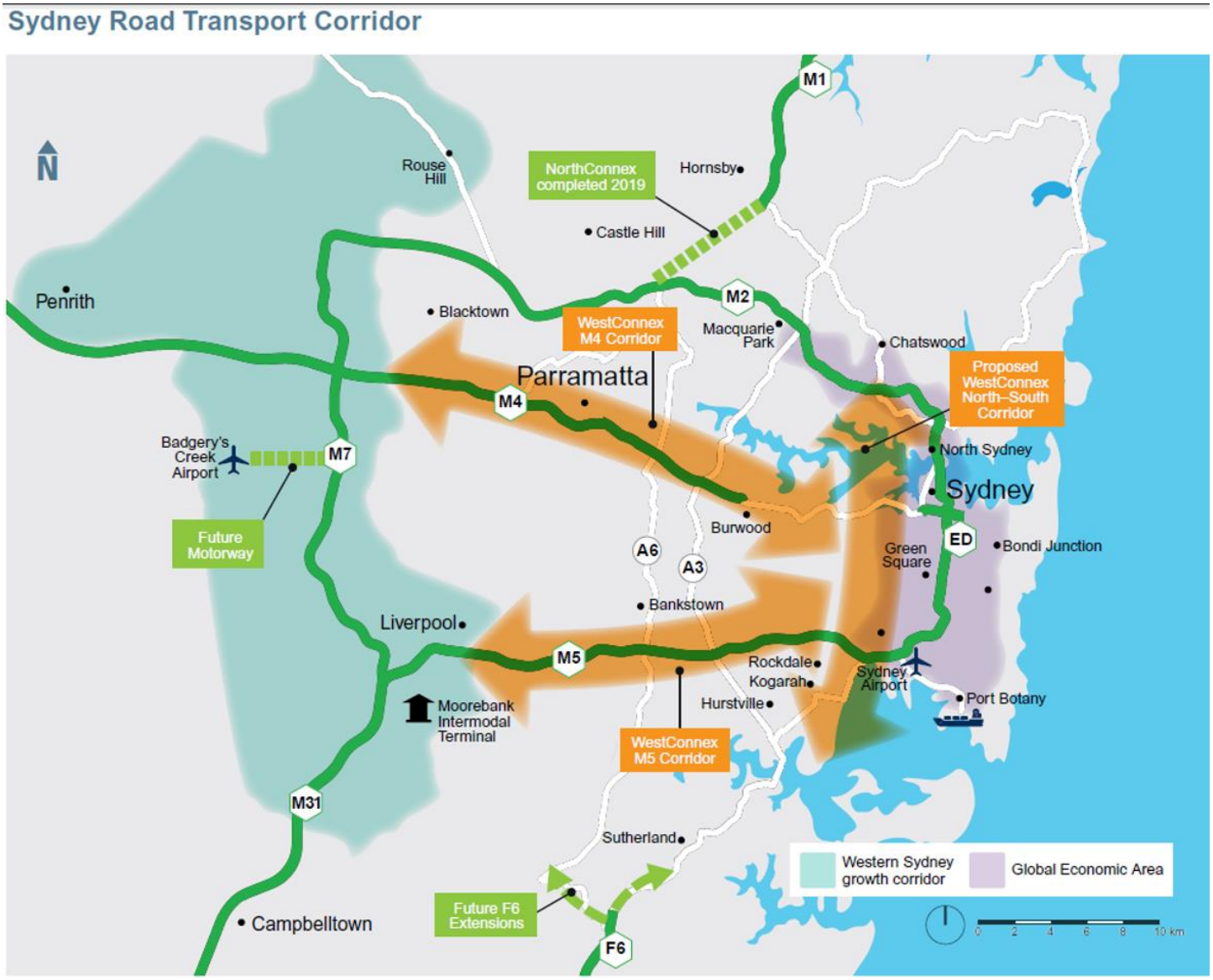


FIGURE 1·15 RECOMMENDED RAILWAY SYSTEMS
SYDNEY–NORTH SYDNEY– 2000

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

Figure 3.7 – Sydney Area Transportation Study 1974 - Figure 1.15 Recommended Railway Systems, Sydney - North Sydney - 2000 - extract



--- Initial WestConnex studies continued the North Western Motorway Plan, indicating a primary driver of the WHT plan is a single project with the Beaches Link.

Figure 3.8 – Sydney Road Transport Corridor - WestConnex study 2011-12

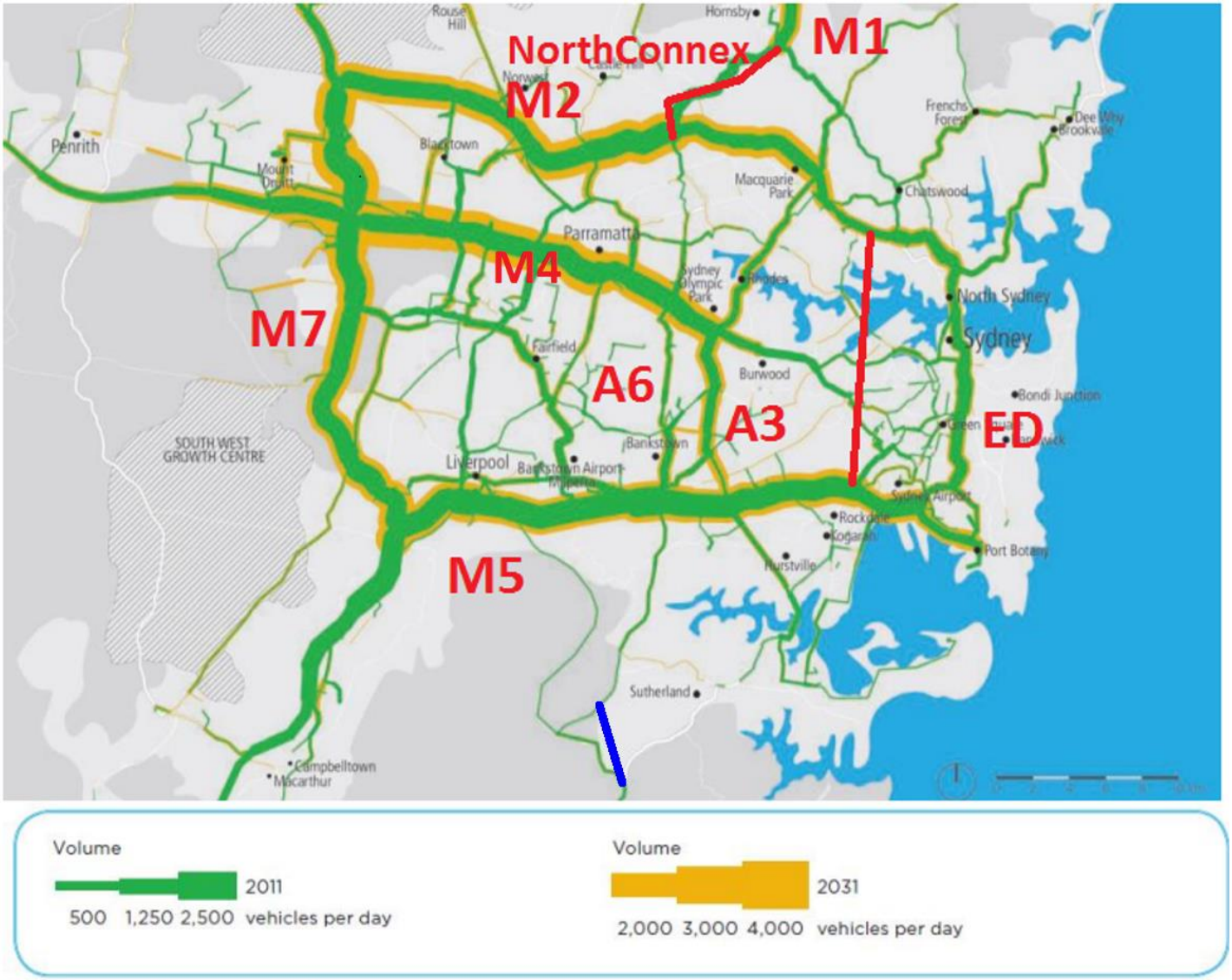


Figure 3-6: Heavy vehicle movements in Sydney, 2011 and 2031

Source: TfNSW, LTTMP, 2012a p.282

--- Heavy vehicles are vehicles over 4.5 tonnes with two or more axles.
--- Heavy vehicles are mainly on motorways west of the A3, except for port traffic.
--- NorthConnex connects to the A6 arterial road which links the M2, M4 and M5.
--- The A6 links the M1 north and south of Sydney.
--- The A6 should be upgraded to allow it to operate as an 80 km/h limited access road attractive to heavy trucks.
--- Eastern Sydney, with the exception of the M5 port corridor, has light industry and a heavy concentration of residential and commercial land use.
--- The low volume of very heavy trucks north of the M5 in Eastern Sydney allows an increase in road grade where a significant saving in road length and cost can be made.
--- The new maximum of 4% grade should be relaxed to the previous standard of about 6.5% if journey length can be significantly reduced.
--- It is noted that the road grade at the western tunnel portal of the M5 motorway is 8%.

Figure 3.9 – Heavy vehicle movements in Sydney, 2011 and 2031, WestConnex studies

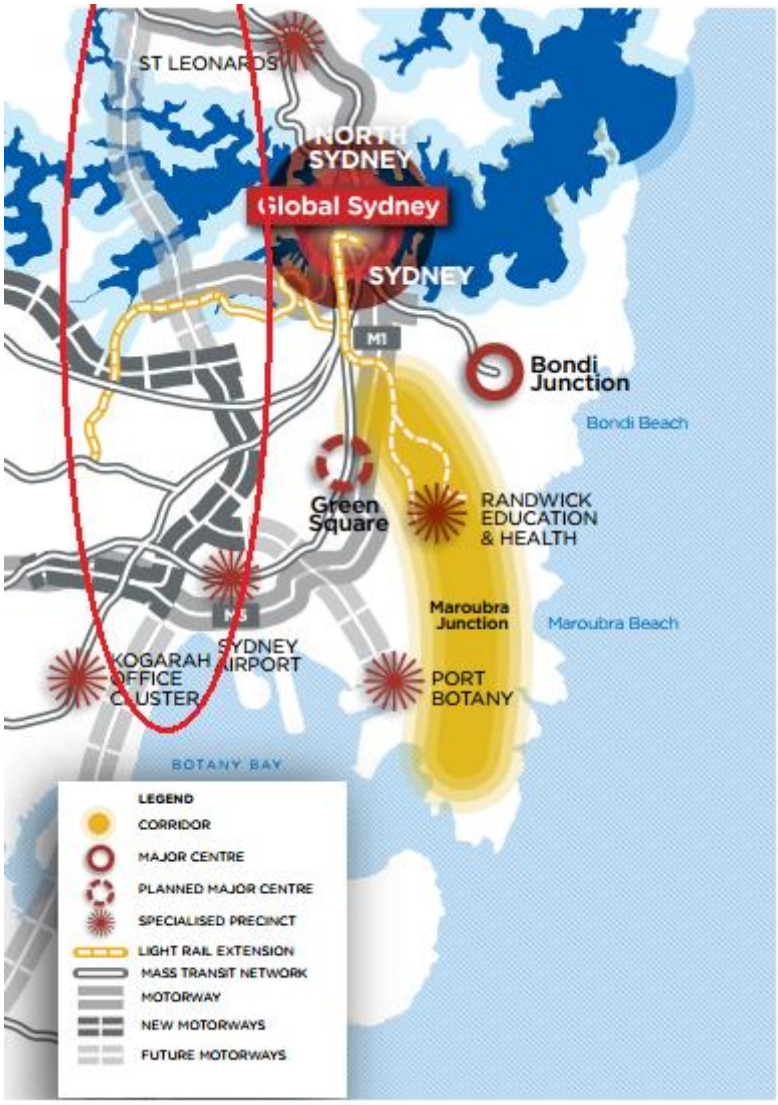
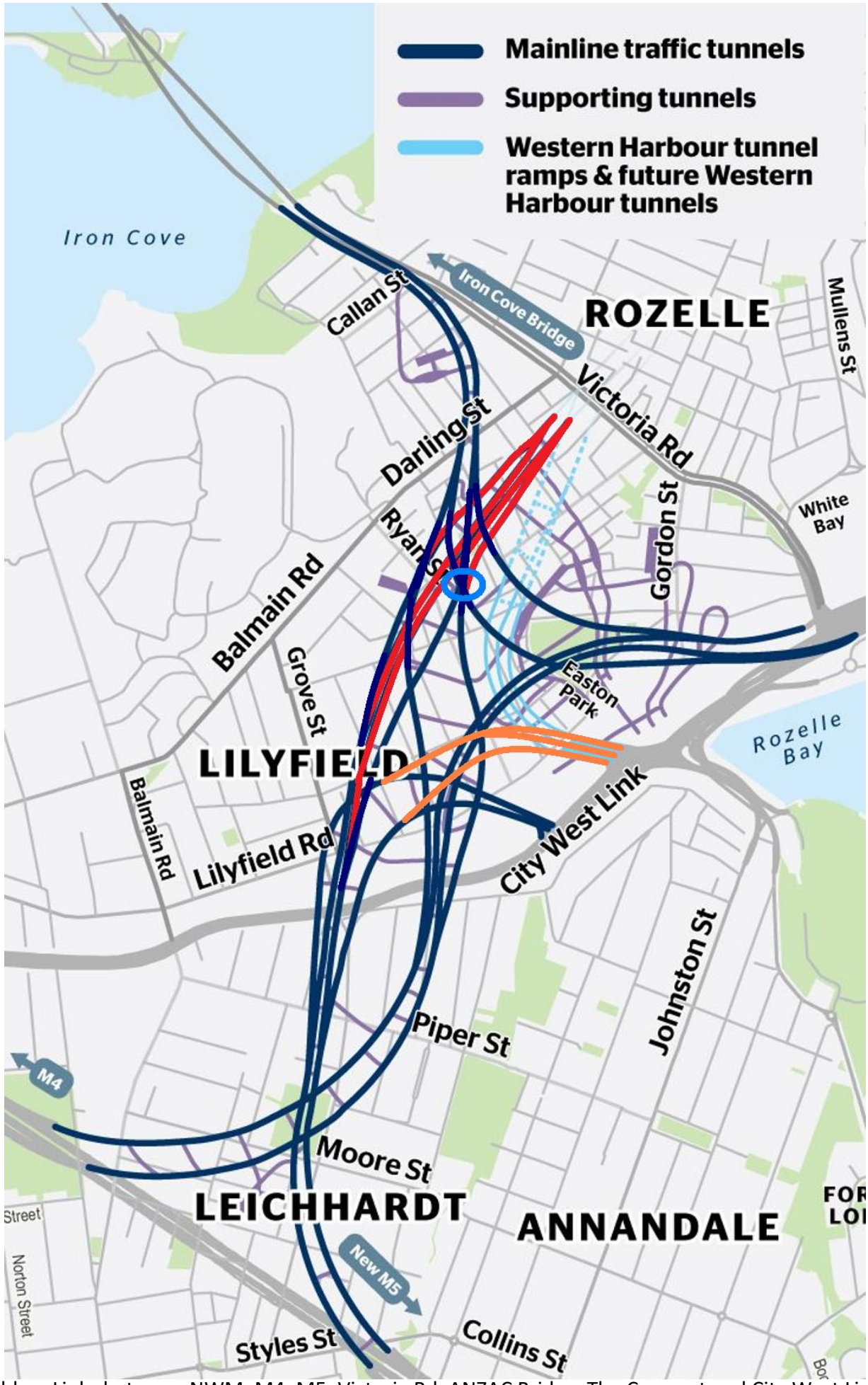


Figure 8: Anzac Parade Corridor

--- Circled motorway shows the government planned to continue with the North Western Motorway during CBD and South East Light Rail planning in 2012-2013

Figure 3.10 – Sydney CBD light rail studies assumed the North Western Motorway would continue



--- Dark blue: Links between NWM, M4, M5, Victoria Rd, ANZAC Bridge, The Crescent and City West Link.
--- Light Blue and Red: additional motorway for Western Harbour Tunnel
--- Orange: Improved M5 Link. The Crescent traffic bound for the NWM would use Victoria Rd though Rozelle.
--- Blue circle: a conflict in this WHT plan with four tunnels merging at one point (3 tunnels merge is max)

Figure 3.11 – M4-M5 Link - additional motorway to change from NMW to WHT plan

--- With Figures 14 & 16, figure serves to illustrate the extra kilometres of construction for 2 northbound exits.

Figure 3.12 – WHT junctions with City West Link Rd, M4 and M5

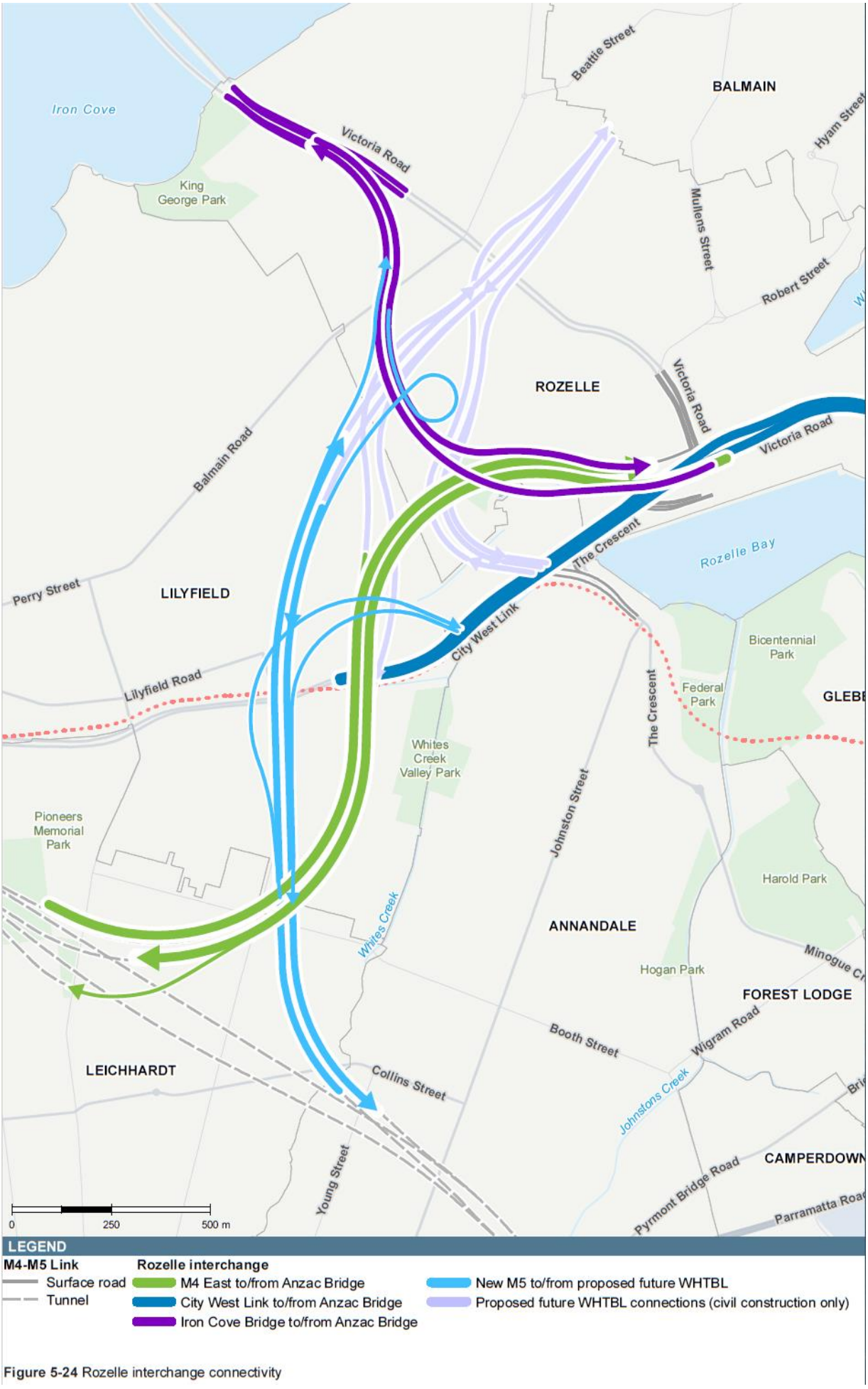
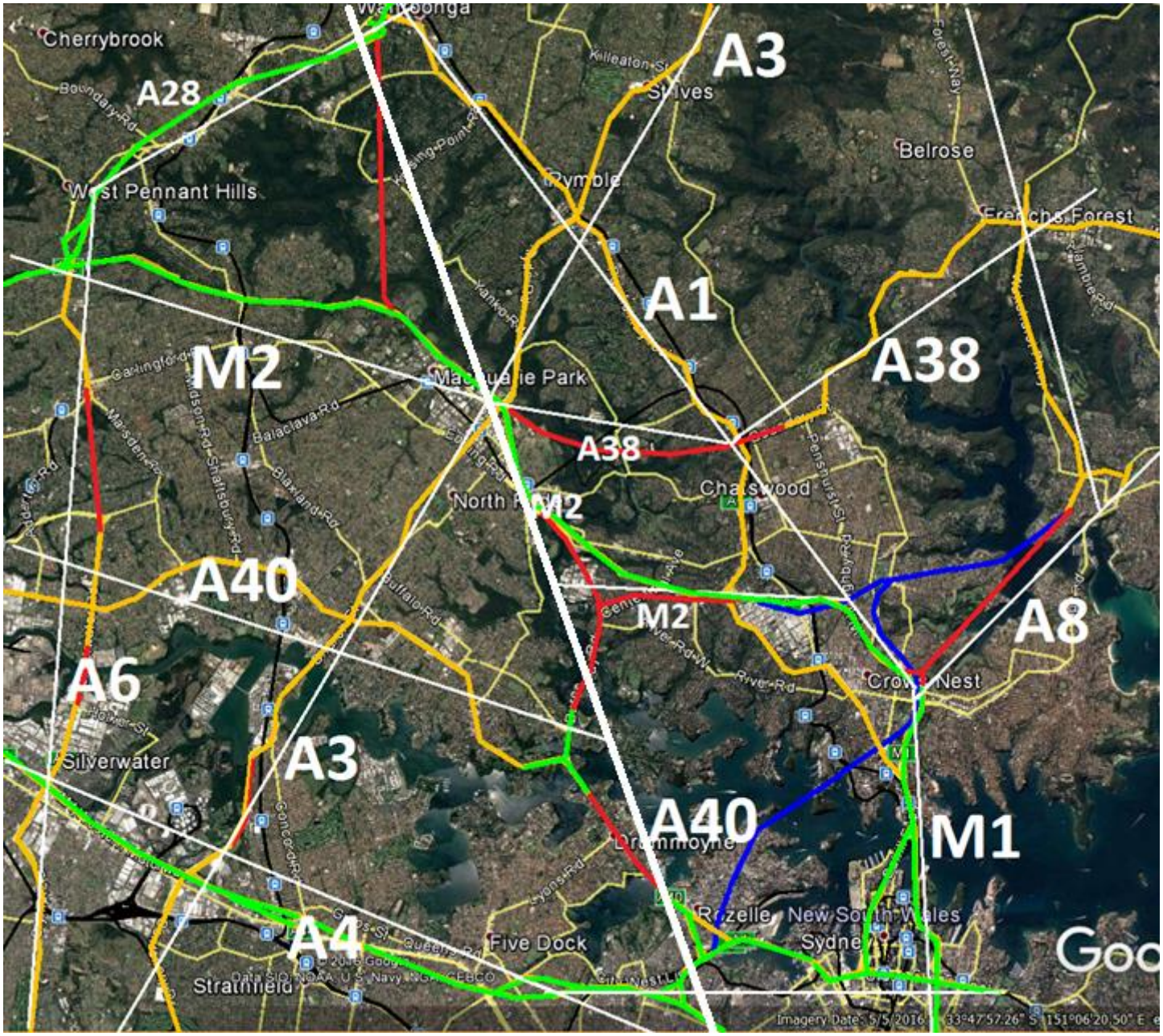


Figure 5-24 Rozelle interchange connectivity

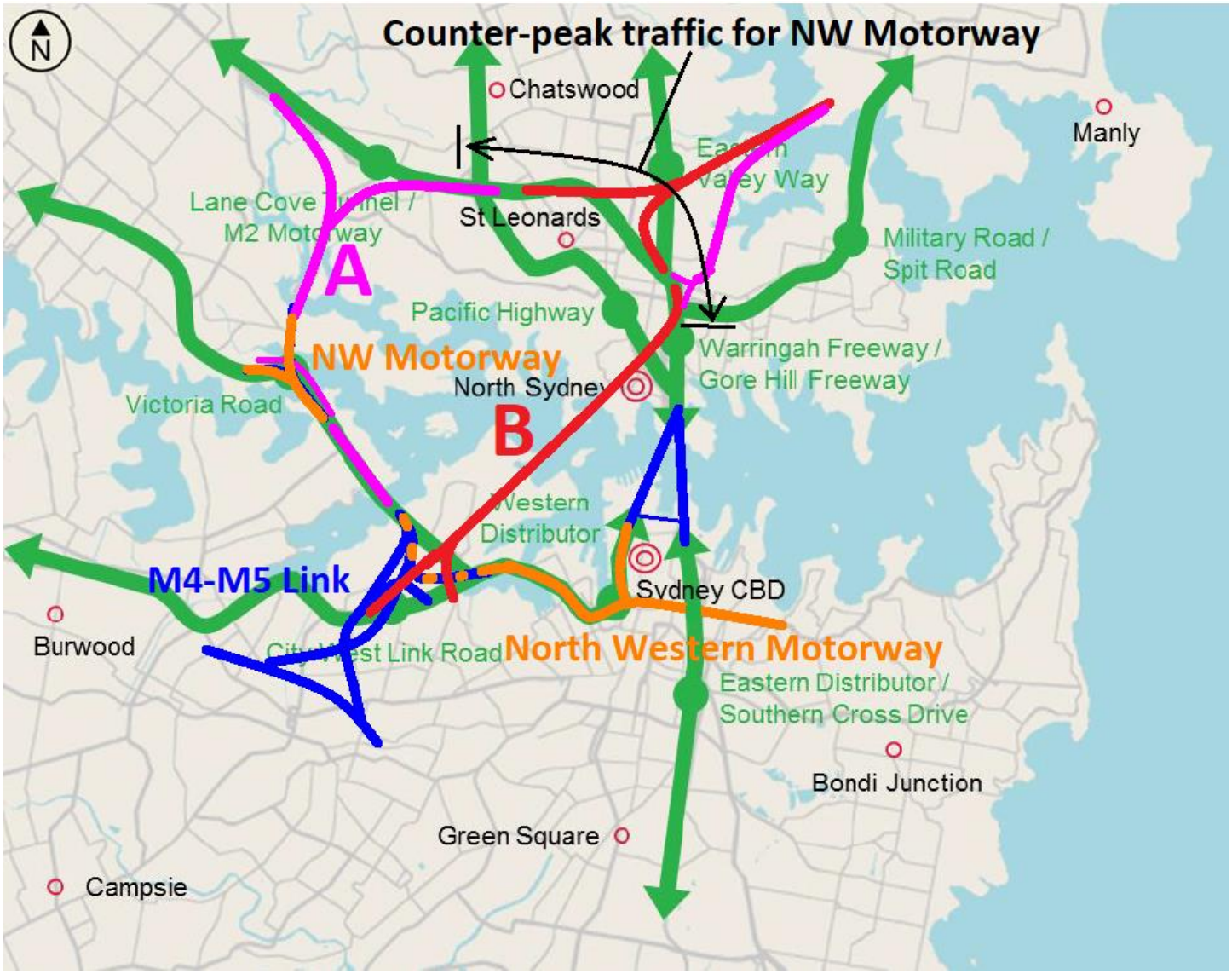
--- This plan has M4 eastbound traffic to Victoria Rd bypassing the City West Link will need take the Western Distributor to King St (city), travel 220 m down Sussex St and rejoin the Western Distributor at Market St.
--- Westbound traffic must use City West Link to Haberfield.

Figure 3.13 – M4-M5 Link EIS - this version has no M4 link to Victoria Rd



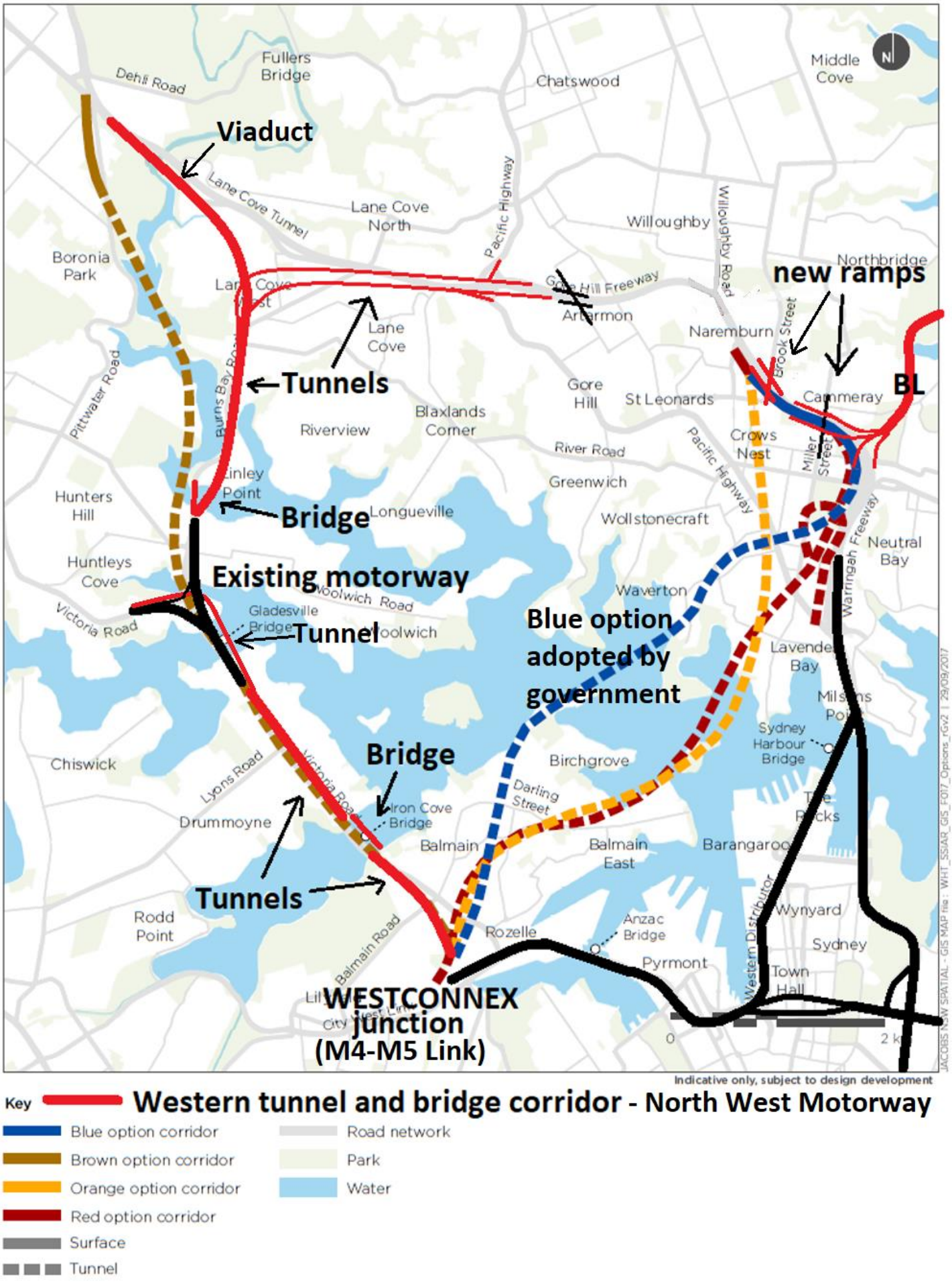
--- Yellow – existing arterial and district roads
--- Green – existing and under construction motorway
--- Blue – WHT-BL project
--- Red - Alternate programme of works

Figure 3.14 – North Western Motorway in the context of northern Sydney road connectivity



--- The Western Distributor, North Western Motorway, Gore Hill Freeway and Warringah Freeway form a cross-harbour circle of connectivity planned in the 1940s with construction still ongoing in the form of the M4-M5 Link's ANZAC Bridge to Iron Cove Link.
--- The M4-M5 Link effectively completes the Western Motorway.
--- Green – corridors considered in the EIS
--- Blue – current harbour crossings and M4-M5 Link (with NWM extension to Iron Cove under construction)
(B) --- Red – Western Harbour Tunnel and Beaches Link
(A) --- Orange – Completed and under construction parts of the North Western Motorway:
---Cross City Tunnel,
--- Western Distributor,
--- ANZAC Bridge,
--- Gladesville Bridge corridor from Drummoyne to Huntley's Point and Hunters Hill,
--- M4-M5 Link component from ANZAC Bridge to Iron Cove (under construction),
(A) --- Pink – Yet to be constructed parts include:
--- Drummoyne Tunnel,
--- Victoria Rd citybound cross-harbour (Parramatta River) tunnel,
--- Hunters Hill to M2 and Gore Hill Freeway via a new Lane Cove Tunnel,
--- Bridges over Iron Cove and Lane Cove River (two).
(A) --- Pink – Alternate Beaches Link based on previous maximum motorway portal grade of ~6.5%.
RMS reduced maximum grade to 4% so that heavy trucks (vehicles over 4.5 tonnes) will pollute less in tunnels, but vehicles of prime concern are less than 1% of main road traffic in eastern Sydney away from port approaches. The arrival of high torque electric trucks removes grade as an issue for trucks when the alternative is longer journeys.

Figure 3.15 – North Western Motorway and Western Harbour Tunnel alternatives



--- Blue option selected by government - likely to make an inseparable project with its Beaches Link.
--- Brown option is an extremely poor version of the North Western Motorway

Figure 3.16 – Harbour crossing options - North Western Motorway or Western Harbour Tunnel of EIS

4 Capacity and demand for cross-harbour road travel

4.1 Population growth

The EIS (Appendix U Tables 4.1 & 4.2) reports population and its growth as per Table 4.1

Table 4.1 – Population growth

		growth % p.a.	
	Population	**2011-16**	**2016-36**
--- the Study Area	170,757	1.3	1.1**
---the relevant LGAs (Inner West, North Sydney, Willoughby, Mosman)	368,450	1.3**	0.9
--- 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
** assumed, not stated in EIS.

The Study Area should have been Sydney east of Parramatta. The cross-harbour roads from James Ruse Drive to the east partially substitute for each other. Cross-harbour traffic volumes west of Gladesville Bridge equal those to the east. Volume to the west is growing, volume to the east is declining.

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.

Of the Table 4.1 growth figures, the most relevant population growth for project analysis is the Greater Sydney growth.

4.2 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).

4.3 Travel Time savings

The WHT EIS Figures 9-3 and 9-4 list travel time savings for start and end points of the project, but not for typical door-to-door cross-harbour journeys.

Journeys likely to be impacted by motorway access restrictions at Falcon St, Miller St and Brook St, have not been studied.

Figures 8.1 and 8.2 (EIS Appendix F, Figure 3.11) indicate road travel times savings for Australia's region best served by public transport – and thus of dubious benefit.

4.4 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 4.2 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 4.2 – 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.

4.5 Cross-harbour private travel demand 2006 onwards

See Section 8 for public transport demand.

Table 4.3 shows cross-harbour road traffic at North Sydney is stable or declining, while demand grows more rapidly the closer to Parramatta.

Table 4.3 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 4.3 – 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											

4.6 Do Minimum scenario

Table 4.4 is "WHT EIS Appendix F (Transport) Table 6-1 & 6-2 Modelled 'Do minimum' peak hour traffic demands at key locations (SMPM)" with average daily traffic and per lane data added to help understand the relationship between daily and peak-hour traffic volumes.

With 2,000 vehicles per lane per hour accepted as a maximum for cross-harbour conditions, the red numbers are a forecast of unmet demand in a "do nothing" scenario.

The Blue numbers, well under 2,000 vehicles per lane per hour, indicate Gladesville Bridge capacity cannot be realised without completion of the North Western Motorway – Sydney to Wahroonga via Rozelle.

Table 4.4 – 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.

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%** (Section 7)

However, the evidence of the Table 4.3 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.

4.7 Demand versus Capacity - Do something cumulative' and 'Do something' scenarios

4.7.1 The project

Table 4.5 is "WHT EIS Appendix F (Transport) Table 8-1 Modelled 'Do something cumulative' traffic demands at key locations (SMPM)" with per lane data to understand demand relative to capacity.

The combined SHB + SHT of 2016 is reached in 2027 by the 'Do Something' option, and exceeded by both the 2037 'Do Something' and 'Do Something Cumulative".

The evidence of Table 4.3 is that demand is not increasing, however, doing something will induce some demand. Why the northbound Sydney Harbour Tunnel should experience 30% and 45% traffic reduction while southbound experiences ~8% reduction is not explained.

The Sydney Harbour Tunnel should lose demand in both directions in a roughly equal proportions due to the WHT, with or without the Beaches Link. Part of the demand loss will be due to access restriction to and from the SHT at Miller St and Brook St.

The overall benefits of the project, in the form of the 83,000 vehicles per day using the WHT in 2037 is small.

Table 4.5 – WHT EIS Appendix F (Transport) Table 8-1 Modelled 'Do something cumulative' traffic demands at key locations (SMPM) (Morning Peak Hour)

Road Location	Lanes	Direction,	2016	2027 'Do minimum'	2027 'Do something'		2027 'Do something cumulative'		2037 'Do minimum'	2037 'Do something'		2037 'Do something cumulative'	
					total	Per lane	Total	Per lane		Total	Per lane	Total	Per lane
The project													
SHB Bradfield Hwy	3	Nth	4850	5500	5500	1833	5450	1817	6000	5800	1933	5800	1933
	3	Sth	**5500**	6050	5600	**1867**	5650	**1883**	6600	5950	**1983**	6000	**2000**
	6	*Co*	*10,350*	*11,550*	*11,100*	1850	*11,100*	1850	*12,600*	*11,750*	1958	*11,800*	1967
SHB Cahill	2	Sth	2600	2900	2650	1325	2600	1300	3200	2850	1425	2800	1400
SHT	2	Nth	**3950**	4200	2900	**1450**	2300	**1150**	4450	3300	**1650**	2950	**1475**
	2	Sth	**3700**	4100	3950	**1975**	3900	**1950**	4350	4200	**2100**	4200	**2100**
	4	Co	*7650*	*8300*	*6850*	1713	*6200*	1550	*8800*	*7500*	1875	*7150*	1788
Comb SHB + SHT/12			***1717***	***22,750***	***20,600***	***1717***	***19,900***	***1658***	***24,600***	***22,100***	***1842***	***21,750***	***1813***
West Distribr CBD	3	Nth	2550	3050	2200	733	2200	733	3300	2300	767	2400	800
	3	Sth	2800	3100	2400	800	2400	800	3350	2400	800	2400	800
	6	Co	*5350*	*6150*	*4600*	767	*4600*	767	*6650*	*4700*	783	*4800*	800

Green – reduction in demand greater than 10%, Co - Combined
Blue – increase in demand greater than 10%
Red – demand 1950 vehicles/lane.hour and over
52% of Harbour bridge Traffic bypasses the CBD in 2016 – the latest data collected by TfNSW

4.7.2 Alternate project North Western Motorway with later Western Distributor Tunnel

Recent TfNSW data shows Sydney bus passenger growth of 9.3% per annum 2014-19.

If we assume AM peak one-hour bus growth of ~4% p.a. from 2019 ~400 buses to 2037, bus volumes double in 18 years to ~800 buses with 40,000 passengers.

While the buses will fit in a 'Bus Only' lane there is not the capacity at Wynyard to receive that many passengers. Even with some passengers diverted to the Sydney Metro, a 'Bus Only' lane would be congested across the Harbour Bridge.

Table 4.6, using data from Table 4.5, compares the WHT's AM peak hour traffic forecasts with forecasts for the Harbour Bridge and Harbour Tunnel with:
--- a North Western Motorway utilising Gladesville Bridge,
--- a 4-lane Western Distributor cross-harbour tunnel,
--- conversion of the Cahill Expressway lanes to rail, and
--- cross-harbour buses replaced by trains.
As the proposed mid-CBD traffic changes will permit a choice Sydney Harbour Tunnel and Western Distributor Tunnel, sufficient traffic will divert to less congested crossings to even out flow between the SHT, WDT and SHB.

Thus, only the combined traffic is considered which will be distributed over 14 lanes instead of the 12 at present.

Per lane traffic volumes are reduced 17% compared to forecasts for the WHT-BL project.

Combined traffic in 2037, 1,500 vehicles per lane per hour (75% of capacity), is sufficiently below capacity to account for variation between lanes, and to allow fast recovery from traffic incidents. In comparison, the WHT has a similar demand (75% of capacity) with the SHT and SHB closer to capacity.

Table 4.6 – Demand on cross-harbour routes with a North Western Motorway and Western Distributor cross-harbour tunnel (Morning Peak Hour) Combined crossings Sydney North Sydney

Road Location	Lanes	Direction,	2016 per lane	2027 'Do minimum'	2027 'Do something'		2027 'Do something cumulative'		2037 'Do minimum'	2037 'Do something'		2037 'Do something cumulative'	
					total	Per lane	Total	Per lane		Total	Per lane	Total	Per lane
Comb SHB + SHT/12			***1,717***	***22,750***	***20,600***	***1,717***	***19,900***	***1,658***	***24,600***	***22,100***	***1,842***	***21,750***	***1,813***
Buses***			***400***				***600***					***800***	
(Combined 6-lane SHB + 4-lane SHT + 4 lane WDT – Buses*)/14**			***1717***	***22,750***	----	----	***19,300***	***1,380***	***24,600***	----	----	***20,950***	***1,500***
*** Bus volumes based on ~4% per annum growth.													

Table 4.7 compares AM peak-hour lane volumes for the Western Harbour Tunnel with the alternate project, the North Western Motorway.

With only four northbound lanes on the Gladesville Bridge, 1,800 vehicles/lane.hour would be exceeded in 2027 and 2037 for North Western Motorway. For an NWM, the Gladesville Bridge should be converted to 8 traffic lanes plus over-hanging pedestrian cycle lanes.

While the Western Harbour Tunnel will reach 75% of capacity in 2037, the North Western Motorway will be at 85% - a better use of infrastructure.

The cross-harbour circle of connectivity that would result from completion of the North Western Motorway would have a combined AM peak hour cross-harbour lane utilization of 80% with traffic able to redistribute over 24 lanes to reduce congestion.

The Western Harbour project compounds peak flows north of Falcon St, while the North Western Motorway traffic turning east from Lane Cove meets Counter peak traffic on the Gore Hill and Warringah Freeways.

Table 4.7 – Demand on cross-harbour routes with a North Western Motorway and Western Distributor cross-harbour tunnel (Morning Peak Hour) Combined crossings Sydney North Sydney

Road Location	Lanes	Direction,	2016 per lane	2027 'Do minimum'	2027 'Do something'		2027 'Do something cumulative'		2037 'Do minimum'	2037 'Do something'		2037 'Do something cumulative'	
					total	Per lane	Total	Per lane		Total	Per lane	Total	Per lane
Gladesville Bridge													
Parramatta River	3	Nth	1017	3800	3750	1250	3750	1250	4150	3950	1317	3950	1317
	4	Sth	913	4050	3800	950	3700	925	4300	4050	1013	4000	1000
	7	Co	*957*	*7850*	*7550*	1080	7450	1064	*8450*	*8000*	1143	*7950*	1136
Western Harbour Tunnel as per project													
Parramatta River	3	Nth	N/A	N/A	2650	883	**3600**	1200	N/A	3700	1233	**4600**	1533
	3	Sth	N/A	N/A	2650	883	**3600**	1200	N/A	3500	1167	**4550**	1517
	6	Co	*N/A*	*N/A*	*5300*	883	7200	1200	*N/A*	*7200*	1200	**9150**	1525
North West Motorway (sum of Gladesville Bridge and WHT)													
Gladesville Bridge + tunnel	5	Nth	*1017*	*3800*	*6400*	1280	**7350**	1470	*4150*	***7650***	1530	**8550**	1710
	4	Nth				1600		**1838**			**1913**		**2138**
	5	Sth	*913*	*4050*	*6450*	1290	**7300**	1460	*4300*	***7550***	1510	**8550**	1710
	10	Co	*957*	*7850*	*12,850*	1285	14,650	1465	*8450*	*15,200*	1520	**17,100**	1710
NWM lanes are 10, 8 on Gladesville Bridge plus two in Victoria Rd tunnel. However, a 7 lane Gladesville bridge is tested where northbound lanes are reduced to 4.													

4.8 Warringah Freeway 2037 "with project" forecasts

The EIS advises the following traffic volumes for the Warringah Freeway:
--- 17% increase (41,000) to 281,000 vehicles/day
--- 'without project', total cross-harbour 341,000 vehicles/day, a 32% increase
--- 'with WHT', total cross-harbour 363,000 vehicles/day, a 40% increase

If we assume 15% of WHT traffic (~13,000 vehicles per day) is to/from North Sydney, and ~6,000 vehicles/day in the Bus Lane, 344,000 vehicles/day will be on the Warringah Freeway in the Falcon St-Ernest St area. A curved screenline across the Warringah Freeway at Ridge St North Sydney and across the WHT main lanes, these vehicles have 20 general purpose lanes – 17,200/lane – adequate.

Cross-harbour traffic induced by WHT of 22,000 vehicles/day (6.5% increase) is low for a 55% increase in general traffic lanes.

Appendix 4A 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, motor cycles, 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 (see figure 4) 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.

5 North Shore traffic modelling and preferred solutions to traffic conflicts

5.1 Traffic modelling

The WHT EIS says the Operational Traffic Model (OTM) included the "NorthConnex, WestConnex, Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and F6 Extension (Stage 1) projects. It also includes "Sydney Metro City & Southwest".

However, EIS Figure 9-2 (Figure 5.1) indicates a much more restricted operational modelling for the project.

The EIS expects traffic on the A40 (Gladesville Bridge) to change little, in part due to the absence of tolling.

The A3 and A6 arterial roads, also alternate harbour crossings, are not mentioned.

EIS Figure 9.2, Operational road traffic model areas (Figure 5.1), indicates Willoughby Rd and Brook St are not modelled north of the motorway junctions.

Despite the WHT-BL project having WHT and SHT access restrictions at Miller St and Brook St, traffic was not modelled on Strathallen Av, Eastern Valley Way, Flat Rock Drive, Alpha Rd, Mowbray Rd, Frenchs Rd, Hampden Rd, Reserve Rd North and the Pacific Hwy between Bay Rd North Sydney and Dickson Ave Artarmon.

Congestion at four critical intersections (Figure 5.2):
--- Willoughby Rd/Motorway,
--- Penshurst/Mowbray/Willoughby
--- Brook St/Motorway
--- Edinburgh Rd/Eastern Valley Way
and poor network structure, limit mid-North Shore traffic growth on motorways.

Figure 5.2 also indicates:
--- two intersections on Boundary St (A38),
--- the Fullers Rd/Pacific Hwy intersection (A1/A38), and
--- Pacific Hwy/Mowbray Rd,
also suffer congestion according to Figure 5.2.

The WHT EIS says the Reserve Rd/Motorway intersection is also congested and reports a plan to widen Reserve Rd to 6 lanes.

A significant portion of the Pacific Hwy is excluded despite the St Leonards-Crows Nest Precinct Study finding the Pacific Hwy at St Leonards is already congested in peak hours (see Figure 5.3).

The RMS has a Pacific Hwy (North Sydney to Wahroonga) study in progress, or completed, but not referenced in the EIS.

The latest Warringah and Gore Hill Freeways plan (Figure 5.4) uses Reserve Rd and Dickson Ave to connect the Pacific Hwy and Beaches Link, when a direct link should be made between such major roads. Major congestion should be expected on Reserve Rd even with a widening to six lanes from Dickson Ave to Barton Rd.

All road routes out of the Willoughby LGA have congestion in peak-hours. It is not surprising that general traffic volumes are declining and public transport use is increasing rapidly.

Some simple changes to the project (Section 11) permit direct connection of some major roads to each other and avoid 'rat-running' on lower category roads as substitute connections.

5.2 Flat Rock Creek screenline

In addition to Sydney Harbour, Flat Rock Creek can be treated as a screenline. It is crossed by Willoughby Rd, Strathallen Ave and Flat Rock Creek – the latter two have other names north and south.

The only year for which TfNSW measured traffic on the screenline is 2008 for a total of 91,295 vehicles (Table 5.1).

As Willoughby Rd volumes have risen 4% over the 10 years to 2019, and Strathallen Ave have fallen 12%, we can, for an understanding of traffic changes, assume Flat Rock Drive experienced a volume change that is the average of the two – 4% decline. This results in an estimate for 2019 is 87,800 – down 3.8% since 2008, as expected from a decline in traffic crossing Sydney Harbour.

There is no information on how much of the screenline traffic:
--- enters the motorway,
--- crosses the harbour as part of the 244,750 (2016) cross-harbour vehicles,
--- destined for the lower north shore,
--- destined for the northern beaches,
--- destined to the west and south west via Gladesville Bridge.

However, the EIS does report motorway intersection performance is reported.

Table 5.1 – RMS Traffic volume viewer - Flat Rock Creek screenline 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	Willoughby Rd	Flat Rock Drive near Brook St	Strathallen Ave	Eastern Valley Way (EVW)	Difference EVW-Strat Diverted to Alpha & Mowbray
10-year growth	3.7%	Insufficient data	-11.8%	-15.1%	
2019	34,285	30,375**	23,153	29,960	6,807
2018	34,348		---	31,259	---
2017	34,885		24,215	34,040	9,825
2016	34,002		24,528	35,767	11,239
2015	33,812		24,716	36,423	11,707
2014	32,787		24,855	36,633	11778
2013	27,827		25,529	36,077	10,548
2012	15,003 N		25,684	35,540	9,856
2011	---		---	34,926	---
2010	26,752		23,940	37,094	13,154
2009	33,051		26,237	35,299	9,062
2008	33,232	31,641	26,332	---	---
2007	34,229		27,512	---	---
2006	36,702		29,186	---	---
Share of total for 3 roads ** based on average volume change of other two roads in screenline. 2008 36.5% 34.7% 28.9% of 91,295 2019 est ~39.0% ~34.6%% ~26.4% of ~87,800 More than 10,800 EVW vehicles divert to Alpha or Mowbray Roads.					

5.3 Cross-harbour conflicting road functions

The conclusions drawn by the EIS on use of keys roads must be challenged. EIS statements indented below are responded to.

> EIS 3.2.2
>
> Congested corridors and conflicting functions of roads around the Harbour CBD - demands to bypass the CBD now larger than those looking to access the CBD (see Figure 3-3). This has resulted in the most critical arterial roads surrounding the Harbour CBD, including the Sydney Harbour Bridge, the Sydney Harbour Tunnel, ANZAC Bridge, Western Distributor and the Warringah Freeway, serving conflicting functions – providing local access to a constrained CBD road network and a bypass route for through traffic.

In response to this conflict, the project ensures traffic at the Miller St and Brook St motorway ramps cannot access the SHT, and traffic at the Falcon St, Miller St and Brook St motorway ramps cannot access the WHT. This traffic can use the Harbour Bridge/Cahill Expressway/Western

Distributor to access the Eastern Distributor and WestConnex, ensuring significant conflict remains.

> Sydney Harbour Tunnel – journeys between centres north of Sydney Harbour and Sydney Airport, Port Botany and the south-west. It also provides access to the eastern side of the Harbour CBD.
>
> Warringah Freeway – key element of the main north–south and east–west motorway network. Its also used to service shorter trips within the Lower North Shore via closely spaced entry and exits.

While it is possible to use the road for shorter strips, the overwhelming majority of traffic is not local. Warringah Freeway traffic is less than cross-harbour traffic.

> Sydney Harbour Bridge – important route between North District and centres to the west, including Greater Parramatta and Sydney Olympic Park, and to the south, including Sydney Airport and Port Botany, but also acts as the primary CBD access road to and from the north.

North District traffic mainly uses roads north of the Parramatta River to approach Greater Parramatta and Sydney Olympic Park. Sydney Airport traffic uses the Sydney Harbour Tunnel. Port Botany is mainly accessed via the M5, A6 and A3.

The Harbour Bridge provides access to the Cahill Expressway which provides access to the Northern CBD in addition to the same destinations as the SHT; Northern CBD (York St, etc), and via the Western Distributor, the Southern CBD, the Inner West, A4 and A40.

> ANZAC Bridge and Western Distributor – primarily designed to provide access between the Harbour CBD and the west, rather than function as the primary arterial corridor between the Inner West and centres north of the Harbour CBD. This is evidenced by the southbound capacity from the Sydney Harbour Bridge through to the ANZAC Bridge being limited to one lane on the Western Distributor. The current and future traffic demands indicate that the majority of customers using this corridor are attempting to bypass the Harbour CBD.

The Cross City Tunnel, Druitt St and King St connections to the Western Distributor are also the start of a motorway via the Anzac Bridge and Gladesville bridge to the M2. This route was planned in the 1940s to deal with future congestion on the Sydney Harbour Bridge. Now called the A4, this route is now 5 km long. The M4-M5 link project will extend this route 2 km across Iron Cove to the A40 (Victoria Rd) at Drummoyne Figure 12.16). It will significantly improve traffic flow to and from Gladesville and Lane Cove during most of the day.

> These conflicting functions combined with the high traffic volumes on these corridors is a major contributor to the congestion and poor network performance for freight, public transport and private vehicle users on these routes and other tributaries. This is because traffic attempting to bypass the CBD is hampered by congested collector/distributor roads. This conflict results in travel speeds that are low in the AM and PM peaks and are forecast to deteriorate even further as traffic demand grows over time.

It is more true to say that Northern CBD buses and cars and Western Distributor traffic, when mixed on the Harbour Bridge, conflict each other.

As Falcon St/Military Rd traffic does not have direct access to the WHT, and Miller St and Brook St traffic will not have direct access to the SHT and WHT, this traffic will continue to use the Harbour Bridge to access the Cahill Expressway/Eastern Distributor and the Western Distributor/Inner West/ A4/ A40/ M4/ M5.

What is needed, rather than the WHT connecting to the Warringah Freeway, the Western Distributor should be connected to the Warringah Freeway via tunnels under the Harbour.

Road connections should be made such that the Harbour Bridge is devoted solely to traffic to and from the Northern CBD (as originally constructed), allowing the Cahill Expressway and Bus Lane on the bridge to be rededicated to rail traffic using the corridor from Wynyard to Milsons Point.

Ernest St

RMS had the intent in earlier versions of the project to remove the motorway ramps from Ernest St and return it to a district access road.

However, ramps have been retained for entry/exit from the Sydney harbour Tunnel. The RMS had intended reducing the road lanes and adding a wide pedestrian cycle path to the bridge.

The EIS has the Ernest St overpass widened to retain the current road lanes and add the pedestrian-cycle path and garden – in part intended to fill the excess space created by removal of the motorway access ramps.

If the median strip between SHT exit lanes north of Mount St was removed to allow vehicles to access the two western lanes, and thus Beaches Link, Miller St and Brook St, the exit to Ernest will likely not be needed (Section 11).

The entry ramp appears redundant as Falcon St provides access to the Sydney Harbour Tunnel.

5.4 Sources of congestion in the Willoughby LGA

Roads with significant congestion include:

Pacific Hwy between Boundary St and Fullers Rd

This is due to the A1 and A38 (Dee Why) routes sharing this 1 km length of road. Delhi-Millwood-Fullers-Help is also a major road for traffic between the M2, the Chatswood CBD and the LGA to the east of Chatswood – distances upto 8 km (Figure 5.3). This route is well below arterial road standard.

The Delhi Rd-M2 junction is the best west-bound motorway access point for a large part of the Willoughby LGA east of the Chatswood CBD.

This congestion is best resolved by:
--- westbound motorway ramps east of the North Shore rail Line via a road determined by local centres criteria. An east-west journey of 4 to 8 km is replaced by a north-south journey of upto 3 km.
--- a tunnel from Boundary St to the A3/M2 motorway junction. While more complex than a tunnel from Boundary St to Delhi Rd North Ryde, it gives a better outcome.

Mowbray Rd

The railway concentrates traffic to a few East-West roads – a key road being Mowbray Rd which is also used to access the M2 westbound.

This congestion is best resolved by:

--- westbound motorway ramps east of the North Shore rail Line via a road determined by local centres criteria. An east-west journey of upto 6.5 km would be replaced by a north-south journey of 1.5 to 3 km.
--- more turning capacity at the Mowbray Rd-Pacific Hwy junction. The Pacific Hwy has sufficient capacity at this intersection for extra turning traffic.

Reserve Rd Artarmon in the PM peak

Congestion arises due to a mix of local (Artarmon-Lane Cove) and motorway traffic and short traffic turning bays to the ramps.

Reserve Rd has the nearest westbound motorway ramps for the Crows Nest-St Leonards growth precinct and Naremburn and Willoughby as they can cross the railway using the Ella St and Lambs Rd railway crossings.

The Pacific Hwy experiences congestion through Crows Nest and St Leonards due to restricted opportunities to cross the North Shore Rail Line (see Figure 5.3). Cardno advise the tolled motorway ramps at Falcon St encourage some traffic to exit the motorway at the Pacific Hwy increasing congestion.

This congestion would be reduced by westbound motorway ramps east of the North Shore rail Line via a road determined by local centres criteria.

St Leonards-Crows Nest growth precinct

No allowance has been made for growth in traffic to the St Leonards-Crows Nest precinct which is expected to grow 60% in the next 20 years.

5.5 Local delays, local streets and local centres

> EIS Executive Summary - Environmental assessment - Traffic and transport impacts during operation - "During operation of the project, potential localised negative impacts include: Localised delays in North Sydney and surrounds, resulting from increased traffic demands and changes to road network operations. Transport for NSW is continuing to develop the North Sydney Integrated Transport Program to improve multi-modal transport outcomes in this area.

These localised delays are likely due to the 'rat runs' identified in Section 11 that result from a lack of direct connections between some major roads.

> • Increased demand on the Gore Hill Freeway to the north/west of the project, leading to localised increases in travel times. Potential management options for this impact include the early delivery of Gore Hill Freeway Connection integration works to increase network efficiency in the Artarmon area.

The Warringah Freeway at North Sydney (Ridge St) has 8 lanes each way. To this we add three lanes each way from the WHT – 11 traffic lanes each way.

While traffic can exit at Falcon St, Beaches Link, Miller St, Brook St, Willoughby Rd, Reserve Rd, Longueville Rd and Pacific Hwy, 11 lanes each way at North Sydney has reduced to two lanes each way at the Lane Cove Tunnel over a distance of just 4 km and 6 exit locations. As lanes are reduced at exits, there is the potential for continuing traffic to exceed the capacity of the remaining lanes.

The Gore Hill Freeway Connection integration works are the Beaches Link integration works at Artarmon according to the BL-GHF Connection scoping report of October 2017. As Beaches Link will induce a traffic shift from Warringah Rd to Beaches Link, we should expect an increase in traffic wishing to enter the Lane Cove Tunnel at Artarmon. Bringing forward the Beaches Link works should not improve outcomes for the WHT-WF project at Artarmon.

> EIS Executive Summary - Environmental assessment - Social and economic impacts – Improve pedestrian and cyclist accessibility and connectivity of active transport routes, which would bring long-term benefits for community cohesion.

Active' transport routes need to include district roads, such as Miller St, Willoughby Rd, Mowbray Rd and Penshurst St, if active transport is to substitute for car travel to local centres and neighbouring centres. In this regard, traffic to and from motorways should not be by roads that link local centres where possible.

5.6 Motorway junction spacing

The project plan increases the freeway junctions between Lavender St Milsons Point and the Pacific Hwy Artarmon. There will be 11 cross-harbour junctions in 6 km – an average of a junction every 600 metres. RMS guidance is for ramps every 2 to 4 km for motorway efficiency.

Junctions every 600 metres is a result of the volume of cross-metropolitan traffic brought together on the Warringah Freeway which is effectively 8 lanes each way. The WHT effectively adds another 3 lanes each way. The EIS Section 3.2.2 claims that a significant portion of the Warringah Freeway traffic is local, but that does not reflect the anecdotal evidence and the fact that Warringah Freeway traffic volumes are less than Sydney Harbour Tunnel plus Sydney Harbour Bridge volumes.

Between Falcon St and Reserve Rd, there will be four junctions in a row with city-facing ramps, but no north-facing ramps. Ramp provision is unbalanced as it was not rebalanced when the M2 and M7 were built.

5.7 Local travel to access motorway in westerly direction

Local travel distance to access the motorway in the westerly direction is up to 8 km for people in the east of the Willoughby LGA (Figures 5.5 & 5.6). This is often travel on congested roads – roads congested due to this traffic. Westerly direction motorway access east of the North Shore Rail Line would significantly reduce congestion in much of the LGA.

5.8 Choice of motorway access location - Brook St preferred

Falcon St, Ernest St, Miller St and Brook St will have reduced connectivity if the project proceeds as planned. Willoughby Rd will experience a traffic increase as a result.

Willoughby Road is favoured by TfNSW for motorway access as this intersection is further from the harbour crossing and thus suffers less congestion. Maximised motorway traffic flow is prioritised over all local considerations.

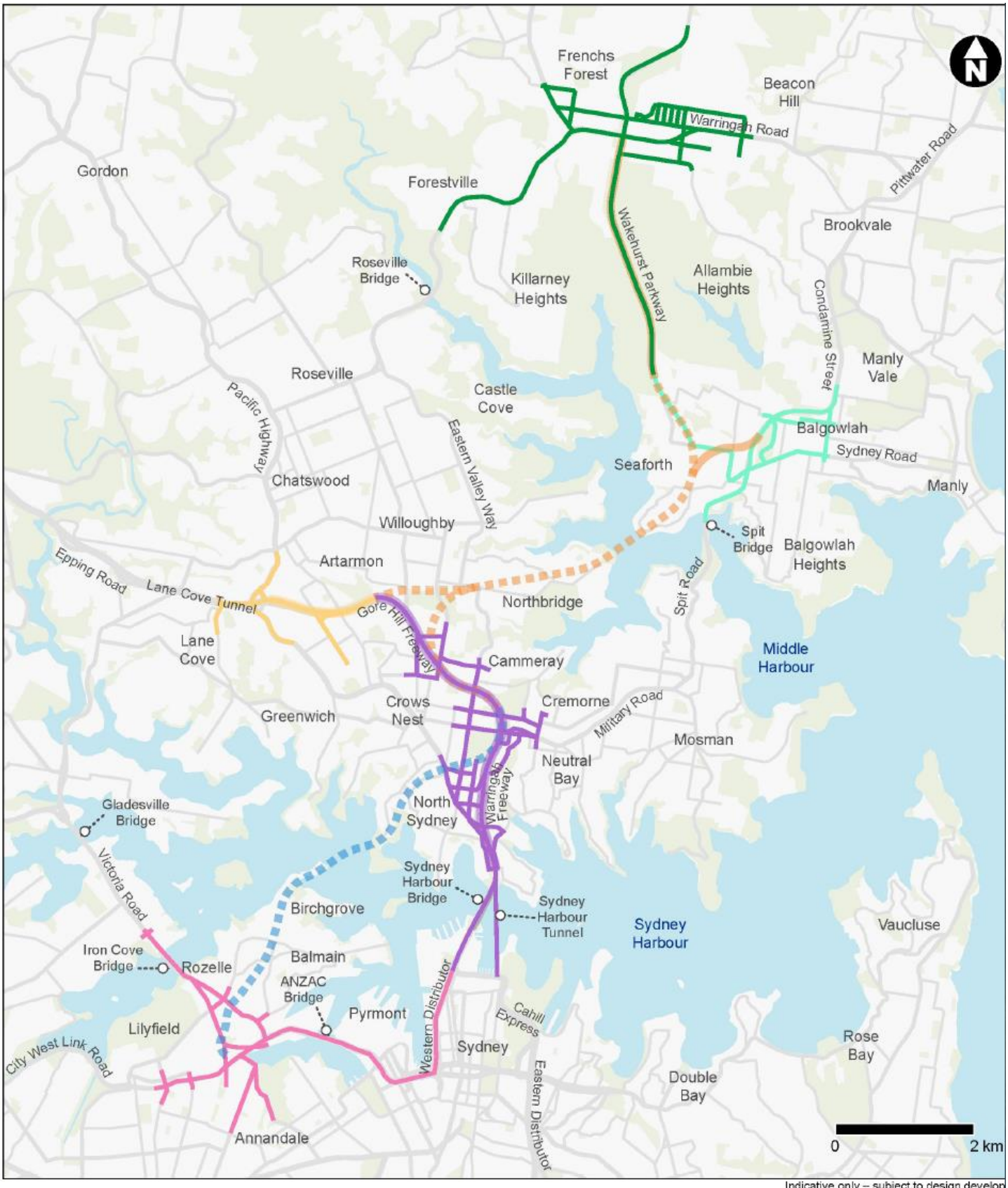
Thus, traffic for the mid-North Shore is being concentrated on the main district road linking Chatswood, Willoughby, Naremburn, Crows Nest and St Leonards (Figure 5.7). There will be even greater conflict between local and cross-regional traffic.

The conflict of local and cross-regional traffic on Willoughby Rd is not addressed.

However, in regards to the conflict, the EIS Executive Summary - Environmental assessment - Traffic and transport - Traffic and transport beneficial outcomes – advises “Returning local streets to communities by moving traffic underground, freeing up local streets for local traffic, and supporting the sustainability of local town centres”.

Measured at a key link road, Merrenburn Ave, Willoughby Rd and Brook St are 350 metres apart. At Chandos St, they are 265 metres apart. The closeness of Willoughby Rd and Brook St, and their nearby links, make them alternatives for each other.

The project can address network structural issues by using Alpha Rd/Flat Rock Drive/Brook St as the main mid-North Shore motorway access road as:
--- it does not pass through any local centres,
--- it is well positioned to distribute traffic to local centres, and
--- only 100 to 150 dwellings would be subject to extra noise and traffic compared to thousands of residents and local centre users on Willoughby Rd if more traffic is directed there – Figure 5.7.



Legend

Operational features

- Western Harbour Tunnel
- Beaches Link
- Warringah Freeway Upgrade
- Gore Hill Freeway Connection

Operational model areas

- Rozelle and surrounds
- Warringah Freeway and North Sydney
- Gore Hill Freeway and Artarmon
- Balgowlah and surrounds
- Frenchs Forest and surrounds

Figure 9-2 Operational road traffic model areas

Figure 5.1 – EIS Figure 9.2 Operational road traffic model areas

Figure 5.2 – Congestion points in the Willoughby LGA (Source- Willoughby Draft Transport Strategy)

Figure 4-15 Daily Vehicle Volumes 2016

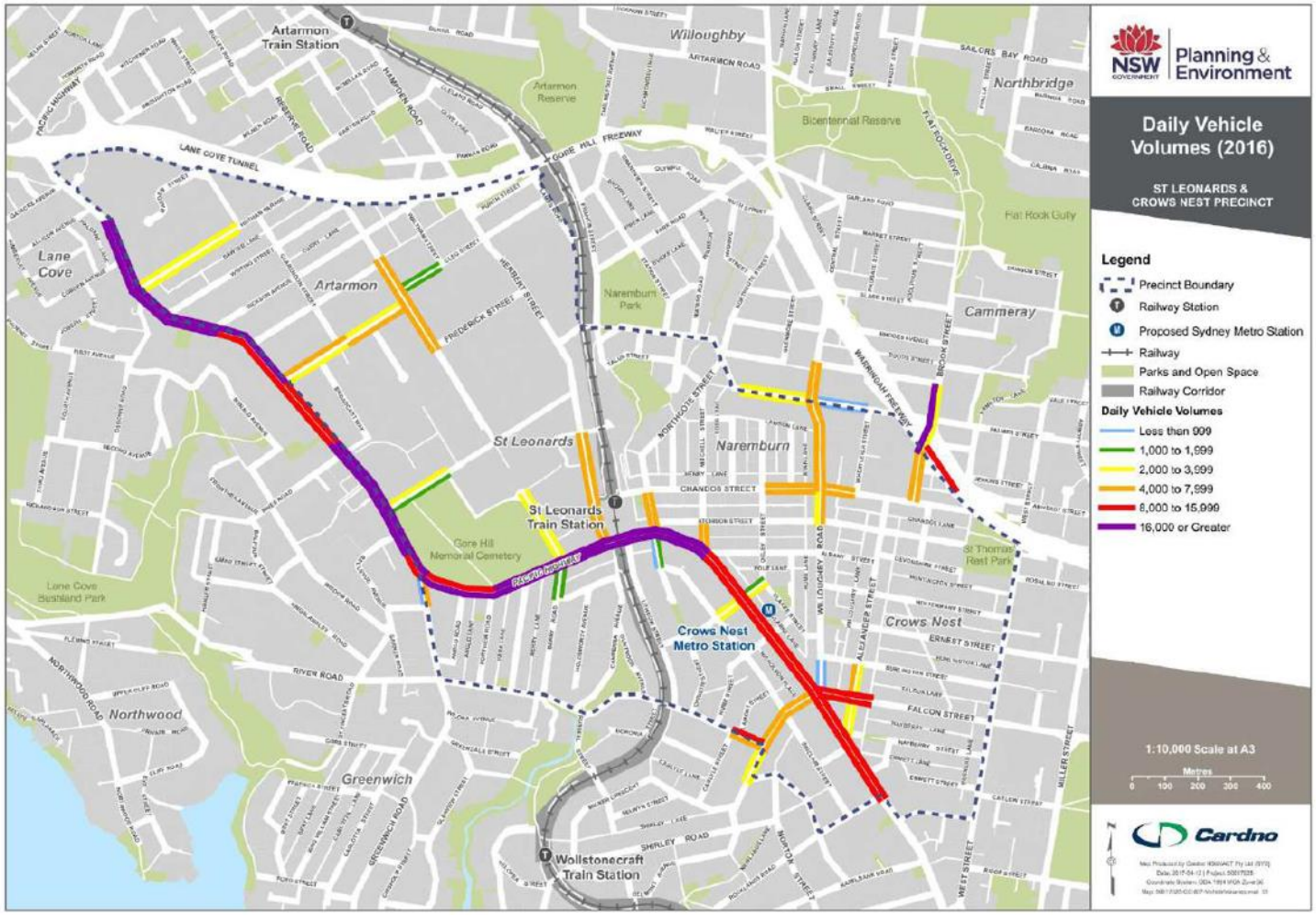


Figure 5.3 – Traffic congestion on Pacific Hwy at St Leonards - Cardno precinct traffic study

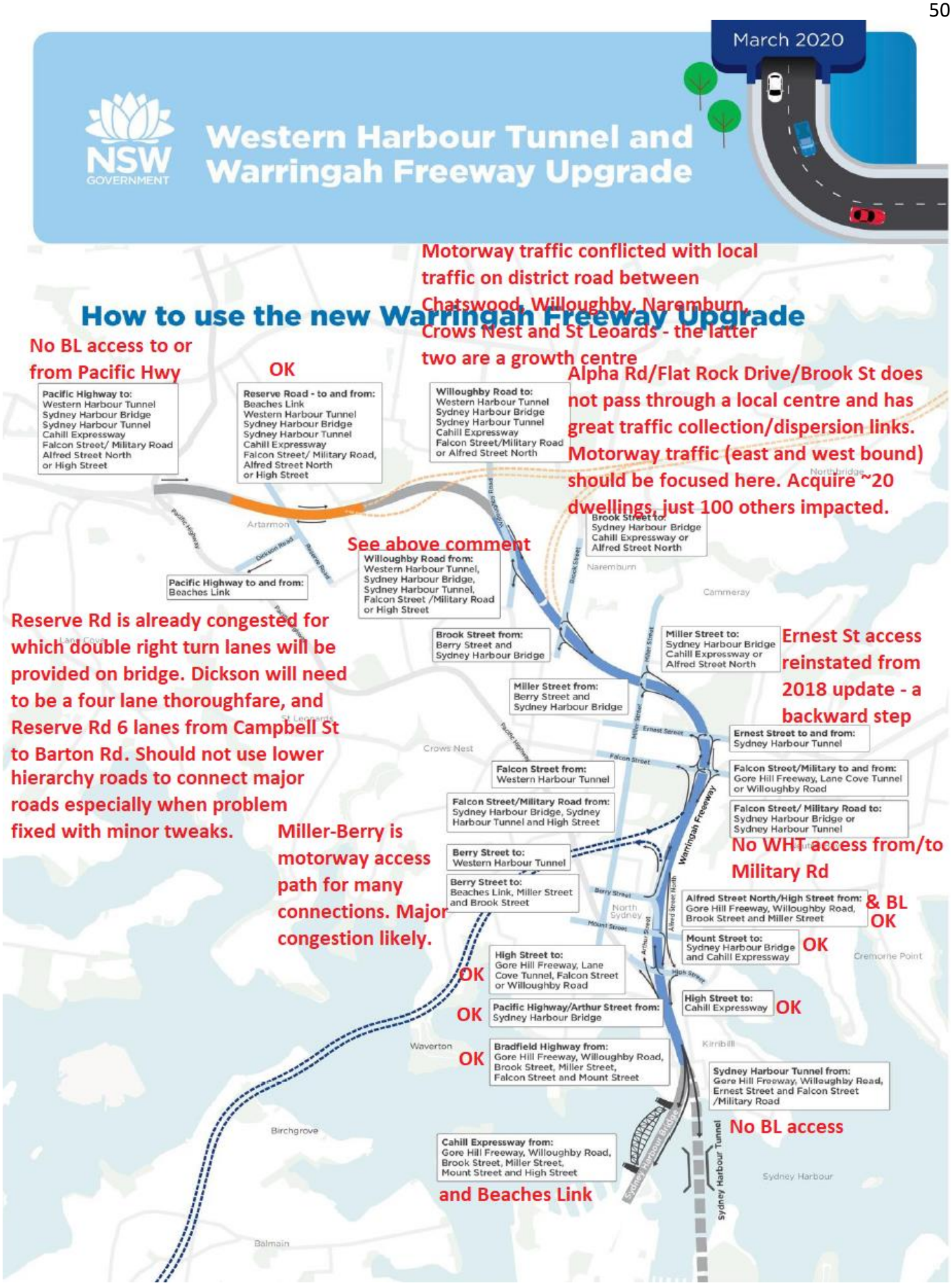


Figure 5.4 – WHT-WF upgrade diagram released post EIS preparation.

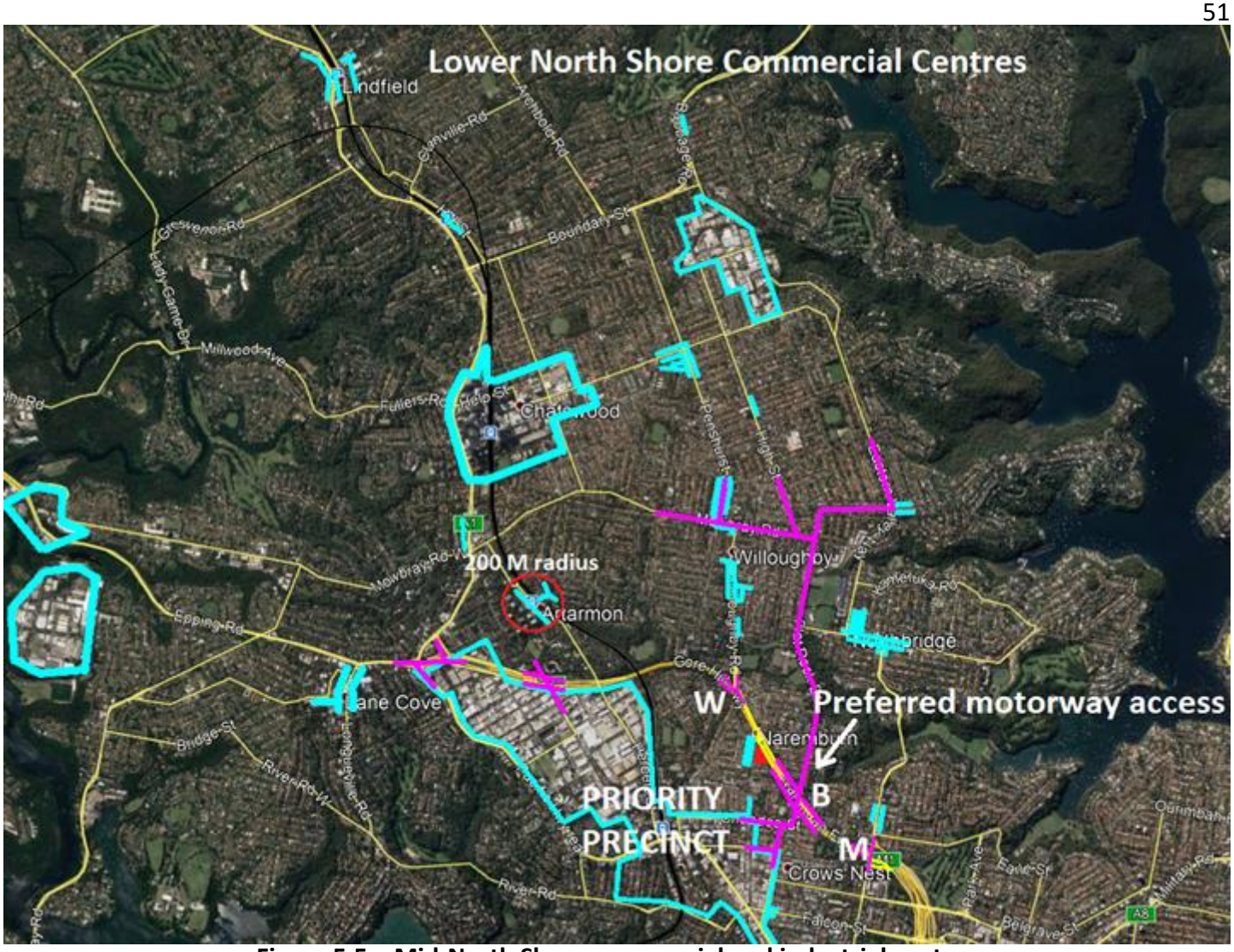
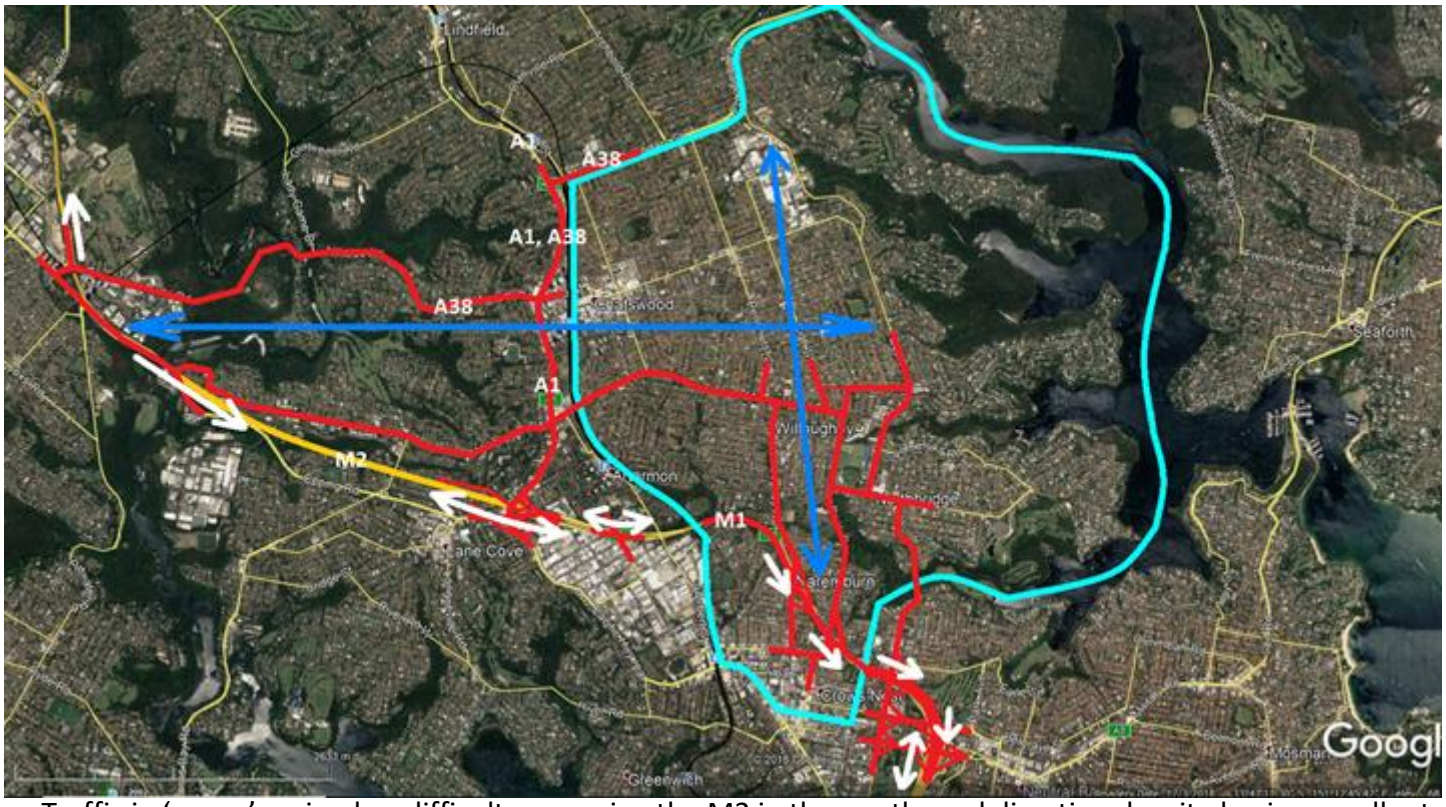


Figure 5.5 – Mid-North Shore commercial and industrial centres



--- Traffic in 'acqua' region has difficulty accessing the M2 in the westbound direction despite having excellent access in the southbound direction, although this will be reduced by the WHT project as presently planned. Westbound motorway access east of the North Shore Line will greatly reduce peak-hour traffic congestion on the Mid-North Shore.

Figure 5.6 – Congestion in area bounded by NSRL, A38, Middle Harbour, West St, Ernest St and Pacific Hwy

Figure 5.7 – Focus motorway traffic on Brook St to avoid cross-region traffic passing through local centres

6 Road pricing (taxation including tolls)

6.1 Current toll system

The state government is studying, with an intent to sell, the future toll income of:
--- the Western Harbour Tunnel,
--- the M1 from Lane Cove to Eastern Distributor, and
--- the Sydney Harbour bridge,
to reduce its debt.

The level of toll, and even whether it goes to government or a private company, impacts demand for tolled road travel and displacement of traffic to non-tolled roads. People who object to, even hate, the government's sale of tolls (taxes) minimise their use of roads with private tolls.

While demand is inelastic to tolls in the short term, they have a large impact on travel patterns in the longer term. Some workers spend $8,000 per year on tolls to and from work, prompting the registration cashback. The raising of the Harbour Bridge toll from $0.20 to $1.00 in 1987 saw an end to cross-harbour traffic growth until the Sydney Harbour Tunnel opened in 1992 (Section 4).

Road pricing includes fuel tax which is only levied on fuel used by roadgoing vehicles.

Electric vehicles are not subject to current fuel taxes. These, and more efficient internal combustion vehicles, have led to a relative decline in fuel taxes and a relative decline in total specific transport taxes. The likely government response is 'per kilometre' pricing.

There has been a shift in tolling from a toll for passing a point on the road network, towards tolling distance travelled. The present toll system is a mix of these pricing methods. Every change in tolling base has resulted in win-fall gains to private toll operators. This includes imposition of the 'triple toll' for heavy vehicles (vehicles over 4.5 tonnes).

Tolls also increase at 1% every 3 months – there are thus 159 increases in tolls over 40 years. The final toll will be 4.8652 times the initial toll. Consumer prices will rise over that time assuming CPI increases of:
--- 1% p.a., 1.49 times
--- 2% p.a., 2.21 times
--- 2.25 p.a., 2.435 times x2 = 4.870 times
--- 3% p.a., 3.26 times
--- 4% p.a., 4.8010 times

There is a high likelihood tolls will increase at twice the consumer price index over the next 40 years while other transport costs are likely to fall due to electrification and vehicle systems consolidation (electrical, power and heat management systems) in a similar manner to consolidation of many functions into phones that led to smart phones.

Current tolls are regarded as high resulting in government giving cash back to individuals needing to drive long distances. The 'cash back' applies to public and private tolls.

These 'cash backs' demonstrate tolling can be varied for social or economic reasons. This further demonstrates the tax nature of road tolls.

The more compact nature of EVs will see much greater variety of local travel two-, three- and four-wheel vehicles which will change parking requirements – particularly increasing them in apartment buildings, and changing the mix of spaces in retail centres.

The present system of selling 40 years of toll income streams (taxes) for short lengths of road, for a lump sum, freezes for 40 years a major road demand and environmental management tool.

The tax power of government ensures governments carry less financial risk than businesses operating in the business environment enabled by the government.

The sale (loss) of reliable taxes (government income streams) must increase the investment risk for investment in government bonds. The cost of finance to the private sector is far higher than to government. The lower the interest rate/cost of capital, the higher the private sector values the income stream. Presently, income received by the NSW government is valued 3 to 4 times higher than when received by Transurban. However, the interest/cost of capital spread is about 3%. As

inflation rises, the value difference falls, but will be far from equal. The credit rating agencies are rating their preferences for private ownership as much as they rate risk.

Based on the cost of finance, future revenues are worth far more to government than the private sector. The sale of a tax warrants a government credit rating downgrade and consequent lower prices for government bonds.

The financial size of a business or government is not material to investment ratings unless they are of a size to cause systemic risk to worldwide investors.

The sale of taxes (toll income stream) for 40 years commits future government to compensate owners of the income streams for any action by government detrimental to the income stream. While any government action that results in an increase in income goes to the companies as a winfall gain. Australia's largest private toll collector, Transurban, has received many winfall gains as motorway network extensions have increased traffic on existing sections of motorway.

The system of winfall gain at the expense of NSW residents should be regarded as another revenue leakage warranting a downgrade in the risk rating of government bonds.

Government bonds are an efficient means of investing in the state economy of which the community transport network is a prime enabler. Government collection of the reliable toll income, more reliable than property taxes, lowers the risk for bond investors.

Current debt impacts interest paid, but is not a guide to future debt or capacity to pay interest. There is a misallocation of risk by the private rating agencies which favours private collection of taxes in the form of tolls.

6.2 A method for transfer of road tolls back to government

The NSW government could buy Transurban and sell-off the non-NSW part of the business to regain control of the NSW motorway network, or it could follow the more gradual approach:

1. Create a government-owned Tolls Collection company whose purpose is purchase, placement and maintenance of NSW road tolling infrastructure, and receipt and distribution of road tolls.

2. Government agrees payments to private toll owners based on projected future toll collection under current agreements and current road network, and the savings to motorway operators in the cost of toll collection. Major point of consideration are:

a) the unsustainability of 1% per quarter year private toll increases in a low inflation environment,
b) vehicle electrification which will require change to per-km road use charges,
c) vehicle automation will permit route selection to minimise tolls based on live traffic monitoring,
d) the increased share of transport costs private motorway tolls will represent - which has the effect of diverting traffic to the arterial road network, causing its congestion, while motorways are under used.
e) a suitable a dispute resolution procedure.

3. Government redesigns motorway tolls - suggest per kilometre charges only. Eliminate present charges for passing toll points. Adjust tolls for vehicle weight classes and zone of metropolitan area in which toll collected. Based on high concentration of tunnels and bridges within the area, toll zones should be:

a) within 10 km radius of the Sydney GPO tower, and
b) outside 10 km from the GPO tower.

4. Toll Collection company's surplus, after paying private toll operators and its own costs, be transferred to government to assist fund transport infrastructure and services.

5. Government retain toll collection indefinitely as:

a) it is a tax,
b) the government's lower cost of capital. Bond rates are about 3% below large operator Transurban's cost of debt and equity. Bond costs in the form of interest are presently around 25% of private debt and equity costs.

7 Freight

EIS Section 9.4.1 advises the “project would provide substantial travel time savings for freight vehicles, improving productivity and increasing the efficiency of the freight network, particularly for freight trips that currently use the Sydney Harbour Bridge”.

Figure 7.1 indicates the A6, A3, A40, Western Distributor and Eastern Distributor are lightly trafficked by heavy vehicles compared to the M2, M4, M7 and M5 – due to industry locations in the Sydney basin.

Hazardous freight, like fuel, is not permitted in tunnels, such as the Western Harbour Tunnel, and will continue to use aboveground routes. The A6 and A3 will remain preferred routes for transport of hazardous goods.

The A6 arterial road has great connections to Sydney’s major freight roads. It is midway between the Warringah Freeway corridor and the M7. It links the M1 at both ends – in the north this is achieved via NorthConnex which is due to open mid-2020.

With Sydney freight, and expected freight growth, mainly confined to A3 arterial Road and roads to its west (except for port access via the M5), an A6 upgrade to a limited access 80 km/h road is the highest priority road freight initiative in Sydney.

An A6 upgrade (Figures 7.2 to 7.5) should have greater priority than the F6 motorway which will direct more traffic towards the traffic constrained Sydney CBD.

The coming electrification of all vehicle types, including trucks, gives them great hill climbing performance without pollution.

Road grades of ~6.5% remain suitable for motorways where there are distance or environmental savings.

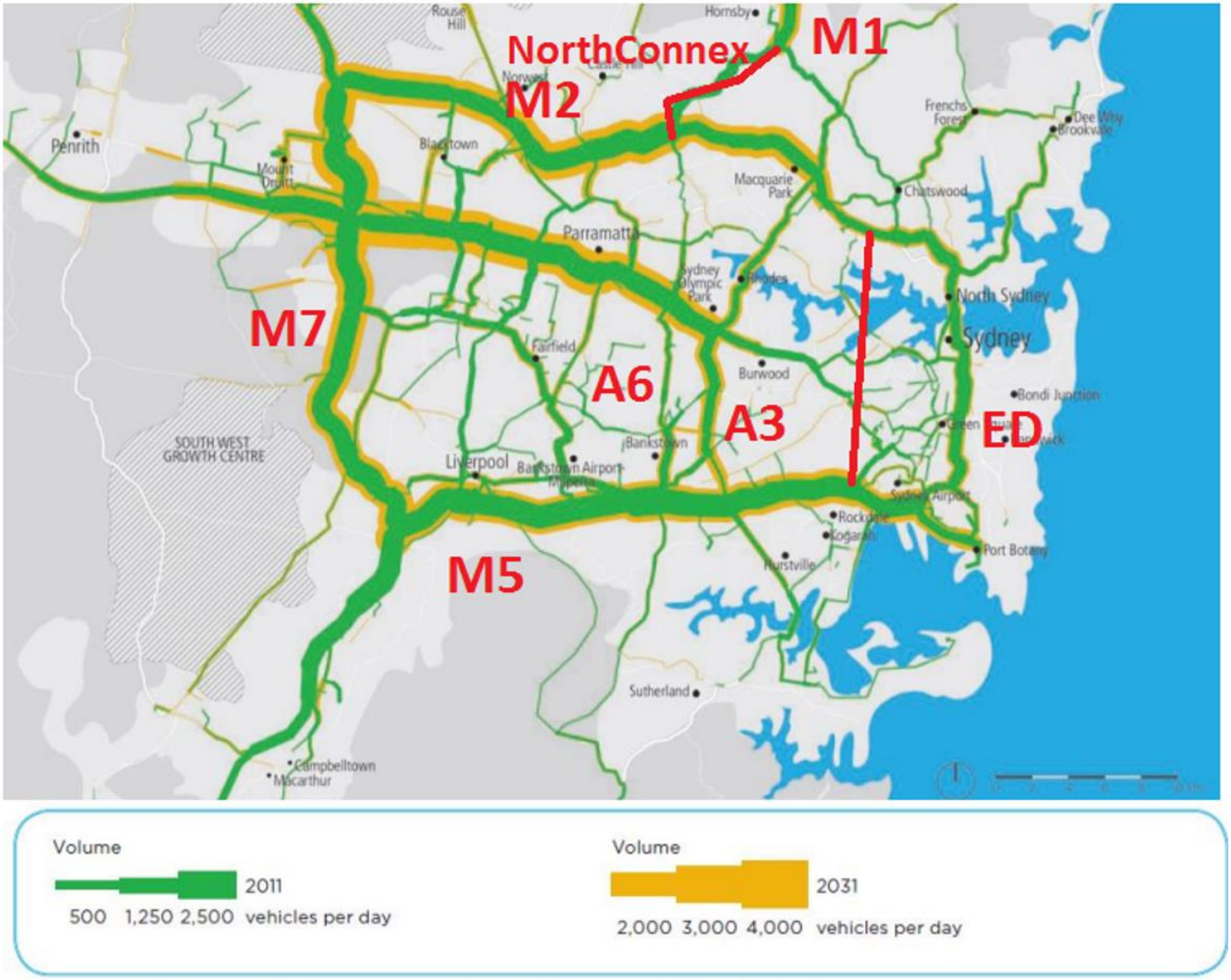
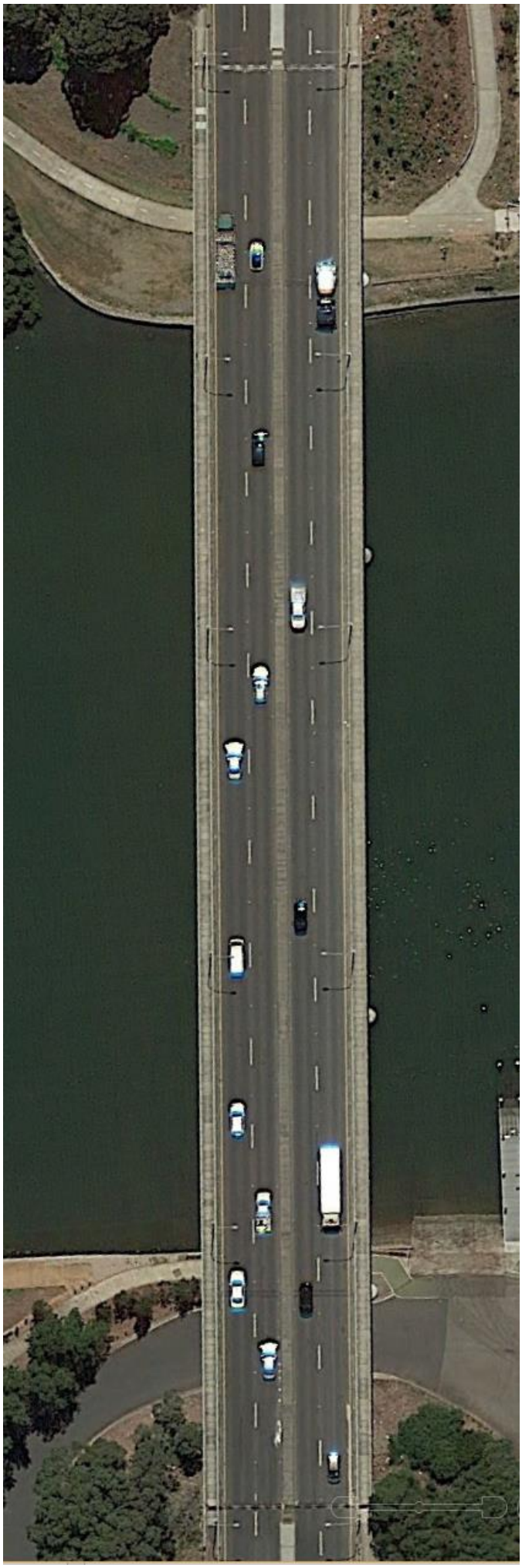


Figure 3-6: Heavy vehicle movements in Sydney, 2011 and 2031

Source: TfNSW, LTTMP, 2012a p.282

Figure 7.1 – Sydney heavy vehicle traffic, current, projects, and main road relationships

Figure 7.2 – Six-lane Dundas Valley tunnel to replace 4-lane Marsden Rd through residential suburbs



Bridge 21.95 m (72 feet) wide. Refurbish with six 3.3 metre lanes and overhanging pedestrian-cycle paths each side.

Figure 7.3 – Silverwater Bridge on A6 arterial road across the Parramatta River

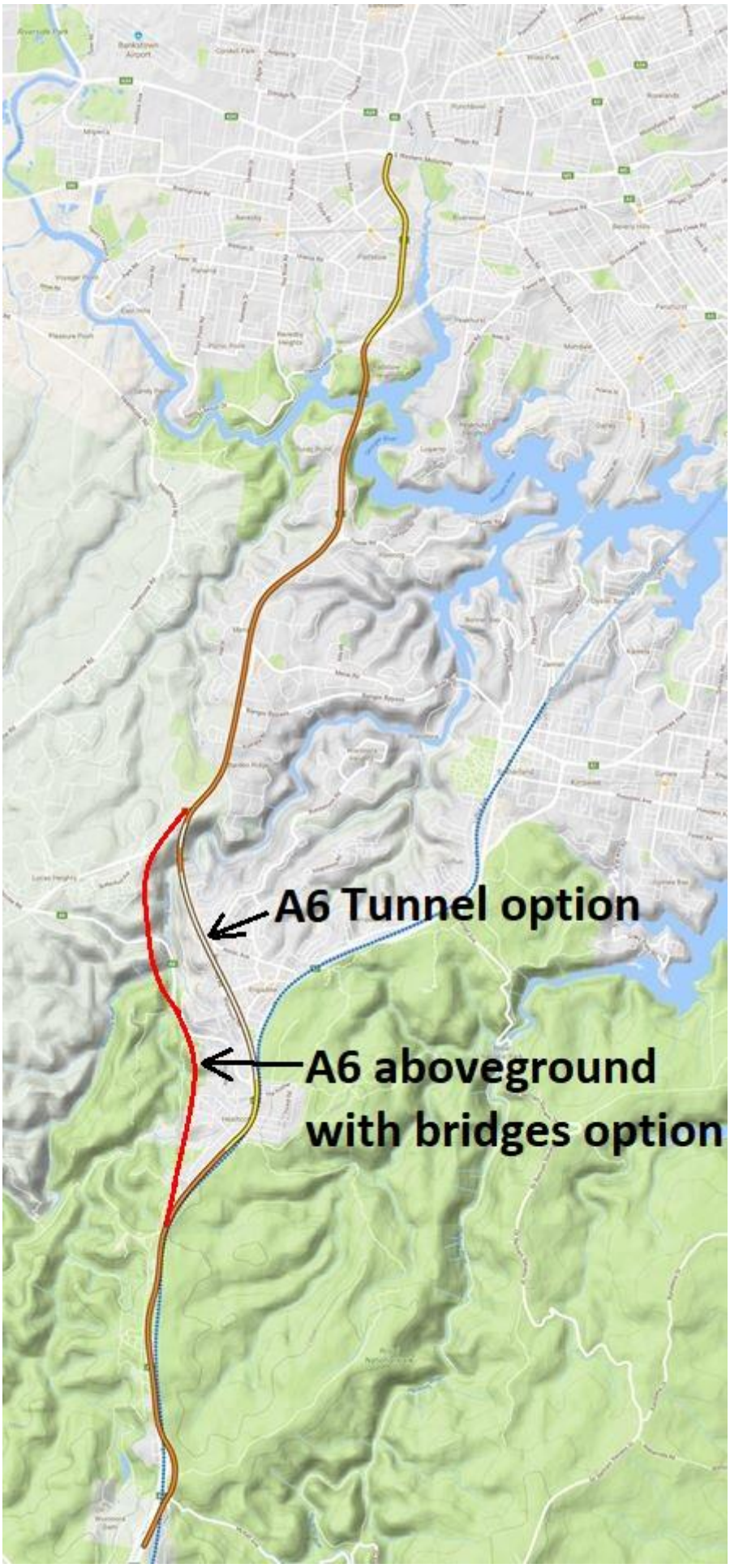
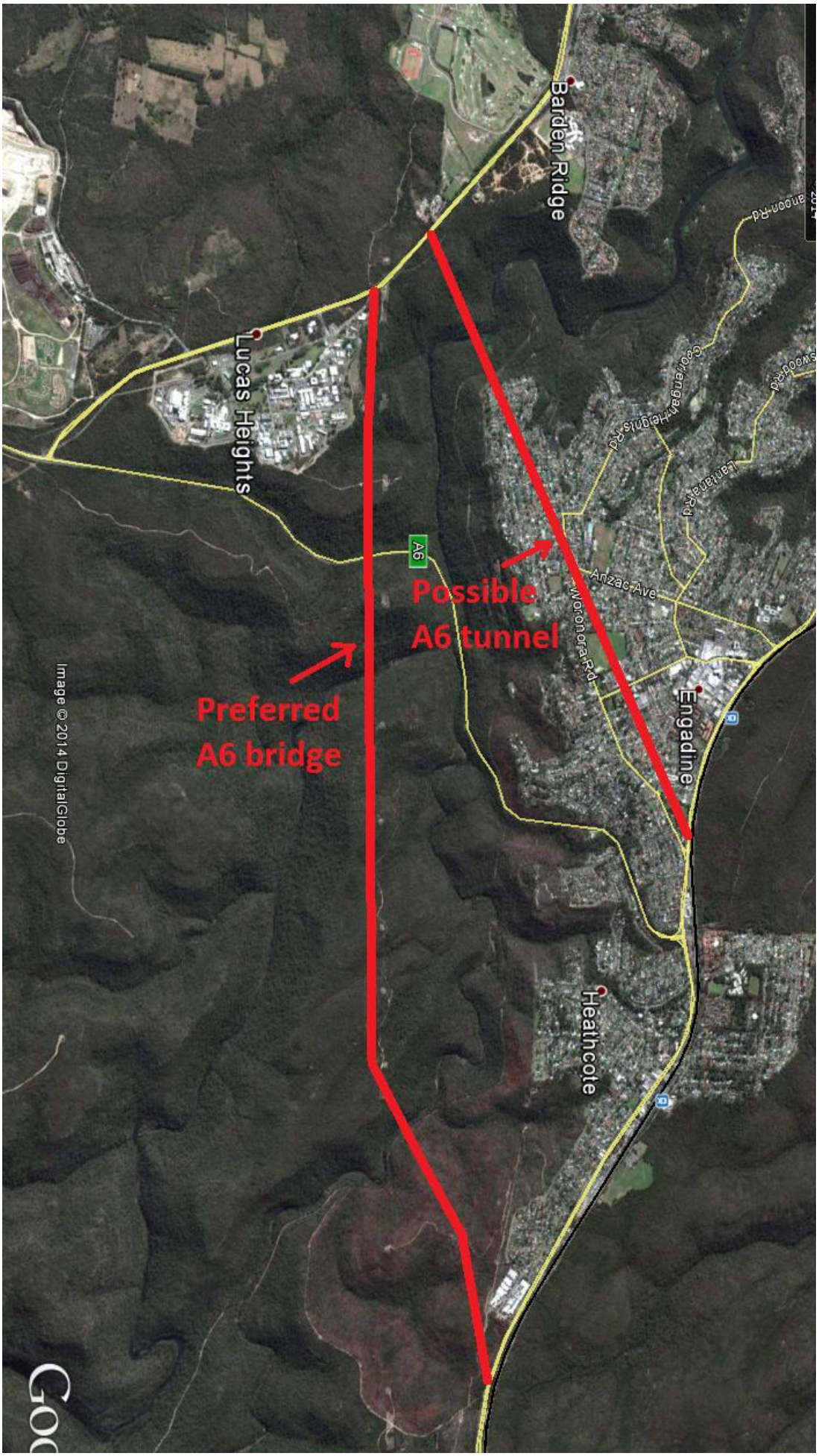


Figure 7.4 – Broad A6 arterial road options from Barden Ridge to Heathcote



A bridge is preferred as it caters for all vehicle types including hazardous goods.

Figure 7.5 – Broad six-lane A6 arterial road options from Barden Ridge to Heathcote - aerial view

8 Public Transport

8.1 Public transport benefits of WHT small relative to alternatives

The project benefit for job accessibility within 30 minutes is small compared to possible public transport options.

WHT EIS Appendix F, Figure 3-11 (Figures 8.1 and 8.2) demonstrates the change in the percentage of jobs accessible within 30 minutes by motor vehicle in the AM peak as a result of the WHT-WY project in 2037.

The triangular area that benefits most is bounded by St Leonards, Balmain, Newtown and Bondi Junction. This is the area of Australia with the highest concentration of quality public transport. The job benefits would appear small compared to those enabled by public transport.

The WHT would support bus public transport access for the USyd/RPAH precinct staff and students living on the North Shore who presently walk from the Redfern Rail station – perhaps after changing from a bus to a train at Wynyard. It may also suit some staff and students who would otherwise need to change from the Sydney Metro to a bus at Central.

Bus services via the WHT to Sydney CBD and Broadway will need to terminate in the Central Station precinct due to bus congestion on Elizabeth St.

The primary benefit of extra cross-harbour road lanes is the opportunity to convert Harbour Bridge lanes to rail transport.

Trains are a superior form of public transport to buses due to direct routes unobstructed by other traffic. Lower train passenger demand growth, relative to bus demand growth, is due to poor metropolitan coverage of the rail network and limited travel options due to the radial nature of the rail network – it is particularly poor for metropolitan travel in the north-south direction. The rail network wider structural issues should be addressed as part of the metropolitan rail network enhancement.

New rail lines induce a switch from private vehicles to trains due to the superior speed and comfort of trains especially in peak hours. A third cross-harbour rail line will reduce travel demand for the Warringah Freeway corridor.

8.2 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 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. 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.

8.3 Public Transport travel demand

The 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 8.1 gives aggregate public transport data reported in the Sydney Morning Herald (Feb 2020).

Table 8.1 – 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 8.2 gathers public and private transport data for the Harbour Bridge.

Table 8.2 – 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 8.3 presents growth in cross-harbour public transport traffic to 2037 at different rates due to the recent growth rates reported in Table 1.

Table 8.3 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.

8.4 Cross-harbour rail capacity additional to Sydney Metro

As noted in Section 4, 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 (Section 3) 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 8.7 to 8.10).

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 8.12.

See Figures 8.4 to 8.6 and 8.11 to 8.15 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 8.13 to 8.15).

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 8.1 – 2011 buses crossing harbour Bridge in AM peak hour (379 buses), and proposed diversion to Cahill Expressway (55 buses)

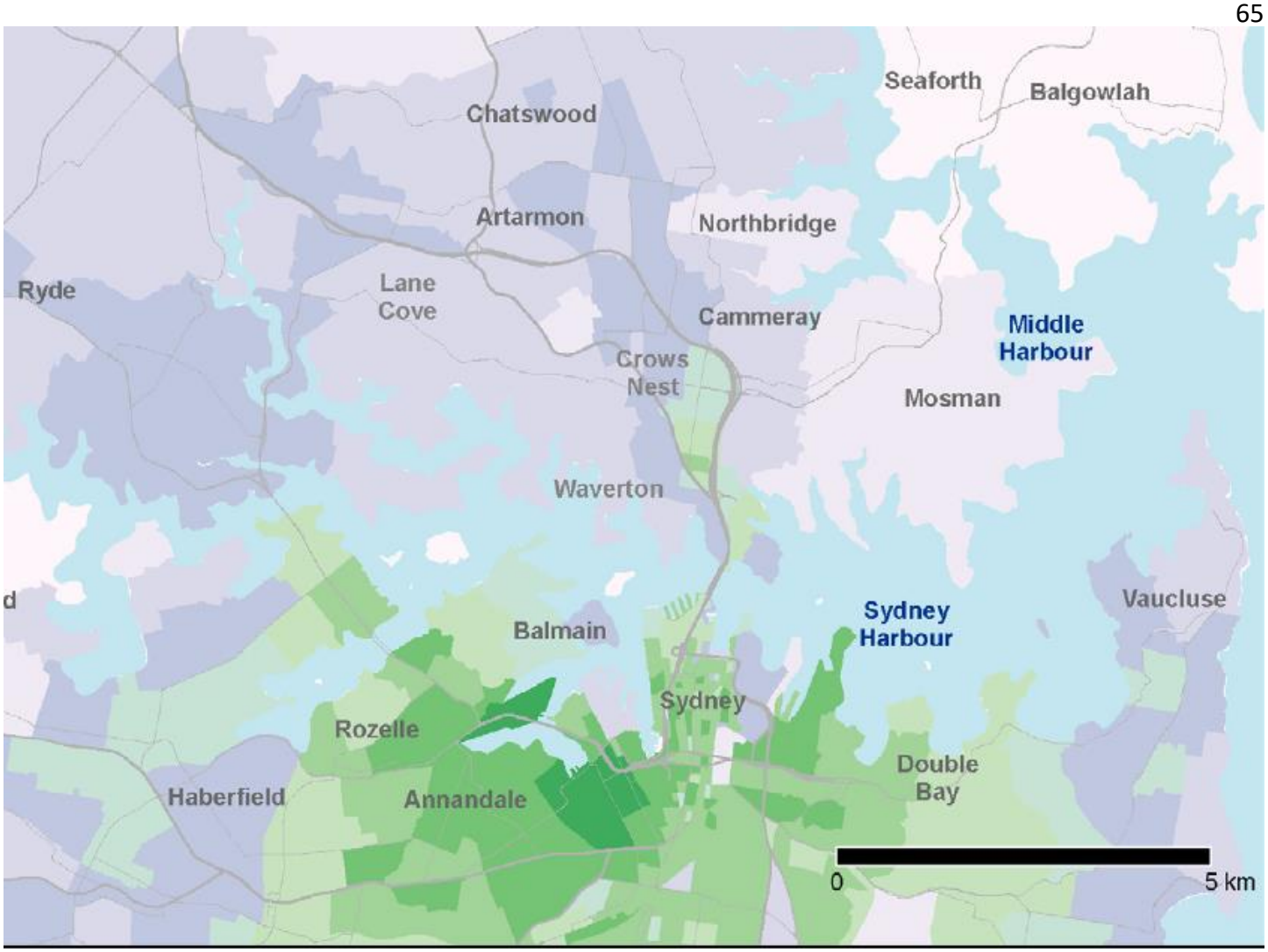
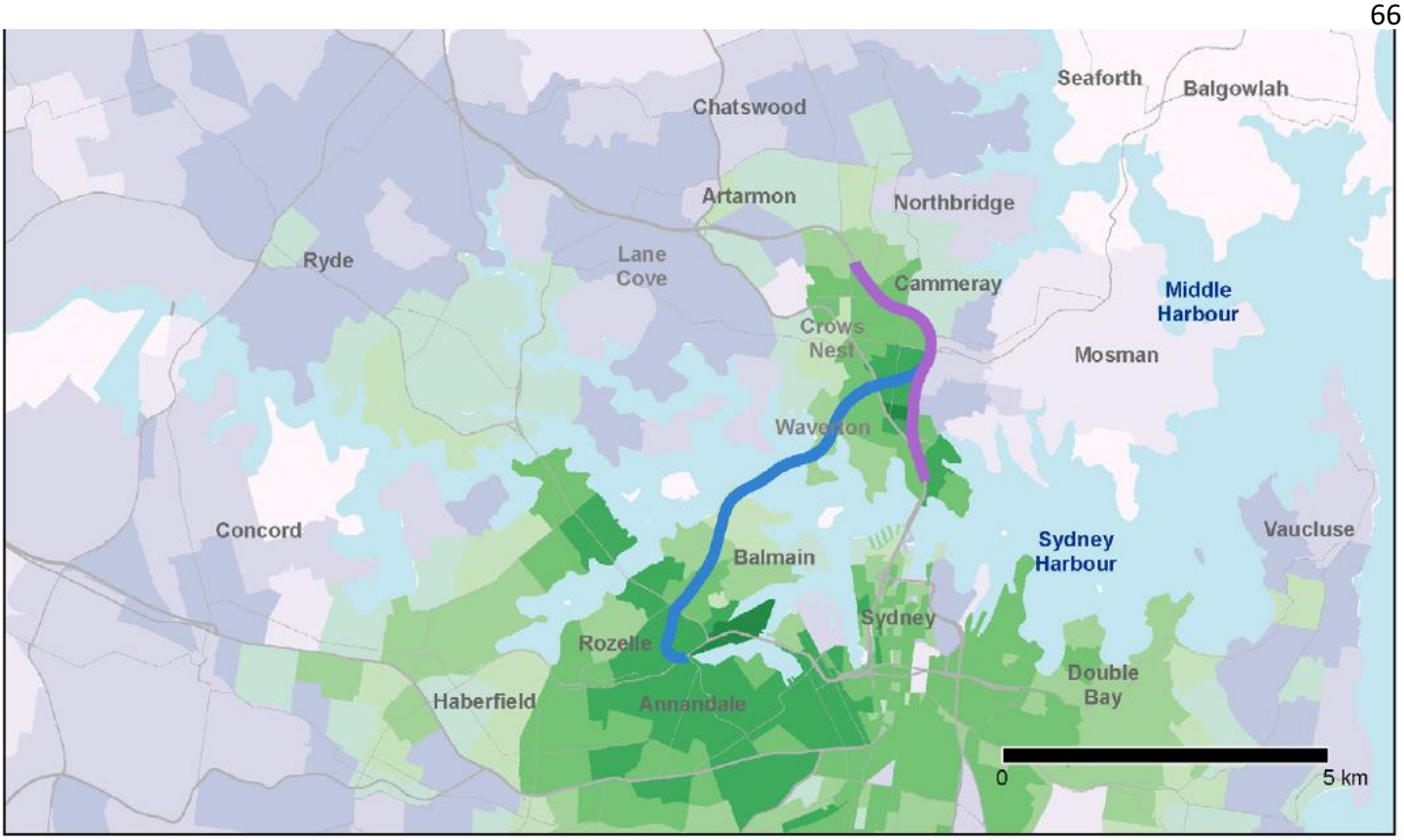


Figure 8.2 – EIS Figure 3-11 (Part 1) Percentage of jobs withing 30 minutes in 2037 without project



Legend

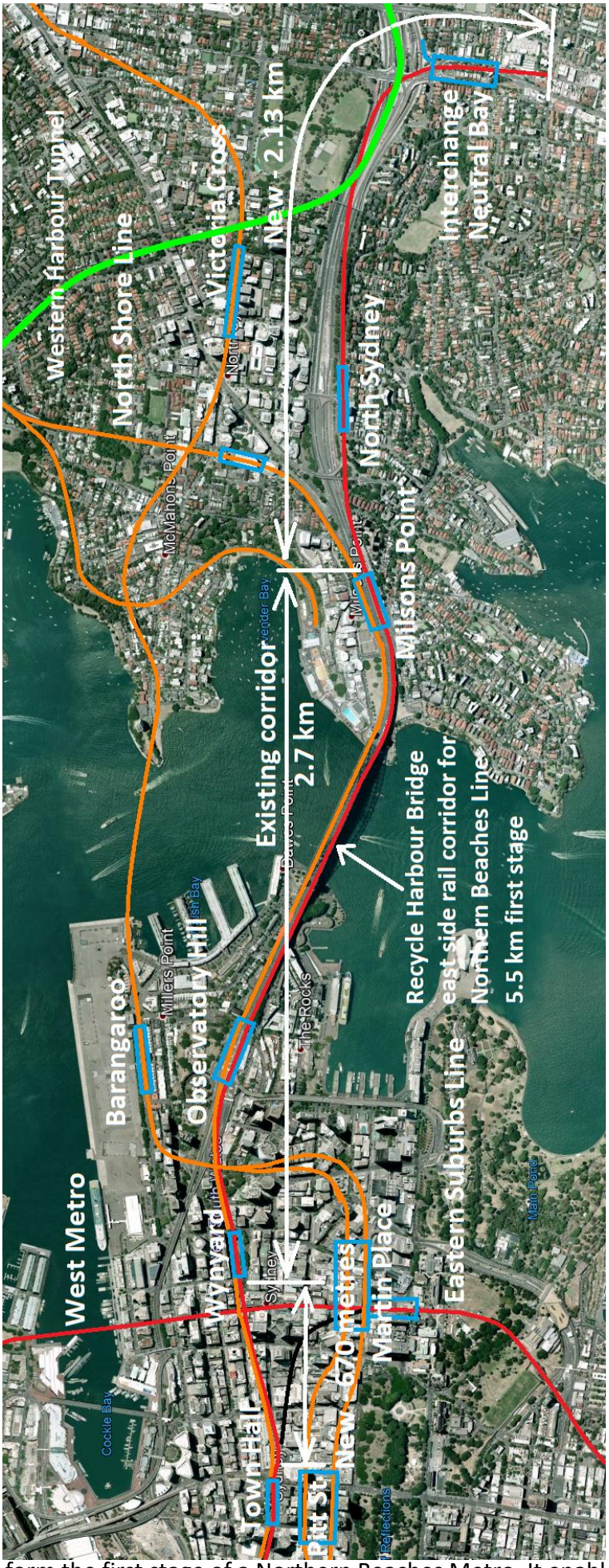
Operational features

- Western Harbour Tunnel
- Warringah Freeway Upgrade

Percentage of jobs within 30 minutes

- 0% to 5%
- 5% to10%
- 10% to 15%
- 15% to 20%
- 20% to 25%
- 25% to 30%
- 30% to 35%
- 35% to 40%
- 40% to 45%
- 45% to 50%

Figure 8.3 – EIS Fig 3-11 (Part 2) Percentage of jobs withing 30 minutes in 2037 with project



--- 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 8.4 – 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

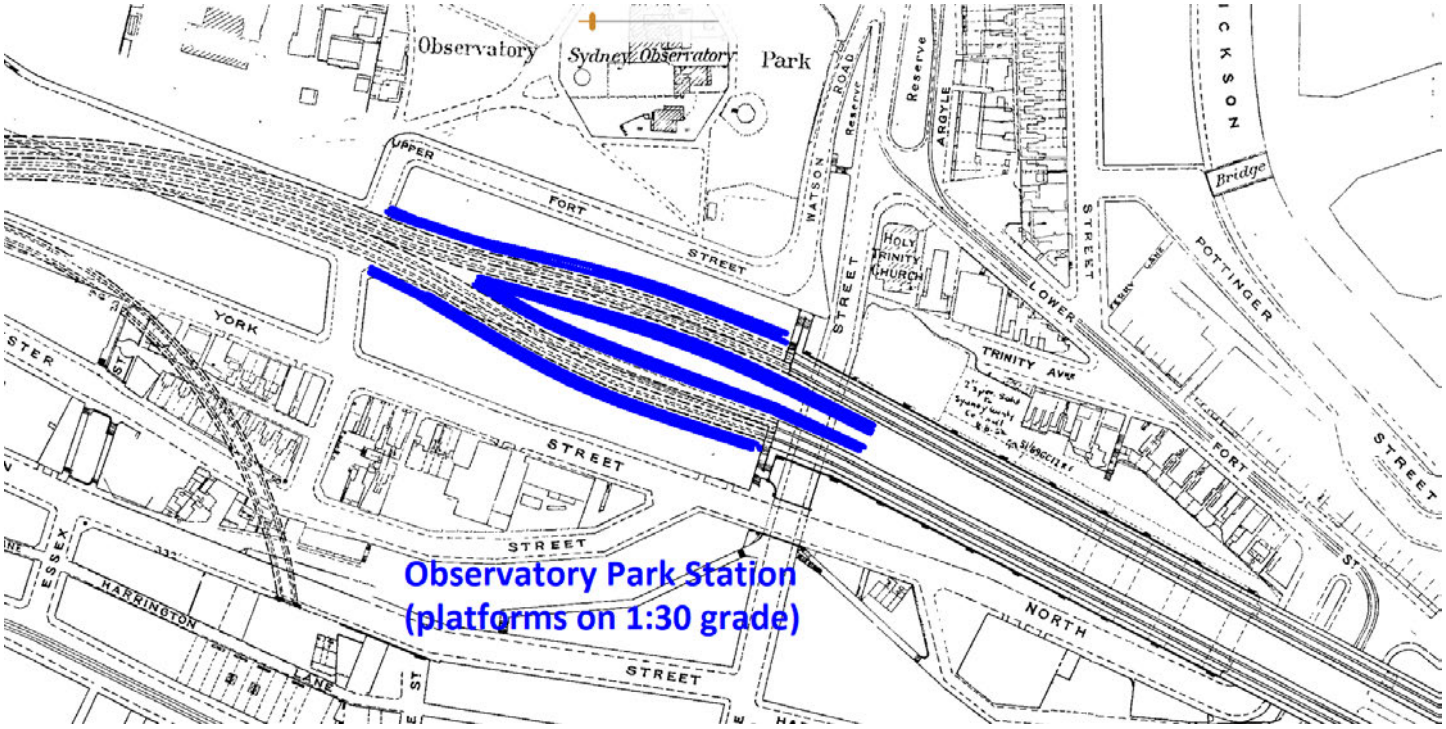
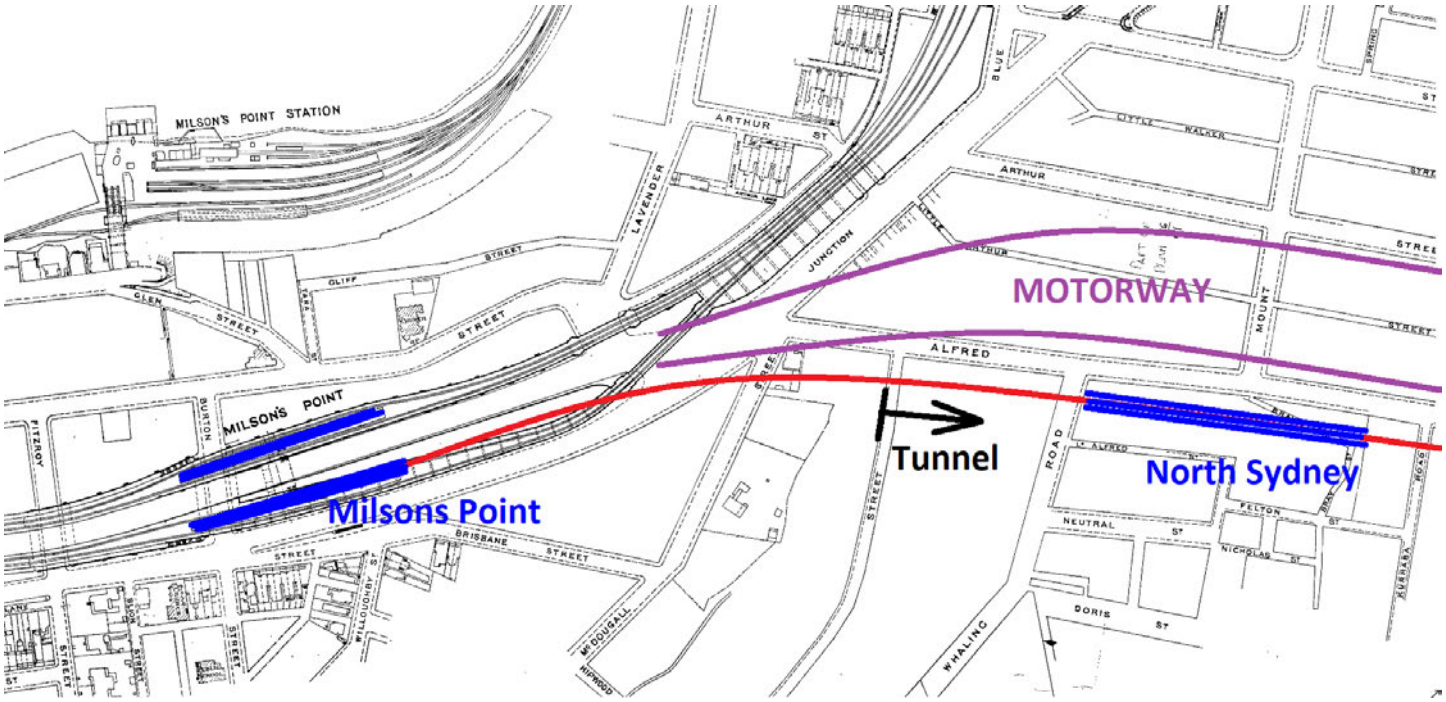


Figure 8.5 – Proposed Observatory Hill station on North Shore and Northern Beaches lines superimposed on 1930 map of 1920s rail works



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

Figure 8.6 – Proposed Northern Beaches line superimposed on 1930 map of 1920s rail works

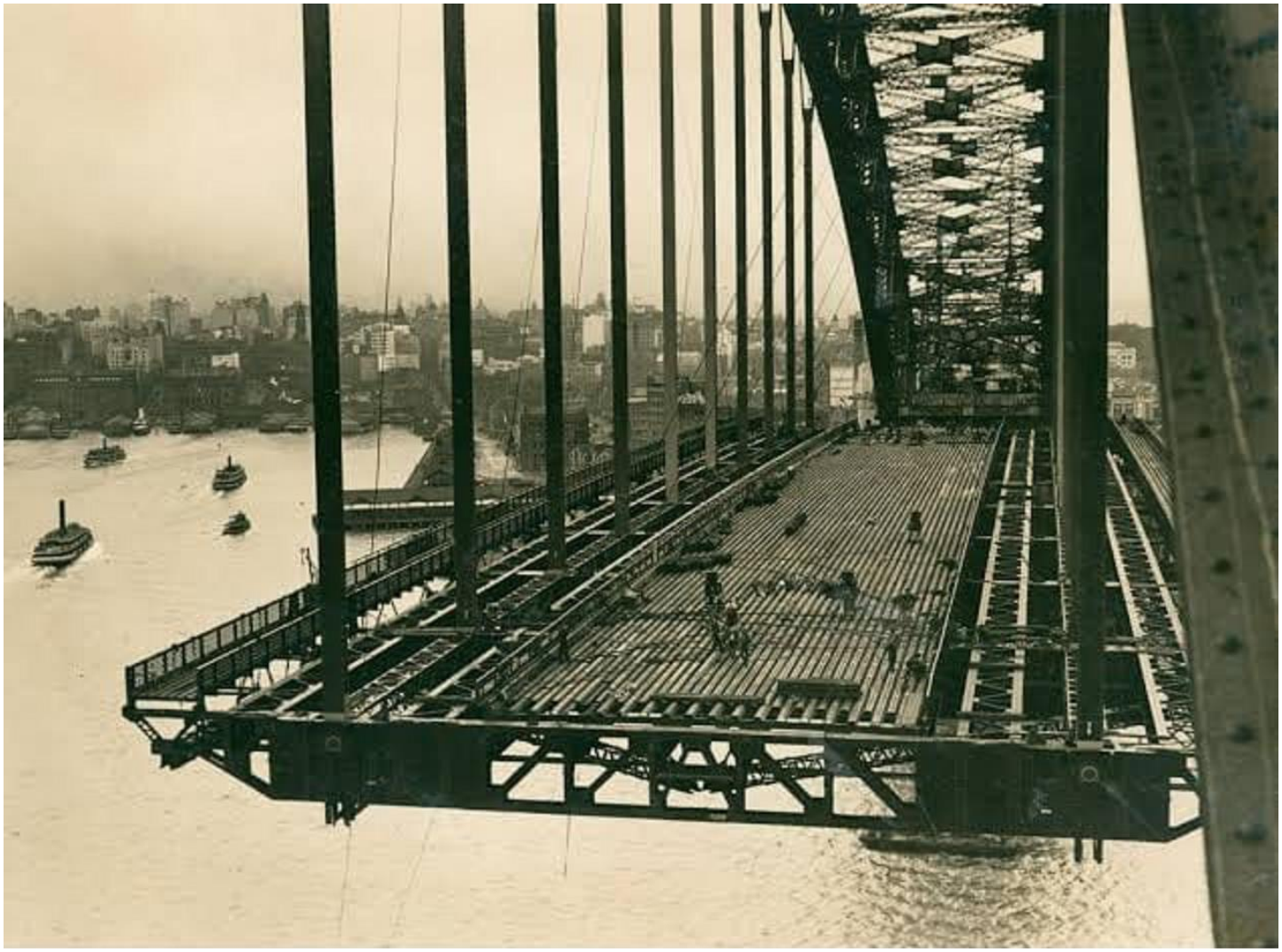


Figure 8.7 – Harbour bridge heavy trusses to support trains both sides

Figure 8.8 – Eastern rail tracks Sydney Harbour Bridge 5 February 1932

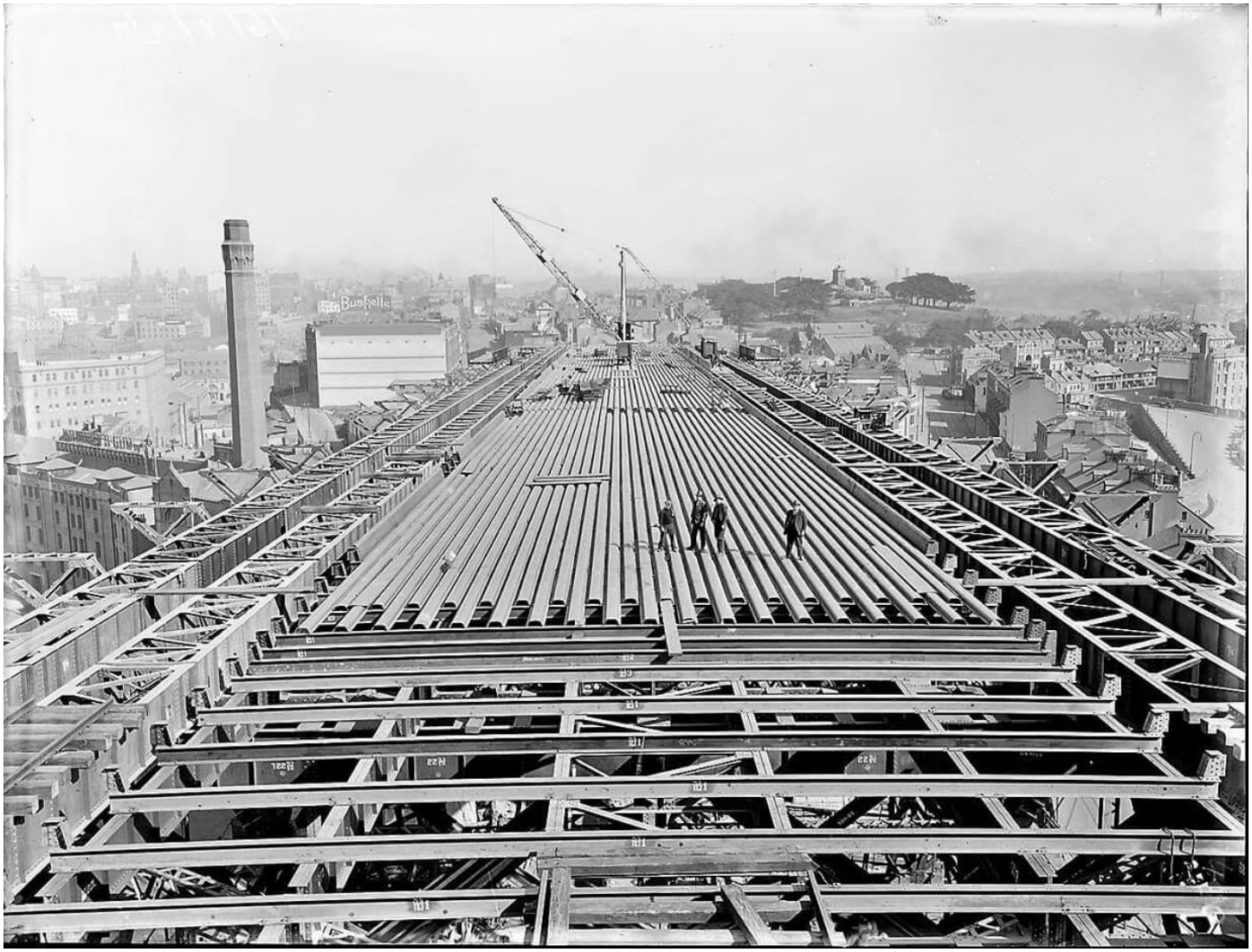


Figure 8.9 – Harbour Bridge heavy trusses on approach spans to support trains

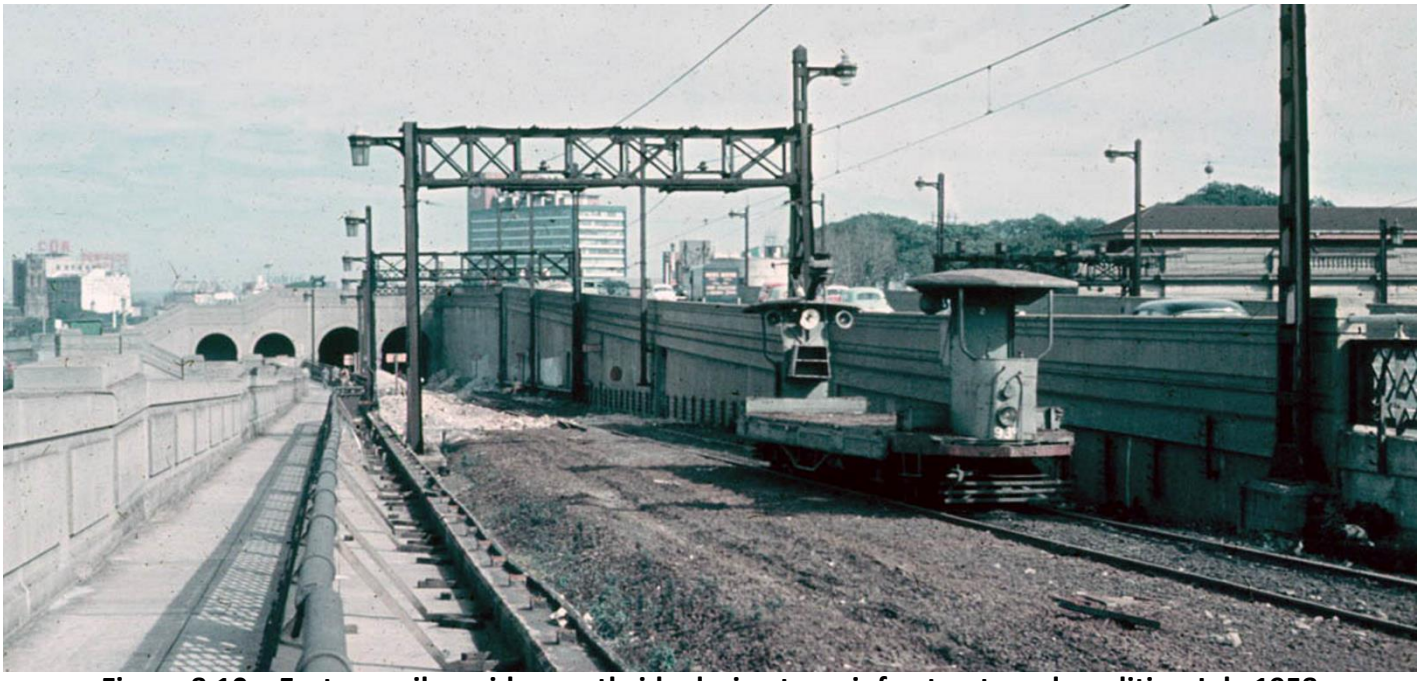
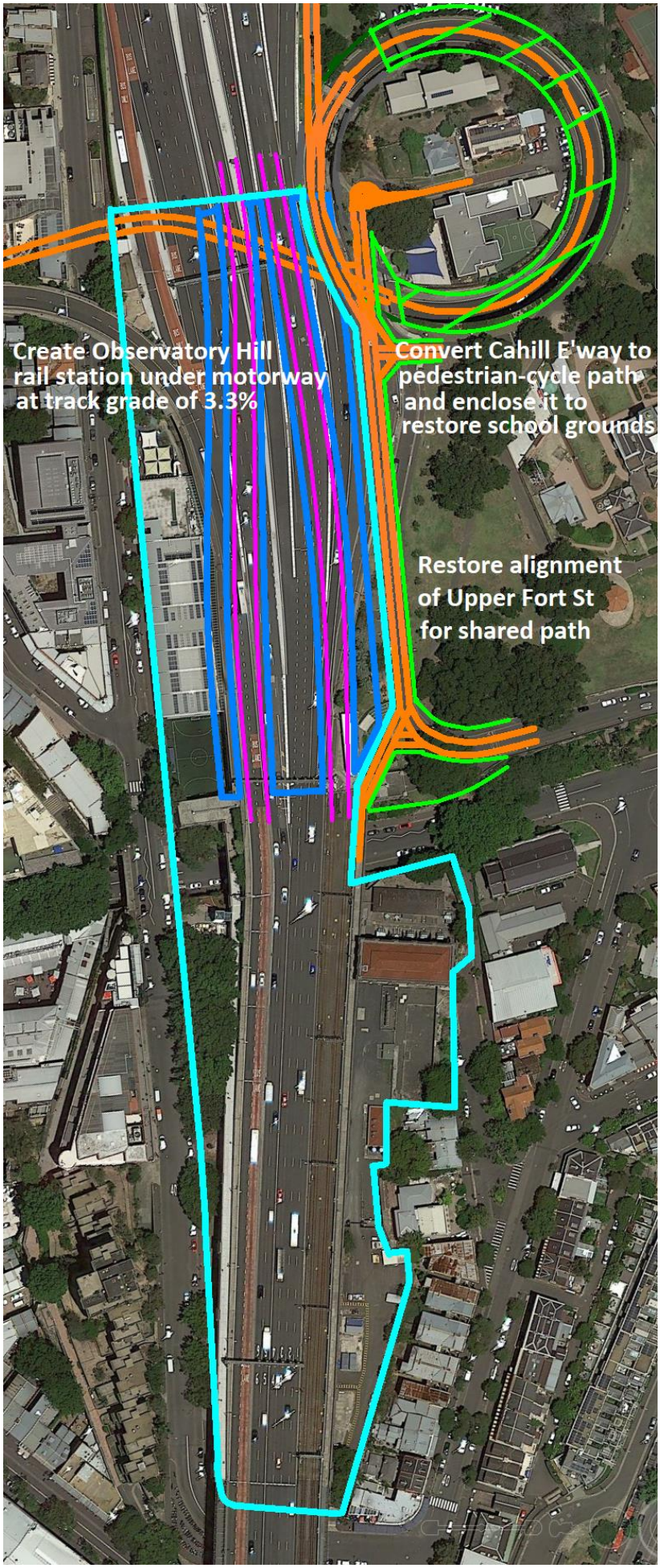


Figure 8.10 – Eastern rail corridor southside during tram infrastructure demolition July 1958

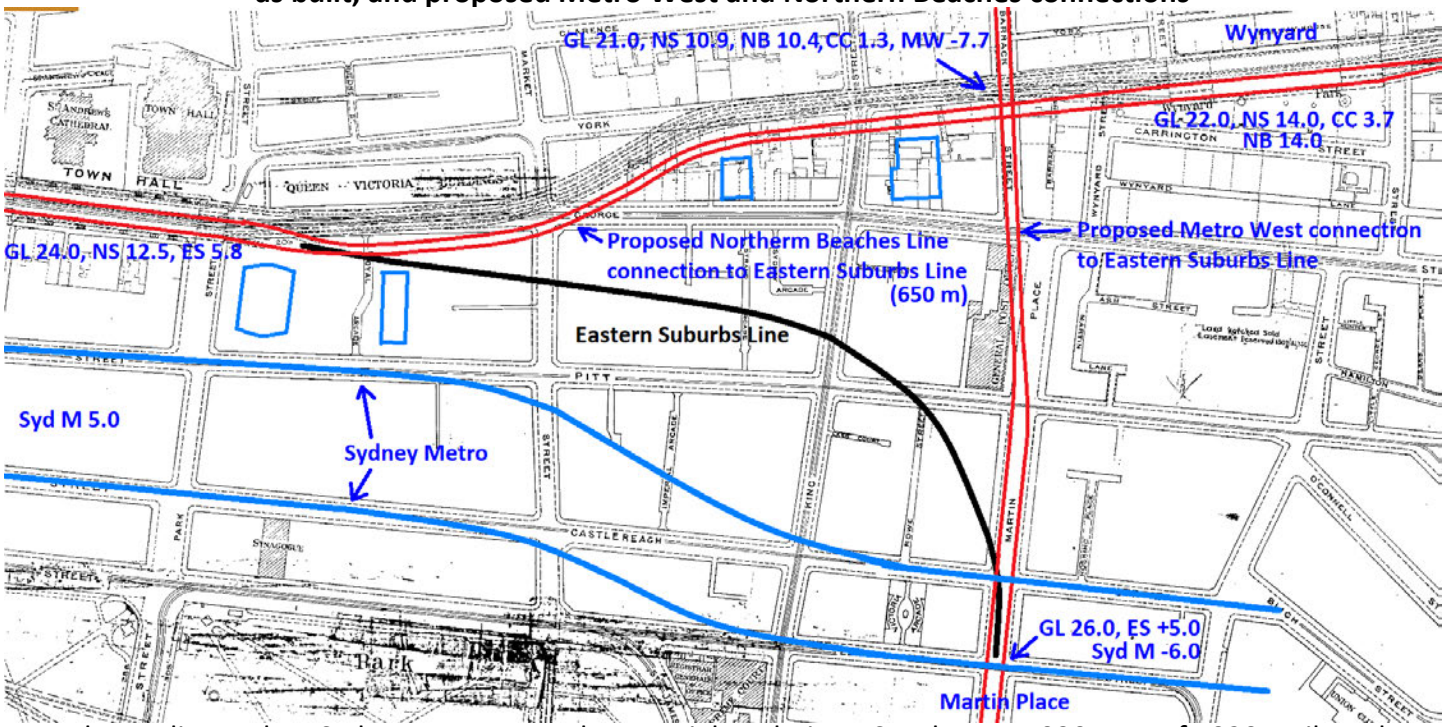


--- See active transport proposal for use of the Cahill Expressway loop.
--- The station could utilise all the TfNSW controlled space outlined in very light blue.

Figure 8.11 – 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 8.12 – 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 8.13 – Proposed Metro West and Northern Beaches Line links to existing infrastructure

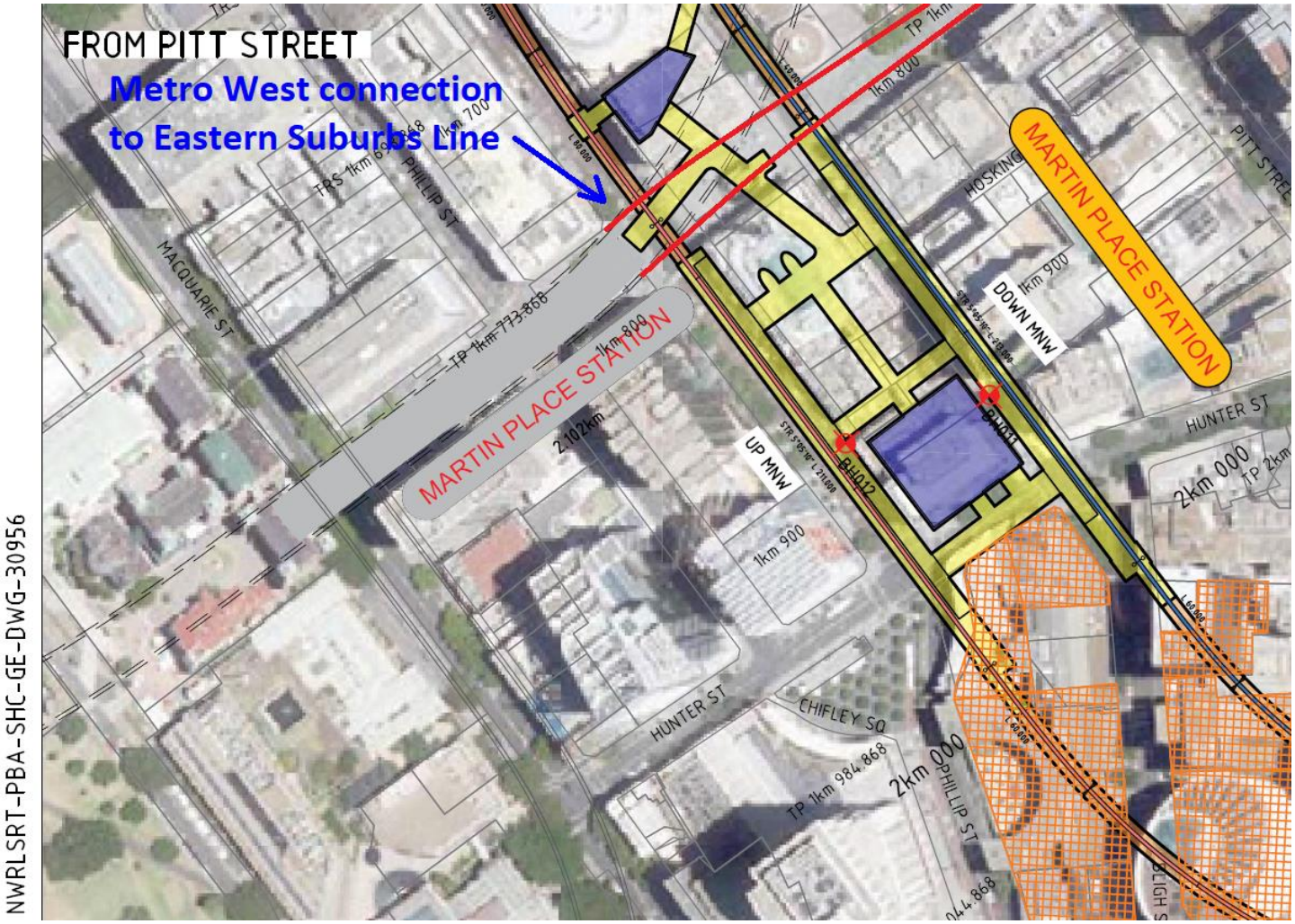


Figure 8.14 – Proposed Metro West connection (red) to Eastern Suburbs line superimposed on Sydney Metro EIS geological plan of Martin Place station

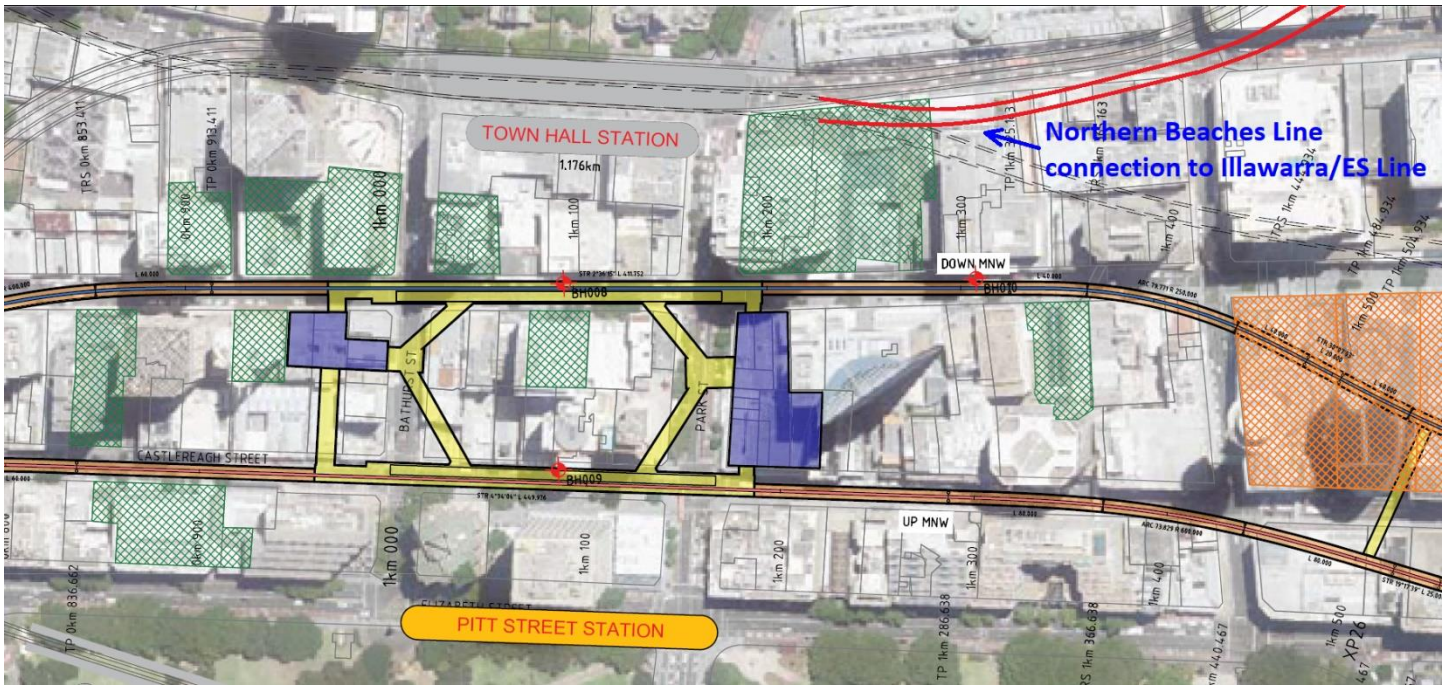


Figure 8.15 – Proposed Northern Beaches line connection (red) to Illawarra/ES line at Town Hall superimposed on Sydney Metro EIS geological plan of Pitt St/Town Hall stations

9 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 (Section 13) makes the road viaduct across Circular Quay unnecessary.

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

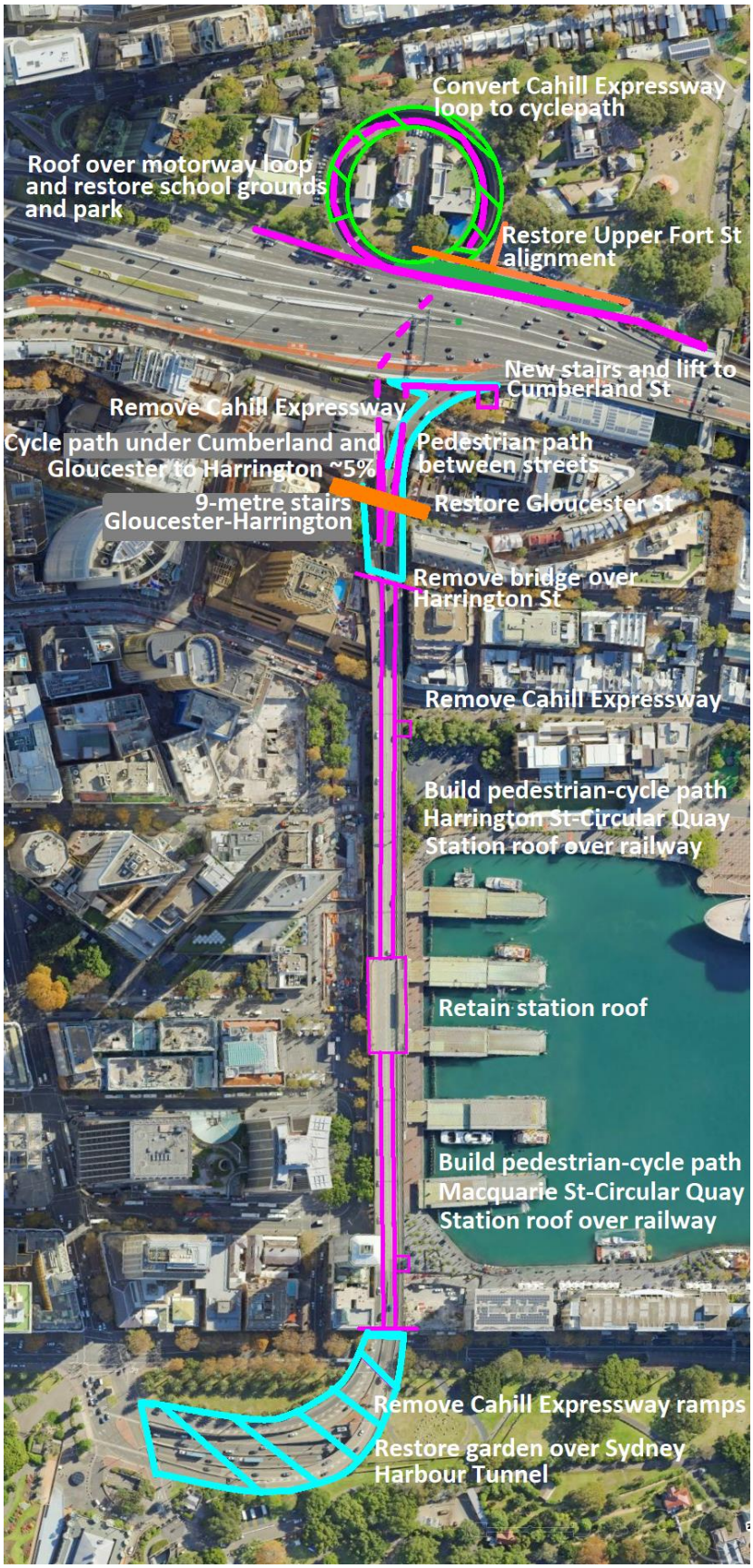
The Cahill Expressway corridor provides great opportunities for pedestrian and cycle connections between the northern CBD and the bridge.

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 9.1 to 9.5. 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.

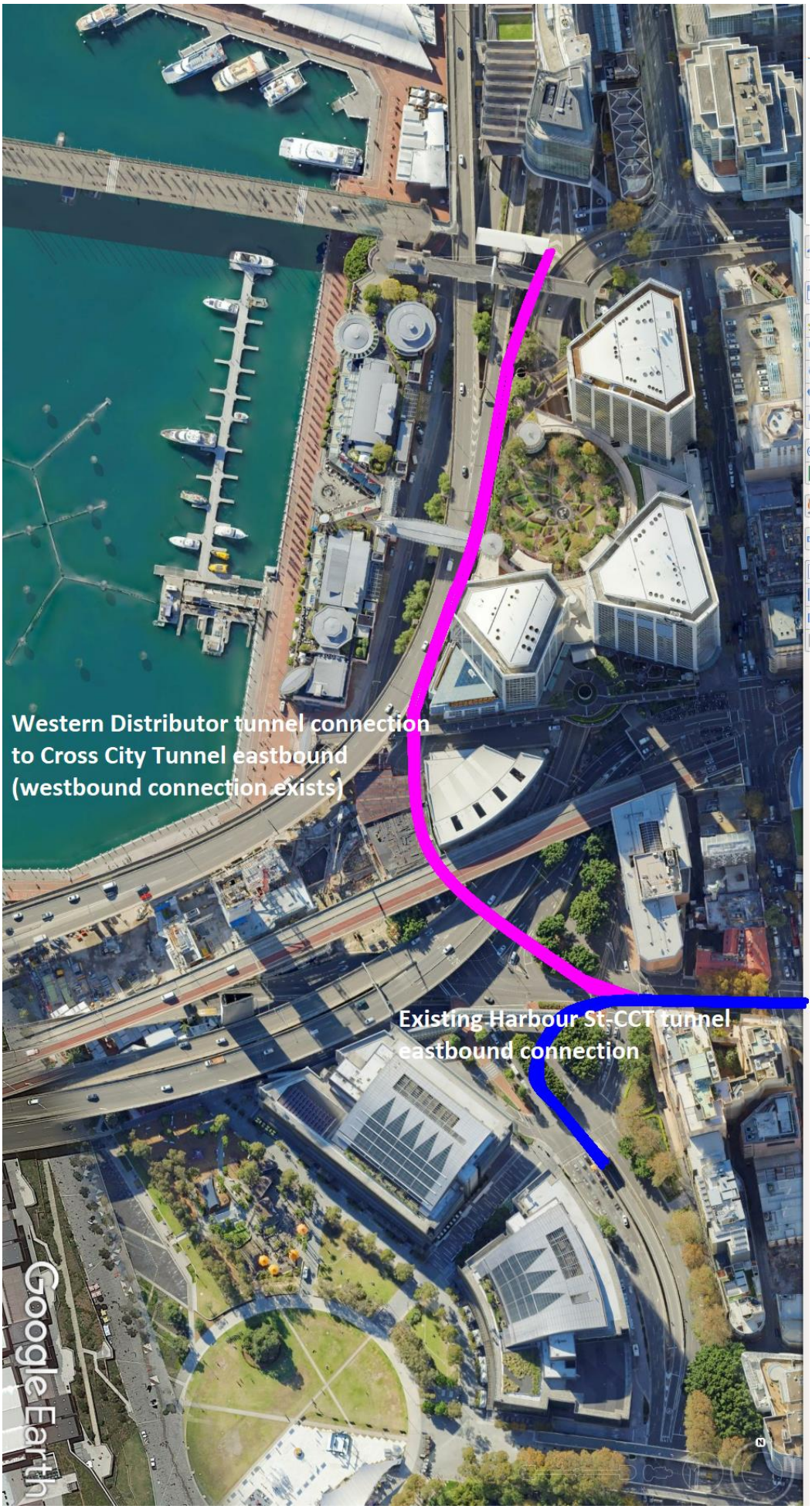
--- Road is replaced by slimline, but wide pedestrian-cycle path that covers the rail track and platforms.

Figure 9.1 – 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

--- 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)

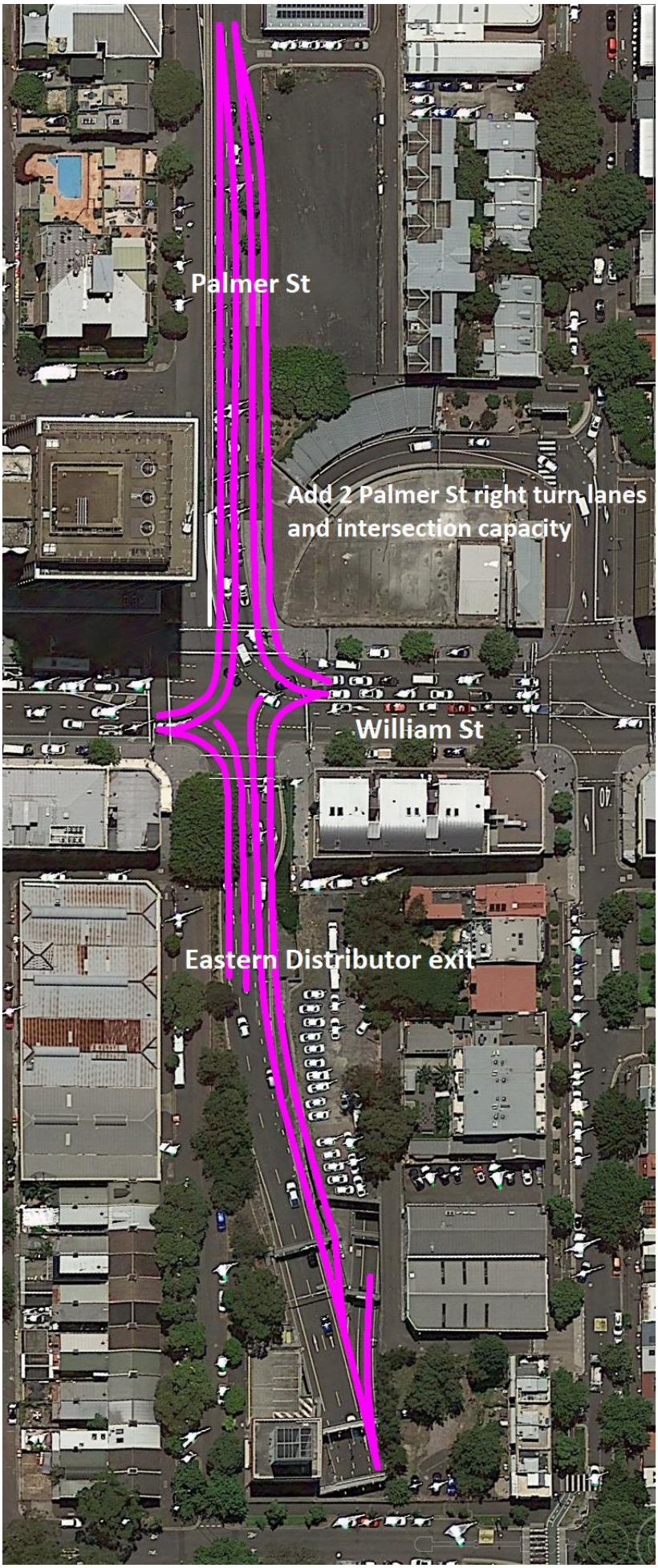
Figure 9.2 – Replace lost northern CBD connectivity (Cahill E'way Circular Quay) with mid-town connectivity

Figure 9.3 – 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 9.4 – 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 9.5 – Add Palmer St southbound right turn at William St and extra intersection capacity

10 Adding much needed parks to the motorway corridor

Artarmon

Two-thirds of Artarmon Park (bounded by the North Shore Line, Parkes Rd, Hampden Rd and Punch St) was taken for the Gore Hill Freeway. The park, 3.5 hectares before the Gore Hill Freeway was built, is on the opposite side of the railway to Artarmon Reserve (the far better-known recreation space east of the railway).

West Artarmon has a shortage of level play space. Due to the railway embankment, Artarmon Reserve is hard to access for the many apartment dwellers of West Artarmon and the workers in the industrial area.

More of the park will be taken for the Beaches Link motorway portal.

However, the motorway is sufficiently below the road levels to allow a park to be created over the motorway (Figure 10.1)

Naremburn

The Warringah Freeway cut Naremburn in half with the deep gash used to provide motorway ramps to Willoughby Rd.

The St Leonards-Crows Nest growth precinct is 500 metres to the south of the Naremburn local centre.

Level park space is virtually non-existent in Naremburn and the St Leonards-Crows Nest growth precinct.

A park over the motorway between Willoughby Rd and Merrenburn Rd would add 1.65 Hectares of level park to the suburb (Figure 10.2). A park could still be realised with the motorway access ramps retained but it would lose size and amenity.

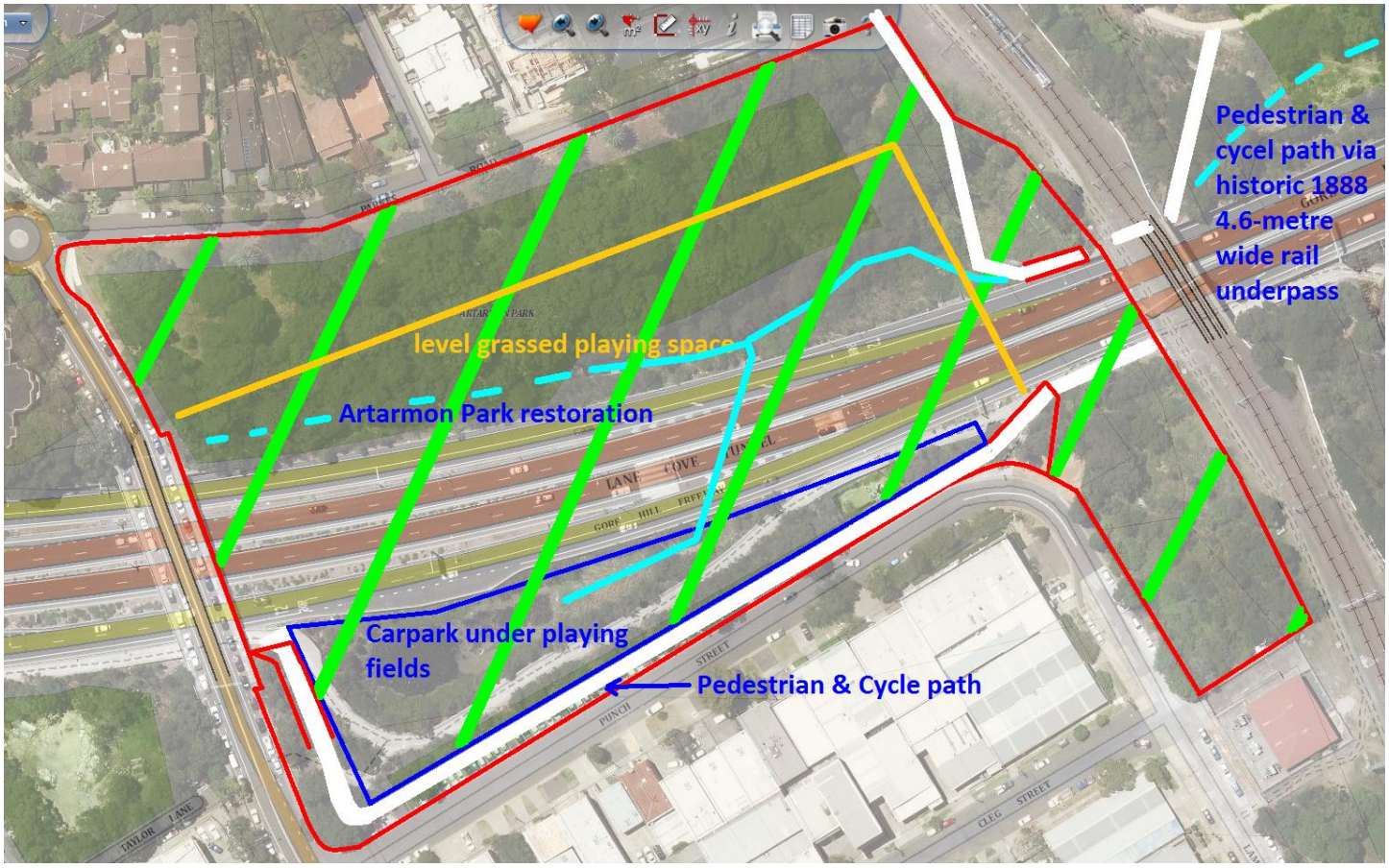


Figure 10.1 – Restoration of Artarmon Park over the Gore Hill Freeway

Figure 10.2 – Building a park over the motorway at Naremburn

11 WHT-BL-Warringah Freeway-Gore Hill Freeway connectivity

11.1 Connectivity resulting from project plan

Connectivity is a primary service feature of roads. It is a major contributor to minimising door-to-door journey times for the greatest number of people.

A matrix of major road connectivity is presented in Table 11.1 to understand which local roads are likely to experience rat-running and congestion as a result of connectivity limitations imposed by the project.

Post the WHT EIS publication for submissions, the government released a new diagram (Figure 11.1) of the Warringah Freeway-Gore Hill Freeway upgrade that may represent a connectivity change from that released in August 2018. However, no image detailing connections was provided. There is insufficient information to know whether connectivity has changed. Thus, this analysis uses the August 2018 diagrams.

The Warringah Freeway-Harbour Bridge corridor averages four vehicle incidents a day requiring assistance. The connectivity limitations are, in part, designed to reduce traffic incidents by reducing traffic lane-changing and merging. Where a direct connection is missing, traffic makes the connection by way of 'rat runs'. 'Rat-running' in this context, means using lower AUSTROADS category roads to achieve connections.

The EIS does not include a study of various combinations of connections, the lane-changing and merging required for the connections, the traffic incident rate for each combination, and the impact on local roads by missing connections made by rat-running. The Department of Planning should require this study be undertaken, the project be revised on the basis of the study and the impacted sections of the EIS be repeated.

The AUSTROADS hierarchy of 'arterial', 'sub-arterial', 'collector' and 'local' roads, reflected in the 'Sydway' street directory, was developed to ensure an efficient road network. In addition to these formal categories, a district road can be described as a road that links local centres and are generally among the earliest roads built.

Lower category roads generally have lower capacity. Motorways have capacities of ~2,000 vehicles per lane per hour. Arterial roads generally have a capacity of a 1,000 to 1,500 vehicles per lane depending on spacing of connections and intersection congestion. Local road capacity is highly variable, a capacity of around 700 vehicle per lane per hour is quoted in literature.

Needing to use rat-runs lowers road network efficiency. The EIS acknowledges additional local congestion in North Sydney. However, operational traffic modelling (EIS Figure 9.2 included in Section 4) was not extensive enough to capture traffic impacts in the Willoughby LGA.

The 'rat-runs', coloured red in Table 11.1, are a cause for concern as they will likely become highly congested - reducing the service of important district roads. Important connections are listed in Table 11.2.

Key missing connections include:
--- Falcon St, Miller St and Brook St will not directly access the WHT (Figures 11.2 & 11.3)
--- Miller St and Brook St will not directly access the SHT (Figures 11.2 & 11.3).
--- Beaches Link will not directly access the Sydney Harbour Tunnel (traffic must use the Harbour Bridge and Cahill Expressway across Circular Quay, or rat-run through already peak-hour congested North Sydney.

These access restrictions will force traffic off Alpha Rd-Flat Rock Drive-Brook St and Miller St-Strahtallen Ave-Eastern Valley Way and onto Willoughby Rd – as the latter will have direct access to the WHT and SHT.

Willoughby Rd, in addition to providing motorway access, is a district road directly linking the Chatswood, Willoughby, Naremburn, St Leonards and Crows Nest centres.

The latter two have development underway that will give their precinct a scale similar to Chatswood and North Sydney. While they will have a Sydney Metro station, 50% of travel to the centre is forecast to be private vehicle road trips.

Alpha Rd-Flat Rock Drive-Brook St, which does not pass through a local centre, is having its motorway access, and traffic, reduced for the benefits of the residents of about 120 dwellings.

The EIS is very concerned with deconflicting local and regional traffic. However, the missing connections result in worse conflict on the Harbour Bridge and Willoughby Rd.

Ernest St

Removal of the Ernest St ramps, returning Ernest St to local and district use, with a garden strip and cycle-path added, was a key element of the project in 2018.

The project has retained Ernest St ramps as the Warringah Freeway western lanes are not accessible to the Sydney Harbour Tunnel.

Proposed modifications to the WHT-BL and BL-GHF project to improve Mid-North Shore connectivity and reduce local road congestion

The following figures suggest modifications to improve the connectivity of the WHT-Warringah Freeway, and Beaches Link-Gore Hill Freeway:

Figure 11.4 - Straighten eastbound Beaches Link tunnel portal to permit traffic from the Pacific Hwy and Longueville Rd to pass north of the portal to the Gore Hill Freeway. Add branch of westbound portal to Reserve Rd that connects to the Pacific Hwy and Longueville Rd exit.

Figure 11.5 - a 500-metre gap in the median strip (marked in red) between northbound SHT and Warringah Freeway lanes from Harbour Bridge. Allows removal the Ernest St ramp by allowing SHT traffic to reach Falcon St westbound.

Figure 11.6 - Southbound tunnel connection (marked in red) between Beaches Link and Sydney Harbour Tunnel access lanes on the Warringah Freeway to permit SHT traffic to access Beaches Link, and Miller St and Brook St ramps

Figure 11.7 - Based on the location of local and regional centres, Mid-North Shore motorway access is concentrated at Brook St to allow local roads to serve local centres – deconflicting traffic. This retained for the North Western Motorway alternative to the Western Harbour Tunnel.

Table 2 identifies the direct connections restored under the 'Modification' column. The net improvement is 13 connections - eight extra desirable connections are made, and five undesirable connections are deleted.

Table 2 also shows the alternative project (Section 12) would make an additional 6 connections.

Table 11.1 – North Shore motorway connections

Black: 2020, Blue: after WHT-BL project, Red: problem connection after WHT-BL, NA: Not applicable

WF: Warringah Freeway WHT: Western Harbour Tunnel BL: Beaches Link

GHF: Gore Hill Freeway PH: Pacific Hwy CE: Cahill Expressway

GHF-BL connections Artarmon

To / From	Beaches Link eastbound	Gore Hill Freeway eastbound	LCT westbound	Pacific Hwy ramp westbound	Longueville Rd westbound	Reserve Rd ramps eastbound	Reserve Rd ramps westbound
Westbound							
Beaches Link	NA NA	NA NA	NA Yes	NA Dickson, Clarendon, Hotham, PH	NA Dickson, Clarendon, Hotham, PH	NA NA	NA New ramp
Gore Hill Freeway	NA NA	NA NA	Yes Yes	Yes Yes	Yes Yes	NA NA	Yes Yes
Eastbound							
LCT	NA via Pac Hwy exit	Yes Yes	NA NA	Yes Yes	NA NA	Yes Yes	NA NA
Pacific Hwy ramp	NA Yes	Yes Hotham, Clarendon, Dickson, Reserve OR Rimmington, Broughton, Buller, Jersey, Reserve	NA NA	NA NA	NA NA	NA NA	NA NA
Longueville Rd	NA Yes	Yes Pac Hwy, Hotham, Clarendon, Dickson, Reserve OR PH north, Howarth, PH south, Rimmington, Broughton, Buller, Jersey, Reserve	NA NA	NA NA	NA NA	Yes Yes	NA NA
Reserve Road ramps	NA Yes	Yes Yes	NA NA	NA NA	NA NA	NA NA	NA NA
Reserve Road ramps	NA NA	NA NA	Yes Yes	No No	Yes Yes	NA NA	NA NA

GHF-WF connections – cross-harbour and Beaches Link bound

To / From	Falcon St	SHT	SHB	WHT	BL to coast
Gore Hill Freeway	via WF, Military via WF, Military	Yes Yes	Yes Yes	NA Yes	NA See Artarmon table
Willoughby Rd	via WF, Military via WF, Military	Yes Yes	Yes Yes	NA Yes	NA via Frenchs Rd OR Merrenburn, then Brook, WF ramp, Amherst, Miller, Berry
Alpha Rd/ Flat Rock Dr /Brook St	via WF, Military via WF ramp, Amherst, Miller	Yes bypass SHT using CE OR via WF ramp, Amherst, Miller, Falcon OR via Mowbray/ Frenchs/ Merrenburn, Willoughby, WF	Yes Yes	NA via WF ramp, Amherst, Miller, Berry	NA via WF ramp, Amherst, Miller, Berry
Eastern Valley Way/ Strathallen/ Miller St	Direct link Direct link	via Falcon St via Falcon St	Yes Yes	NA via Miller, Berry	NA via Miller, Berry
Falcon St	NA NA	Yes Yes	Yes Yes	NA via Miller, Berry	NA via Miller-Berry
BL from coast	via WF to Nth Syd (Alfred, High, WF ramp), WF, Falcon St ramp	bypass SHT using CE OR via WF, Alfred, High, Miller, Falcon, WF	via Cahill Expressway	Yes	NA

Table 11.1: North Shore motorway connections (continued)
Black: 2020, Blue: after WHT-BL project, Red: problem connection after WHT-BL, NA: Not applicable
WF: Warringah Freeway WHT: Western Harbour Tunnel BL: Beaches Link
GHF: Gore Hill Freeway PH: Pacific Hwy CE: Cahill Expressway

GHF-WF connections – North and West bound

To / From	Falcon St	Miller St	Brook St/ Flat Rock/ Alpha Rd	Willough-by Rd	GHF	WHT to M4/M5	BL to coast
SHB	Yes WF east lanes	Yes Yes	Yes WF west lanes	Yes All lanes	Yes All lanes	NA via PH, Walker, Berry	NA via WF west lanes
SHT	Yes Yes	Yes Bypass SHT with CE, SHB OR via WF, Falcon	Yes Bypass SHT with CE, SHB, WF OR via WF, Willoughby, Merrenburn or Frenchs or Mowbray	Yes Yes	Yes Yes	NA Bypass SHT with CE, PH, Walker, Berry OR via WF, Falcon, Miller, Berry	NA Bypass SHT with CE, SHB, WF OR via WF, Falcon, Miller, Berry
WHT	NA WEST: direct ramp EAST: via Falcon west, Miller, Ernest, West St, Falcon	NA via Falcon St west	NA via Falcon west, Miller, Ernest, Alexander, Chandos OR via WF, Willoughby then Chandos or Merrenburn or Frenchs	NA Yes	NA Yes	NA NA	NA Yes
Falcon St	NA NA	via Miller St via Miller St	Yes via WF, Willoughby, then Chandos or Merrenburn OR via Miller, Ernest, Alexander, Chandos	Yes Yes	Yes Yes	NA via Miller, Berry	NA via Miller, Berry, WF
Miller St	Direct link Direct link	NA NA	via Strathallen, Sailors Bay Rd OR via Falcon St, WF via Strathallen, Sailors Bay Rd OR via Berry St, WF	via Falcon St, WF via Falcon St, WF	via Falcon St, WF via Falcon St, WF	NA via Berry	NA via Berry, WF
Brook/ Flat Rock/ Alpha	NA NA	NA NA	NA NA	via Chandos, OR Merren-burn, OR Frenchs, OR Mowbray Same	via WF ramp, Amherst, Miller, Falcon, WF via WF ramp, Amherst, Miller, Falcon, WF	NA NA	NA NA
Wi-lough-by Rd	NA NA	NA NA	NA NA	NA NA	via Merrenburn, Brook, then as above OR Chandos, Christie, PH OR Mowbray, Elizabeth, Brand, Hampden, Jersey, Reserve Same	NA NA	NA NA

Table 11.2 – Summary table of selected Mid-North Shore direct connections including Beaches Link

Cross-harbour or BL bound ramps			**Project**	**Modification**	**NWM Alt**
Willoughby Rd	to	SHT, WHT & SHB	Yes	No	No
Alpha-FRD-Brook	to	SHT	No	Yes	Yes
Alpha-FRD-Brook	to	WHT	No	Yes	Yes
Alpha-FRD-Brook	to	GHF	No	Yes	Yes
Alpha-FRD-Brook	to	NWM via GHF	No	No	Yes
Alpha-FRD-Brook	to	BL both directions	No	No	Yes
EVW-Miller St	to	SHT & WHT	No	No	No
EVW-Miller St	to	BL coast bound	No	No	Yes
Ernest St	to	SHT	Yes	No	No
Falcon St	to	WHT	No	No	No
BL from coast	to	SHT	No	Yes	Yes
BL from coast	to	NWM	No	Yes	Yes
North/westbound					
SHT	to	Falcon	East only	Yes	Yes
SHT	to	Ernest St	Yes	No	No
SHT	to	Miller St	No	Yes	Yes
SHT	to	Brook-FRD-Alpha	No	Yes	Yes
SHT	to	Willoughby	Yes	No	No
SHT	to	BL coast bound	No	Yes	Yes
WHT	to	Falcon-Military eastbound	No	No	No
WHT	to	Ernest St	No	No	No
WHT	to	Miller	No	No	No
WHT	to	Brook-FDR-Alpha	No	Yes	No
WHT	to	Willoughby	Yes	No	No
Falcon St	to	Brook-FRD-Alpha	No	Yes	Yes
Falcon St	to	BL coast bound	No	No	No
EVW-Miller St	to	BL coast bound	No	No	Yes
Alpha-FRD-Brook	to	GHF west bound	No	Yes	Yes
Willoughby Rd	to	GHF west bound	No	No	No
NWM	to	Willoughby & Miller	No	No	No
NWM	to	Brook St	No	No	Yes
NWM	to	BL coast	No	No	Yes
NWM	to	Falcon St	No	No	Yes
Artarmon eastbound					
Pac Hwy & Longueville	to	GHF	No	Yes	Yes
LCT	to	GHF	via PH ramp	Yes	Yes
Reserve Rd	to	GHF, BL	Yes	Yes	Yes
Artarmon westbound					
Beaches Link	to	Pac Hwy & Longueville	No	Yes	Yes
Beaches Link	to	LCT	Yes	Yes	Yes
GHF	to	Pac Hwy & Longueville	Yes	Yes	Yes
Reserve Rd	to	LCT, Longueville	Yes	Yes	Yes
Reserve Rd	to	Pacific Hwy ramp	No	No	No
		Total connections	**10.5**	**19**	**25**

Sydney Harbour Tunnel (SHT), Western Harbour Tunnel (WHT),
Beaches Link (BL), Gore Hill Freeway (GHF),
Lane Cove Tunnel (LCT), North Western Motorway (NWM),
Flat Rock Drive (FRD), Eastern Valley Way (EVW)

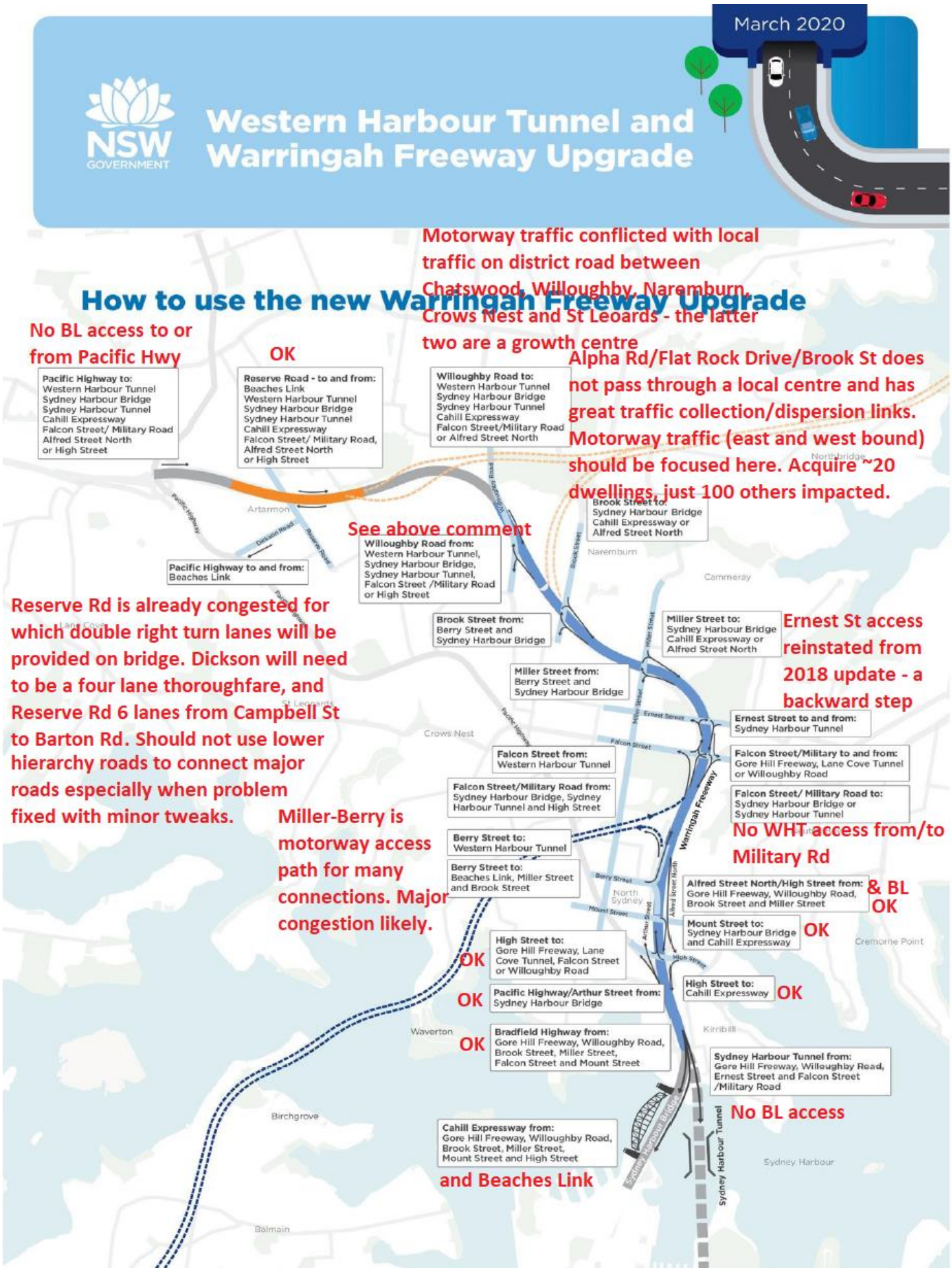
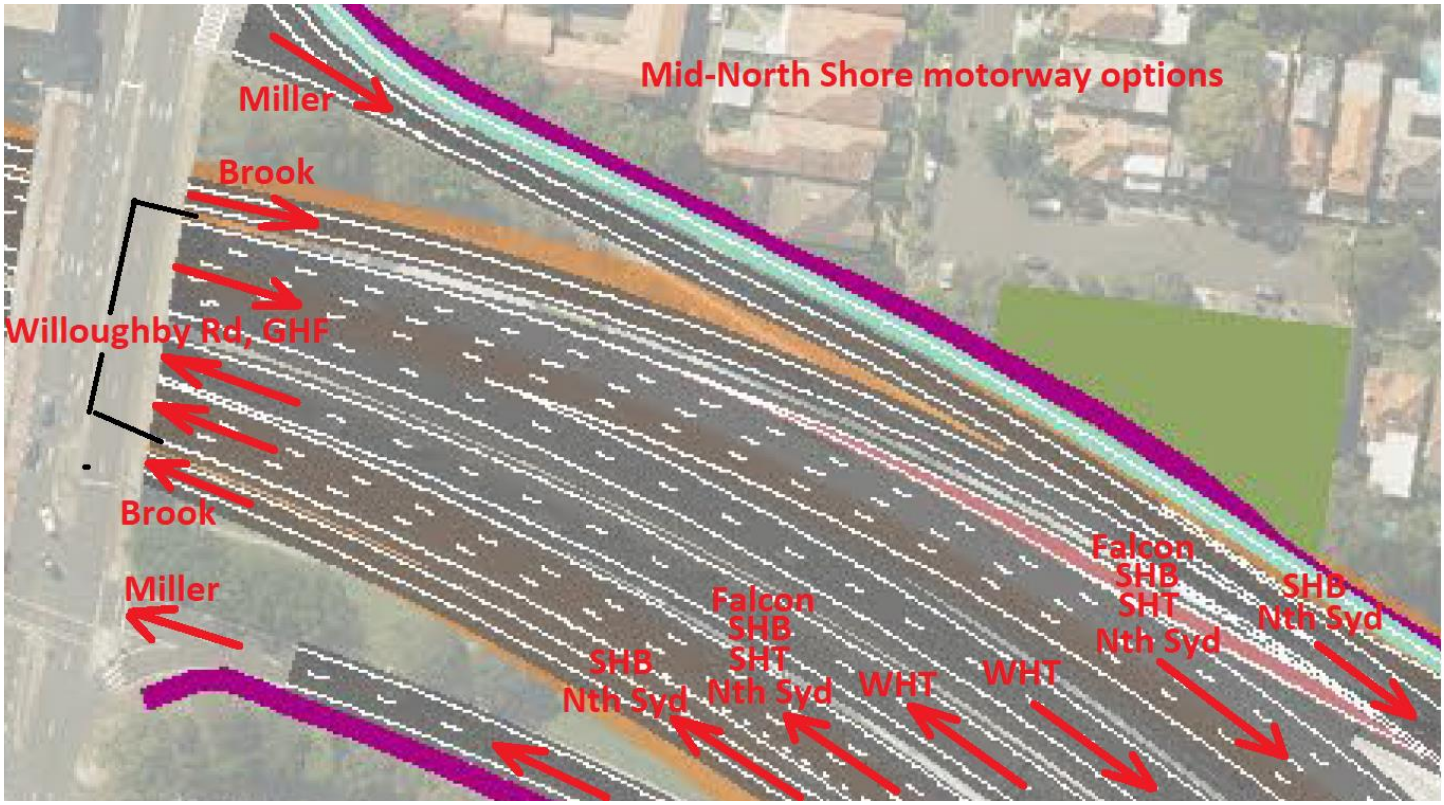
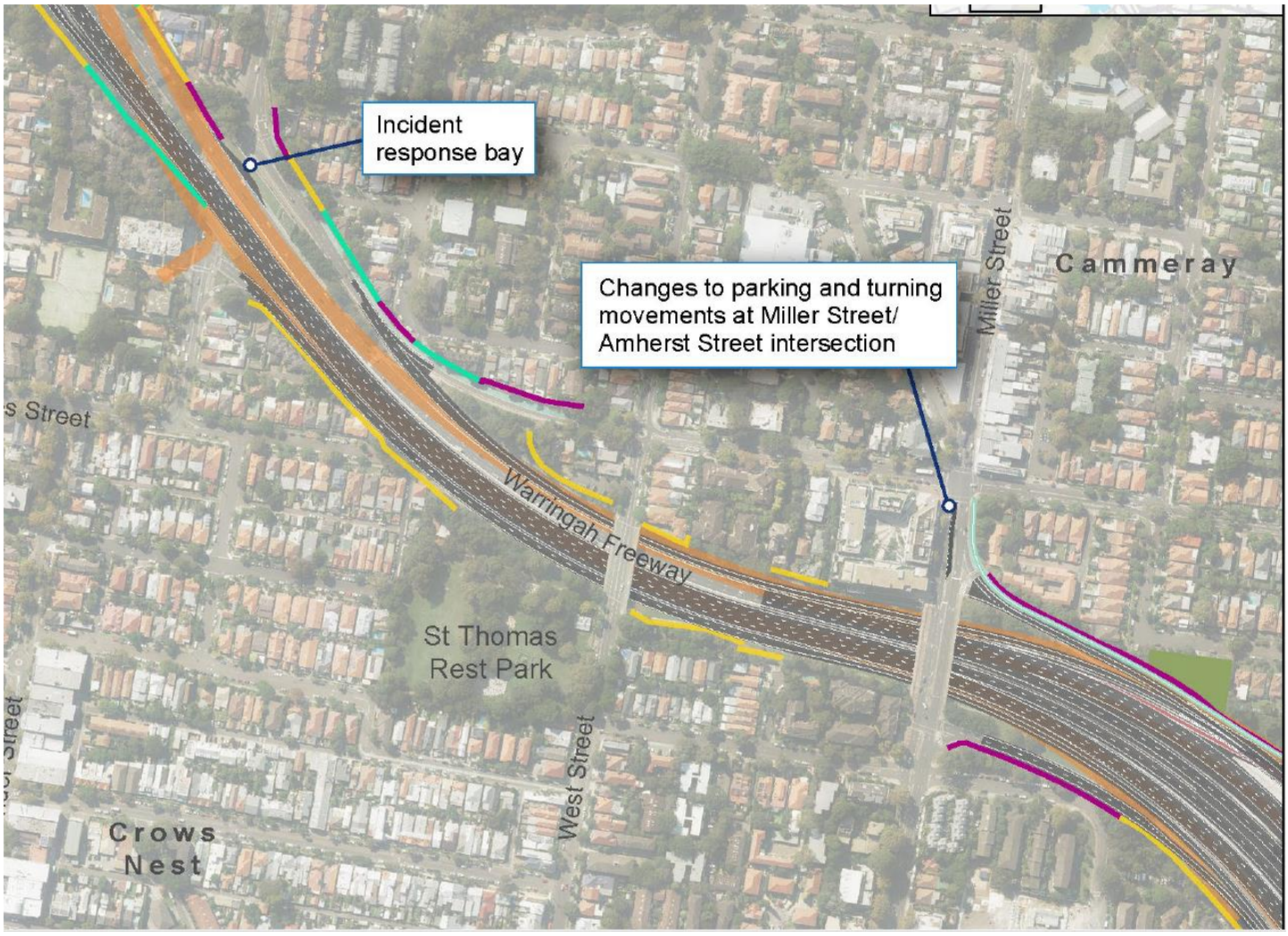


Figure 11.1 – Latest post EIS release TfNSW proposal for Warringah and Gore Hill Freeways with comments



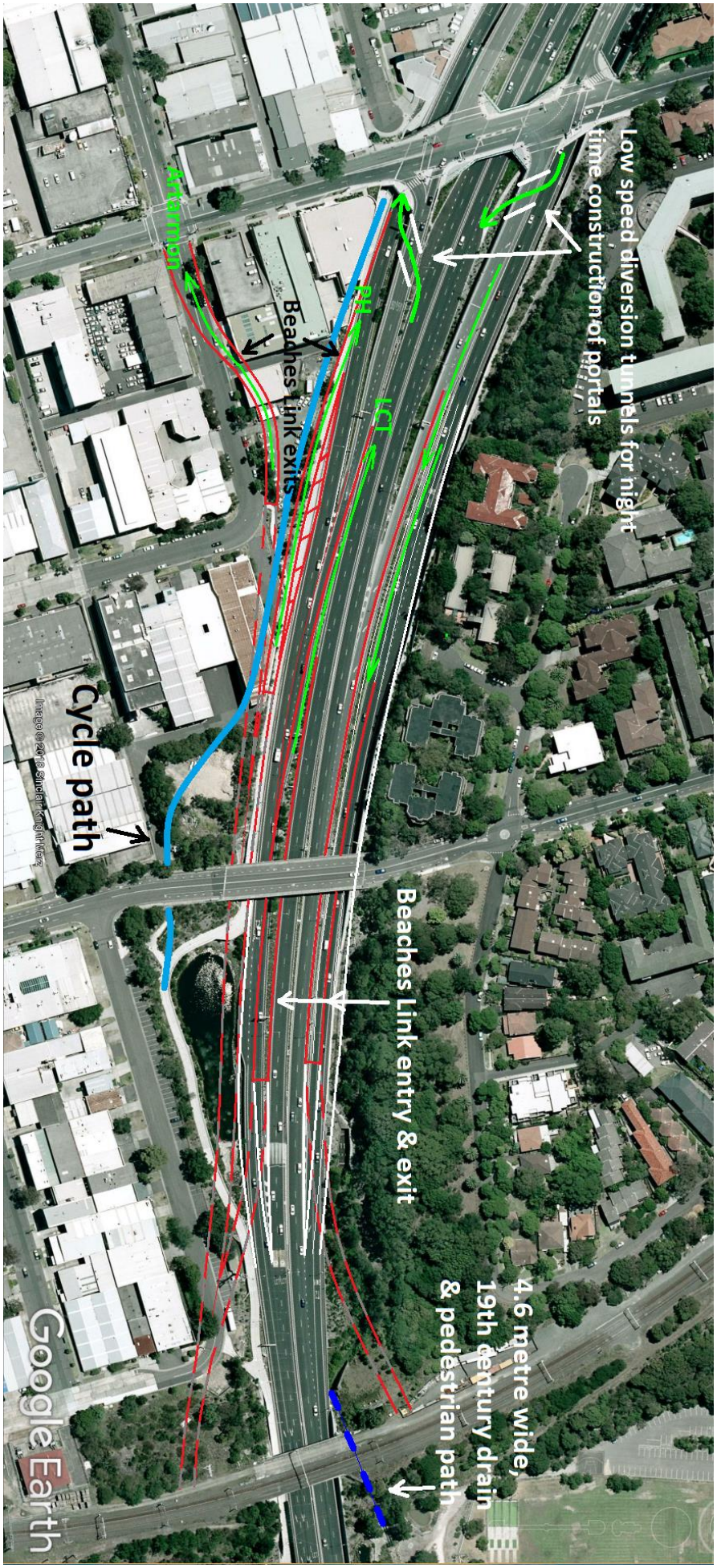
--- Miller St and Brook St motorway ramps have no access to the SHT and WHT

Figure 11.2 – Extract from Figure 5.5 of the WHT EIS - marked with connectivity



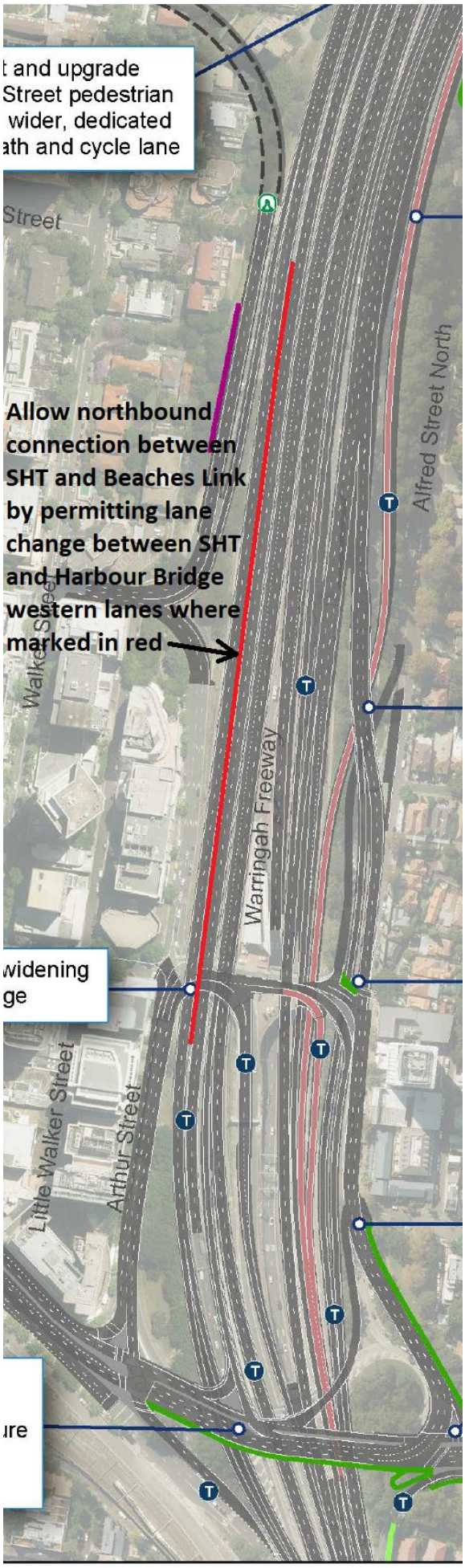
--- Miller St and Brook St motorway ramps have no access to the SHT and WHT

Figure 11.3 – Extract from Figure 5.5 of the WHT EIS



--- Straighten eastbound BL tunnel portal to permit traffic from the Pacific Hwy and Longueville Rd to pass north of the portal to the Gore Hill Freeway.
--- Add branch of westbound portal to Reserve Rd that connects to the Pacific Hwy and Longueville Rd exit.

Figure 11.4 – Modifications to Beaches Link to restore missing connectivity



Red line – a 500 metre gap in the median strip between SHT and western lanes of Warringah Freeway

Figure 11.5 - WHT EIS Figure 5.28 Warringah Freeway with northbound connection between the Sydney Harbour Tunnel and Beaches Link - 500 metre gap in median strip

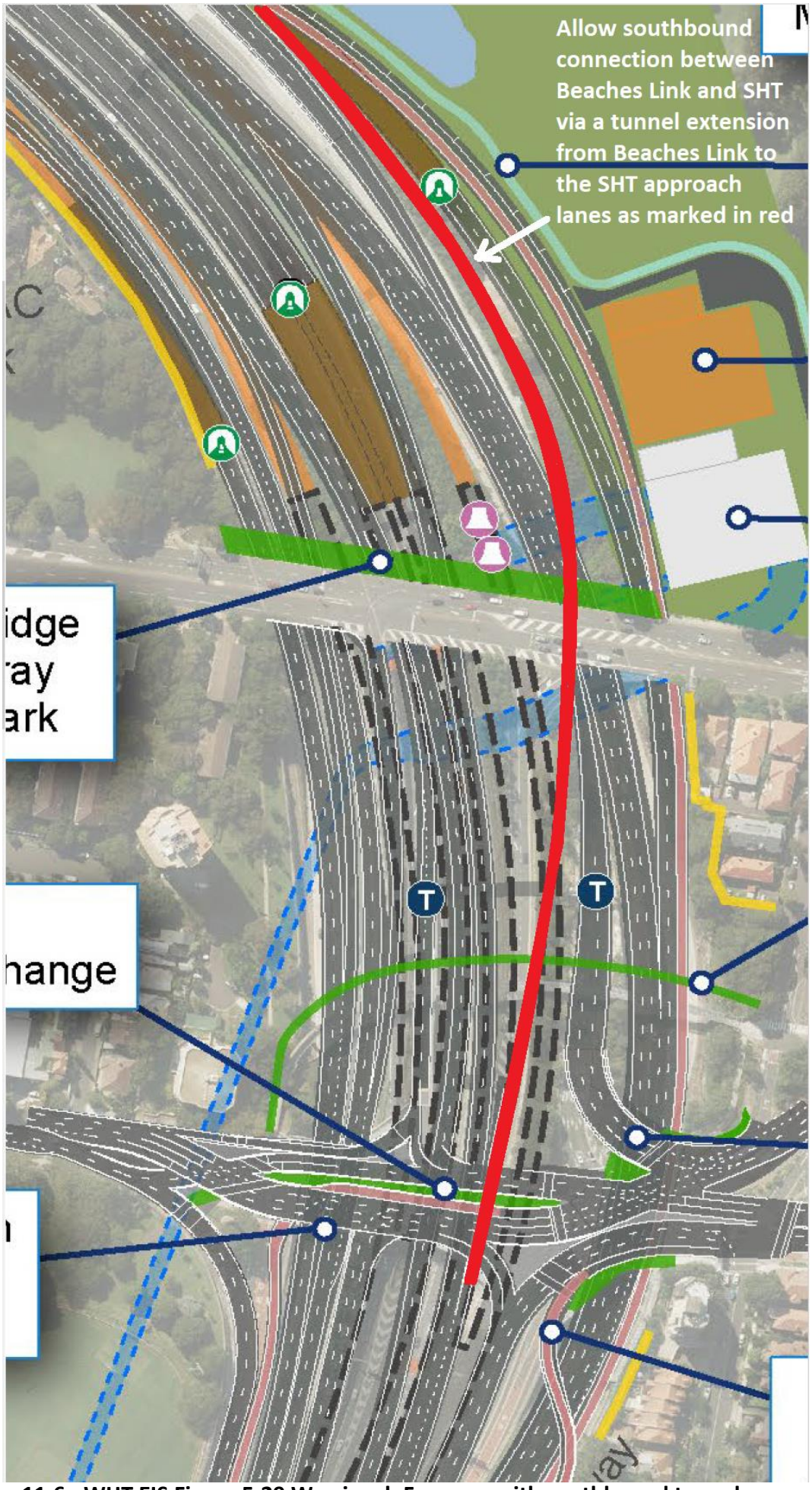


Figure 11.6 - WHT EIS Figure 5.29 Warringah Freeway with southbound tunnel connection between Beaches Link and Sydney Harbour Tunnel access lanes

Figure 11.7 – Focus motorway traffic on Brook St to avoid cross-region traffic passing through local centres

12 Alternative project - completion of the North Western Motorway and the cross-harbour circle of connectivity

12.1 North Western Motorway and the cross-harbour circle of connectivity

As noted in Section 3, the North Western Highway (North Western Motorway (NWM) as we would now call it) has been a feature of Sydney planning since the 1940s.

The 1948, 1953, 1968 and 1974 plans had the NWM sharing the traffic burden with the Warringah Freeway, effectively providing a 'cross-harbour circle-of-connectivity'.

The 'circle' permits a significant portion of traffic to vary the harbour crossing point, at the time of travel, based on expected travel times influenced by demand, traffic incidents, maintenance, etc. Today, with a major portion of the western arc of the 'circle' missing, few motorists have route choice.

The NWM has been built intermittently since the 1960s with the latest section under construction as part of the M4-M5 Link project.

The first section (Gladesville Bridge) opened in 1964. The bridge has been stranded at about 50% of its daily crossing capacity when compared to the Sydney Harbour Tunnel (Section 4).

A project to release the stranded capacity would have far greater value than an all-new crossing. Completing the former North Western Motorway is that project.

For decades it was envisaged as aboveground and carving through suburbs and river valleys. Now it could be completed with tunnels and bridges next to existing bridges (see Figure 12.1 to 12.21).

The NWM would utilize counter peak motorway traffic flows between the Pacific Hwy and Falcon St (Figure 12.1) that presently suffer peak congestion.

The NWM harbour/river crossing would comprise eight lanes on Gladesville Bridge plus a two- or three-lane tunnel for southbound Victoria Rd traffic not seeking to enter the motorway.

Further cross-harbour road capacity is envisaged in the form of an A6 arterial road upgrade (Section 7), and a four-lane Western Distributor Tunnel (Section 13) to replace capacity lost to conversion of the Cahill Expressway lanes to rail use (Section 8) – the latter being a far more valuable use of harbour bridge 'lanes'.

The all-tunnel (9 km) western ("brown") option of the WHT EIS between Rozelle and the M2 has no intermediate or eastern connections and thus delivered less than half the value of a completed North Western Motorway. The value of the "brown" option being purely the 5.5 km saving in travel for M2 traffic linking to the M4, M5, Sydney CBD, Inner-west or Airport.

Perhaps half the 104,000 vehicles crossing the Lane Cove River at North Ryde would wish to the use "brown" option. This compares the 83,000 vehicles forecast for the WHT in 2037 and possibly 160,000 vehicles that would use the NWM.

North Western Motorway works completed so far include:
--- The Western Distributor
--- The Cross-City Tunnel
--- The Anzac Bridge
--- The Gladesville Bridge

Under construction is the M4-M5 Link project which includes extending the North Western Motorway to Iron Cove.

To complete a North Western Motorway requires:
--- The last 750 metres of 4-lane M4-M5 Link lanes to Iron Cove upgraded to 6-lanes,
--- an extension to the M2 at North Ryde including:
    --- 2 x three-lane tunnels (total 5.5 km) under Drummoyne and Lane Cove,
    --- new bridges over Iron Cove (442 m with 52.5 m spans to match existing) and the Lane Cove River (350 m Lindley Point, 750 m North Ryde) next to existing bridges,

--- 1 x two (or three) lane tunnel (1.4 km), including 350 m submerged tube tunnel, from Huntleys point to Drummoyne,

--- 2 x two-lane tunnels (2.8 km) from the NWM under Lane Cove to the Gore Hill Freeway and Pacific Hwy,

--- the Southerly corridor, 2 x two lane tunnels (6 km) for NorthConnex in addition to the Westerly corridor (9 km) which is nearing completion and expected to open in mid-2020).

Rozelle to the M2 at North Ryde, via an NWM is 5.5 km shorter than via the WHT of this EIS – a major saving for a majority of M2 traffic crossing the Lane Cove River and a major energy and greenhouse gas saving.

In the absence of a comparison study of completion of the North Western Motorway versus the WHT project, the motivation for the WHT of the EIS is surely a continuous project with the Beaches Link.

The benefit-cost ratio (BCR) of the NWM with a separate Beaches Link, likely far exceeds the BCR of the combined WHT-BL project.

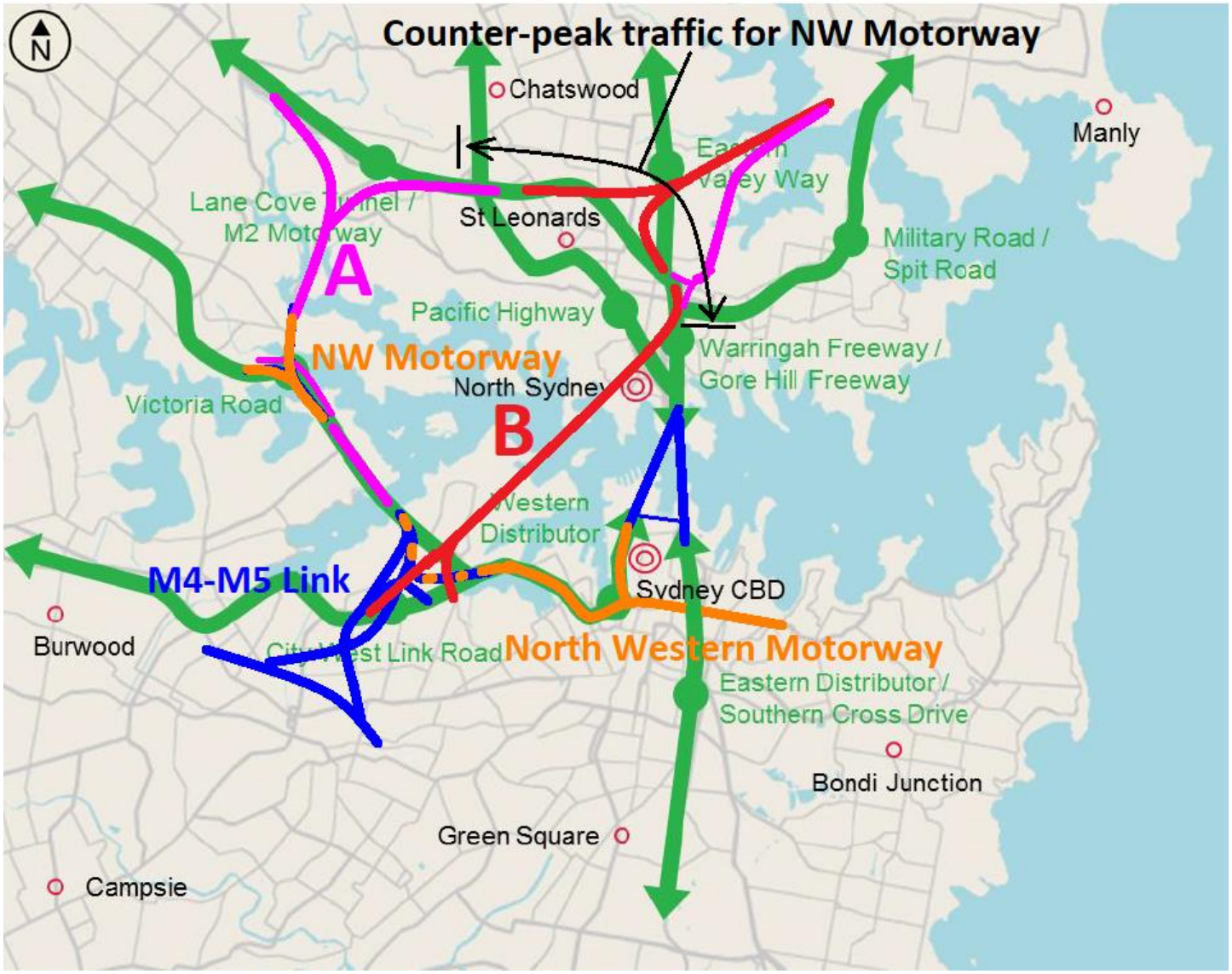
12.2 Beaches Link

Beaches Link, second half of the Warringah Freeway, can still be completed as a separate project as envisaged in the 1948 to 1974 studies. The County of Cumberland Plan 1948 (Section 3) has two versions of Beaches Link – the southerly option is envisaged.

With standard maximum portal grades of ~6.5%, rather the 4% maximum adopted for the Beaches Link, a direct approach to the motorway at the Cammeray Golf Course is possible. West- and south-facing ramps are then possible and permit connectivity missing from the current plan. The tunnel saving is 2 x ~3.5 km tunnels.

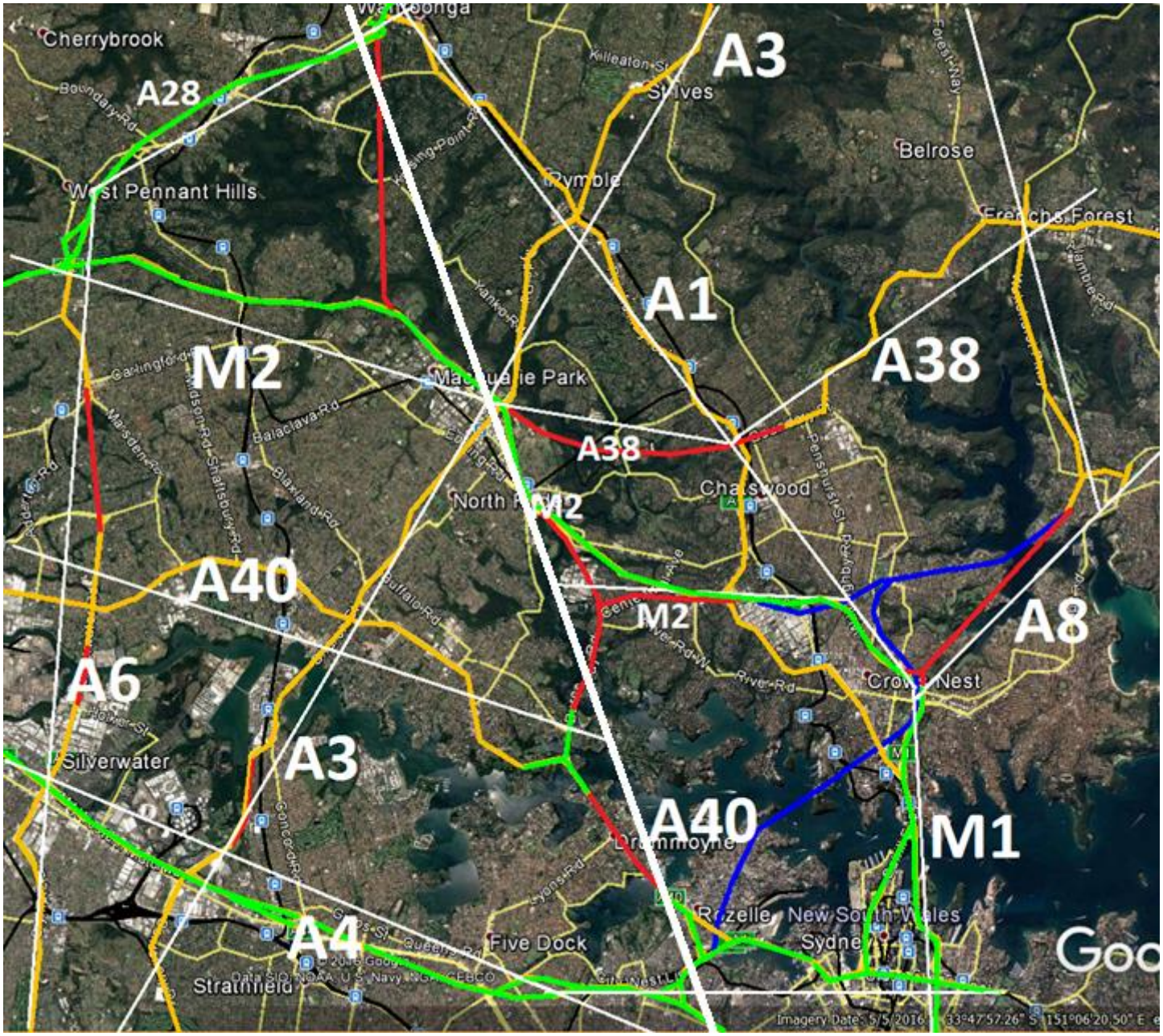
For comparison, maximum grade of M5 western portal is 8%. The grade of the Gladesville Bridge was set at 6% in the 1957 tender and built to this grade. The grade of the WHT, as planned from the Waverton Coal Loader park to the Warringah Freeway is 4.1%, down from 5.5%, achieved by extending the tunnels 550 metres.

The WHT grade is less than the maximum grade of the Sydney Metro with its steel wheels on steel rails low friction path (4.4%). A 4% maximum road grade is ridiculous requirement given the electrification of road vehicles underway.



--- Green Current road corridors as identified in the EIS
--- Orange North Western Motorway built and under construction
--- Blue Sydney Harbour Bridge, Sydney Harbour Tunnel and M4-M5 Link project
--- Pink(A) North Western Motorway with separate Beaches Link option
--- Red (B) The WHT-BL project

Figure 12.1 – Cross-harbour road options near the Sydney CBD



--- White – Grid applied to northern Sydney roads for spatial analysis. Northern Western Motorway represented by heavy white line.
--- Green and orange – existing and under construction roads
--- Blue – WHT and Beaches Link
--- Red – works to complete the North Western Motorway and A38, improve the A6 for heavy vehicles, and a cheaper, shorter, more functional Beaches Link suitable for the low level of heavy vehicles east of the A3.

Figure 12.2 – North Western Motorway in the context of northern Sydney road connectivity

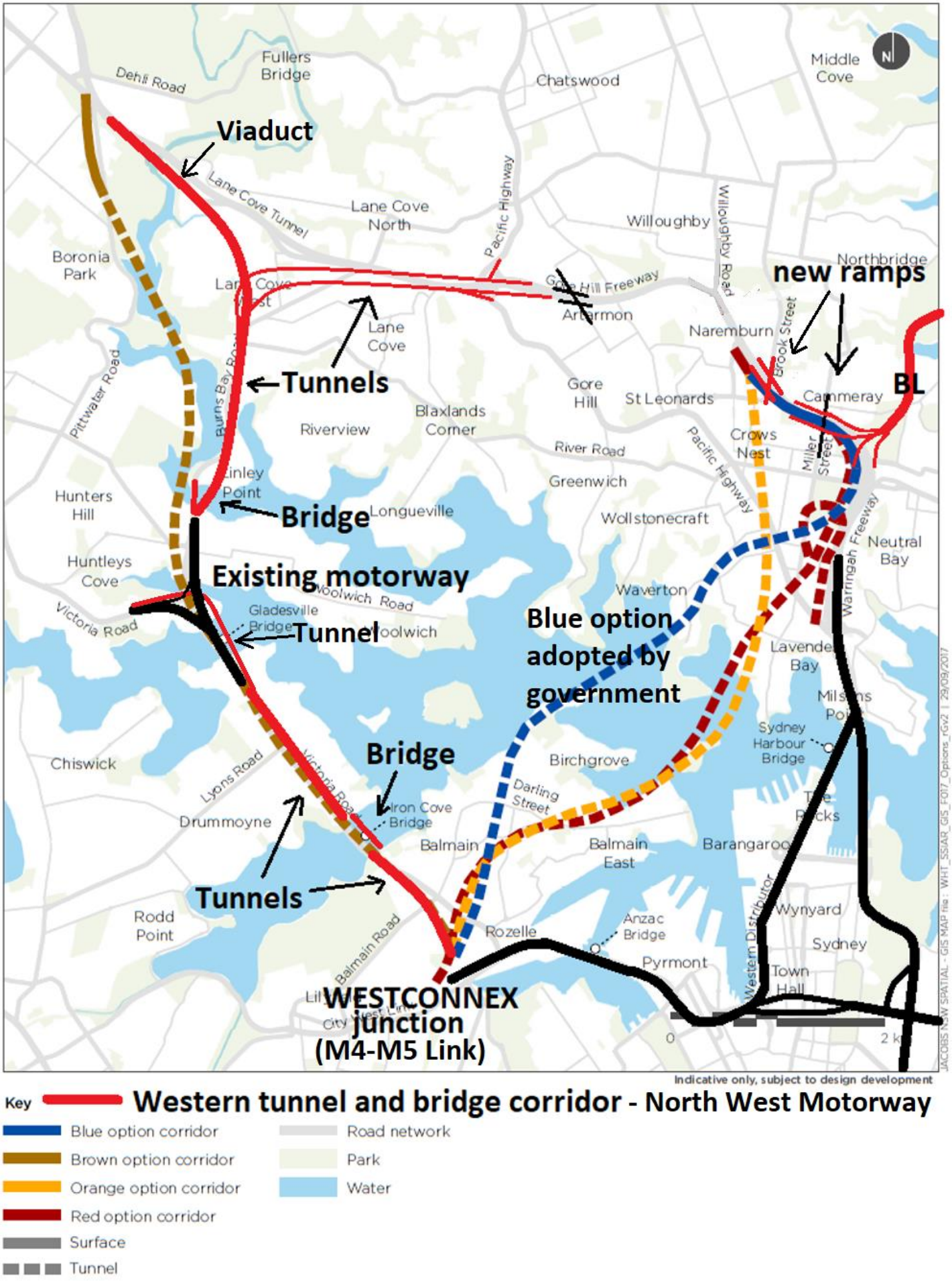


Figure 12.3 – WHT options including an option to complete the North Western Motorway

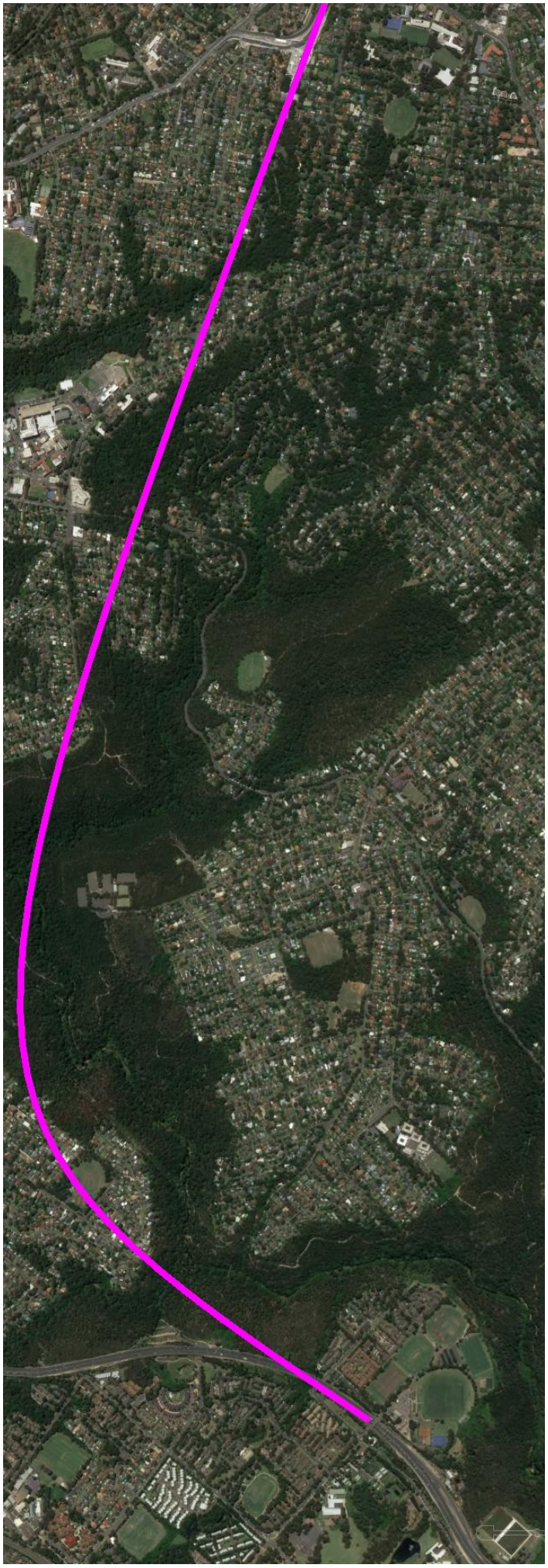
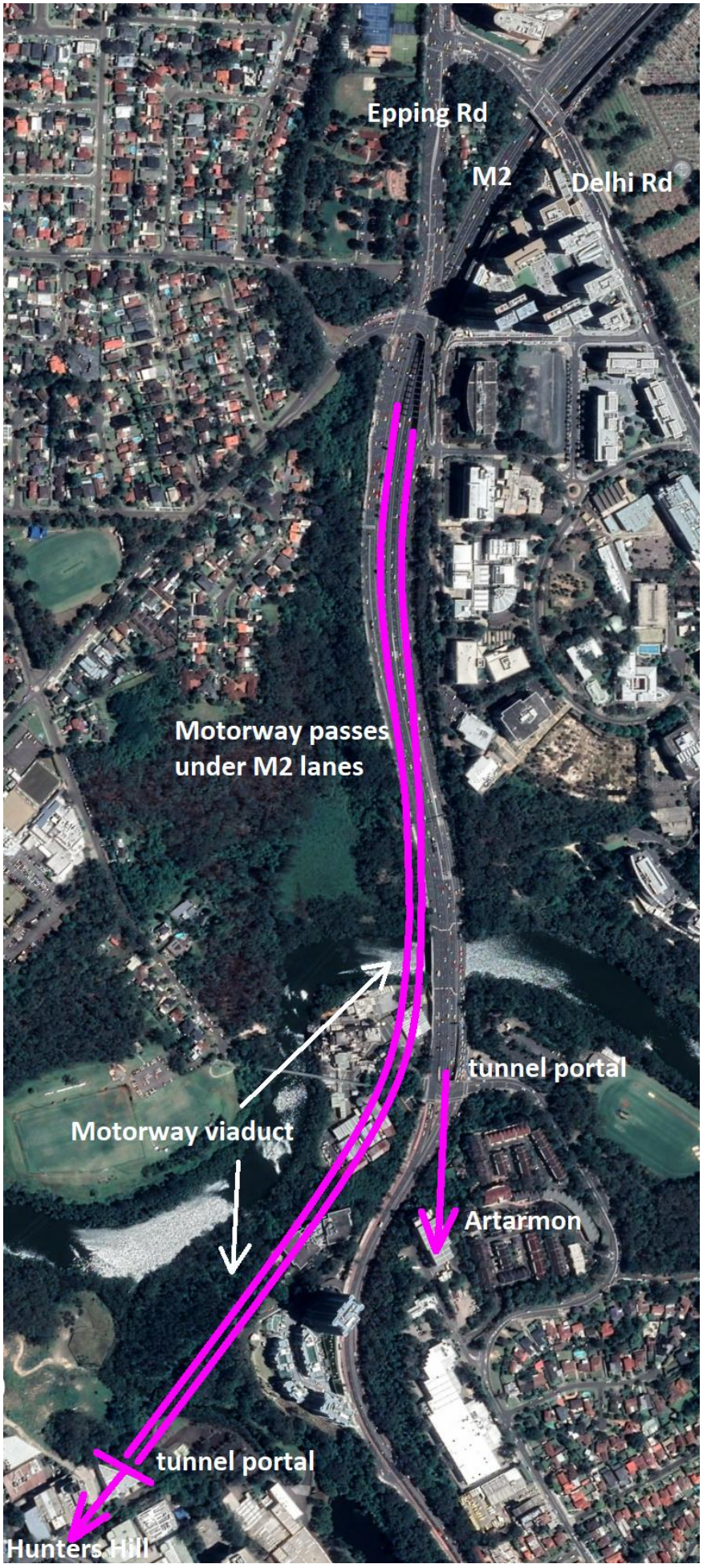


Figure 12.4 – Indicative NWM tunnel connection between M1 at Wahroonga (top) and M2 at Macquarie Park



--- Entry and exit provided to Epping Rd in the westerly direction – see Figure 11.
--- Northbound Lane Cove bound traffic will need to exit the NWM at Hunters Hill or take the Artarmon branch of the NWM to the Pacific Hwy.

Figure 12.5 – Indicative North Western Motorway connections to the M2 and Epping Rd

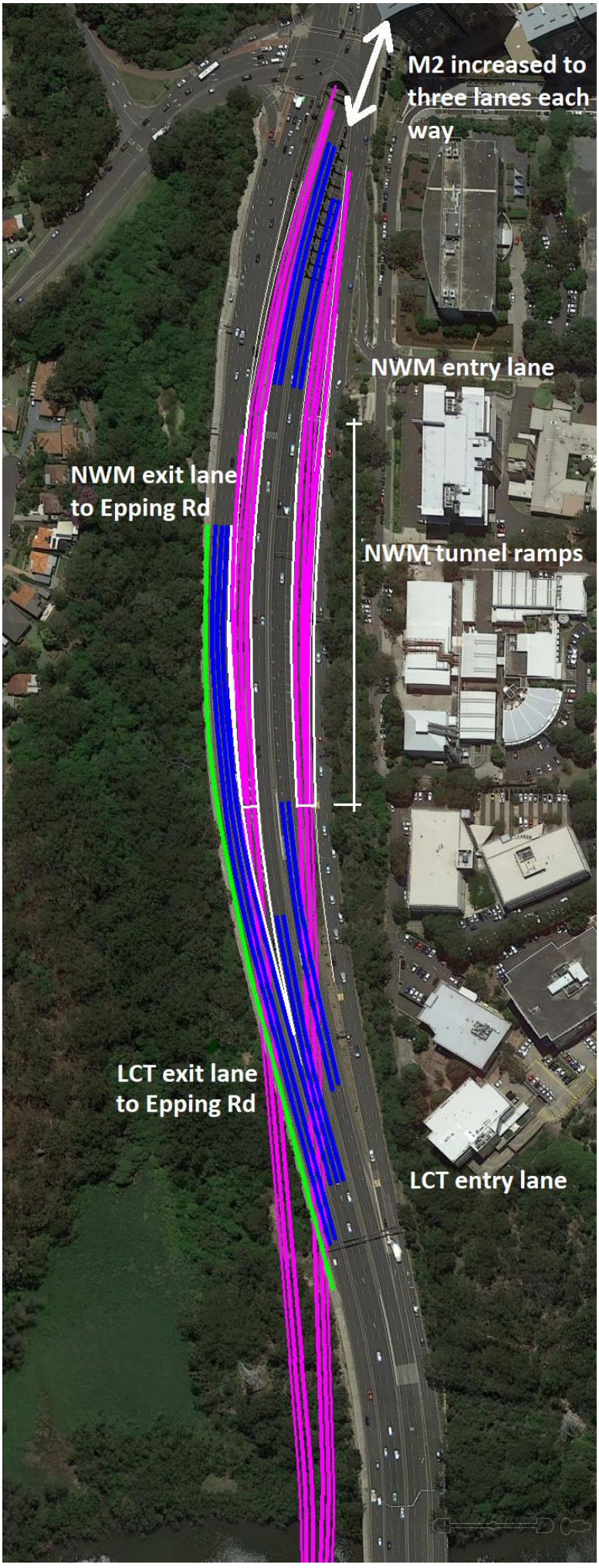


Figure 12.6 – Indicative North Western Motorway connections to the M2 and Epping Rd

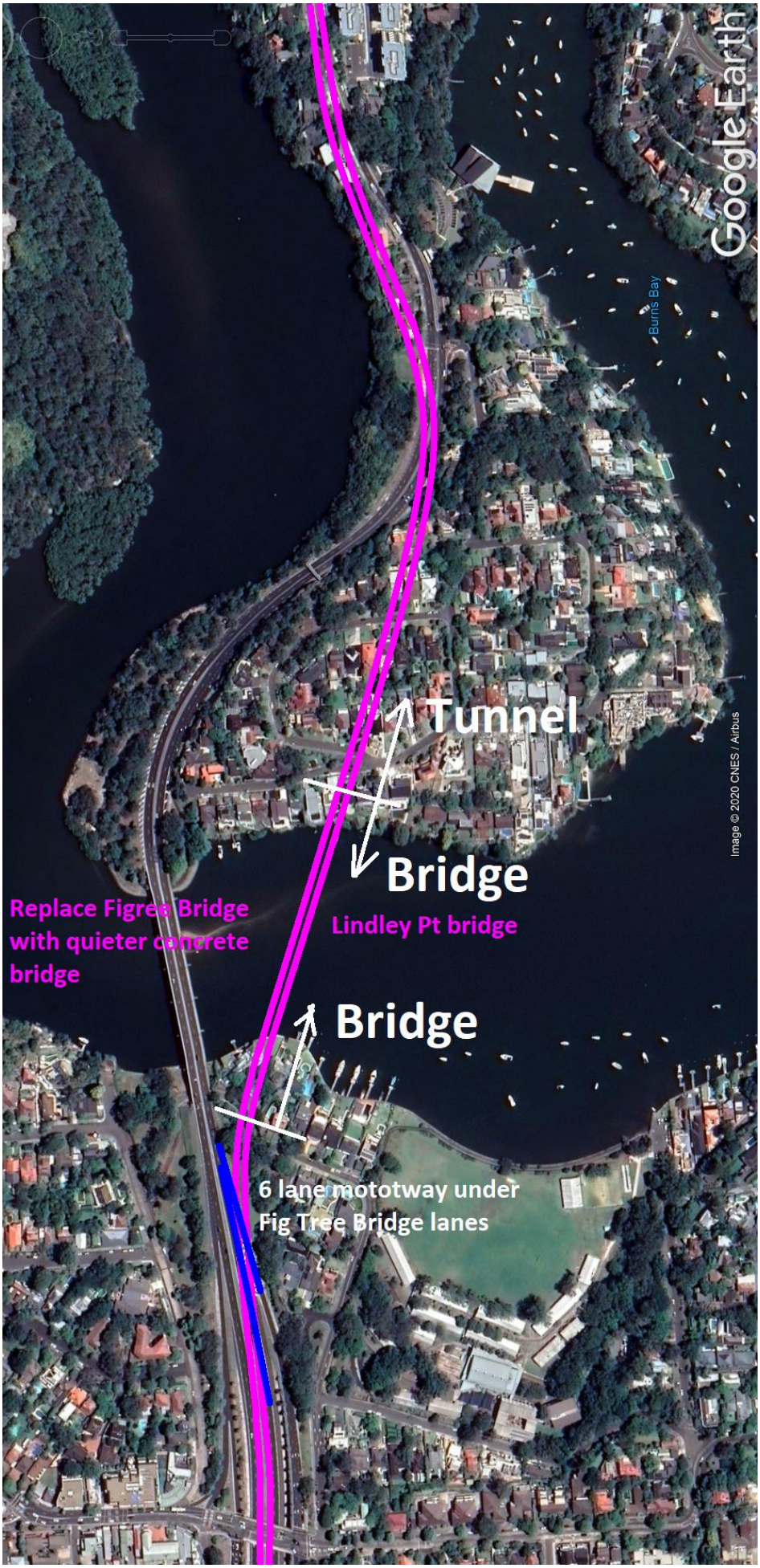
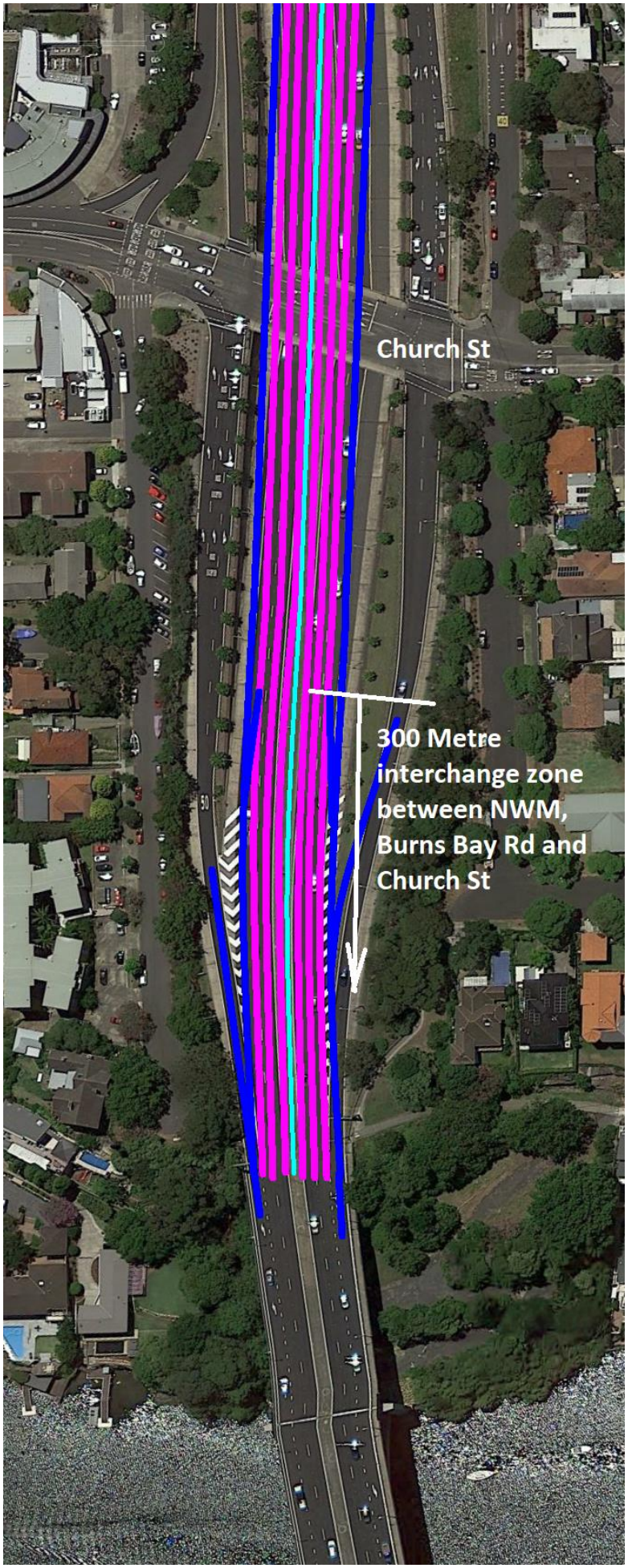


Figure 12.7 – Indicative North Western Motorway crossing of the Lane Cove River at Hunters Hill-Lindley Point

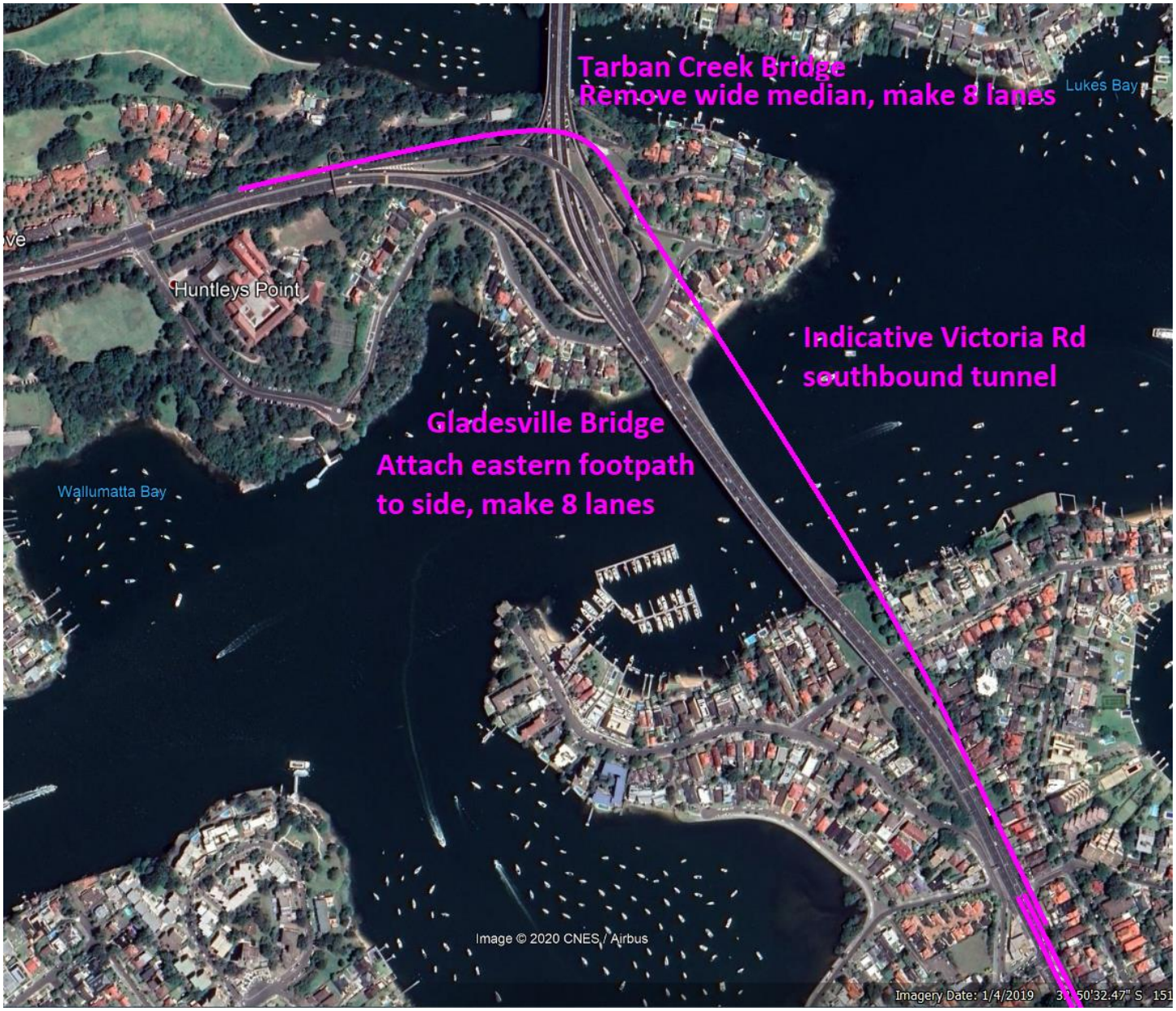
--- Aus 200 navigation chart 1999
--- Maximum water depth at crossing approximately 2.5 metres

Figure 12.8 – Indicative North Western Motorway crossing of the lane Cove River from Hunters Hill to Lindley Point



--- The crest of the road lanes under Church St is cut down to allow Burns Bay Rd to pass over the NWM on the northern side of the Hunters Hill Peninsula.

Figure 12.9 – Indicative North Western Motorway interchange with Hunters Hill ramps and Burns Bay Road

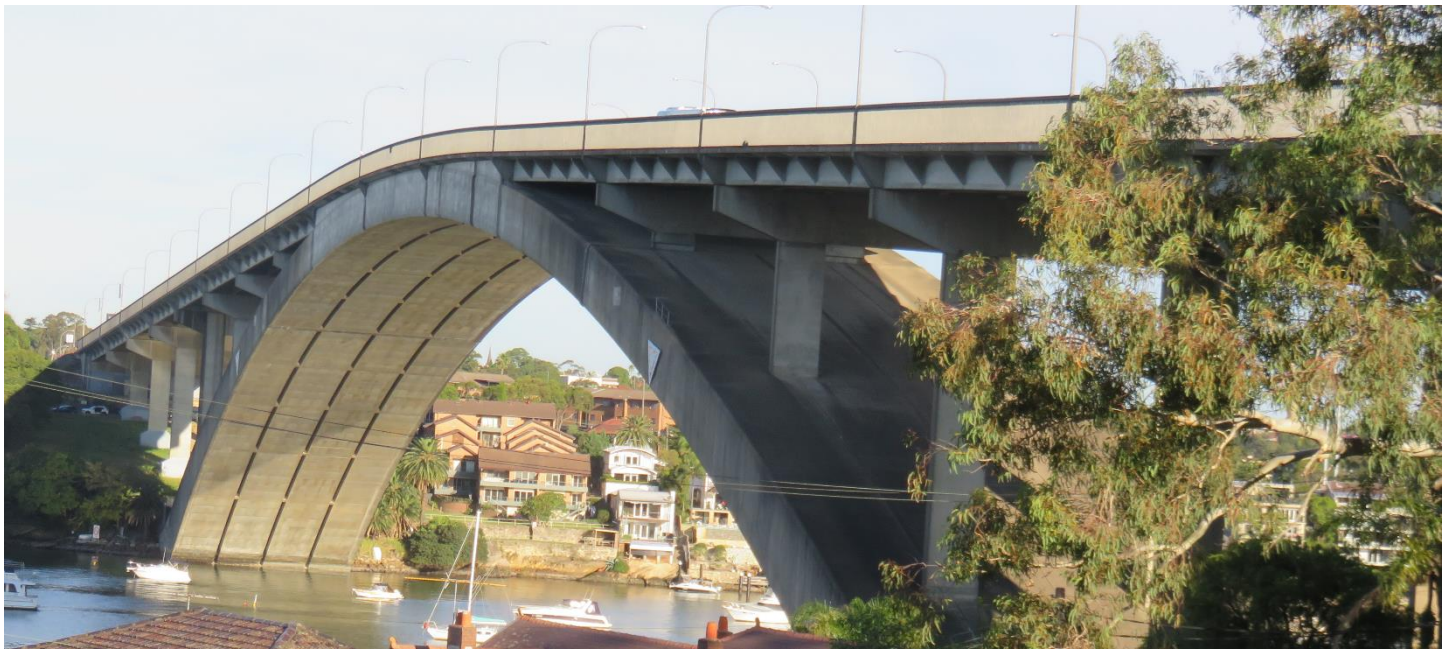


--- As per WHT EIS proposal for Reserve Road bridge widening at the GHF, the eastern and western footpaths are narrowed to provide space for an eighth traffic lane.
--- Pedestrian-cycle paths are added to both sides of the bridge with good design used to disguise the over-hang of the concrete spans.

Figure 12.10 – Indicative North Western Motorway and Victoria Rd crossing of Parramatta River

--- Aus 200 navigation chart 1999
--- Maximum water depth at Victoria Rd tunnel approximately 12 metres

Figure 12.11 – Parramatta River at Gladesville Bridge



--- Proposed widening of footpaths will be barely perceptible

Figure 12.12 – Gladesville Bridge in 2020

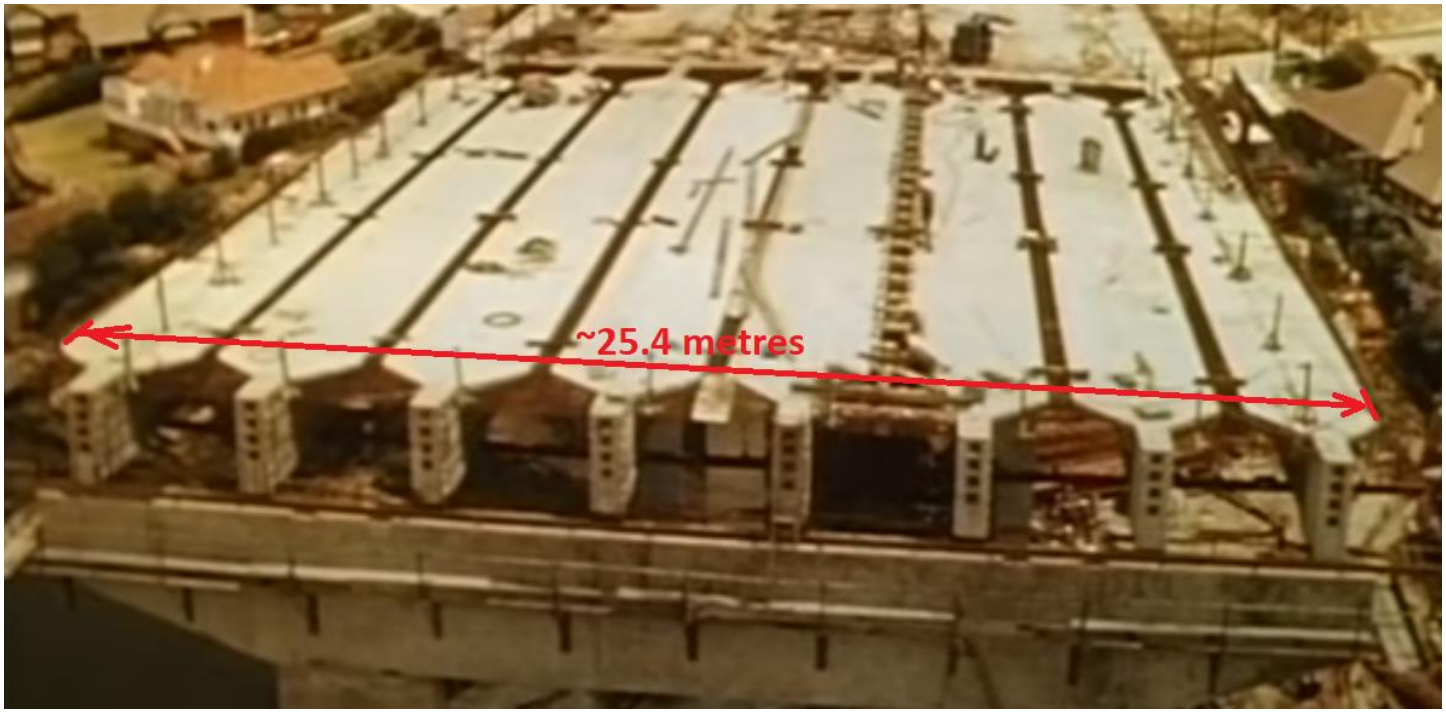


Figure 12.13 – Gladesville Bridge construction 1964 – 8 deck 'T' beams adequate for 8 traffic lanes

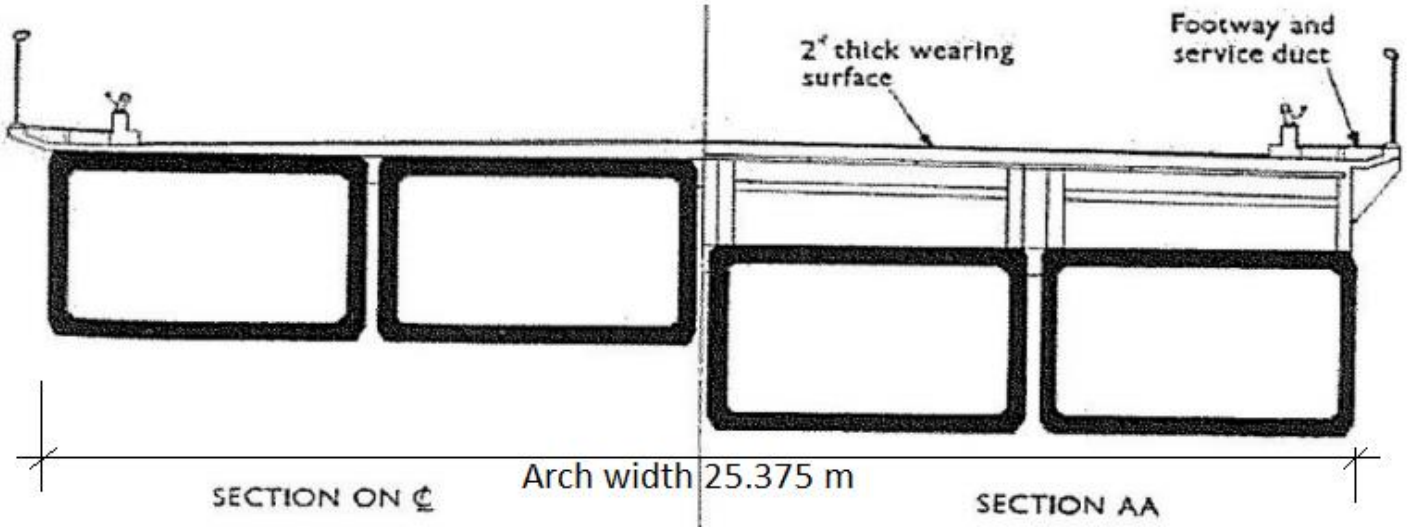
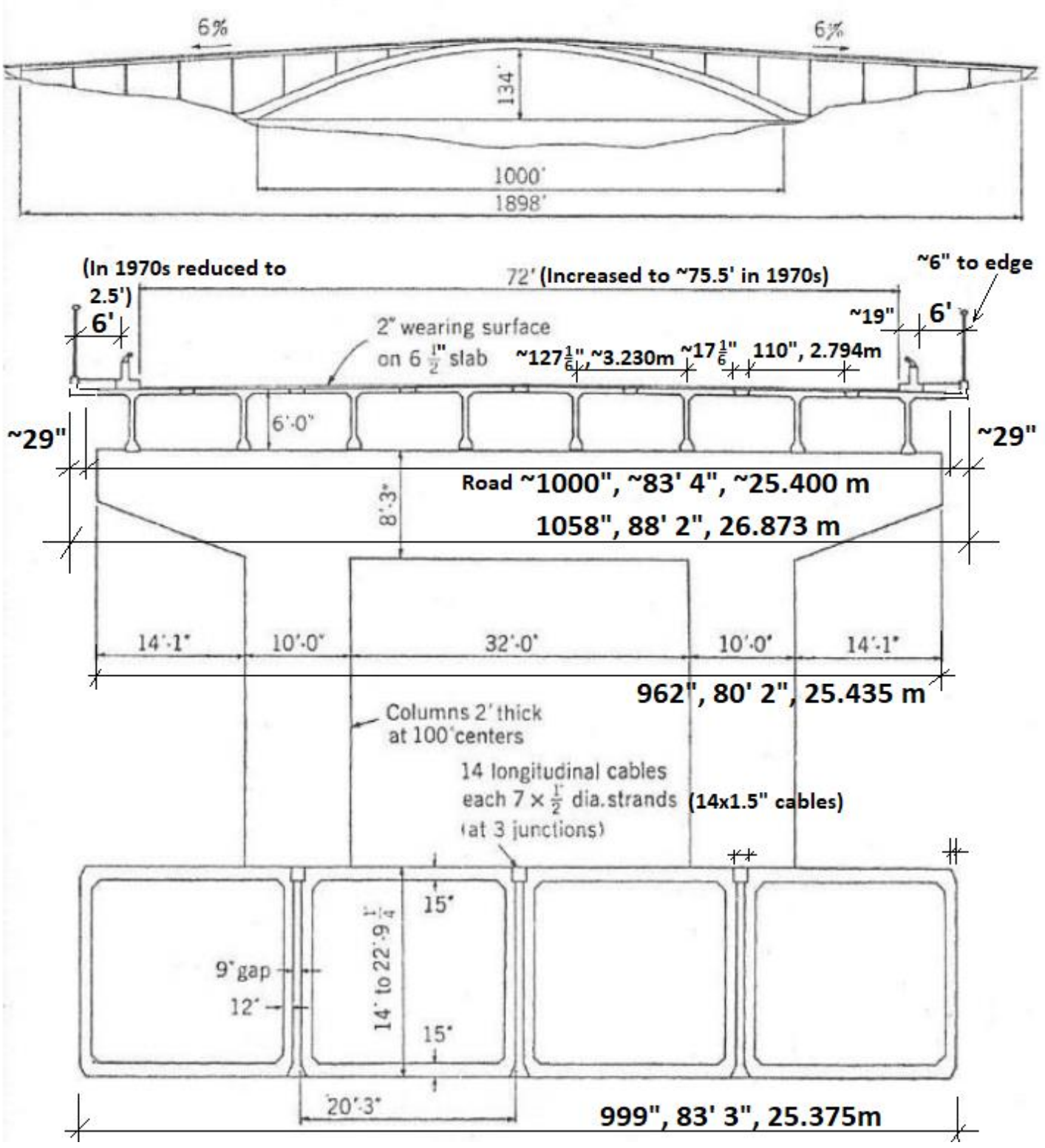
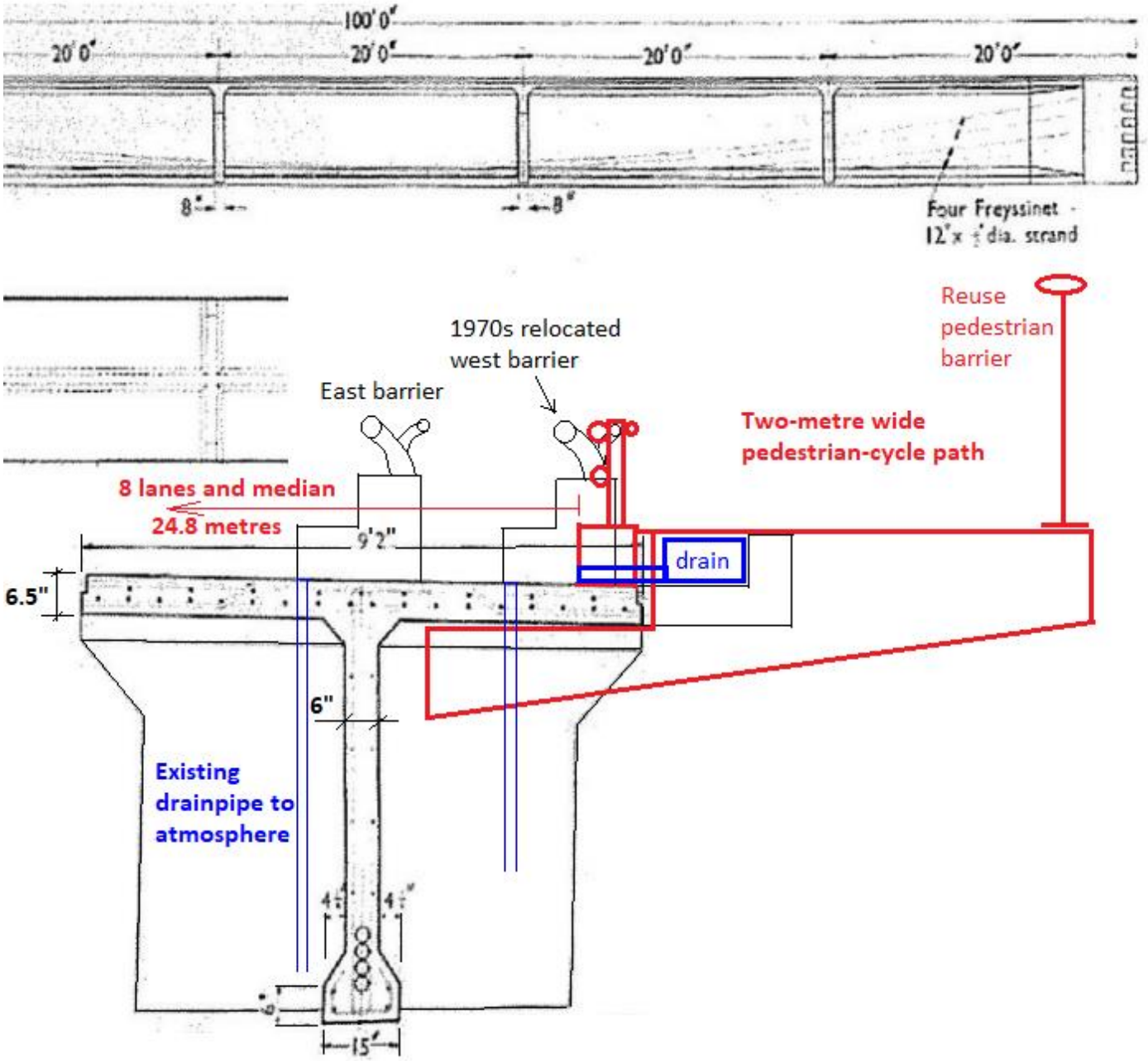


Figure 12.14 – Gladesville Bridge arch at crest – arch has sufficient width to support 8 traffic lanes



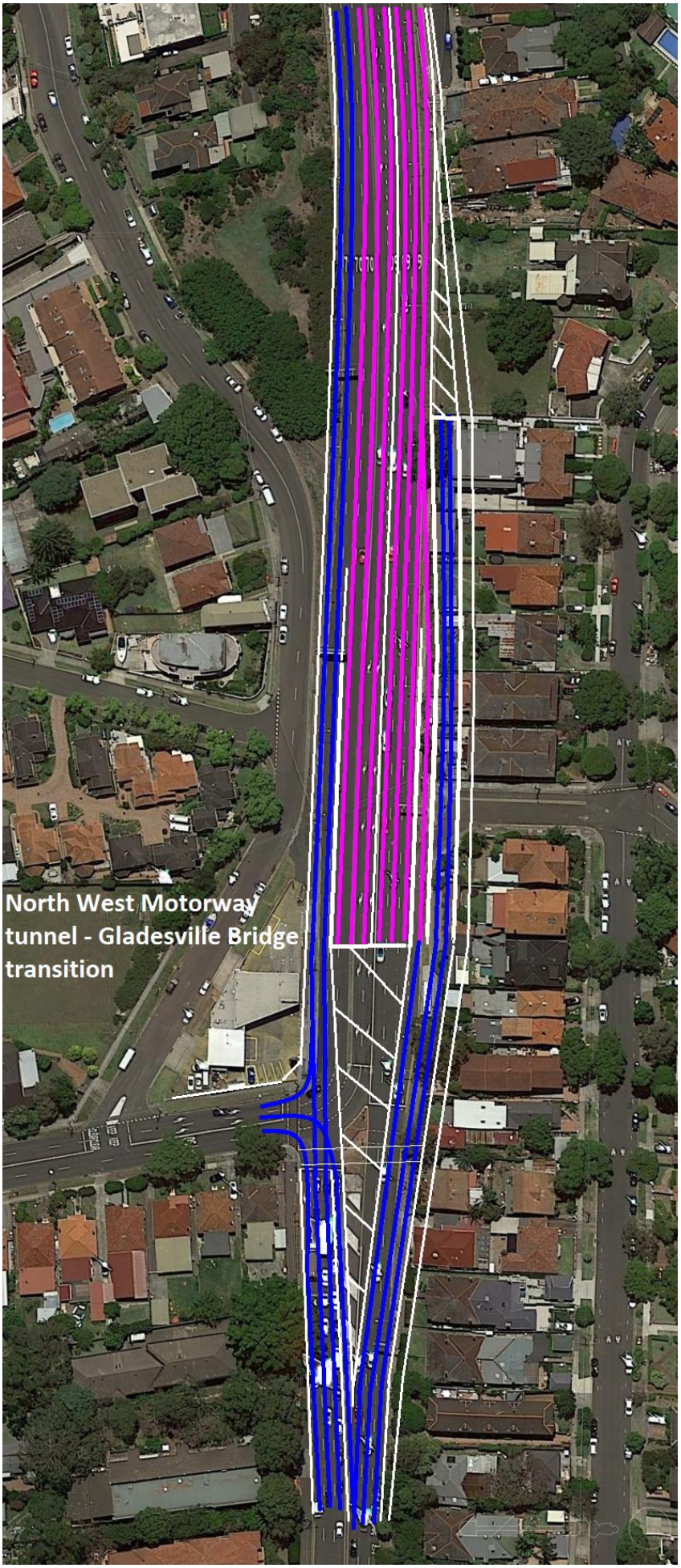
--- (') feet; (") inches.

Figure 12.15 – Gladesville Bridge X-section dimensions



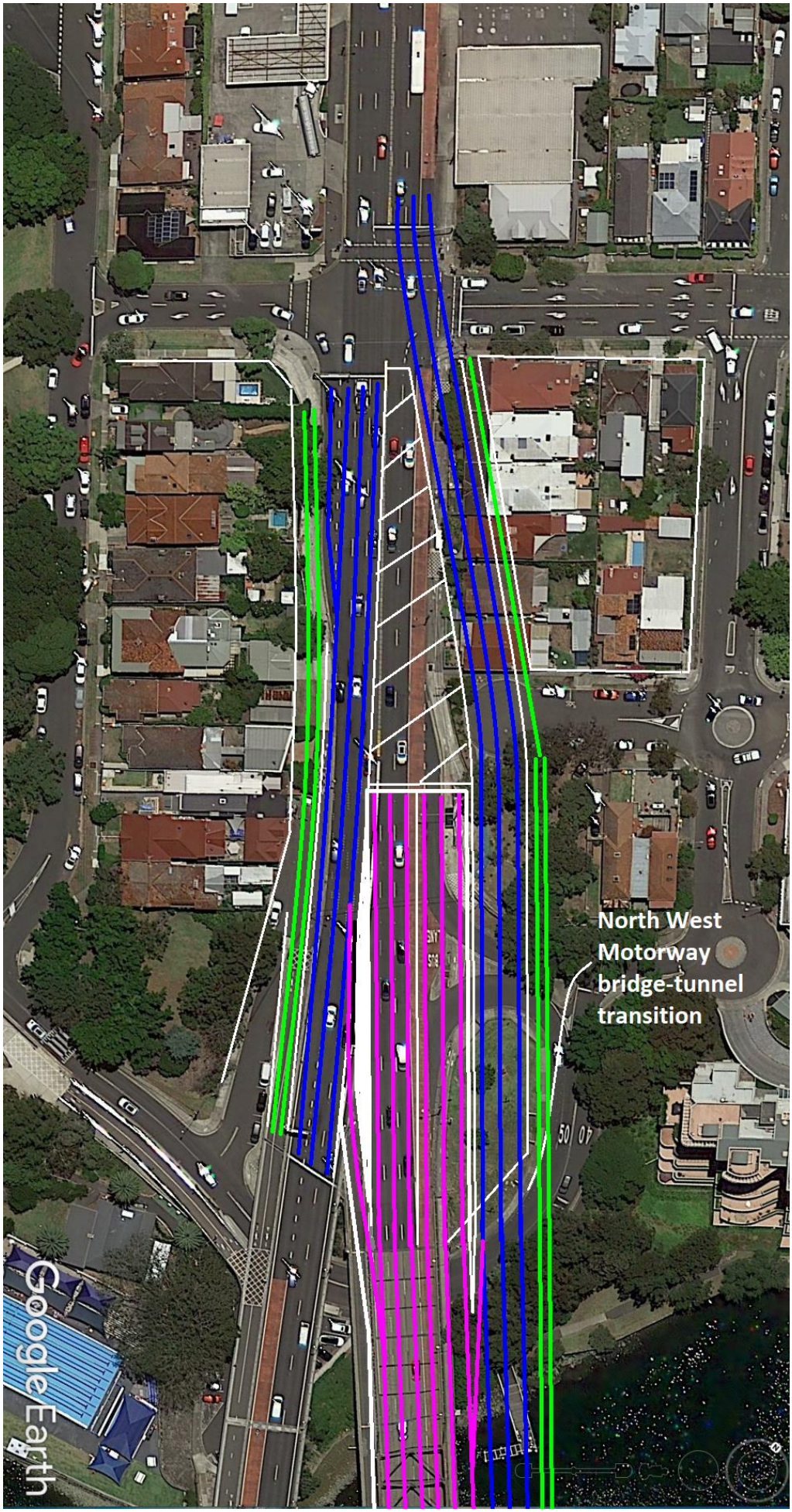
--- Top, placement of web stiffeners at 20 ft intervals along 100 ft precast beams (6kpsi, 41 MPa concrete).
--- West footpath narrowed by 1.07 metres in 1970s to permit 7 road lanes of 3.1 m.
--- Bridge widening for 8 traffic lanes of 3.05 m, and two pedestrian-cycle paths of 2.0 to 2.5 m.
--- Road pollution presently dropped to atmosphere when road washed by rain. Replace with drain to pollution control traps

Figure 12.16 – Gladesville Bridge widening for 8 traffic lanes and two pedestrian-cycle paths



--- Two northbound Victoria Rd lanes use bridge. Interchange with motorway on bridge.
--- Victoria Rd southbound emerge from cross-harbour (Parramatta River) tunnel (2, possibly 3, lanes) to join an exit lane from the bridge.

Figure 12.17 – North Western Motorway interchange at Drummoyne Gladesville Bridge approach

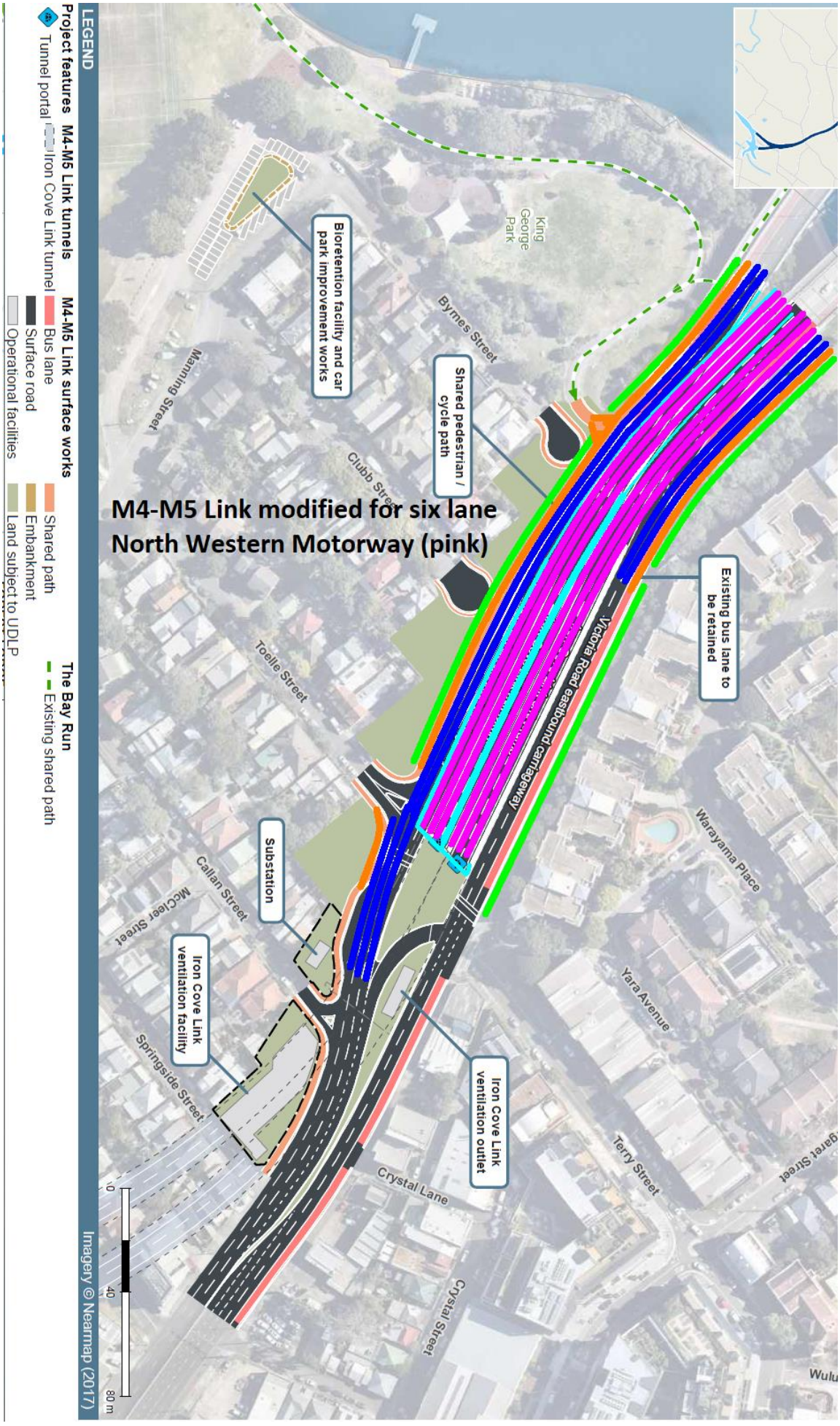


--- Rising terrain ensures minimal intrusion of motorway aboveground

Figure 12.18 – North Western Motorway interchange northern side of Iron Cove

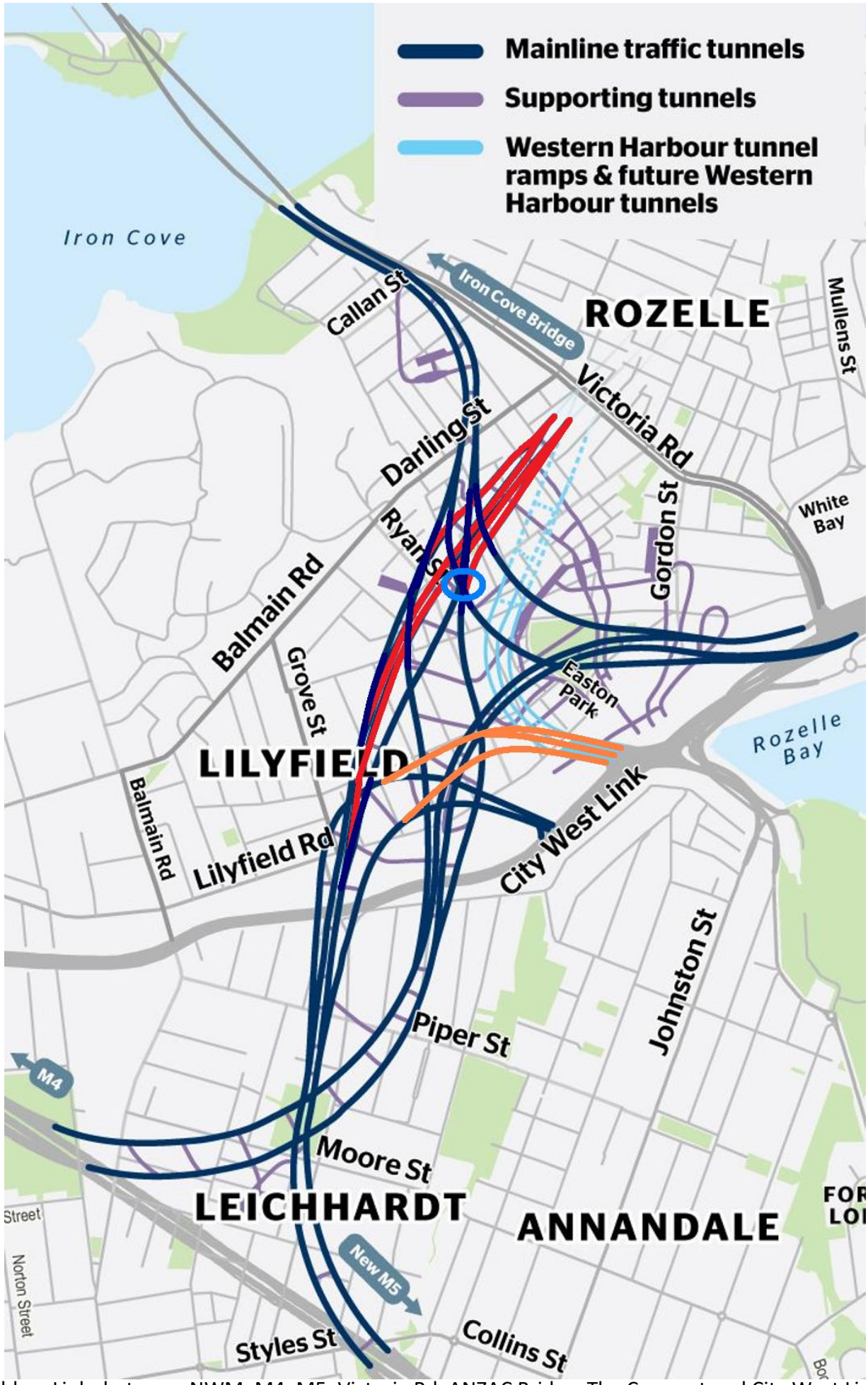
--- Aus 200 navigation chart 1999
--- Blue – recent bridge with 3 road lanes and pedestrian-cycle path
--- Pink – Victoria Road southbound with pedestrian-cycle path
--- Existing bridge replaced by 6 lane bridge once Victoria Rd southbound complete

Figure 12.19 – Iron Cove - water depth approximately 4 metres at bridges



--- For NWM alternative, ~750 metres of Link motorway to the Iron Cove bridges is widened from 4 to 6 lanes (including 220 metres of exposed tunnel ramp from bridges).
--- New bridges, Victoria Rd citybound bridge built before NWM replaces below standard Iron Cove Bridge.

Figure 12.20 – M4-M5 Link Iron Cove connection with NW Motorway - modified M4-M5 Link drawing



--- Dark blue: Links between NWM, M4, M5, Victoria Rd, ANZAC Bridge, The Crescent and City West Link.
--- Light Blue and Red: additional motorway for Western Harbour Tunnel
--- Orange: Improved M5 Link. The Crescent traffic bound for the NWM would use Victoria Rd though Rozelle.
--- Blue circle: a conflict in this WHT plan with four tunnels merging at one point (3 tunnels merge is max)

Figure 12.21 – M4-M5 Link - additional motorway to change from NMW to WHT plan

13 Lane Cove to Sydney CBD (M1) motorway corridor upgrade

Due to changes of political priorities and intermittent construction over decades, the M1 corridor (Gore Hill Freeway-Warringah Freeway) from the Pacific Hwy Lane Cove to the City has service structure issues – some of which are addressed by6 the project.

The growth of public transport demand is high due to better quality services which includes mobile phone services to make greater use of travel time, while private road travel demand is falling as noted in earlier chapters.

A key element of this proposal is provision of a Western Distributor harbour tunnel to replace the Cahill Expressway harbour bridge lanes converted to rail use (Section 8) and deconfliction (separation) of traffic to and from the highly dense northern end of the City CBD and traffic bypassing it.

Proposed upgrade works, drawn from WHT plans where possible, are presented in order from Lane Cove to Sydney City in Figures 13.1 to 13.18.

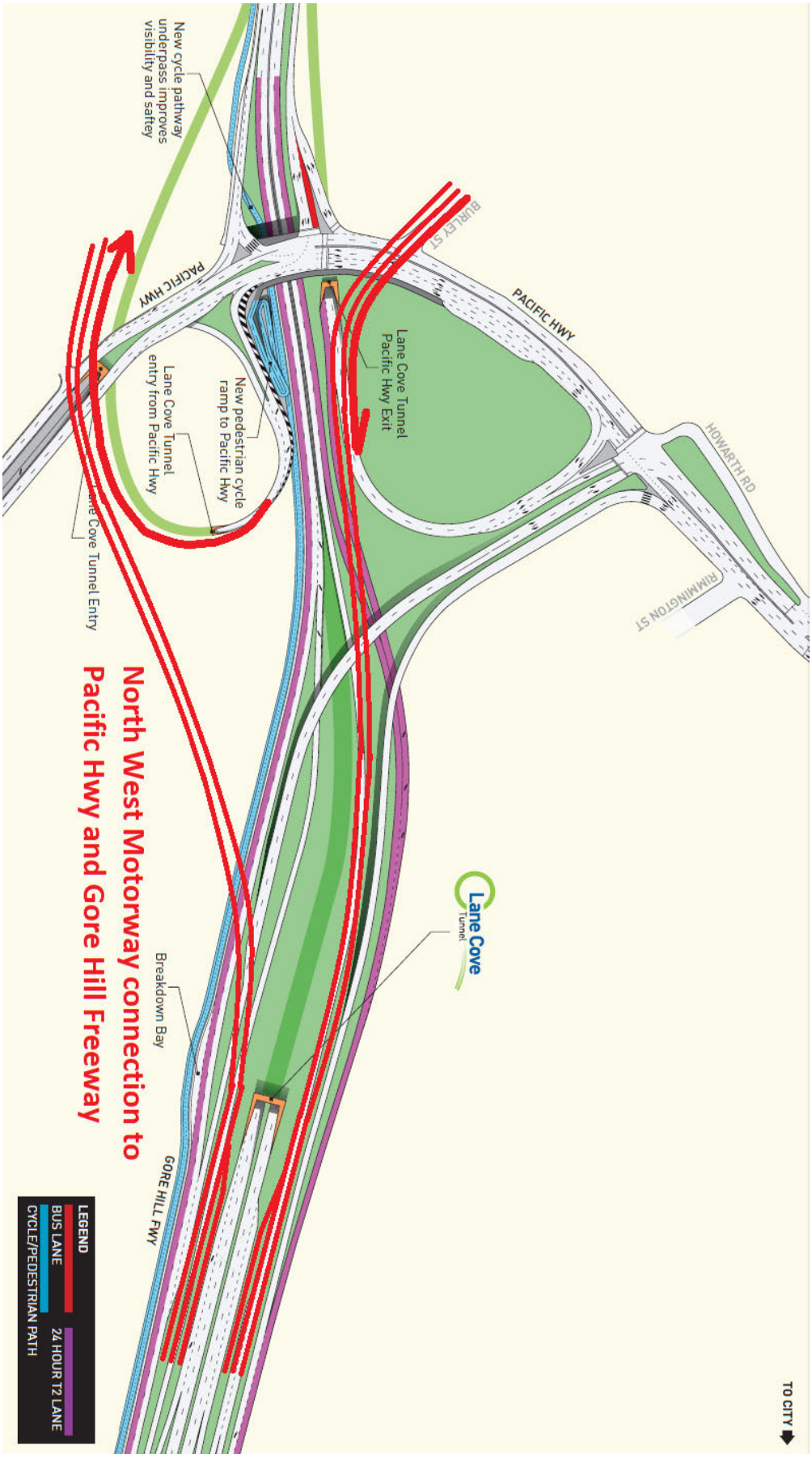


Figure 13.1 – Indicative NWM connection to Pacific Hwy, Reserve Rd and GHF at Artarmon

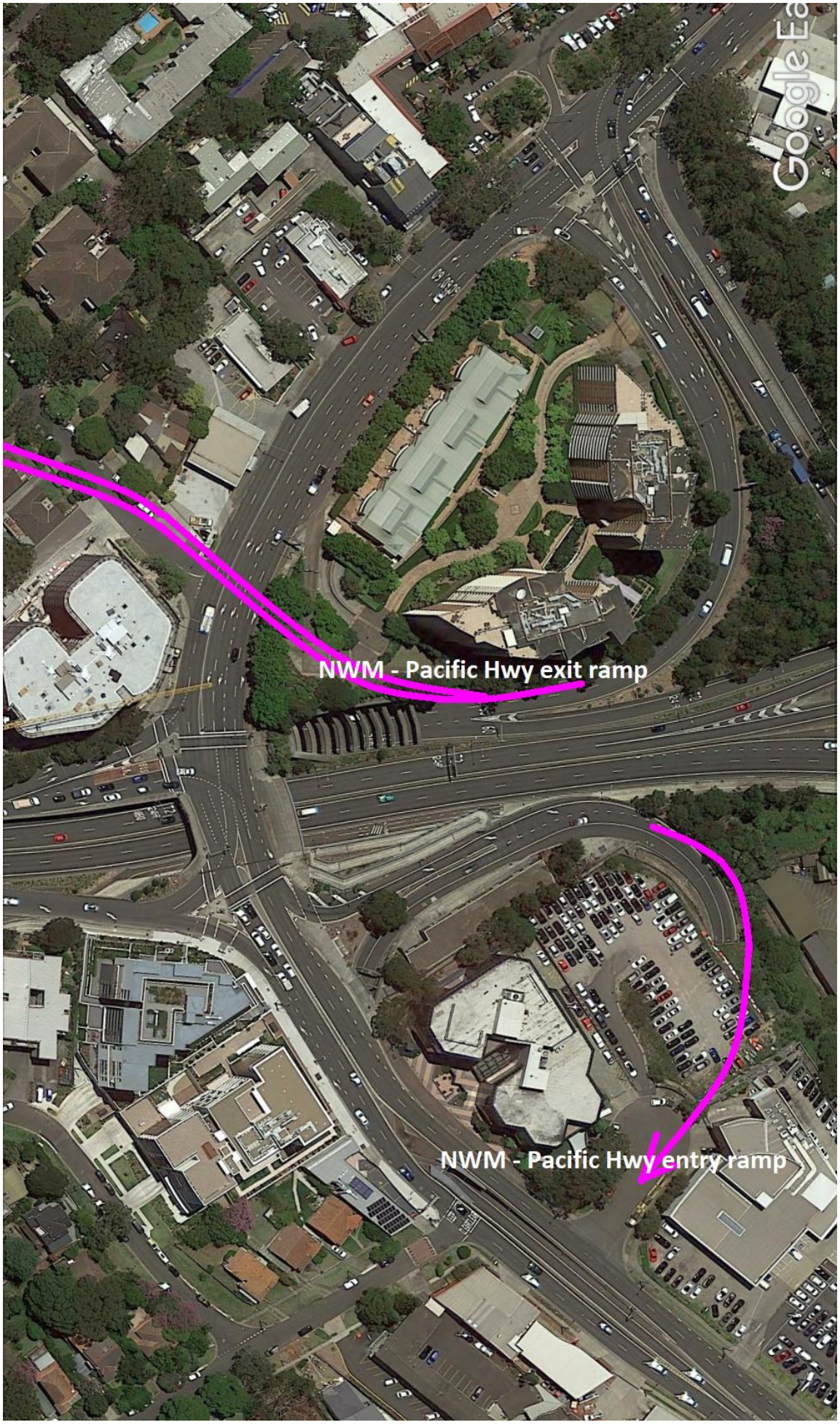


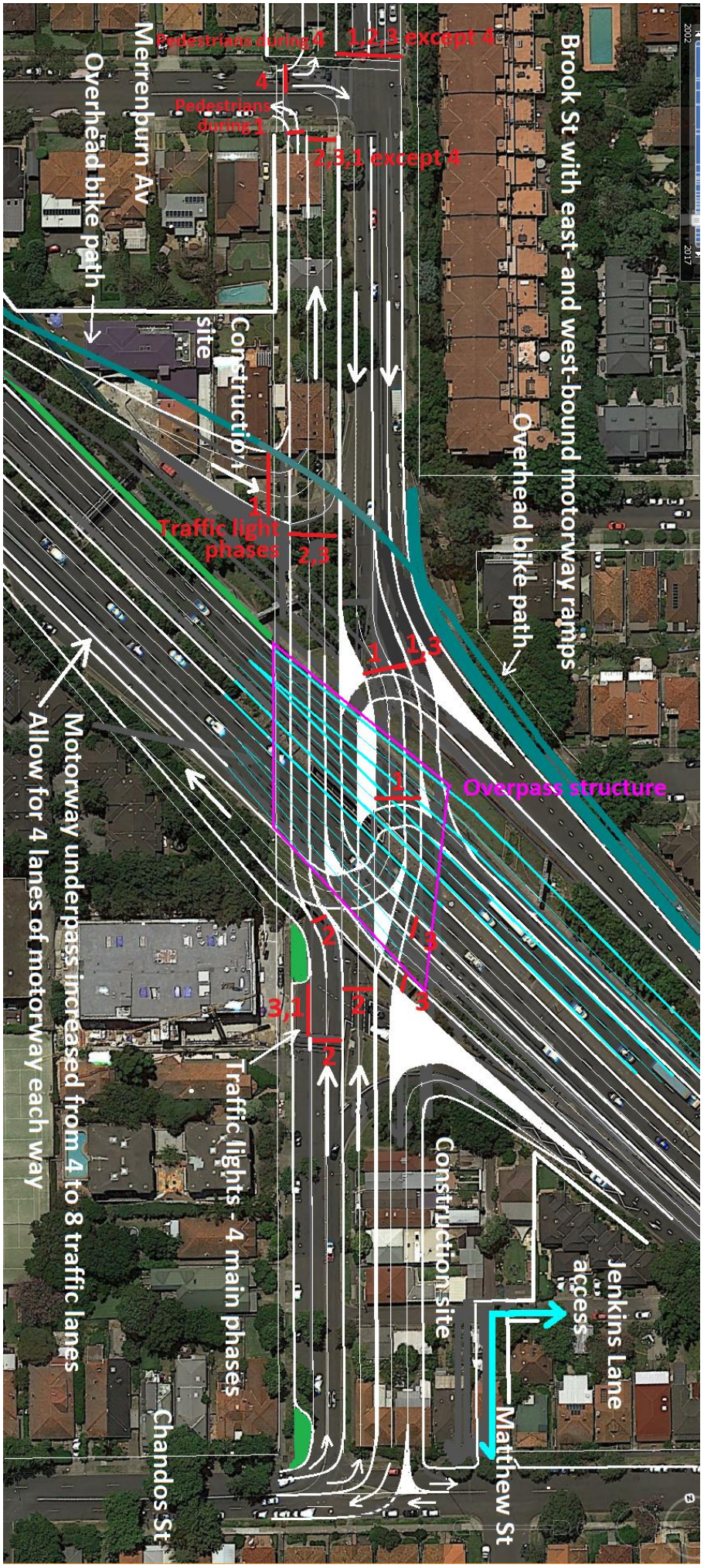
Figure 13.2 – Indicative NWM connection to Pacific Hwy at Artarmon

--- Reserve Road motorway overpass rebuilt to permit extra lanes to pass under and to provide two turning lanes to/from each ramp. NWM shown in pink.

Figure 13.3 – Indicative NWM connection to Reserve Rd and GHF at Artarmon

--- For the loss of 21 dwellings, motorway access for the mid-North Shore east of the railway can be deconflicted from four local centres – Naremburn, Willoughby, Northbridge and Cammeray. (See Section 10 (Parks) for Willoughby Rd jcn)

Figure 13.4 – Focus motorway traffic on Brook St to avoid cross-region traffic passing through local centres



--- 3-phase signals achieved by directing some traffic from the motorway to Crows Nest via Merrenburn Ave.

Figure 13.5 – Indicative Brook St motorway junction with both east and west facing ramps

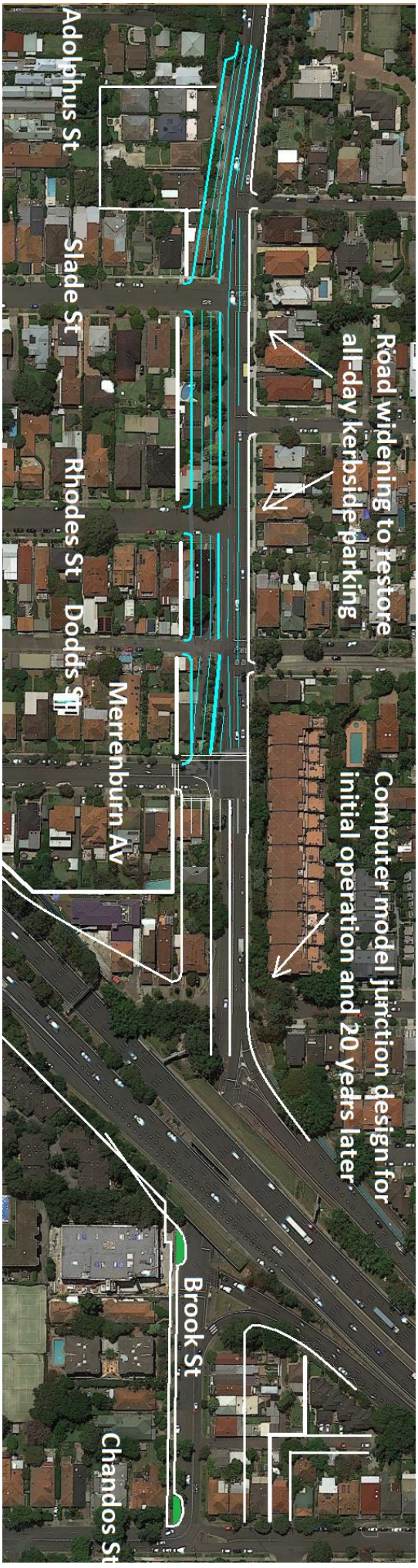
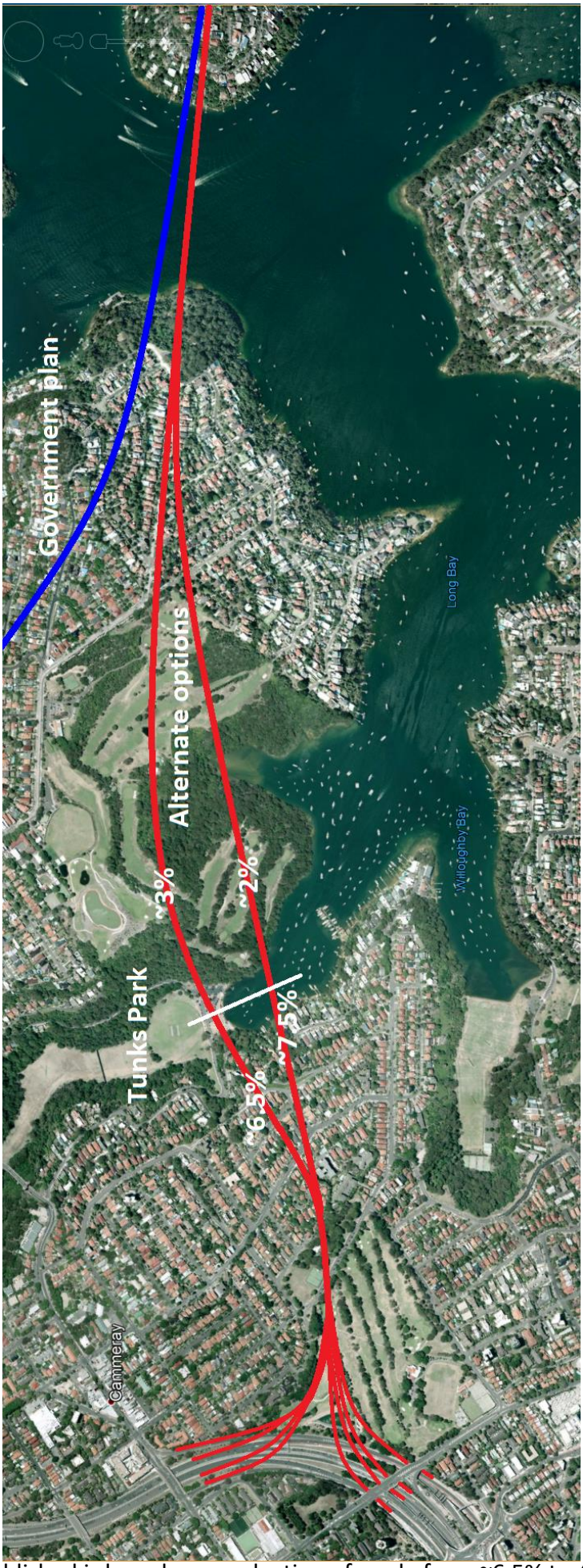


Figure 13.6 – Indicative Brook St widening

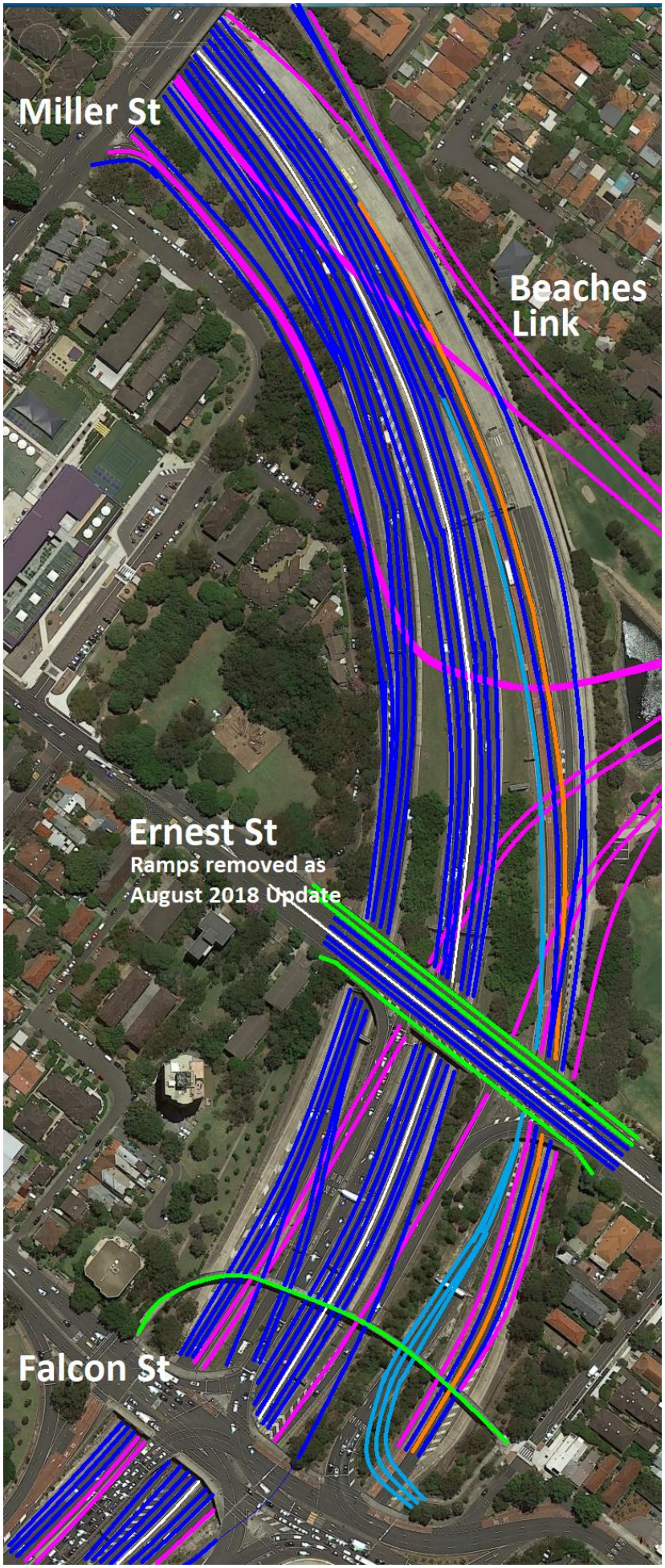


--- Beaches Link route as published is based on a reduction of grade from ~6.5% to 4% to reduce heavy truck pollution. However, heavy trucks (over 4.5 tonnes) are less than 4% of traffic, and trucks with 4, or more, axles are less than 1% of traffic. The arrival of electric vehicles will eliminate the pollution issue.
--- A 6.5% grade allows a 3.5 km reduction in length of Beaches Link and better positioned connections.

Figure 13.7 – Indicative Beaches Link connection to the Warringah Freeway from Middle Harbour

--- Aus 200 navigation chart 1999
--- Water depth for Middle Harbour crossing is over 30 metres

Figure 13.8 – Beaches Link crossing of Middle Harbour



--- In contrast to the WHT-BL plan, this Beaches Link plan has both north and south bound connections to and from Miller St, Brook St, Gore Hill Freeway, Sydney Harbour Bridge, Sydney Harbour Tunnel, High St (N. Sydney), Berry St, and the WHT if built.

Figure 13.9 – Indicative Beaches Link connecting lanes to Warringah Freeway

--- North West Motorway proposal reduces Warringah Freeway traffic at Cammeray/Neutral Bay by 80,000 vehicles per day. Reduced traffic permits return of Ernest St to a local road as per August 2018 Update.

Figure 13.10 – Eliminate Ernest St connections as per WHT-WF plan August 2018 Update

--- ‘Diverging Diamond’ Falcon St junction of EIS adopted for a two-phase intersection

Figure 13.11 – Falcon St junction

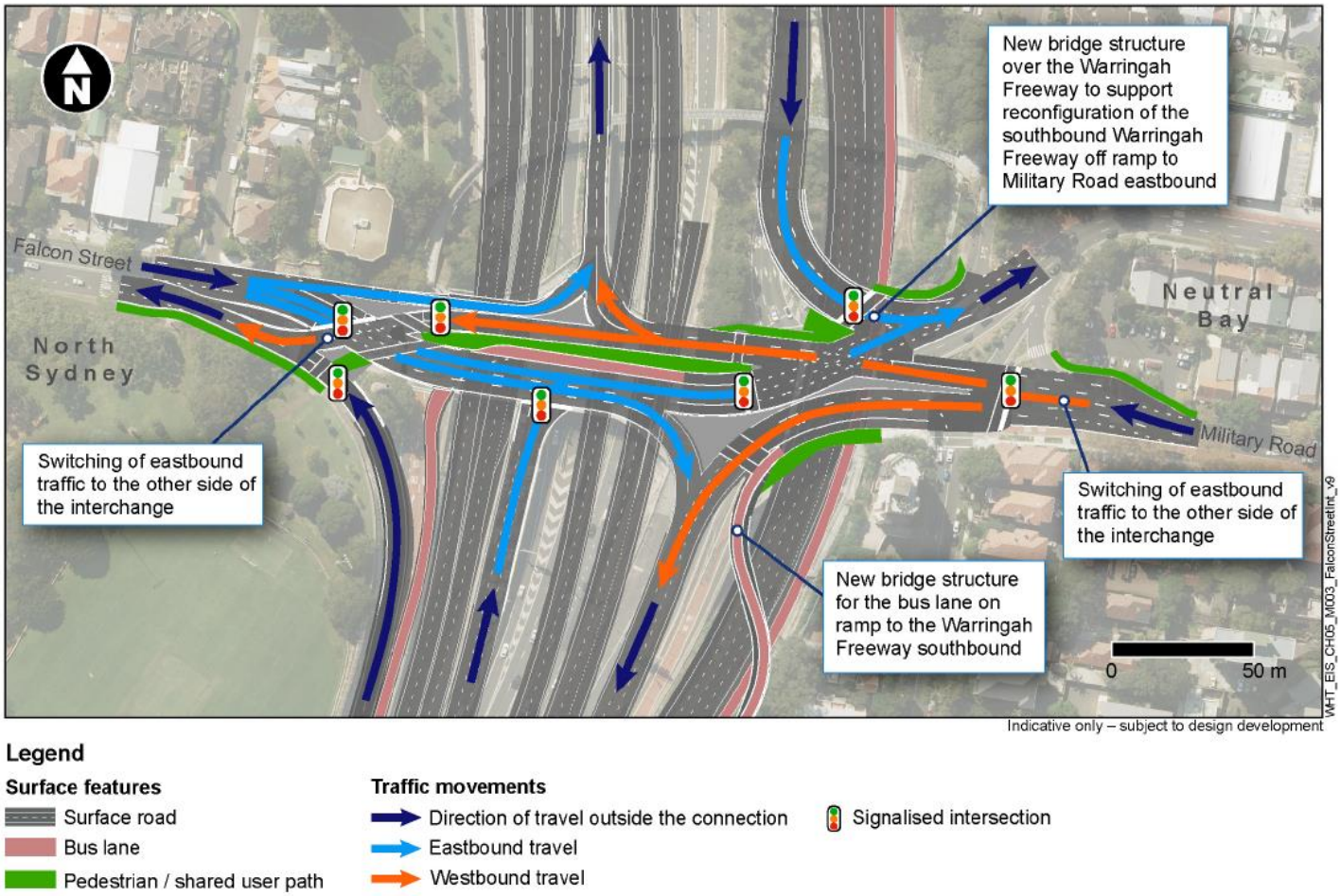


Figure 5-27 Upgrade of the Falcon Street interchange

Figure 13.12 – Falcon St junction modelled on this diagram from the EIS

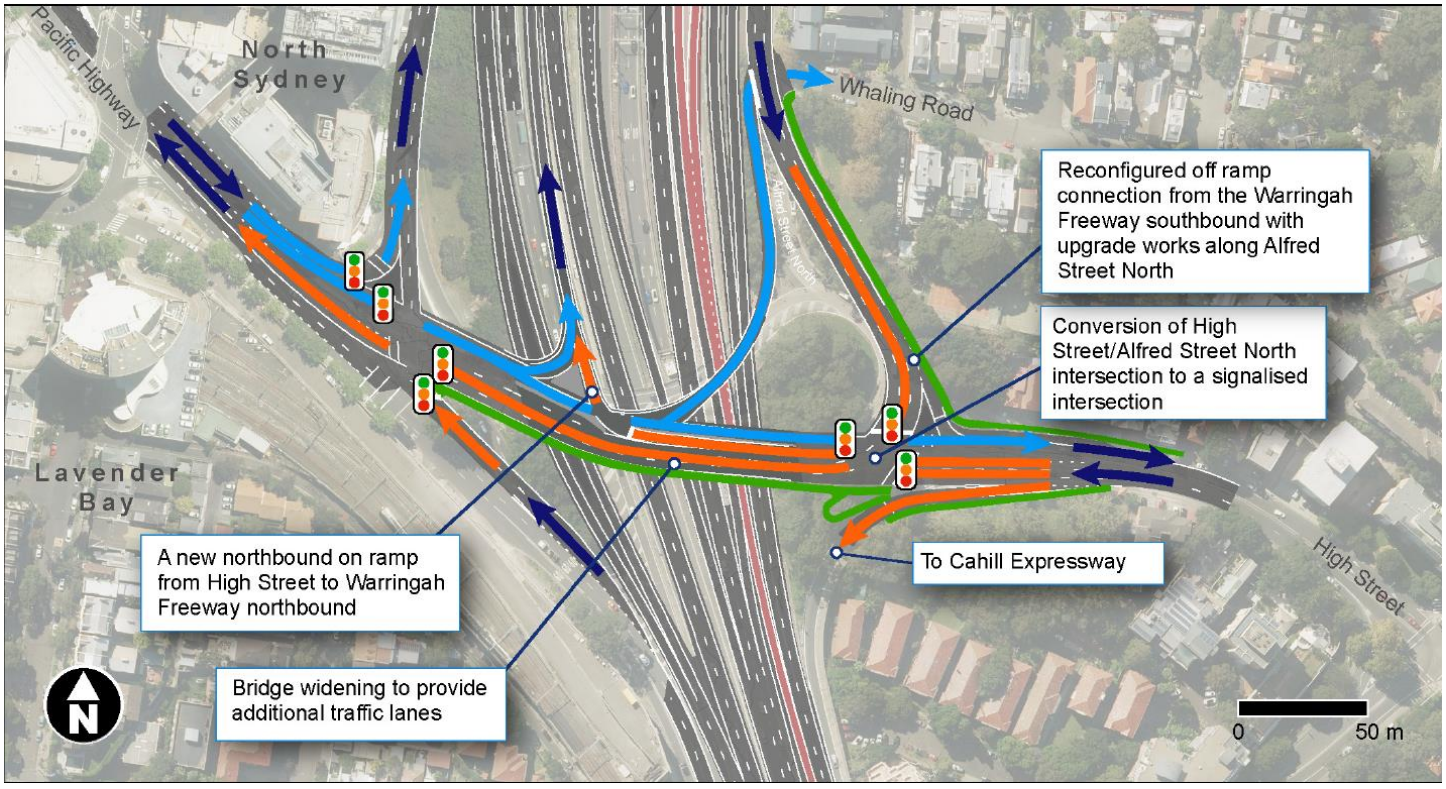
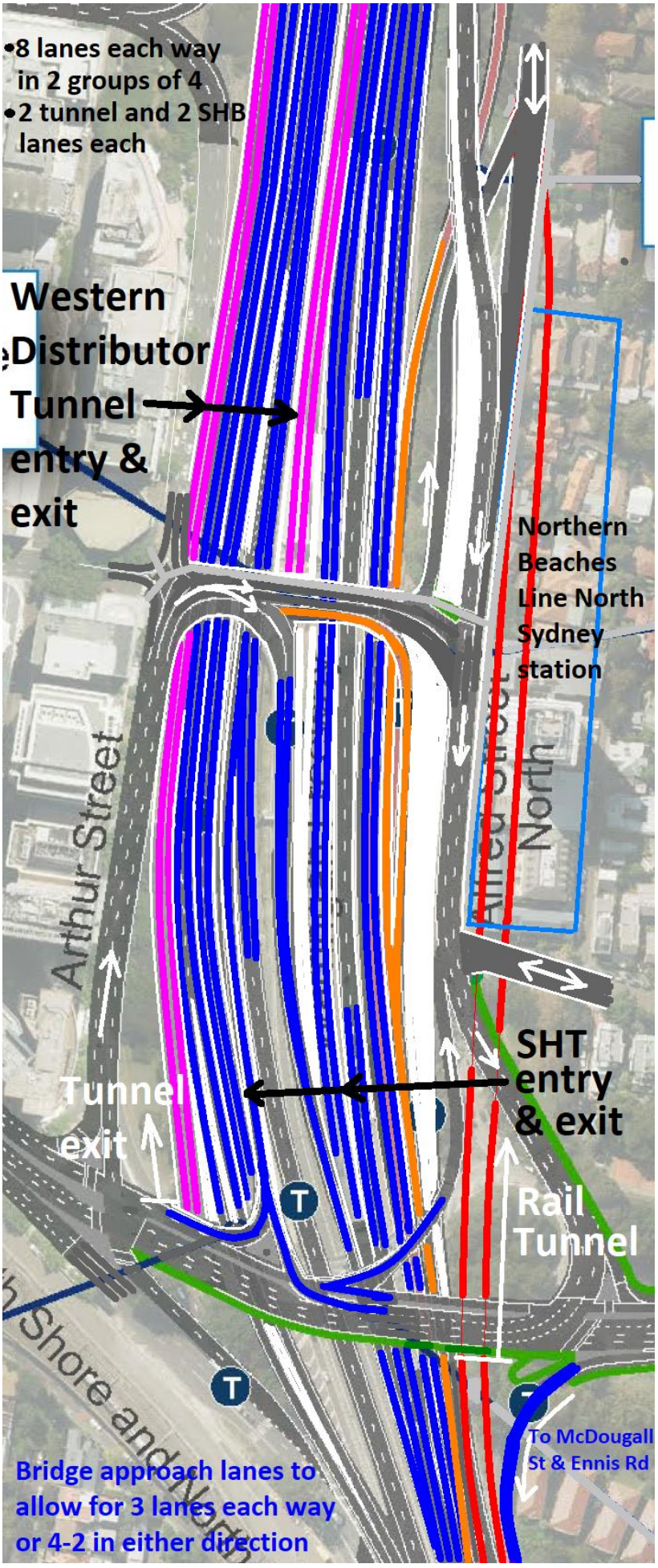
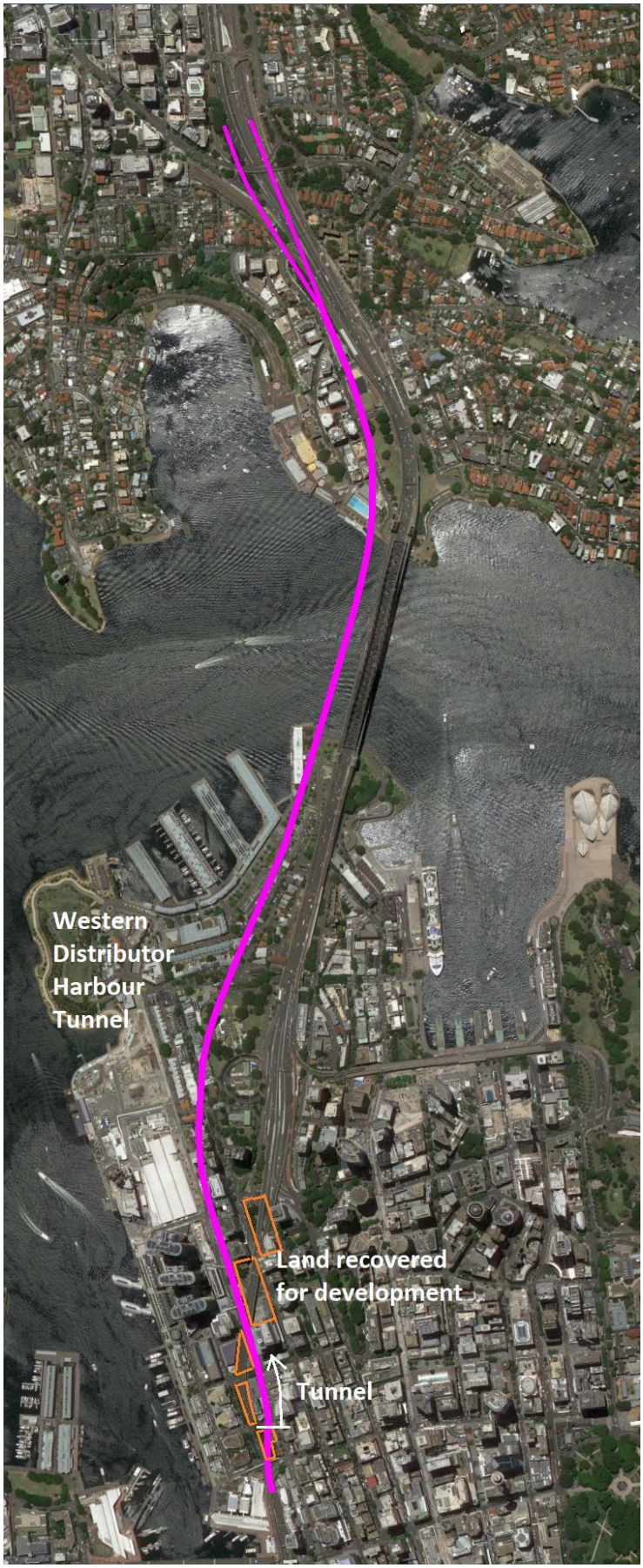


Figure 13.13 – High St and Mount St interchanges modelled on this diagram from the EIS



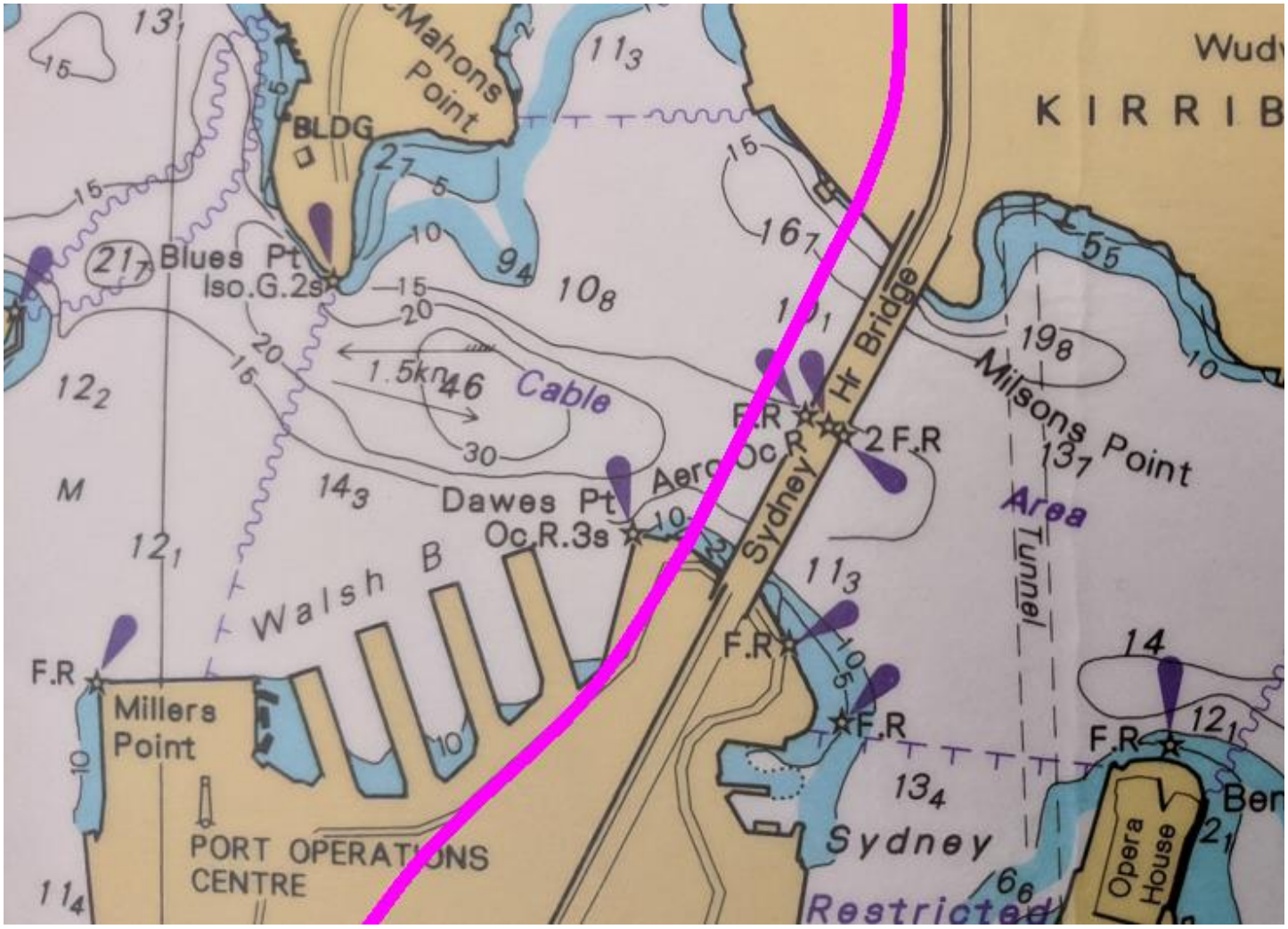
--- In this proposal the Cahill Expressway lanes are converted back to rail use.

Figure 13.14 – High St and Mount St interchanges modelled on the EIS



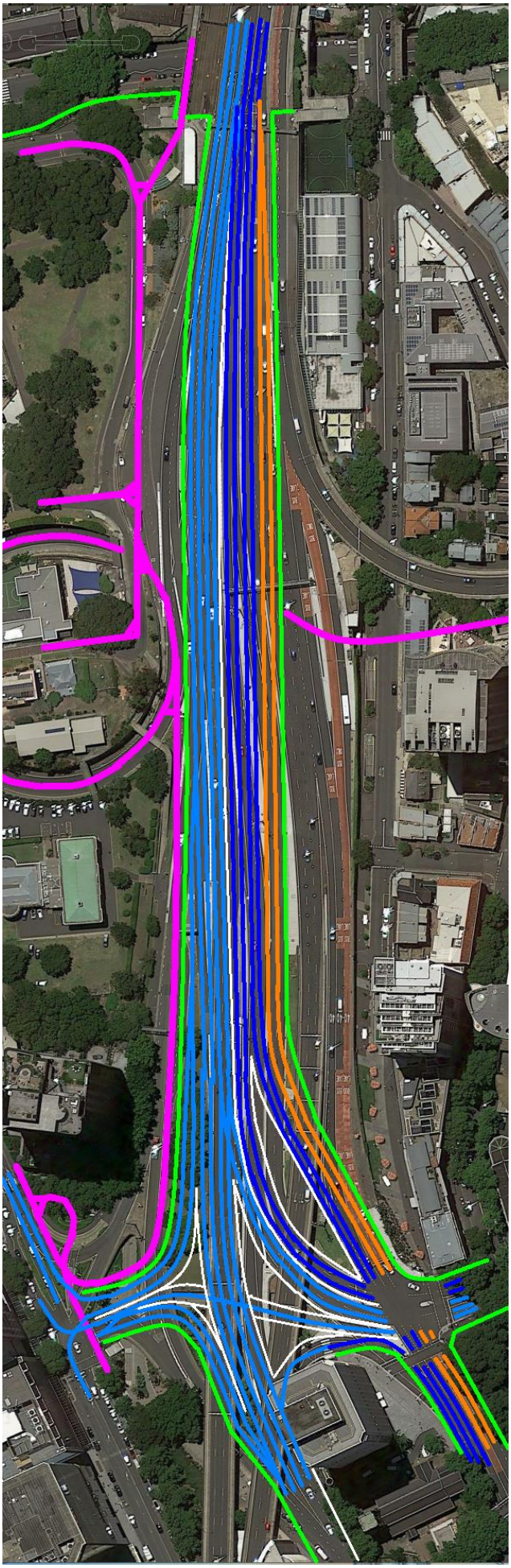
--- WHT project will leave significant regional and local traffic conflict on Harbour Bridge.
--- Public transport demand across the metropolitan area was 7.4% p.a. for 5 years to June 2019.
--- In 10 years demand will be sufficient for 3 rail lines (6 tracks) across Sydney Harbour allowing a large cut in bus travel and associated costs. The “three cities” plan is driving growth of the Sydney CBD, internally, and to the west and south, ensuring continued high growth in public transport demand.
--- Reverting the Cahill Expressway and Bus Lane back to a rail corridor, will reduce the Harbour Bridge road lanes to six, or possible five if a bus lane is retained.
--- a Western Distributor tunnel will deconflict Harbour Bridge traffic and release land for human use.

Figure 13.15 Replace Western Distributor ramps to Harbour Bridge with Western Distributor harbour tunnel



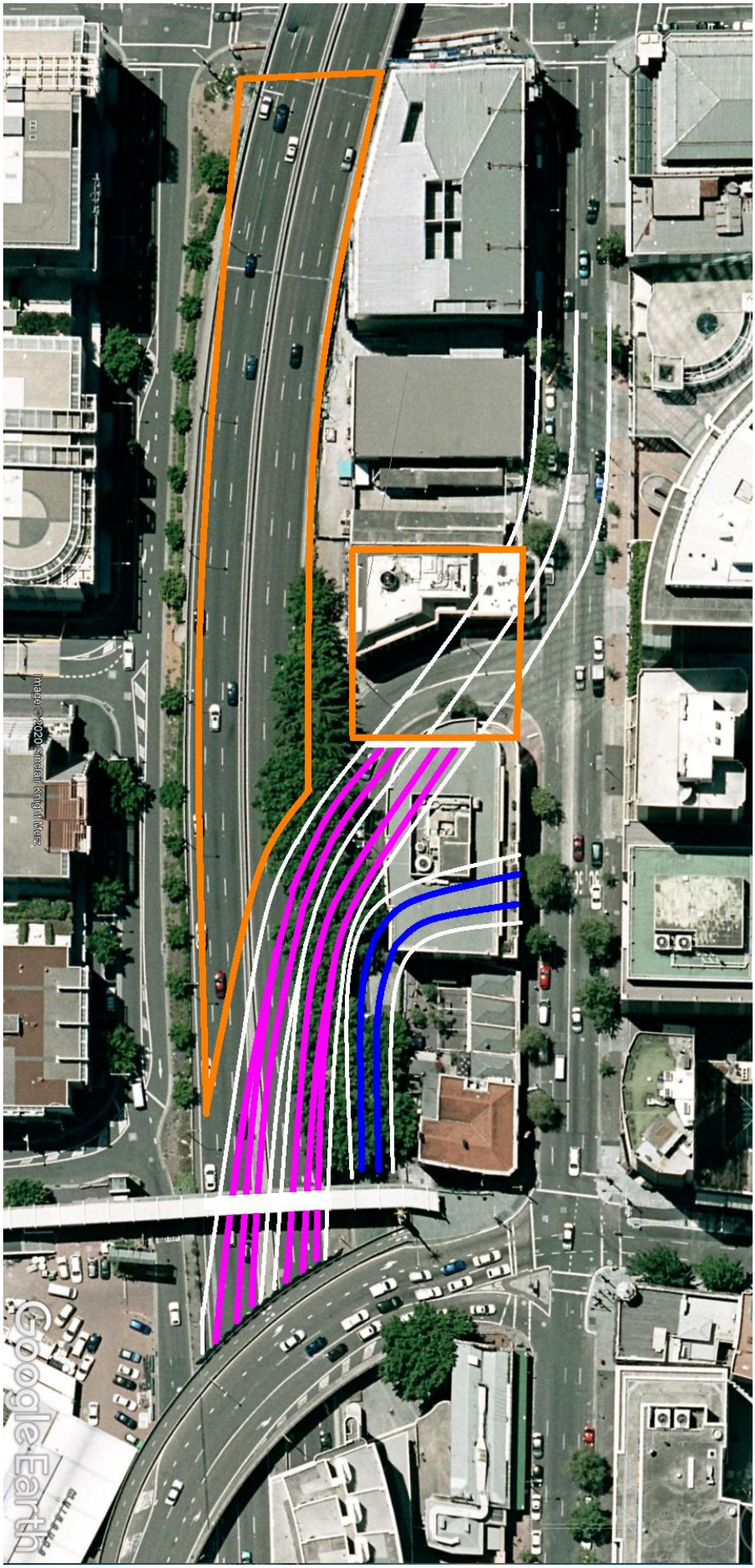
--- Aus 200 navigation chart 1999

Figure 13.16 – Proposed Western Distributor tunnel under Sydney Harbour



--- Recovered space converted to park except for the site in red which would be sold for development.

Figure 13.17 – Bradfield Hwy consolidation to free space when Cahill Expressway converted to Rail



--- Blue – Relocated Slip St-Sussex St intersection that preserves heritage buildings to its south.
--- Pink – Ramps to Western Distributor tunnel portal.
--- Orange – recovered development sites.

Figure 13.18 – Indicative Western Distributor tunnel portal