WestConnex Transport Modelling

Summary Report

City of Sydney
April 2015

SGS Economics & Planning

Independent insight.

SGS Economics and Planning Pty Ltd
ACN 007 437 729
www.sgsep.com.au
Offices in Canberra, Hobart, Melbourne and Sydney

TABLE OF CONTENTS

EXECUTIVE SUMMARY		**1**
The WestConnex project		1
Modelling the traffic impacts of WestConnex		2
Questions raised by the modelling		6
1	**WESTCONNEX TRANSPORT MODELLING**	**7**
1.1	Project Details	7
1.2	The transport model	8
1.3	Transport modelling results	9
1.4	Future Extensions	16
1.5	Tolling	16
2	**TRAFFIC IN THE REST OF SYDNEY**	**18**
2.1	Urban Renewal	20
2.2	Traffic change overview	24
2.3	Public transport	27
2.4	Commercial vehicles	28
3	**THE MODEL**	**30**
3.1	Tolls	31
	WestConnex toll levels	31
3.2	Changes to Road Network	33
4	**CONCLUSION**	**35**
APPENDIX		**36**
WestConnex infrastructure		36
WestConnex Tolling Point		38

LIST OF FIGURES

FIGURE 1	WESTCONNEX ALIGNMENT (DECEMBER 2014)	1
FIGURE 2	CHANGE IN LOS – 2021 BASE CASE VS 2011 – AM PEAK	3
FIGURE 3	VOLUME TO CAPACITY RATIO 2026 (BASE CASE WITHOUT WESTCONNEX)	3
FIGURE 4	VOLUME TO CAPACITY RATIO 2026 (WITH WESTCONNEX STAGES 1, 2 & 3)	4
FIGURE 5	WESTCONNEX ALIGNMENT (DECEMBER 2014)	7
FIGURE 6	VOLUME CHANGES WESTCONNEX VS NO WESTCONNEX (2026)	10
FIGURE 7	M4 HOMEBUSH BAY DR – CONCORD RD 2026 TRAFFIC, EASTBOUND.	10
FIGURE 8	WESTCONNEX SECTIONS	11
FIGURE 9	IMPACT OF M4 AND M5 TOLLED (BASE CASE)	17
FIGURE 10	V/C RATIO 2026 (PROJECT STAGE 1 & 2)	18
FIGURE 11	CHANGE IN ACCESSIBLE JOBS – 2026 STAGE 1 & 2 VS BASE CASE	19
FIGURE 12	CHANGE IN ACCESSIBLE JOBS – 2026 STAGE 1, 2 & 3 VS BASE CASE	20
FIGURE 13	DISCARDED PLAN FOR PARRAMATTA ROAD	21
FIGURE 14	CHANGE IN LOS 2026 (STAGE 1 &2 VS BASE)	22
FIGURE 15	CHANGE IN LOS 2026 (STAGE 1, 2 & 3 VS BASE)	23
FIGURE 16	CHANGE IN LOS 2026 (PROJECT STAGE 1, 2 & 3 VS BASE)	25
FIGURE 17	CHANGE IN LOS 2041 (PROJECT STAGE 1, 2 & 3 VS 2011)	26
FIGURE 18	TRAVEL TIME ASSESSMENT – BUS CORRIDORS	27
FIGURE 19	TRAVEL TIME ALONG BUS CORRIDORS	28
FIGURE 20	CHANGE IN COMMERCIAL VEHICLES 2026 (STAGE 1 & 2 VS BASE)	29
FIGURE 21	CHANGE IN COMMERCIAL VEHICLES 2026 (WESTCONNEX VS BASE)	29
FIGURE 22	KEY STAGES OF THE ZENITH MODELS	30
FIGURE 23	ROAD PROJECTS INCLUDED UNTIL 2041	34
FIGURE 24	PT PROJECTS INCLUDED UNTIL 2041	34
FIGURE 25	WESTCONNEX	36
FIGURE 26	WESTCONNEX STAGE 1	37
FIGURE 27	WESTCONNEX STAGE 2	37
FIGURE 28	WESTCONNEX STAGE 3	38
FIGURE 29	WESTCONNEX ALIGNMENT	38
FIGURE 30	WESTCONNEX STAGE 1 ALIGNMENT AND TOLLED SECTIONS	39
FIGURE 31	WESTCONNEX STAGE 3 ALIGNMENT AND TOLLED SECTIONS	39
FIGURE 32	WESTCONNEX STAGE 2 ALIGNMENT AND TOLLED SECTIONS	40

LIST OF TABLES

TABLE 1	MODEL KPIS – PRIVATE VEHICLE STATISTICS	5
TABLE 2	WESTCONNEX CONNECTIONS TO THE EXISTING NETWORK	8
TABLE 3	TRANSPORT MODELLING VARIABLES	11
TABLE 4	DAILY TRAFFIC VOLUMES (CLOCKWISE)	12
TABLE 5	DAILY TRAFFIC VOLUMES (COUNTERCLOCKWISE)	13
TABLE 6	DAILY TRAFFIC VOLUMES ON PARRAMATTA ROAD SECTIONS	14
TABLE 7	TRAFFIC VOLUMES 2031 'DO MINIMUM' AND FULL WESTCONNEX	21
TABLE 8.	TOLL CHARGES FOR EXISTING MOTORWAYS	32
TABLE 9	WESTCONNEX REFERENCE TOLLING SCENARIO	32

GLOSSARY

Base case	The scenario without the construction of WestConnex
CBD	Central Business District
Clockwise	A journey starting at the western end of the M4 and travelling to the southwestern end of M5 along WestConnex
Counterclockwise	A journey starting at the southwestern end of M5 and travelling to the western end of the M4 along WestConnex
KPI	Key Performance Indicators
Urban Renewal	Redeveloping an area to house more people and jobs
WDA	WestConnex Delivery Authority
LTTMP	Long Term Transport Master Plan
Level of Service	Is a summary measure of the Volume Capacity (VC) Ratio
Volume Capacity (VC) Ratio	A measure that reflects mobility and quality of travel along a transport link. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). A VC of 1.00 indicates the roadway facility is operating at its designed carrying capacity. Above 1 is over capacity and below 1 is under capacity

EXECUTIVE SUMMARY

Sydney traffic congestion will worsen with or without WestConnex, with the project only making a minor difference to Sydney's overall traffic in the future.

The WestConnex project would create newer, better motorways. But tolls mean a smaller share of Sydney's motorists would use them. Displaced motorists will instead use free alternatives, increasing traffic on other roads, including Parramatta Road. The net effect is similar to the status quo. However, some local areas could see fewer vehicles on their streets if all sections of WestConnex are built.

The WestConnex project

The WestConnex project is the biggest motorway project in Australia's history. WestConnex is a series of projects designed to upgrade and link two existing motorways in Sydney's south west (the M5) and west (the M4). The combined cost of the project is estimated at $15 billion. The business case for the project has not been released and the impacts on traffic have so far remained unknown.

The project is due to be completed in stages. Stages 1 and 2 focus on upgrading and extending the M4 and M5, and are due to be completed by 2019. Stage 3 involves the construction of a tunnel linking Stages 1 and 2 and is due to be completed by 2023.

FIGURE 1 WESTCONNEX ALIGNMENT (DECEMBER 2014)

Source: WestConnex Delivery Authority

By the time the project is complete, Sydney will be bigger, busier and more crowded city. The metropolis is projected to grow to accommodate around 6.2 million people by 2031, and 8.5 million by 2061. Traffic volumes will have grown, and the congestion clogging Sydney will have worsened.

In this context, evaluating the traffic effects of proposed transport projects is an important part of determining whether they should proceed. The City of Sydney has commissioned this report in order to help the public evaluate WestConnex.

The effect of WestConnex on Sydney's traffic is best forecast using computer modelling. The results of such a process are presented in this report.

Modelling the traffic impacts of WestConnex

Modelling was completed by Veitch Lister Consulting (VLC), an expert transport modelling firm. VLC use the Zenith traffic model, which incorporates future land use changes, public transport and road travel.

The Zenith model was first established in 1988 and is a mature travel demand modelling facility that is frequently used to understand transport projects. In Australia Zenith has been used to model:

- Cross-City Tunnel (provision of expert services in legal proceedings);
- M5 Motorway (for a toll road operator);
- Lane Cove Tunnel (forecasting demand post opening for ABN Amro);
- Sydney Metro (as part of submission to Infrastructure Australia);
- CityLink Toll Road (for the Victorian Government); and
- EastLink Toll Road (for the Victorian Government).

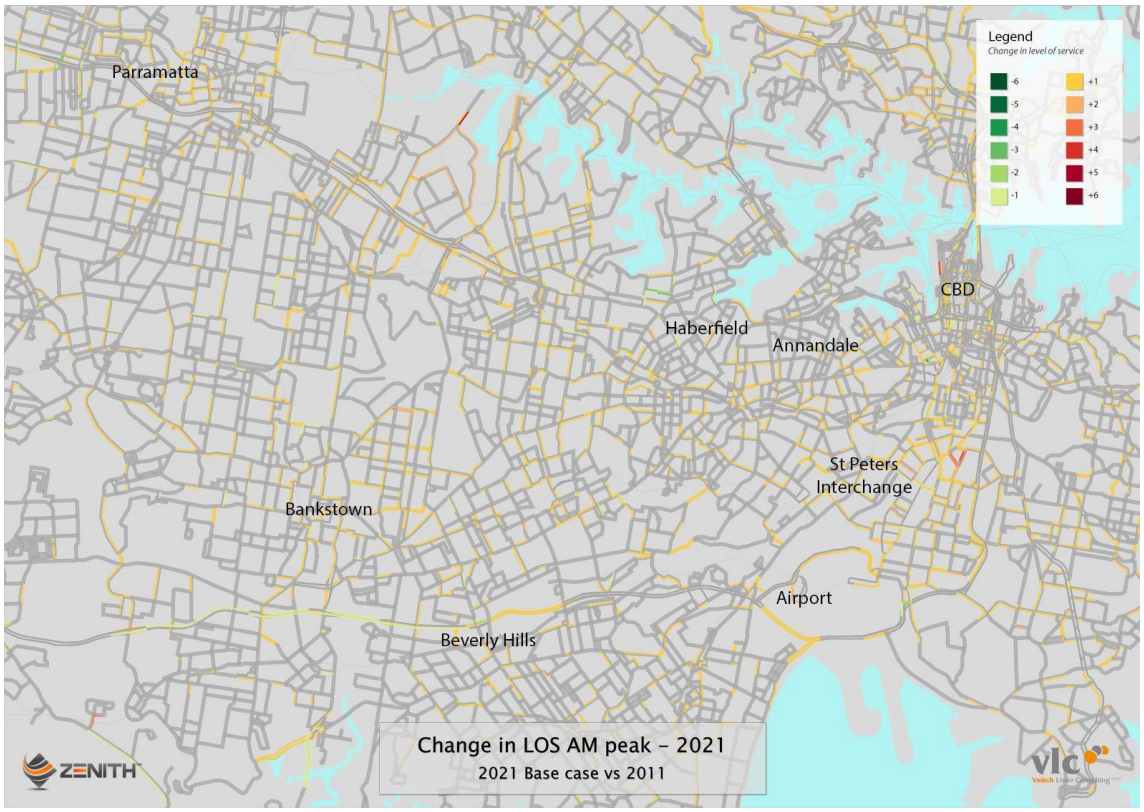
For modelling the future traffic conditions of Sydney and the impact of WestConnex, modelling was undertaken for a base case that did not include WestConnex as well as several forecasts relating to the provision of the road. For the WestConnex project, the Zenith model forecasts where and how traffic will change:

- in 2021, representing the completion of Stage 1 and 2;
- in 2026, representing the completion of Stage 3; and
- in 2041, representing the project at maturity.

Under the base case, Sydney traffic congestion will worsen (Figure 2). This is driven in part by a widening gap between employment and population growth, with employment growth in the east outstripping population growth in the west. The project only makes a minor difference to Sydney's overall traffic.

At each point in time, the Zenith model constructs scenarios where WestConnex is built and is not built, in order to make meaningful comparisons. Figure 3 and Figure 4 illustrate road capacity in 2026 under two future scenarios: without WestConnex (Figure 3) and with all stages of WestConnex (Figure 4).

FIGURE 2 CHANGE IN LOS – 2021 BASE CASE VS 2011 – AM PEAK



Source: Veitch Lister Consulting

FIGURE 3 VOLUME TO CAPACITY RATIO 2026 (BASE CASE WITHOUT WESTCONNEX)

Source: Veitch Lister Consulting

FIGURE 4 VOLUME TO CAPACITY RATIO 2026 (WITH WESTCONNEX STAGES 1, 2 & 3)

Source: Veitch Lister Consulting

Figure 3 and Figure 4 clearly show Sydney's road network will experience significant capacity constraints by 2026.

The modelling confirms that WestConnex will not improve access to the Sydney CBD. Like other parts of the Global Economic Corridor, the CBD is already congested and has little parking available.

Stage 1, the M4 widening and eastern extension, and Stage 2, the New M5 and St Peters interchange, will not be sufficient to encourage a significant level of traffic off alternate routes.

Traffic flows on parts of Parramatta Road will increase by over 20 per cent as vehicles avoid paying the toll on the M4 and M4 eastern extension. This finding is consistent with the WestConnex Delivery Authority's own assessment presented in the M4 Widening Environmental Impact Statement and with the traffic flow impacts observed when the M4 toll was removed in 2010.

Under WestConnex Parramatta Road will take more traffic in the future, not less.

This growth in traffic along Parramatta Road will clearly jeopardise the government's planned urban renewal and population growth along this corridor.

The M5 East will, despite the completion of the New M5, remain the preferred route connecting the airport, port and the city. The New M5 will not provide a more attractive route to these key destinations and will not relieve congestion on the M5 East. Traffic volumes on the M5 East will continue to increase by up to 25 per cent, leading to increased congestion and peak spreading.

The traffic from the New M5 will flow into the St Peters area via an interchange on the site of the Alexandria landfill. By 2021 over 31,000 vehicles a day will be using this interchange, increasing to over 55,000 vehicles by 2041. These vehicles will flow onto the local road network, impacting on residential and commercial areas, and increasing traffic and congestion in the corridor between the CBD and the

airport. This will impact the viability of urban renewal areas such as Green Square and Ashmore, reducing future housing potential.

WestConnex has a relatively minor impact on Sydney-wide traffic. The Sydney-wide effect of the project is summarised in the following table.

Differences are most notable along the paths of the upgraded motorway sections (WestConnex Stages 1 and 2), which appear green in places – representing low volume to capacity ratios - if WestConnex is built. The change in their volume capacity ratio is due not only to increased capacity, but also tolls.

In 2026, the Sydney-wide differences in traffic between a Sydney with WestConnex and one without is very modest, as measured in car trips, car hours, or commercial vehicle hours. In 2026 the largest proportional difference is a 2.8 per cent fall in commercial vehicle hours in the morning, from 62,598 to 60,842.

TABLE 1 MODEL KPIS – PRIVATE VEHICLE STATISTICS

PRIVATE VEHICLE STATISTICS		2021 base	2026 base	2026 project Stage 1 & 2	2026 project Stage 1, 2 & 3
Car Trips	AM	2,010,602	2,146,880	2,146,335	2,147,065
	Inter Peak	10,584,355	11,326,354	11,320,905	11,325,047
	PM	2,067,151	2,208,755	2,208,155	2,208,882
	Total	**14,662,108**	**15,681,989**	**15,675,395**	**15,680,994**
Commercial Vehicle Trips	AM	111,958	118,934	118,934	118,934
	Inter Peak	599,197	637,169	637,169	637,169
	PM	98,562	104,761	104,761	104,761
	Total	**809,717**	**860,865**	**860,865**	**860,865**
Car KMs	AM	19,504,557	20,658,296	20,632,881	20,721,759
	Inter Peak	99,425,262	105,535,127	105,325,460	105,731,563
	PM	21,325,707	22,615,061	22,590,004	22,683,491
	Total	**140,255,526**	**148,808,483**	**148,548,345**	**149,136,812**
Commercial Vehicle KMs	AM	2,353,402	2,488,521	2,476,796	2,485,618
	Inter Peak	13,574,717	14,355,865	14,298,698	14,340,292
	PM	2,161,429	2,285,386	2,275,540	2,284,049
	Total	**18,089,548**	**19,129,773**	**19,051,034**	**19,109,959**
Car Hours	AM	541,192	593,566	584,112	582,188
	Inter Peak	2,338,576	2,541,915	2,516,884	2,509,705
	PM	564,946	619,700	610,642	608,512
	Total	**3,444,714**	**3,755,182**	**3,711,638**	**3,700,406**
Commercial Vehicle Hours	AM	57,319	62,598	61,233	60,842
	Inter Peak	288,509	312,311	307,761	305,964
	PM	51,160	55,874	54,703	54,345
	Total	**396,988**	**430,784**	**423,697**	**421,151**
Average Trip Length - Car [km]	AM	11	11	11	11
	Inter Peak	11	11	11	11
	PM	12	12	12	12
Average Trip Length - Commercial Vehicle [km]	AM	23	23	23	23
	Inter Peak	25	25	25	25
	PM	24	24	24	24

Source: Veitch Lister Consulting

Questions raised by the modelling

The modelling has provided a better understanding of the impacts of WestConnex, while also raising areas for further investigation.

The northern extension (including the Western Harbour Tunnel) and southern extension to WestConnex are vital for generating traffic for WestConnex Stage 3 but are currently outside the $15 billion price tag. As such, the currently funded WestConnex project potentially locks Sydney into a series of large scale road projects that are required to achieve the benefits of committed stages.

Should the costs as well as the benefits of these extensions be attributed to WestConnex? Or should they be financed separately from the first three stages of WestConnex, with the benefits similarly excluded?

From available information[1], Stage 1 is initially funded by the government and then sold to finance Stage 2 and 3. However, more recent announcements have indicated Stages 1 and 2 are to be delivered concurrently. The length of time government holds and operates WestConnex, the concessions (tolls and length) for a private operator and the private sectors appetite for risk will determine if WestConnex is a value for money investment for New South Wales. Are there better transport projects for New South Wales to invest in?

The role that tolls play on existing roads in managing Sydney's future traffic demand should be evaluated. Reviewing or introducing pricing mechanisms was included as part of the NSW Long Term Transport Master Plan. Congestion pricing uses tolls to alter demand and has been shown to substantially affect behaviour and reduce traffic congestion. Rather than increasing road capacity by building new road infrastructure, can congestion on the existing road network be better managed through a new or updated price mechanism?

[1] http://www.westconnex.com.au/documents/westconnex_industry_engagement_briefing_oct2013.pdf

1 WESTCONNEX TRANSPORT MODELLING

1.1 Project Details

The WestConnex project is the biggest motorway project in Australia's history. It comprises three key components:

- widening the M4 which links Western Sydney and North Strathfield, and extending it towards the city centre, via a tunnel;
- upgrades to the M5 which currently links south-west Sydney and the airport, by construction of new tunnels and new interchanges (the New M5). The New M5 will extend closer to the CBD
- A tunnel linking the M5 and M4, passing under inner Sydney and providing off-ramps to the CBD and airport.

Tunnelling components account for the bulk of the $15 billion cost of the project. Currently, the NSW Government is contributing $1.8 billion to the project and the Federal government $1.5 billion. The Federal government is also providing a concessional loan of up to $2 billion to help bring forward delivery of Stage 2, allowing work to start in 2015. The remainder is to be funded using tolls.

FIGURE 5 WESTCONNEX ALIGNMENT (DECEMBER 2014)

Source: WestConnex Delivery Authority

The points at which WestConnex links with the existing network are listed in Table 2. The Appendix provides detailed maps on the assumed road connections and tolling point for WestConnex.

TABLE 2 WESTCONNEX CONNECTIONS TO THE EXISTING NETWORK

Stage	Connection to the existing network
Stage1 (M4 widening)	Church Street, Parramatta
	M4 James Ruse Drive, Clyde
	M4 Silverwater Road, Silverwater
	M4 Hill Road, Auburn
	M4 Homebush Bay Drive, Homebush
Stage1 (M4 extension)	Concord Road, North Strathfield
	Wattle Street, Haberfield
Stage 2	Campbell Street, St Peters
	M5 exit, Arncliffe
	Bexley Road and Kingsgrove Road, Bexley North
	King Georges Road, Beverly Hills
Stage 3	Frederick Street, Haberfield
	City West Link
	Parramatta Road, Annandale
	Canal Road, St Peters

Source: WestConnex Delivery Authority and Veitch Lister Consulting

1.2 The transport model

Modelling was completed by Veitch Lister Consulting (VLC), an expert transport modelling firm. VLC use the Zenith traffic model, which incorporates future land use changes and both public transport and road travel.

The Zenith model was first established in 1988 and is a mature travel demand modelling facility that is frequently used to understand transport projects across Australia. Zenith has been used to undertake travel demand forecasting and modelling for major projects in New South Wales including:

- Cross-City Tunnel (provision of expert services in legal proceedings);
- M5 Motorway (for a toll road operator);
- Lane Cove Tunnel (forecasting demand post opening for ABN Amro); and
- Sydney Metro (as part of submission to Infrastructure Australia).

Other major projects include.

- East West Link Toll Road (for the Victorian Government);
- Melbourne Metro Project (for submission to Infrastructure Australia);
- CityLink Toll Road (for the Victorian Government); and
- EastLink Toll Road (for the Victorian Government).

The Zenith model is explained in detail in Section 3 and more information can be obtained from here http://www.veitchlister.com.au/zenith/overview .

There are key metrics which are used to assess transport projects. These include the volume capacity ratio and level of service. The volume capacity (VC) ratio is a measure that reflects mobility and quality of travel along a transport link. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). A VC of 1.00 indicates the roadway facility is operating at its designed carrying capacity. Above 1 is over capacity and below 1 is under capacity.

The level of service is a summary measure of the VC Ratio. For the purposes of the model six levels of service were defined.

A - VC ratio between 0 and 0.6;
B - VC ratio between 0.6 and 0.8;
C - VC ratio between 0.8 and 1;
D - VC ratio between 1 and 1.2;
E - VC ratio between 1.2 and 1.6;
F - VC ratio > 1.6.

Tolling Assumptions

The modelling of tolls is important and has been undertaken in a conservative fashion. Existing tolls have been increased over time at CPI, and new tolls have been modelled on a conservative basis using existing public information.

In order to apply the appropriate toll in the model, values from the reference tolling scenario have been converted to cents per km for each stage of WestConnex, results are listed in 2013 Australian dollars.

- Stage 1: 55 c/km;
- Stage 2: about 45 c/km;
- Stage 3: about 50 c/km.

A toll cap of $7.35 has been applied in the model and a multiplier of 3 has been used for Light Commercial Vehicles and Heavy Commercial Vehicles.

1.3 Transport modelling results

The Zenith model creates outputs for each section of the roadway at different points in time and at different stages of completion. The daily traffic volumes resulting from the modelling are presented in Table 4, Table 5 and Table 6 (Figure 8 shows the location of some of the key points shown in the table). There is a significant amount of information contained in these three tables. Table 3 provides an explanation of the categories listed in each column of the three tables.

The second last column of the Table 4, Table 5 and Table 6 shows the percentage change in the number of vehicles using the upgraded WestConnex in 2026, after all stages are complete. The comparison is with 2026 in a no WestConnex scenario. The overall effect of the $15 billion WestConnex project is a minor (in relative terms) increase in total traffic volumes using the road.

Modelling shows that after being upgraded, the existing M4 section of WestConnex will carry fewer vehicles. This is explained by motorists selecting alternate routes[2] to avoid tolls (Figure 6).

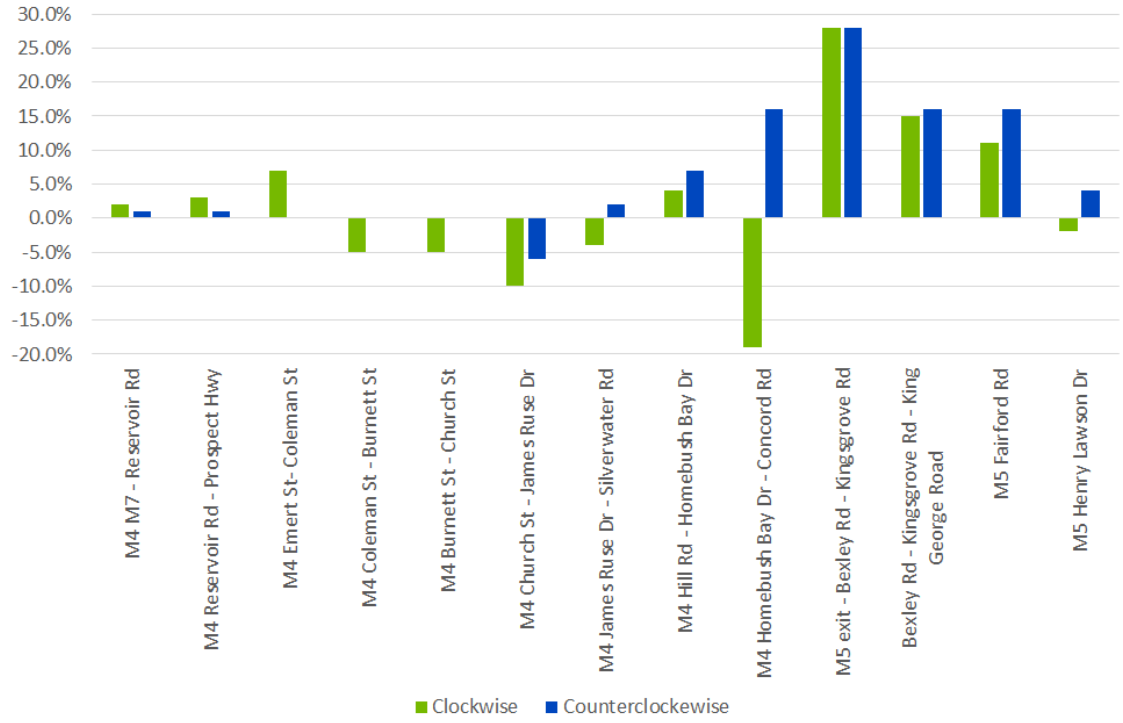
In 2026, when the project is complete, the most notable example of a traffic drop is a 19 per cent drop on the M4 eastbound, between Homebush Bay Drive and Concord Road (Figure 7).

Diversion of traffic from the tolled M4 results in an increased volume-to-capacity ratio in several places, notably Parramatta Road. That road, which runs parallel to the M4, will carry increased traffic volumes under the scenario where WestConnex is constructed and tolled. This is likely to impede plans for urban renewal and residential development in the precinct.

This below figure shows the changes in traffic volumes along M4 and M5 corridors of WestConnex in 2026.

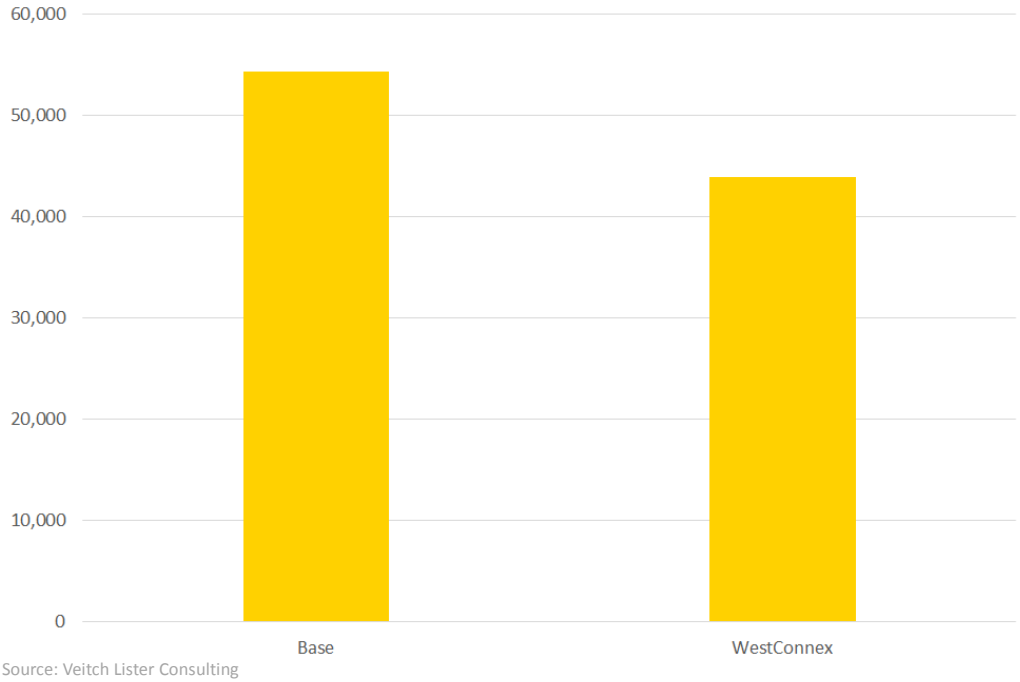
[2] The model suggests that even a small number of drivers will switch from their cars to public transport.

FIGURE 6 VOLUME CHANGES WESTCONNEX VS NO WESTCONNEX (2026)



Source: Veitch Lister Consulting

FIGURE 7 M4 HOMEBUSH BAY DR – CONCORD RD 2026 TRAFFIC, EASTBOUND.

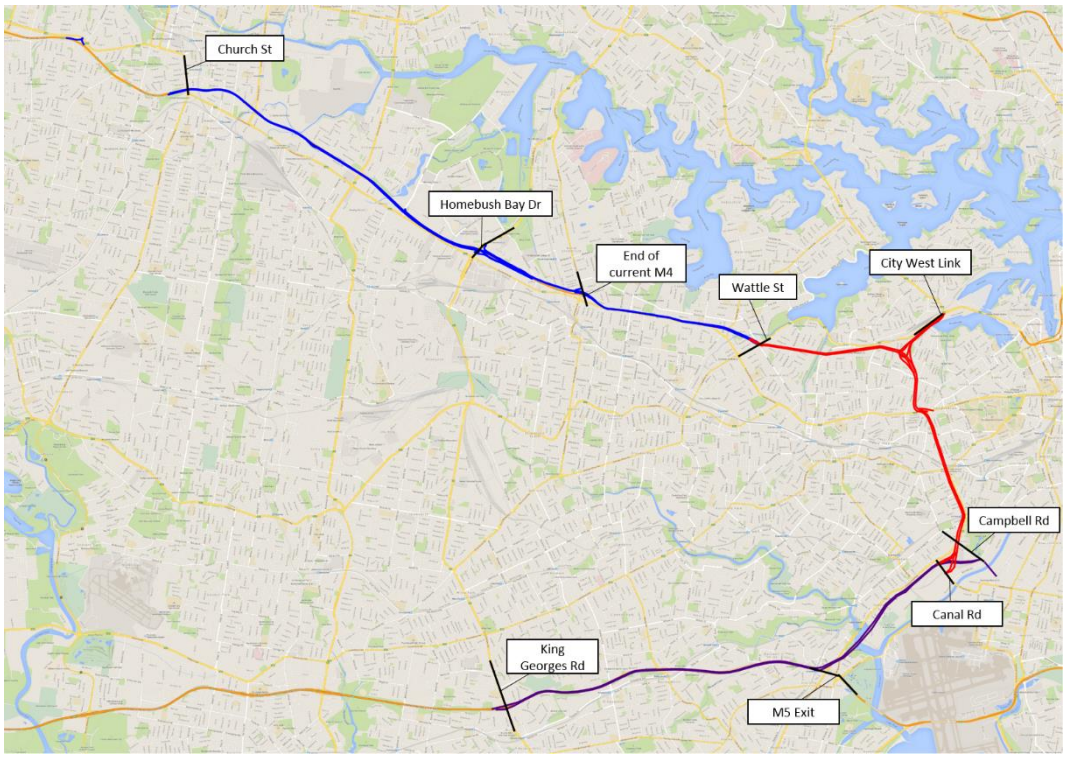


Source: Veitch Lister Consulting

According to the model, the M5 sees a consistent but modest increase in traffic. The M4 will see mostly decreased traffic volumes travelling towards the city, and mostly no change in volumes travelling the other way, except for a 17 per cent increase at Homebush Bay Drive. The M5 East / New M5 will carry up to 15 per cent more traffic in both directions and see a 30 per cent increase in traffic using the Bexley Road exit[3].

[3] The chart does not depict the changes along the Stage 3 section of tunnel because no percentage comparison is possible

FIGURE 8 WESTCONNEX SECTIONS



Source: Veitch Lister Consulting

TABLE 3 TRANSPORT MODELLING VARIABLES

	Column	Explanation
1	Corridor	The broader corridor in which the section sits
2	Section	The section of the road being examined.
3	Dir	The direction of the traffic.
4	2021 Base	The estimate of the daily volume of vehicles using that section in 2021 without WestConnex
5	2021 S12	The estimate of the daily volume of vehicles using that section in 2021 with Stages 1 and 2 of WestConnex completed
6	2021 % diff	The percentage difference between column 5 and 5.
7	2026 base	The estimate of the daily volume of vehicles using that section in 2026 without WestConnex
8	2026 S12	The estimate of the daily volume of vehicles using that section in 2026 with Stages 1 and 2 of WestConnex completed
9	2026 S12 % diff	The percentage difference between column 7 and 8.
10	2026 S123	The estimate of the daily volume of vehicles using that section in 2026 with Stages 1, 2 and 3 of WestConnex completed
11	2026 S123 % diff	The percentage difference between column 7 and 10
12	2041 S123	The estimate of the daily volume of vehicles using that section in 2026 with Stages 1, 2 and 3 of WestConnex completed

Source: SGS Economics & Planning

TABLE 4 DAILY TRAFFIC VOLUMES (CLOCKWISE[4])

Corridor	Section	Dir	2021 base	2021 S12	2021 % diff	2026 base	2026 S12	2026 S12 % diff	2026 S123	2026 S123 % diff	2041 S123
M4 Widening	M4 M7 - Reservoir Road	EB	72,800	72,100	-1%	90,000	89,800	0%	91,900	2%	99,800
	M4 Reservoir Road - Prospect Hwy	EB	74,500	73,800	-1%	91,100	90,900	0%	93,400	3%	100,900
	M4 Emert Street - Coleman Street	EB	75,900	78,000	3%	88,600	91,300	3%	94,800	7%	102,100
	M4 Coleman Street - Burnett Street	EB	85,000	74,900	-12%	97,200	87,700	-10%	92,100	-5%	99,400
	M4 Burnett Street - Church Street	EB	94,300	82,300	-13%	106,500	95,800	-10%	101,200	-5%	109,600
Westconnex Stage 1	M4 Church Street - James Ruse Dr	EB	71,000	50,900	-28%	77,000	61,500	-20%	69,300	-10%	78,800
	M4 James Ruse Dr - Silverwater Road	EB	80,000	59,700	-25%	82,700	68,000	-18%	79,200	-4%	90,200
	M4 Hill Road - Homebush Bay Dr	EB	67,900	50,800	-25%	70,100	57,200	-18%	73,200	4%	84,400
	M4 Homebush Bay Dr - Concord Road	EB	53,300	18,500	-65%	54,300	22,000	-59%	43,900	-19%	50,600
	Concord - Road Frederick Street	EB		22,900			26,400		55,400		63,900
Westconnex Stage 3	Frederick Street - White Street	EB							53,500		63,200
	White Street - Parramatta Road	SB							53,500		67,700
	Parramatta Road - Canal Road	SB							35,900		46,600
Westconnex Stage 2	Campbell Street - M5 exit	SB		16,000			17,700		23,400		28,300
WestConnex stage 2 / M5 East	M5 exit - Bexley Road and Kingsgrove Road	WB	51,200	62,600	22%	52,300	67,100	28%	66,800	28%	79,900
	Bexley Road and Kingsgrove Road - King George Road	WB	68,700	76,700	12%	70,400	81,600	16%	80,800	15%	94,200
M5	M5 Fairford Road	WB	6,200	6,800	10%	6,300	7,100	13%	7,000	11%	7,600
	M5 Henry Lawson Dr	WB	5,800	5,900	2%	6,000	6,200	3%	5,900	-2%	6,700
	M5 Main Toll Plaza	WB	61,400	61,800	1%	64,400	64,700	0%	64,300	0%	72,900

Source: Veitch Lister Consulting

[4] A journey starting at the western end of the M4 and travelling to the southwestern end of M5 along WestConnex

TABLE 5 DAILY TRAFFIC VOLUMES (COUNTERCLOCKWISE[5])

Corridor	Section	Dir	2021 base	2021 S12	2021 % diff	2026 base	2026 S12	2026 S12 % diff	2026 S123	2026 S123 % diff	2041 S123
M4 Widening	M4 M7 - Reservoir Road	WB	72,800	72,500	0%	91,100	90,900	0%	92,400	1%	100,900
	M4 Reservoir Road - Prospect Hwy	WB	73,700	72,800	-1%	91,200	90,500	-1%	92,300	1%	100,000
	M4 Emert Street - Coleman Street	WB	71,900	67,900	-6%	88,300	84,900	-4%	88,200	0%	95,500
	M4 Coleman Street - Burnett Street	WB	80,200	76,000	-5%	96,800	93,100	-4%	96,500	0%	104,100
	M4 Burnett Street - Church Street	WB	91,400	85,200	-7%	106,500	101,700	-5%	106,000	0%	114,800
Westconnex Stage 1	M4 Church Street - James Ruse Dr	WB	69,000	52,400	-24%	76,500	65,700	-14%	71,600	-6%	81,400
	M4 James Ruse Dr - Silverwater Road	WB	78,100	63,400	-19%	81,000	72,800	-10%	82,300	2%	93,400
	M4 Hill Road - Homebush Bay Dr	WB	68,200	56,000	-18%	70,900	63,700	-10%	75,900	7%	87,600
	M4 Homebush Bay Dr - Concord Road	WB	53,300	39,700	-26%	54,600	46,100	-16%	63,400	16%	76,400
	Concord - Road Frederick Street	WB		19,800			21,900		53,300		63,000
Westconnex Stage 3	Frederick Street - White Street	WB							52,300		63,900
	White Street - Parramatta Road	NB							48,600		63,700
	Parramatta Road - Canal Road	NB							32,500		45,000
Westconnex Stage 2	Campbell Street - M5 exit	NB		15,300			16,900		20,900		26,900
WestConnex stage 2 / M5 East	M5 exit - Bexley Road and Kingsgrove Road	EB	52,000	65,600	26%	53,400	70,500	32%	68,500	28%	82,500
	Bexley Road and Kingsgrove Road - King George Road	EB	69,700	80,200	15%	71,500	85,400	19%	83,000	16%	96,800
M5	M5 Fairford Road	EB	5,800	6,500	12%	5,800	6,900	19%	6,700	16%	7,300
	M5 Henry Lawson Dr	EB	5,100	5,400	6%	5,300	5,700	8%	5,500	4%	6,200
	M5 Main Toll Plaza	EB	67,200	68,200	1%	70,700	71,800	2%	70,800	0%	79,700

Source: Veitch Lister Consulting

[5] A journey starting at the southwestern end of M5 and travelling to the western end of the M4 along WestConnex

TABLE 6 DAILY TRAFFIC VOLUMES ON PARRAMATTA ROAD SECTIONS

Corridor	Section	Dir	2021 base	2021 S12	2021 % diff	2026 base	2026 S12	2026 S12 % diff	2026 S123	2026 S123 % diff	2041 S123
Parramatta Road	Parramatta Road btwn Church St and James Ruse Drive	EB	17,900	20,700	16%	18,800	21,300	13%	21,100	12%	22,300
	Parramatta Road btwn Church St and James Ruse Drive	WB	20,100	24,200	20%	21,600	24,700	14%	24,500	13%	24,700
	Parramatta Road btwn James Ruse Dr and Silverwater Road	EB	27,300	32,900	21%	29,600	33,500	13%	33,300	13%	34,800
	Parramatta Road btwn James Ruse Dr and Silverwater Road	WB	27,500	31,900	16%	30,300	32,700	8%	32,400	7%	34,400
	Parramatta Road btwn Silverwater Road and Homebush Bay	EB	18,100	21,100	17%	19,500	21,800	12%	21,200	9%	22,700
	Parramatta Road btwn Silverwater Road and Homebush Bay	WB	18,900	22,200	17%	20,100	22,800	13%	22,800	13%	24,400
	Parramatta Road btwn Homebush Bay Drive and Concord Road	EB	17,500	22,300	27%	18,400	22,500	22%	22,300	21%	24,300
	Parramatta Road btwn Hombush Bay Drive and Concord Road	WB	18,000	22,200	23%	18,900	22,300	18%	22,700	20%	25,000
	Parramatta Road btwn Concord Rd and Great N Road	EB	27,100	18,500	-32%	28,000	18,700	-33%	17,900	-36%	19,900
	Parramatta Road btwn Concord Rd and Great N Road	WB	27,000	20,400	-24%	27,900	21,300	-24%	18,200	-35%	20,300
	Parramatta Road btwn Frederick St and Liverpool Road	EB	20,000	21,300	7%	20,600	22,100	7%	15,600	-24%	16,400
	Parramatta Road btwn Frederick St and Liverpool Road	WB	21,100	22,200	5%	21,700	23,400	8%	16,500	-24%	17,500

Source: Veitch Lister Consulting

In 2021, more vehicles use the M4 and M5 in the scenario where WestConnex is not built. In 2026, after the completion of Stage 3, WestConnex patronage increases and the results become mixed. Some sections of the motorway see more traffic in the scenario where WestConnex is built, despite the tolls, while others see less.

Stage 1, the M4 widening and eastern extension, and Stage 2, the New M5 and St Peters interchange, will not be sufficient to encourage a significant level of traffic off alternate routes.

Traffic flows on Parramatta Road will increase by up to 22 per cent (between Homebush Bay Drive and Concord Road) as vehicles avoid paying the toll on the M4 and M4 eastern extension. This finding is consistent with the WestConnex Delivery Authority's own assessment presented in the M4 Widening Environmental Impact Statement and with the traffic flow impacts observed when the M4 toll was removed in 2010. As a result of WestConnex, Parramatta Road will take more traffic in the future, not less.

Traffic growth on Parramatta Road will clearly jeopardise the government's planned urban renewal and population growth along this corridor.

The M5 East will, despite the completion of the New M5, remain the preferred route connecting the airport, port and the city. The New M5 will not provide a more attractive route to these key destinations and will not relieve congestion on the M5 East. Traffic volumes on the M5 East will continue to increase by up to 25 per cent, leading to increased congestion and peak spreading.

The traffic from the New M5 will flow into the St Peters area via an interchange on the site of the Alexandria landfill. By 2021 over 31,000 vehicles a day will be using this interchange, increasing to over 55,000 vehicles by 2041. These vehicles will flow onto the local road network, impacting on residential and commercial areas, and increasing traffic and congestion in the corridor between the CBD and the airport. This will impact the viability of urban renewal areas such as Green Square and Ashmore, reducing future housing potential.

Given the scale of the project the total changes brought about by WestConnex are modest. The improved road will benefit those that use it, but they do not represent a large share of all Sydney travellers. Low growth in users means it is unlikely there will be sufficient demand to ensure the various WestConnex toll roads are viable. This was the experience in several recent toll road projects in Australia's major cities.

Some previous toll road projects have overestimated travel time savings and drivers' willingness to pay to the point where the toll roads have been financial failures[6]. Failed toll roads have shaken the private sector's appetite for investment in WestConnex, meaning the government would be taking on the risk of the project until toll revenues are attractive to private sector investors. Consequently NSW taxpayers could be exposed to financial risks.

From available information[7], Stage 1 is intended to be funded by the government and then sold to finance Stage 2 and 3. However, more recent announcements have proposed Stages 1 and 2 be delivered concurrently. The length of time government holds and operates WestConnex, the concessions (tolls and length) for a private operator and the private sectors appetite for risk will determine if WestConnex is a value for money investment for NSW.

[6] These include the Lane Cove Tunnel[6], Cross City Tunnel and the Clem 7.

[7] http://www.westconnex.com.au/documents/westconnex_industry_engagement_briefing_oct2013.pdf

1.4 Future Extensions

WestConnex also provides for southern and northern extensions that will potentially draw more traffic onto the motorway. The Western Harbour Tunnel and southern extension to WestConnex are vital for generating traffic for WestConnex stage 3 but are currently outside the $15 billion price tag. This traffic may be vital to the financial viability of the WestConnex motorway.

However, in assessing WestConnex should costs and benefits of these further extensions be attributed to WestConnex? This is unclear at this stage.

As such, the WestConnex project potentially locks Sydney into a series of large scale road projects. Meanwhile, other formerly road-centric cities in North America and Asia are discovering that for metropolises above a certain size, public transport offers greater advantages than road.

Los Angeles – Mass Transit Transformation

Los Angeles is well known for its extensive freeway network but it has been investing significantly in mass transit since the early 1990s. The Metro Rail network was initiated by the construction of the Blue and Green light rail lines and the Red and Purple subway lines in the early 1990s. These initial bones have been added to considerably since, with extensions to existing lines as well as the construction of the Gold and Expo light rail lines in 2003 and 2012 respectively. Two bus rapid transit lines were also opened in the 2000s.

While investment has been flowing into the system for three decades, in 2008 L.A. County passed *Measure R*, a ballot proposition that raised sales taxes to create a dedicated funding stream for new transit. This revenue source is expected to generate over $40 billion (US) over the next 20 years, with these funds dedicated to transit upgrades and new line extensions. From this funding source several line extensions and two new lines are already under construction, with planning currently underway for five additional lines and further network extensions. These planned projects all have funding earmarked from *Measure R*. In addition to projects under construction or in the latter stages of planning, there are numerous proposed lines and expansions being considered (but without funding commitment).

An alternative approach for Sydney is to address particular bottlenecks that would improve the efficiency of the existing motorway network without building whole new motorways. That would allow greater investment in transit corridors which are better able to shape the city.

1.5 Tolling

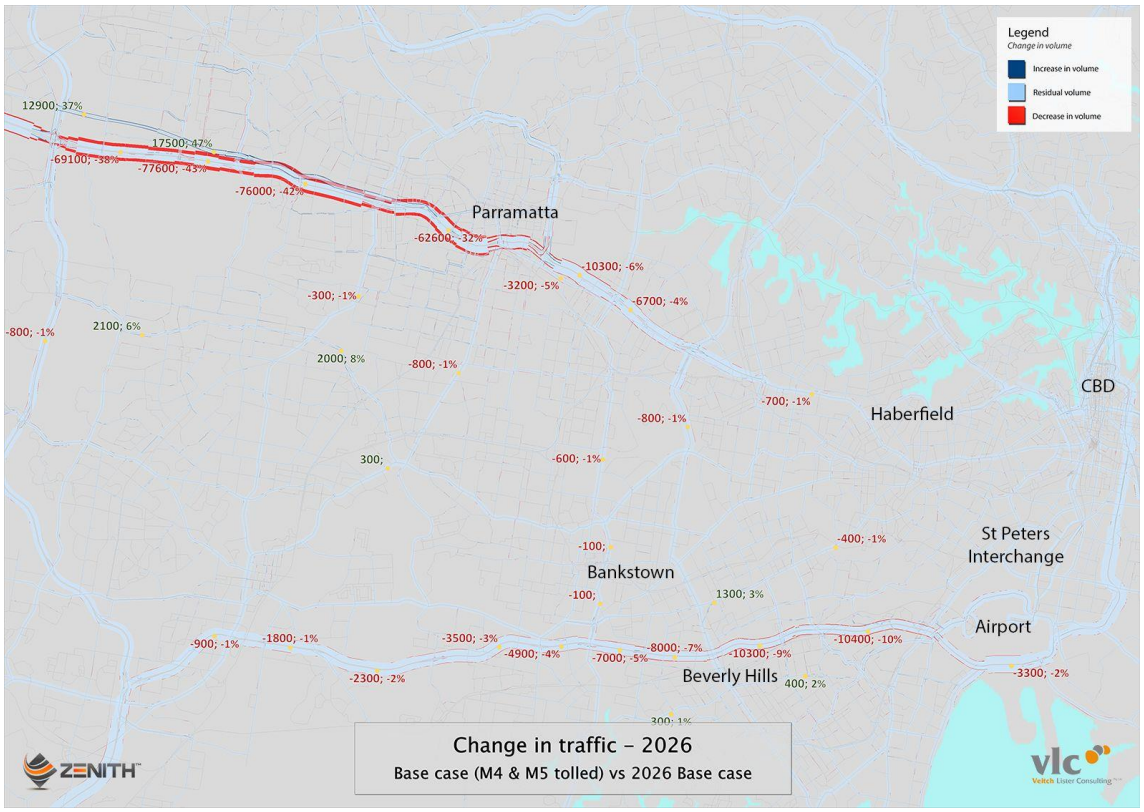
The model shows a major driver of improved volume-to-capacity ratio on the M4 is the introduction of tolls. If this were desired, a reduction in usage could be achieved simply by tolling the motorway without upgrading.

Figure 9 shows the impact of the introduction of tolls on the full length of the M4 and on the M5 east from Beverly Hills to Princes Highway in the base case (i.e. without WestConnex).

The model predicts a heavy reduction on the M4 (of about 40 per cent) and an increase on the Great Western Highway (of about 50 per cent). There will be a small reduction on Parramatta Road mainly due to the reduction in traffic coming from the M7 via the M4. Other local roads will see a slight increase in traffic volumes.

The M5 has fewer valid alternatives, and therefore a contained increase in the toll values does not have such a greater an effect. Reductions in traffic on the M5 and M5 East are usually within 10 per cent with the maximum in the M5 east tunnel.

FIGURE 9 IMPACT OF M4 AND M5 TOLLED (BASE CASE)



Source: Veitch Lister Consulting

This raises a broader issue, the role that tolls play in managing future Sydney's traffic demand. The introduction of pricing mechanisms was included as part of the New South Wales Long Term Transport Master Plan. Congestion pricing uses tolls to alter demand and has been shown to substantially affect behaviour and reduce traffic congestion.

Rather than increasing road capacity by building new road infrastructure, congestion on the existing road network may be better managed through a new or updated price mechanism. The Bureau of Transport Statistics has previously produced research drawing from Household Travel Survey's that shows there are still a number of discretionary trips being made in peak periods that could be shifted to non-peak times.

2 TRAFFIC IN THE REST OF SYDNEY

Traffic conditions in the rest of Sydney will deteriorate quickly during the construction phase. This will continue after the completion of Stages 1 and 2. That deterioration will be alleviated in part when WestConnex Stage 3 is complete. However, even with that improvement, traffic conditions across Sydney will be worse than they were in 2011.

The benefits of WestConnex accrue primarily once the entire project has been constructed (i.e. Stage 1, 2 and 3). At the completion of just Stages 1 and 2, roads in the inner Sydney area are more likely to be at capacity, as depicted in the map below.

FIGURE 10 V/C RATIO 2026 (PROJECT STAGE 1 & 2)

Source: Veitch Lister Consulting

In this scenario, the WestConnex motorways largely appear as green, because the impact of tolls is enough to dissuade many motorists from using them.

The complete WestConnex project is greater than the sum of its parts. This means that the construction phase – when Stage 1 and 2 are complete and Stage 3 is underway – will present difficulties for Sydney. Any delay in construction – not inconceivable given the scale of the tunnelling work being undertaken – would extend the problematic period.

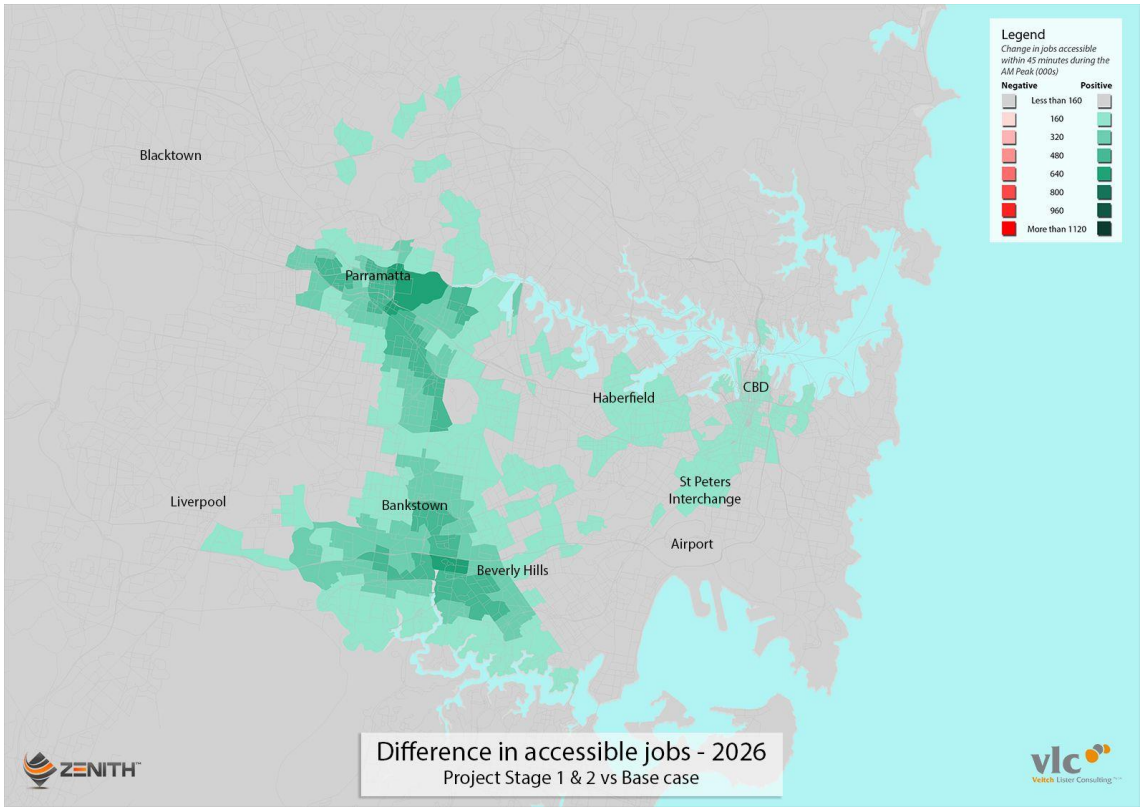
The findings with respect to the broader financial benefits of WestConnex are consistent with Infrastructure Australia's[8] own assessment; that the benefits of any one stage of WestConnex are lower than the benefits that flow from the entire project as the stages are complementary to each other. Project delays will significantly impact the project's economic merits.

Areas of inner Sydney, for example Dulwich Hill and Petersham, will see reduced traffic volumes after the construction of Stage 3, as some north-south traffic moves to the new tunnel.

Figure 11 and Figure 12 show the change in jobs accessible[9] within 45 minutes in the two 2026 project scenarios when compared with the base case.

Figure 11 shows that Parramatta and Bankstown are expected to benefit the most in terms of accessibility to jobs when only Stages 1 and 2 are completed, while Figure 12 shows that Stage 3 will increase the accessibility from Parramatta and Bankstown as well as from Green Square. In general the introduction of WestConnex Stage 3 increases the accessibility to jobs from the M4 and the M5 corridors.

FIGURE 11 CHANGE IN ACCESSIBLE JOBS – 2026 STAGE 1 & 2 VS BASE CASE

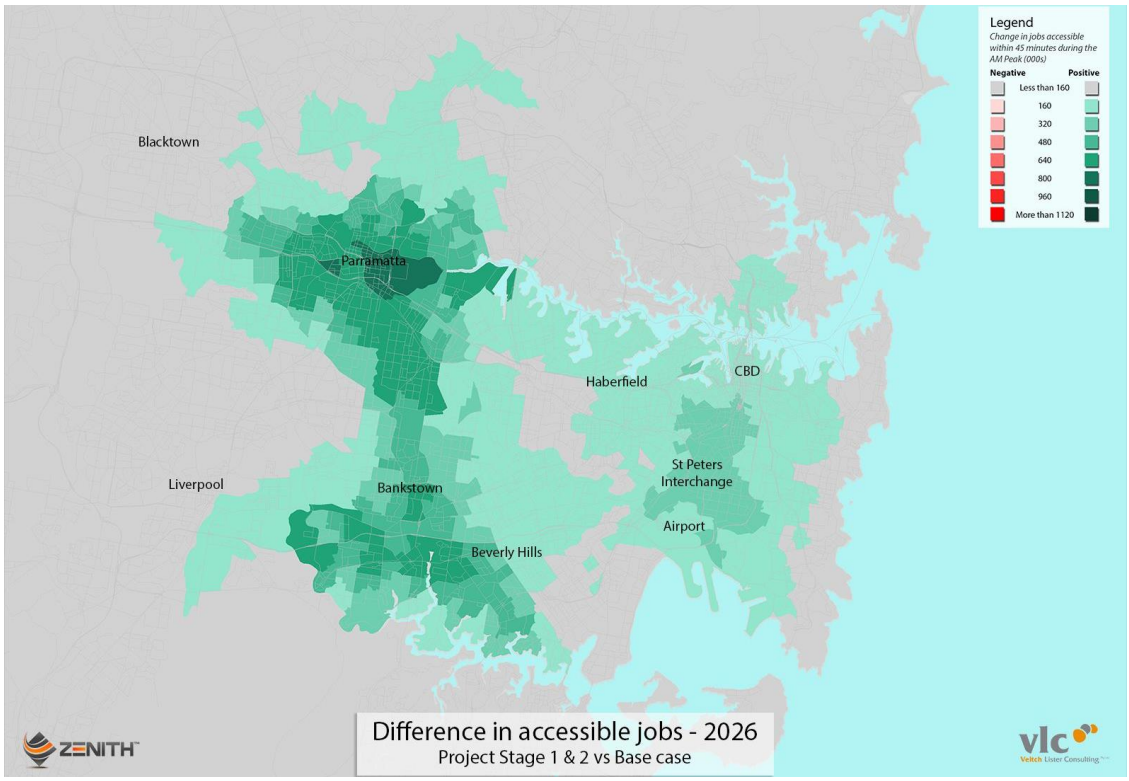


Source: Veitch Lister Consulting

[8] http://www.infrastructureaustralia.gov.au/project_assessments/files/NSW-WestConnex.pdf

[9] That is, from someone's home, how many jobs can be accessed in 45 minutes by car during peak hour?

FIGURE 12 CHANGE IN ACCESSIBLE JOBS – 2026 STAGE 1, 2 & 3 VS BASE CASE



Source: Veitch Lister Consulting

2.1 Urban Renewal

The 2012 State Infrastructure Strategy that announced WestConnex highlights its strategic intent as broader than transport.

"WestConnex is intended to be more than a motorway. It is a scheme designed to act as a catalyst to renew and transform the parts of Sydney through which it passes. WestConnex is intended to develop as an integrated land use and transport scheme delivering on road transport, urban renewal and public transport outcomes"[10].

But the effect of the construction of a major toll road can be paradoxical if the tolls discourage its use. Its capacity as an agent of renewal is diminished if it actually causes more local traffic.

The Zenith model finds increased traffic along parts of Parramatta Road. This finding is consistent with the WestConnex M4 Widening Traffic and Transport Working Paper – Working Paper 4[11]. This paper (page 145, Table 7.3) shows that in 2031 there is a 20 per cent (10,460 vehicles) increase in traffic on Parramatta Road (at the Duck River) following the introduction of WestConnex.

[10] Infrastructure NSW 2012, State Infrastructure Strategy

[11] https://majorprojects.affinitylive.com/public/cb35014b2a44c81e83fe58dfd330d39f/13_Appendix_D_Traffic_and_Transport.pdf

TABLE 7 TRAFFIC VOLUMES 2031 'DO MINIMUM' AND FULL WESTCONNEX

Road	Without WestConnex (Do Minimum)	Full WestConnex	Difference
M4 Motorway	194,180	168,760	-25,420
Parramatta Road	52,030	62,490	10,460
M2 Motorway	140,430	140,840	410
Victoria Road	68,250	75,770	

Source Jacobs SKM, WestConnex Road Traffic Model, 2014

The impact of increased traffic on Parramatta Road could be significant. A major impetus for the development of a motorway project was the desire to achieve urban renewal along the Parramatta Road corridor.

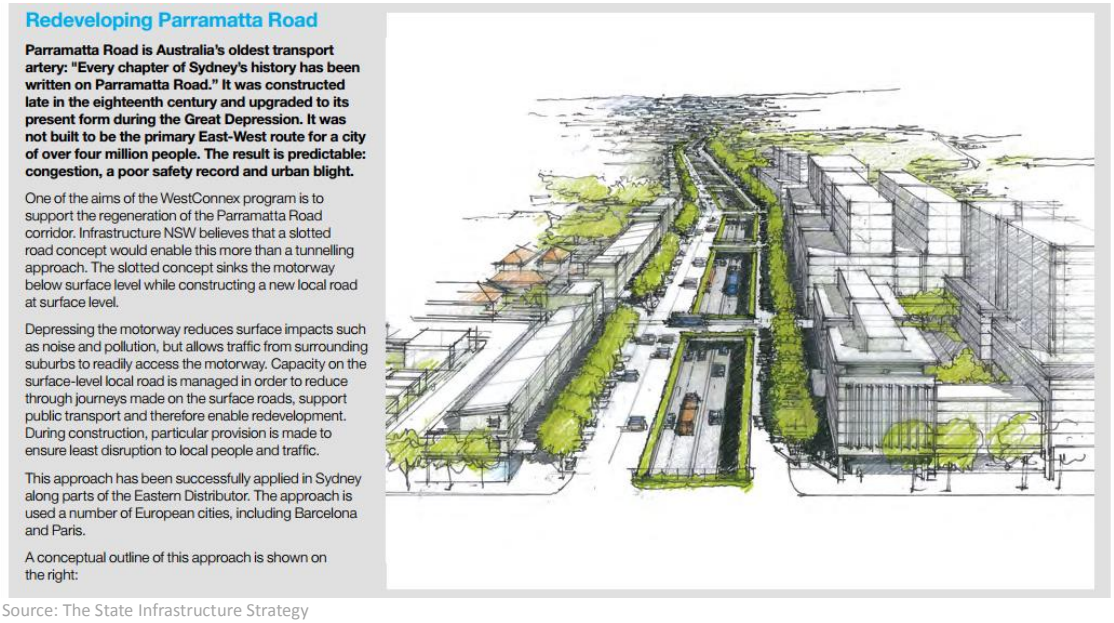
The draft Parramatta Road Urban Renewal Strategy identified areas that will be the focus of growth and change along the corridor. The numbers of people living in these defined areas is expected to rise by 51,600 by 2031 to achieve a total of 69,700. The population increase in these areas is 3.2 per cent of Sydney's overall expected population growth of 1.6 million to 2031.[12]

Urban renewal would transform Parramatta Road, bringing life to local communities and improving the commercial feasibility for residential, retail and commercial development.

Initially the WestConnex project proposed that urban renewal would be achieved by directing trucks and cars underground (to improve amenity) and improving above ground public transport (to improve connectivity) in the inner west. Investments of up to $200 million will be made to improve the built environment in the Parramatta Road corridor.

But the results of traffic modelling suggest amenity is unlikely to improve.

FIGURE 13 DISCARDED PLAN FOR PARRAMATTA ROAD



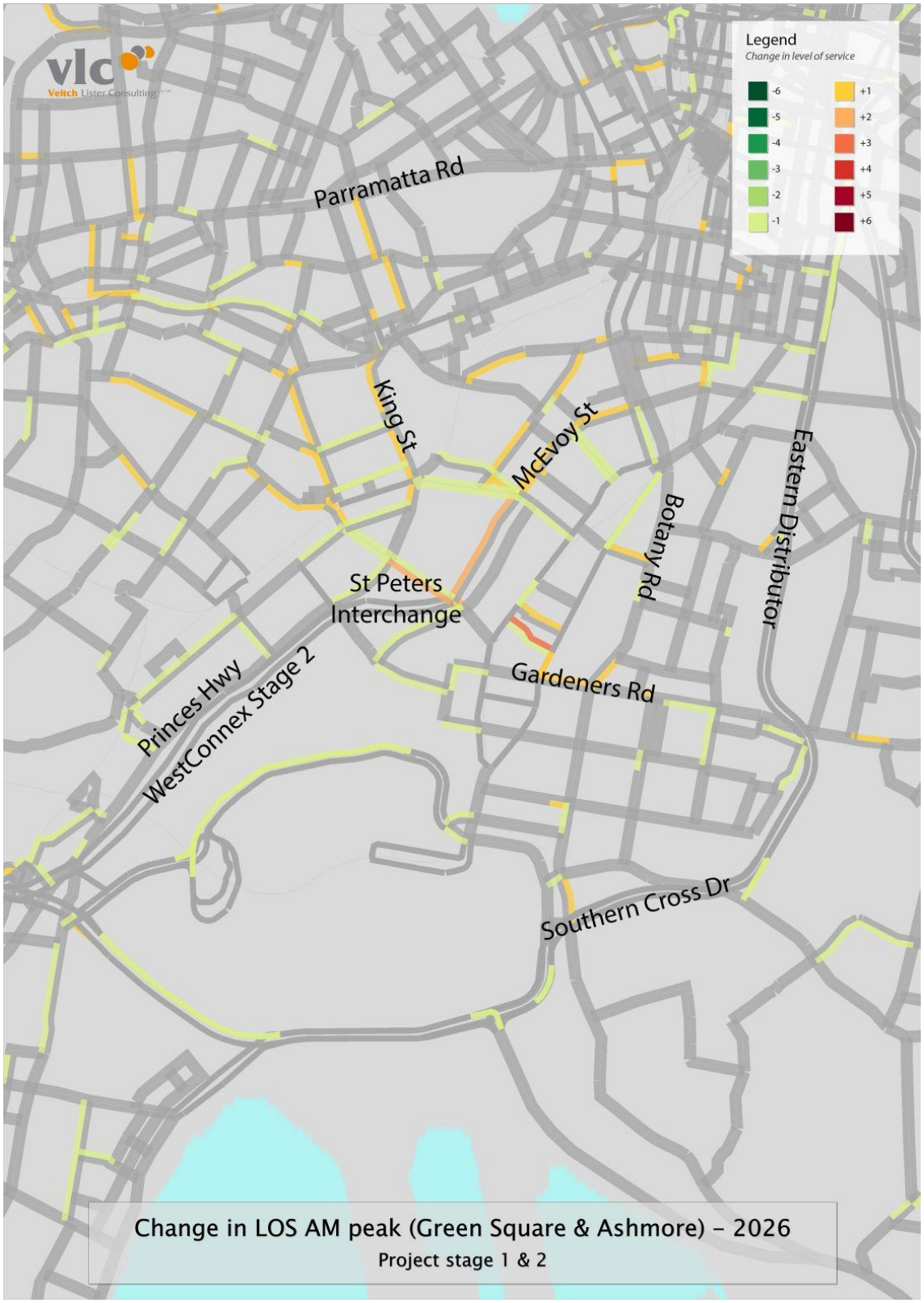
Source: The State Infrastructure Strategy

Urban revitalisation is critical for Sydney as it seeks to add an extra million people. Not all of Sydney's new residents can live on the fringes of the city. Infill development is crucial to the function of a growing city.

[12] http://www.newparramattard.com.au/downloads/file/urbanrenewal/DraftParramattaRoadURS_Web_final_20141121.pdf

The key surface road of King Street in Newtown is at capacity under the base case. Due to the limited capacity of King Street the introduction of WestConnex does not have a significant adverse impact on King Street.

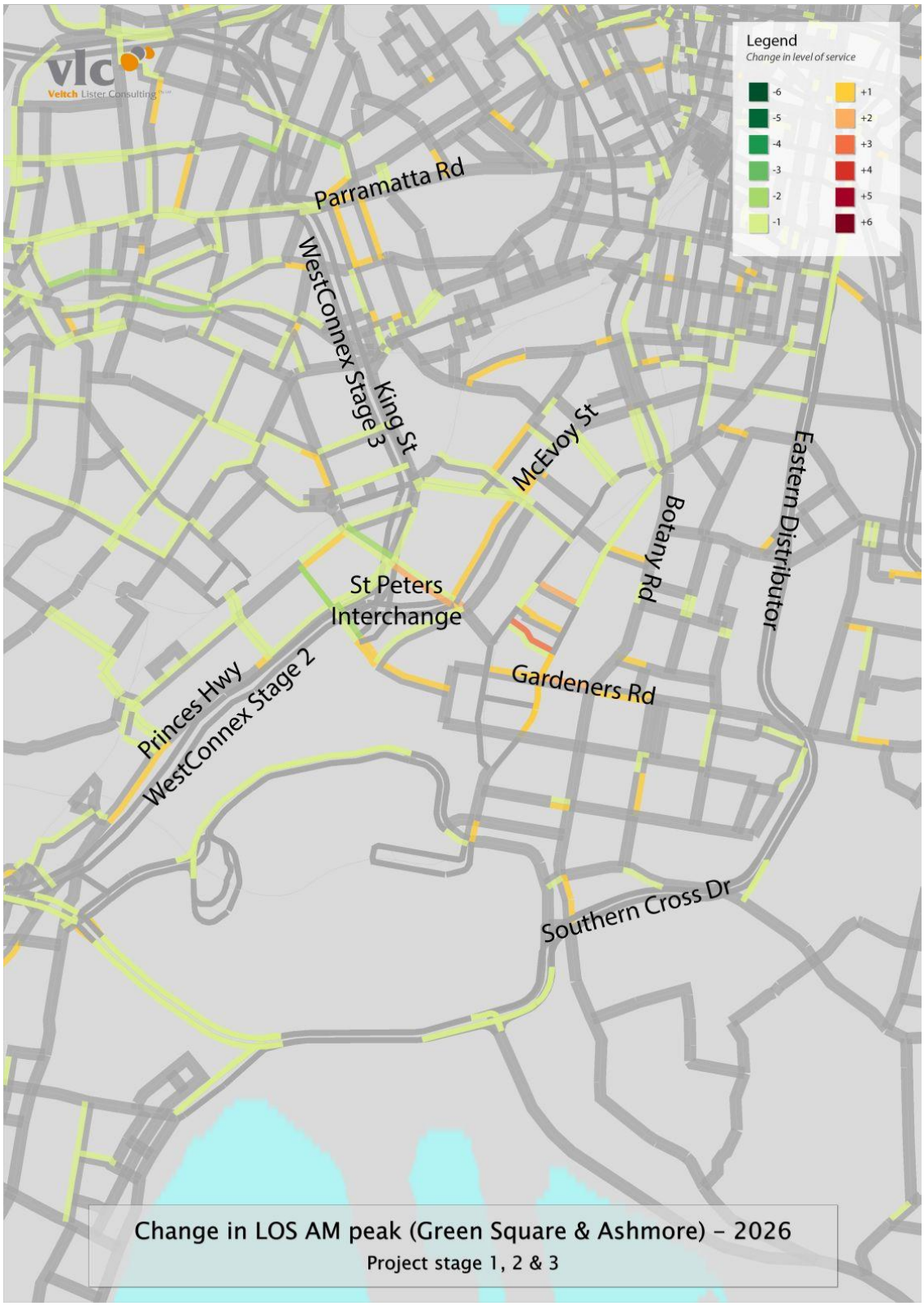
FIGURE 14 CHANGE IN LOS 2026 (STAGE 1 &2 VS BASE)



Source: Veitch Lister Consulting

The Green Square urban renewal area will also see an increase in traffic in some areas. The increase is especially pronounced prior to the construction of Stage 3, as visible in the map overleaf. Roads which have their level of service improved (e.g. from B to A) are coloured in green, while roads where the level of service gets worse (e.g. from B to C) are coloured in yellow and red.

FIGURE 15 CHANGE IN LOS 2026 (STAGE 1, 2 & 3 VS BASE)



Source: Veitch Lister Consulting

2.2 Traffic change overview

The roads around Green Square may get more crowded, but not all parts of Sydney see a traffic increase. Parts of the inner south see a reduction in traffic on local roads, as through-traffic is diverted onto the motorways, especially the tunnel constructed as part of Stage 3.

Figure 16, on the following page, shows the change in traffic levels associated with the completion of the whole WestConnex project. It allows for comparison between two alternative futures: one where WestConnex is built and one where it is not.

It shows areas of improvement in the south of Sydney, and areas where traffic gets worse, such as Green Square and Beverley Hills.

Areas that will see a benefit include Dulwich Hill and Petersham. There is little effect in the CBD.

Figure 17, on the page after, shows the total change between 2011 and 2041. It shows a significant city-wide increase in traffic congestion by 2041 despite the construction of WestConnex.

FIGURE 16 CHANGE IN LOS 2026 (PROJECT STAGE 1, 2 & 3 VS BASE)

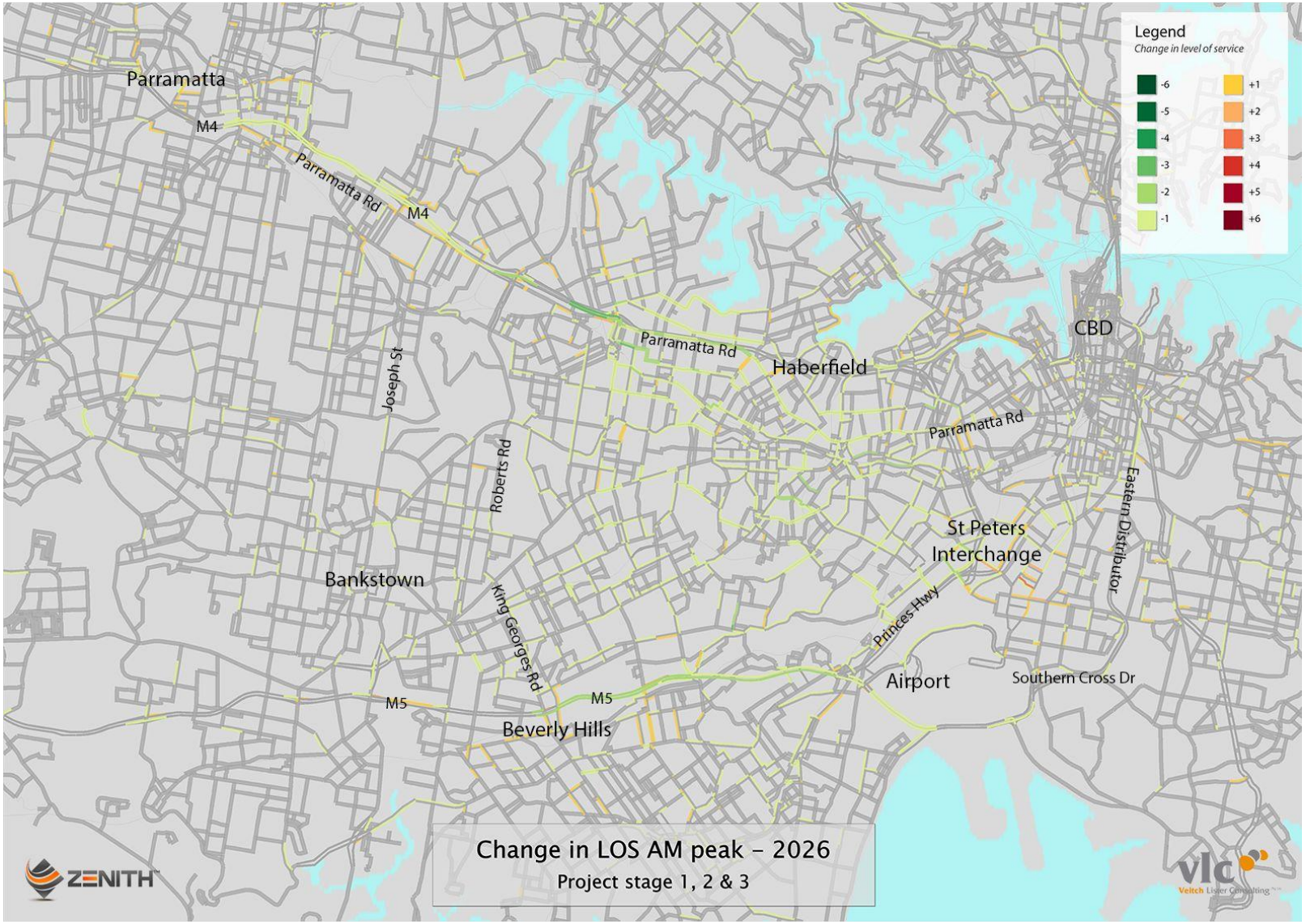
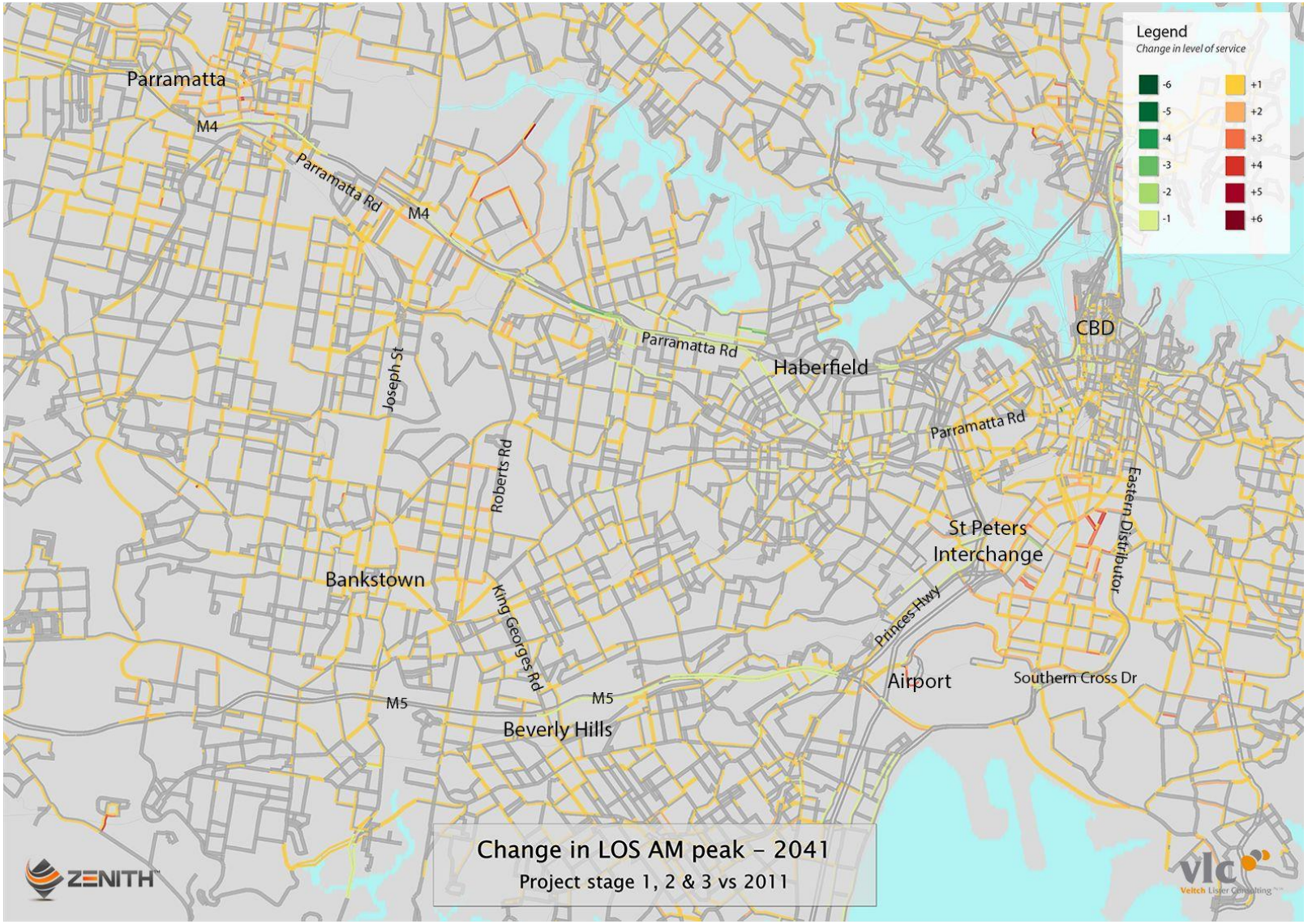


FIGURE 17 CHANGE IN LOS 2041 (PROJECT STAGE 1, 2 & 3 VS 2011)



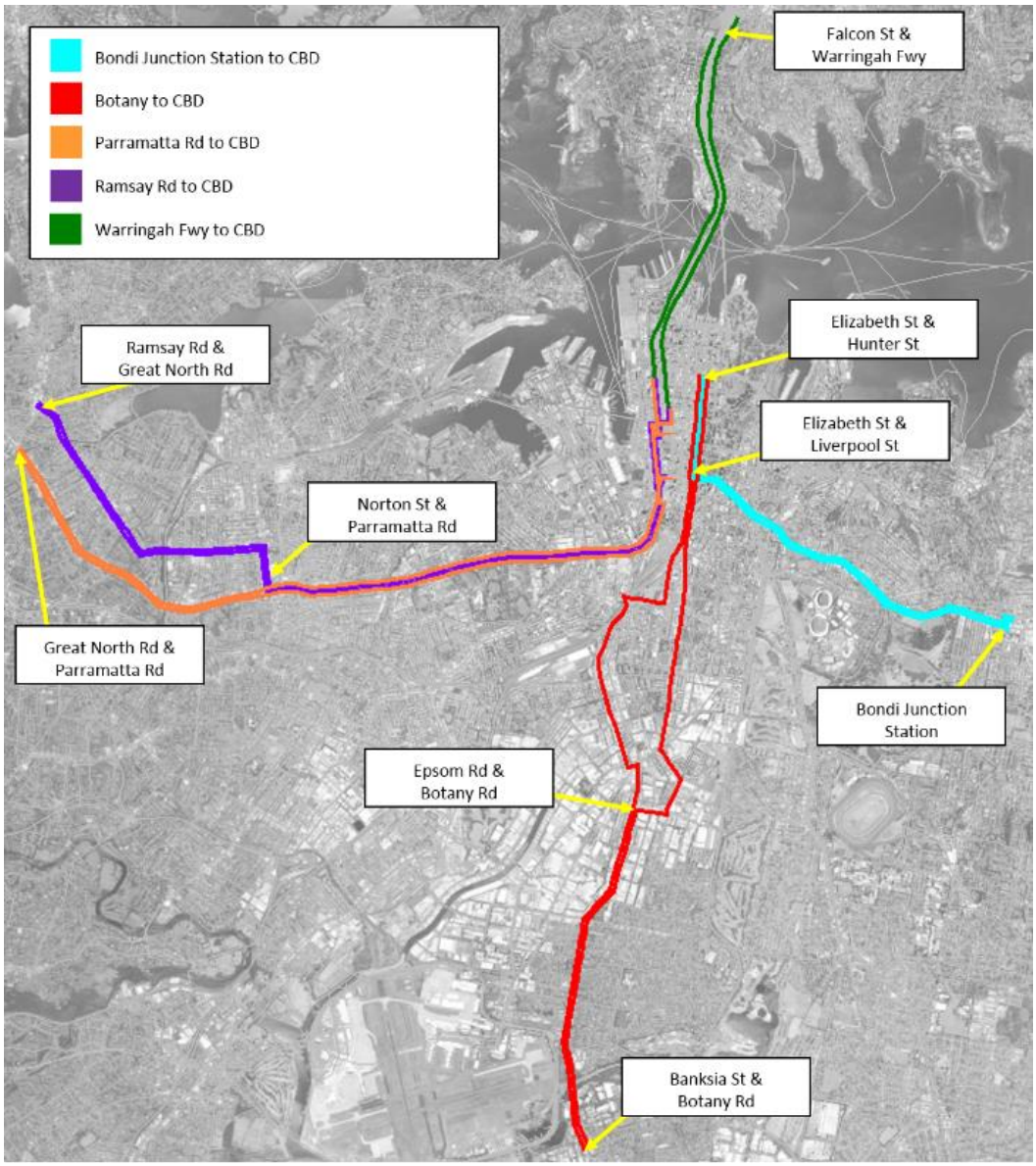
2.3 Public transport

WestConnex is intended to improve public transport travel times. The modelling shows improvements, but they are minor.

Change in travel times on bus routes

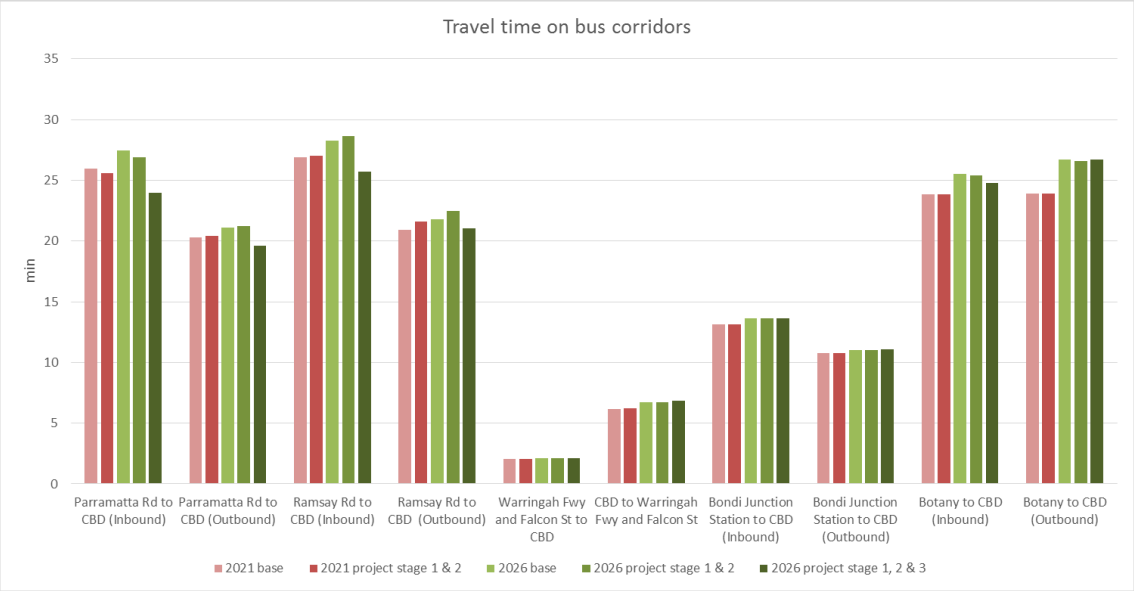
In order to understand the effect of WestConnex on the local network, travel times along some bus corridors were examined. Figure 18 shows the bus routes analysed for this purpose, while the travel times in the AM peak hours are plotted in Figure 19 for each scenario. In general no major changes are expected, and delays will be contained within one minute. The corridor from Ramsay Road to the CBD will experience a small improvement (contained within 5 minutes) due to the decongestion of the M4.

FIGURE 18 TRAVEL TIME ASSESSMENT – BUS CORRIDORS



Source: Veitch Lister Consulting

FIGURE 19 TRAVEL TIME ALONG BUS CORRIDORS



Source: Veitch Lister Consulting

2.4 Commercial vehicles

Some of Sydney's roads will see a decrease in commercial vehicle traffic while other roads will see an increase.

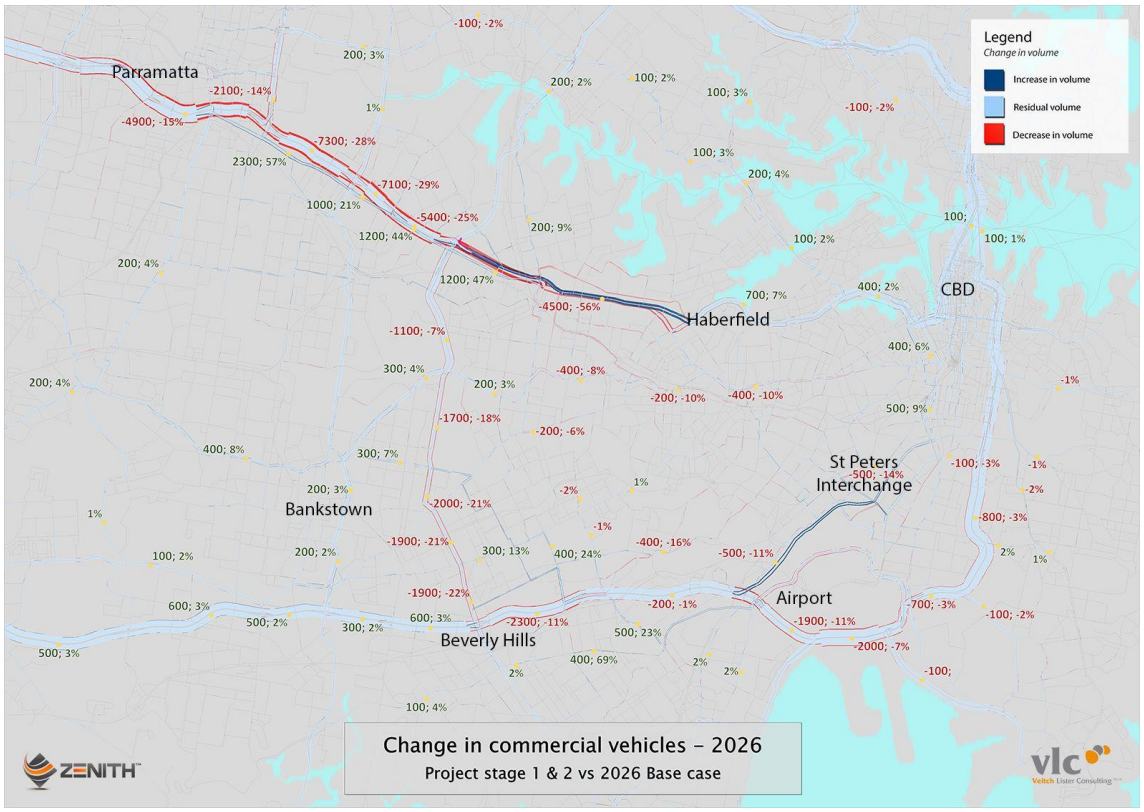
The figures overleaf illustrate the patterns of commercial vehicle travel after Stage 1 and 2; and after Stage 3. The patterns are similar to that described in the previous section. In both cases the main diversion is from the M4 to Parramatta Road and other local roads.

A reduction in commercial vehicles is observed on King Georges Road (up to 22 per cent and 32 per cent when Stage 3 is completed) and on General Holmes Drive (about 11 per cent and up to 17 per cent when Stage 3 is completed). ANZAC Bridge has a very small increase in commercial vehicle volumes when only Stages 1 and 2 are operational, but it reaches a 30 per cent increase with completion of Stage 3.

The green numbers on the map indicate increases in commercial vehicle traffic. Along Parramatta Road the increases are as much as 53 per cent after Stage 3, due to the impact of tolling.

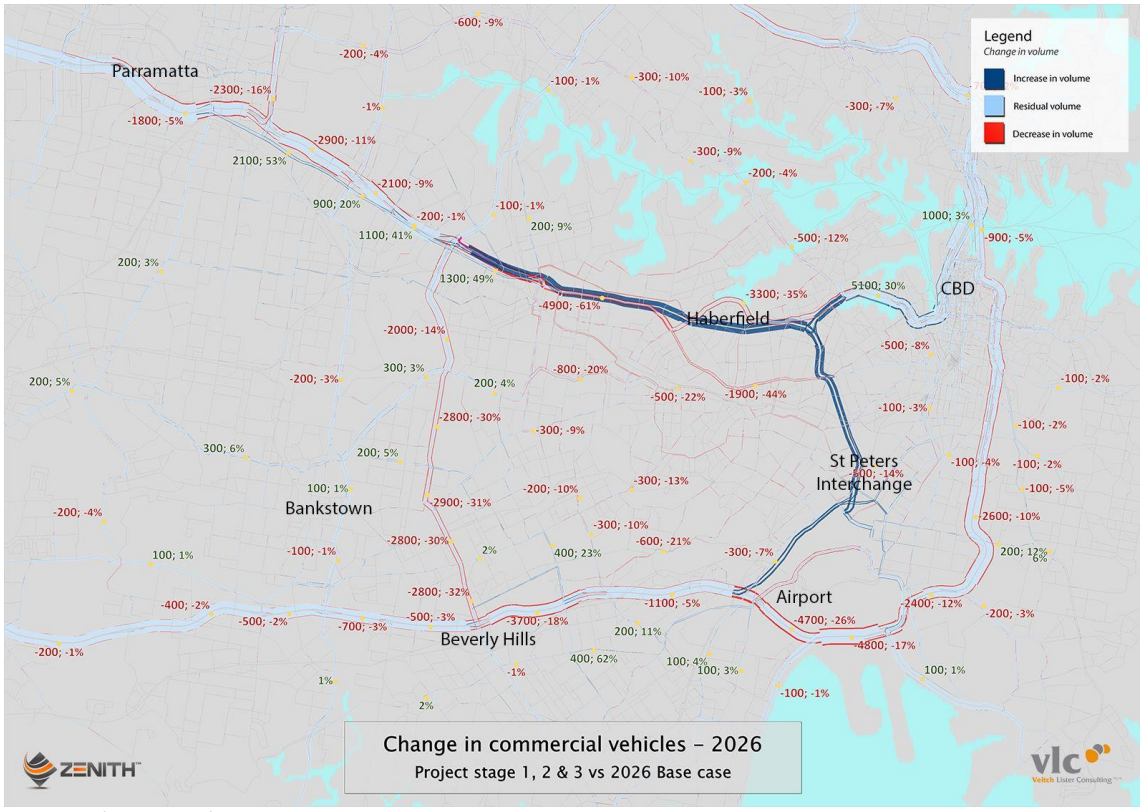
Red numbers indicate the completion of WestConnex will reduce commercial vehicle traffic. This effect is prevalent across southern Sydney, with a maximum decrease of 44 per cent in Petersham predicted by the model.

FIGURE 20 CHANGE IN COMMERCIAL VEHICLES 2026 (STAGE 1 & 2 VS BASE)



Source: Veitch Lister Consulting

FIGURE 21 CHANGE IN COMMERCIAL VEHICLES 2026 (WESTCONNEX VS BASE)



Source: Veitch Lister Consulting

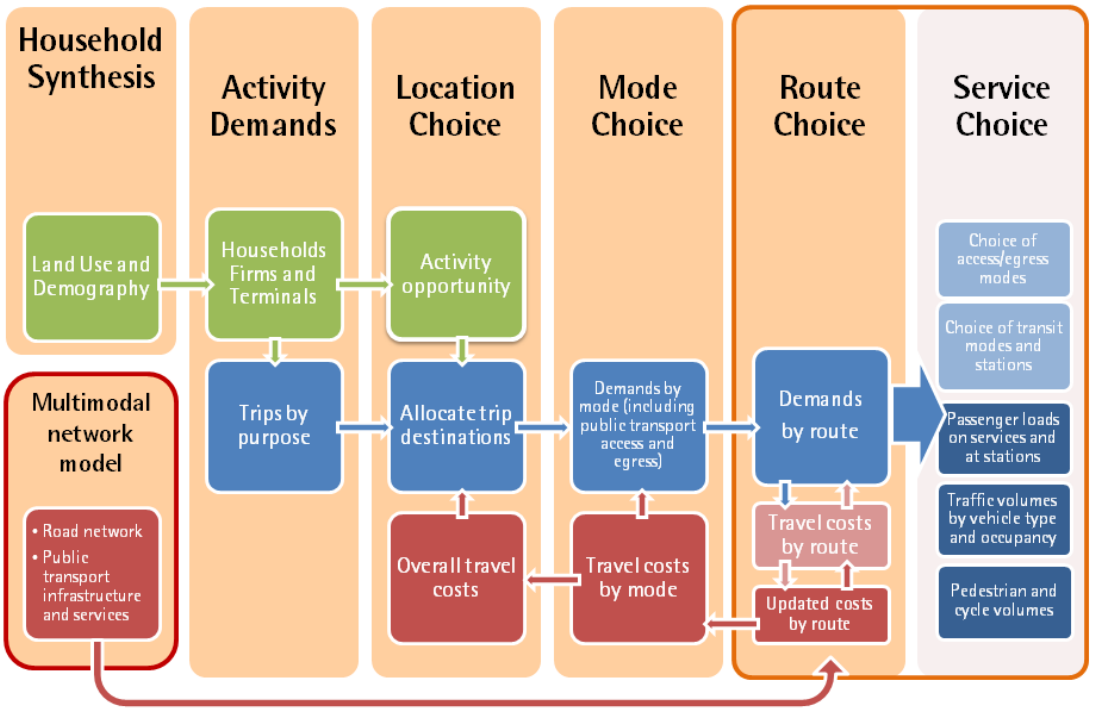
3 THE MODEL

The transport model – Zenith - is based on standard employment and population projections compiled by the Bureau of Transport Statistics.

The prime objective of Zenith is to provide a planning tool to support the evolving policy issues of relevance to planners and government. This is accomplished through replicating the demand for travel by residents and visitors in the Sydney region, which is derived from the demand for participation in activities. Travel choices may differ depending on the activity for which the travel is undertaken. The nature of the activity may influence the frequency, timing and duration of participation, the location, as well as the mode of travel and in some cases, the route chosen.

The Zenith travel demand model simulates the travel behaviour of households, firms and visitors within the Sydney region associated with their participation in the range of activities described above. The model makes use of information that is available to describe the potential demands for these activities in each location, such as statistics on employment in various industries, enrolments at educational facilities, and demographic variables such as population and households. The key stages of the Zenith model process are illustrated in Figure 22.

FIGURE 22 KEY STAGES OF THE ZENITH MODELS



Source: Veitch Lister Consulting

The model works by dividing each region into several thousand travel zones, providing a high degree of resolution for forecasting movements between suburbs and across the city. A large range of demographic, socioeconomic and land use variables are used to identify the types of households and range of activities in each zone.

The model forecasts the number of trips made for work, education, shopping, personal business, recreation, social and "other" journey purposes (why travel?). It simulates the decisions made by households regarding the time period (when?), destination (where?) and mode of travel (how?) for each trip, with models developed from surveys of travel behaviour undertaken in each region.
Having determined the destination and mode of travel, the model then reflects the choice of route for trips by private or commercial vehicle, public transport and active travel modes such as cycling and walking.

Transport models are useful planning tools, but travel demand forecasting is not a precise science, and there are numerous outside factors which are difficult to predict or quantify. Changes in government policy, for example, occur on a regular basis and can affect modelled outcomes.

Other major assumptions, in particular fuel costs, can also prove difficult to foresee. Various factors impact the petrol price paid by motorists at the pump, including the Australian dollar exchange rate and perceptions of potential oil supply[13]. In both examples, a transport model is the ideal tool for testing the sensitivity of future travel demand to these exogenous factors, mitigating the level of uncertainty around modelled forecasts.

3.1 Tolls

The toll levels for existing roads have been calculated using information made publicly available by Sydney Motorways and reported in Table 8.

WestConnex toll levels

Toll levels reported in the public documents (Table 9) have been used as reference to calculate the toll value on each WestConnex section.

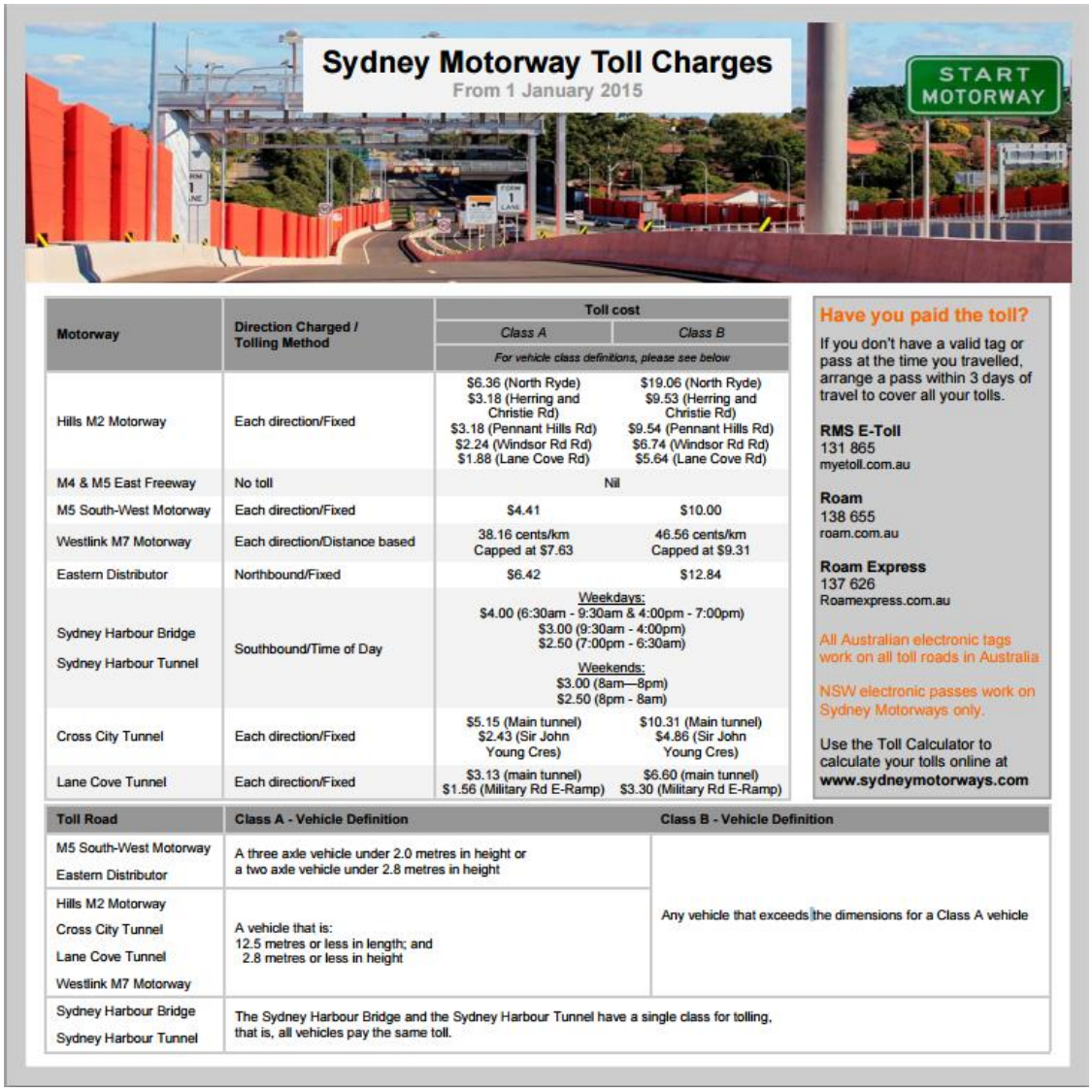
In order to apply the appropriate toll in the model, values from the reference tolling scenario have been converted to cents per km for each stage of WestConnex, results are listed 2013 Australian dollars.

- Stage 1: 55 c/km;
- Stage 2: about 45 c/km;
- Stage 3: about 50 c/km.

A toll cap of $7.35 has been applied in the model. A multiplier of 3 has been used for commercial vehicles (both LCV and HCV).

[13] http://www.atrf.info/papers/2010/2010_gargett.pdf

TABLE 8. TOLL CHARGES FOR EXISTING MOTORWAYS



Motorway	Direction Charged / Tolling Method	Toll cost	
		Class A	Class B
		For vehicle class definitions, please see below	
Hills M2 Motorway	Each direction/Fixed	$6.36 (North Ryde) $3.18 (Herring and Christie Rd) $3.18 (Pennant Hills Rd) $2.24 (Windsor Rd Rd) $1.88 (Lane Cove Rd)	$19.06 (North Ryde) $9.53 (Herring and Christie Rd) $9.54 (Pennant Hills Rd) $6.74 (Windsor Rd Rd) $5.64 (Lane Cove Rd)
M4 & M5 East Freeway	No toll	Nil	
M5 South-West Motorway	Each direction/Fixed	$4.41	$10.00
Westlink M7 Motorway	Each direction/Distance based	38.16 cents/km Capped at $7.63	46.56 cents/km Capped at $9.31
Eastern Distributor	Northbound/Fixed	$6.42	$12.84
Sydney Harbour Bridge Sydney Harbour Tunnel	Southbound/Time of Day	Weekdays: $4.00 (6:30am - 9:30am & 4:00pm - 7:00pm) $3.00 (9:30am - 4:00pm) $2.50 (7:00pm - 6:30am) Weekends: $3.00 (8am—8pm) $2.50 (8pm - 8am)	
Cross City Tunnel	Each direction/Fixed	$5.15 (Main tunnel) $2.43 (Sir John Young Cres)	$10.31 (Main tunnel) $4.86 (Sir John Young Cres)
Lane Cove Tunnel	Each direction/Fixed	$3.13 (main tunnel) $1.56 (Military Rd E-Ramp)	$6.60 (main tunnel) $3.30 (Military Rd E-Ramp)

Have you paid the toll?

If you don't have a valid tag or pass at the time you travelled, arrange a pass within 3 days of travel to cover all your tolls.

RMS E-Toll
131 865
myetoll.com.au

Roam
138 655
roam.com.au

Roam Express
137 626
Roamexpress.com.au

All Australian electronic tags work on all toll roads in Australia

NSW electronic passes work on Sydney Motorways only.

Use the Toll Calculator to calculate your tolls online at **www.sydneymotorways.com**

Toll Road	Class A - Vehicle Definition	Class B - Vehicle Definition
M5 South-West Motorway Eastern Distributor	A three axle vehicle under 2.0 metres in height or a two axle vehicle under 2.8 metres in height	Any vehicle that exceeds the dimensions for a Class A vehicle
Hills M2 Motorway Cross City Tunnel Lane Cove Tunnel Westlink M7 Motorway	A vehicle that is: 12.5 metres or less in length; and 2.8 metres or less in height	
Sydney Harbour Bridge Sydney Harbour Tunnel	The Sydney Harbour Bridge and the Sydney Harbour Tunnel have a single class for tolling, that is, all vehicles pay the same toll.	

Source: Sydney Motorways

TABLE 9 WESTCONNEX REFERENCE TOLLING SCENARIO

Stage	Indicative average toll ($2013, incl GST)	Indicative min/max toll ($2013, incl GST)
M4 Widening (Church Street to Homebush Bay Drive)	$3.00	Min: $1.50 Max: $3.90
M4 East (Homebush Bay Drive to Parramatta Road and City West Link)	$2.40	Min: $2.00 Max: $3.60
Stage 2 – M5 East Airport Link (Beverly Hills to St Peters)	$2.70	Min: $1.70 Max: $4.80
Stage 3 – M4 South (Haberfield to St Peters)	$3.00	Min: $1.80 Max: $4.10
WestConnex average toll	**$4.50**	**Min: $1.50 Max: $7.35 (cap)**

Source: WestConnex Delivery Authority

F6 toll values (2013 AUD)

- 50 cents per km have been charged on the F6.
- A multiplier of 3 has been used for LCV and HCV.

Western Harbour Tunnel toll values (2013 AUD)

- 50 cents per km have been charged on the Western Harbour Tunnel toll values.
- A multiplier of 3 has been used for LCV and HCV.

M5 east toll values (2013 AUD)

- The same WestConnex toll values have been used for the M5 tolled sensitivity test.
- A multiplier of 3 has been used for LCV and HCV.

M4 widening toll values (2013 AUD)

- The same WestConnex stage 1 cents per km have been used for the M4 tolled sensitivity test.
- A multiplier of 3 will be used for LCV and HCV.

All the costs associated with vehicle operations, infrastructure and public transport have been assumed to increase by CPI. This is a conservative assumption due to the lack of publicly available information. Some sensitivity tests may be required to investigate the effect of higher growth rates that may occur.

3.2 Changes to Road Network

The model includes known improvements to the road and public transport system over coming decades. These are listed below and mapped overleaf.

Main included projects

- 2021
  - M5 west widening (040)
  - M2 to F3 Corridor (NorthConnex) (083)
  - South West Rail Link (PT001)
  - North West rail link (PT003)

- 2026
  - M4 widening untolled (054)
  - Sydney Rapid Transit
  - Badgerys creek airport

- 2041
  - Western Harbour Tunnel
  - F6
  - Badgerys creek airport rail

Main excluded projects

- Northern Beaches Motorway Tunnel

FIGURE 23 ROAD PROJECTS INCLUDED UNTIL 2041

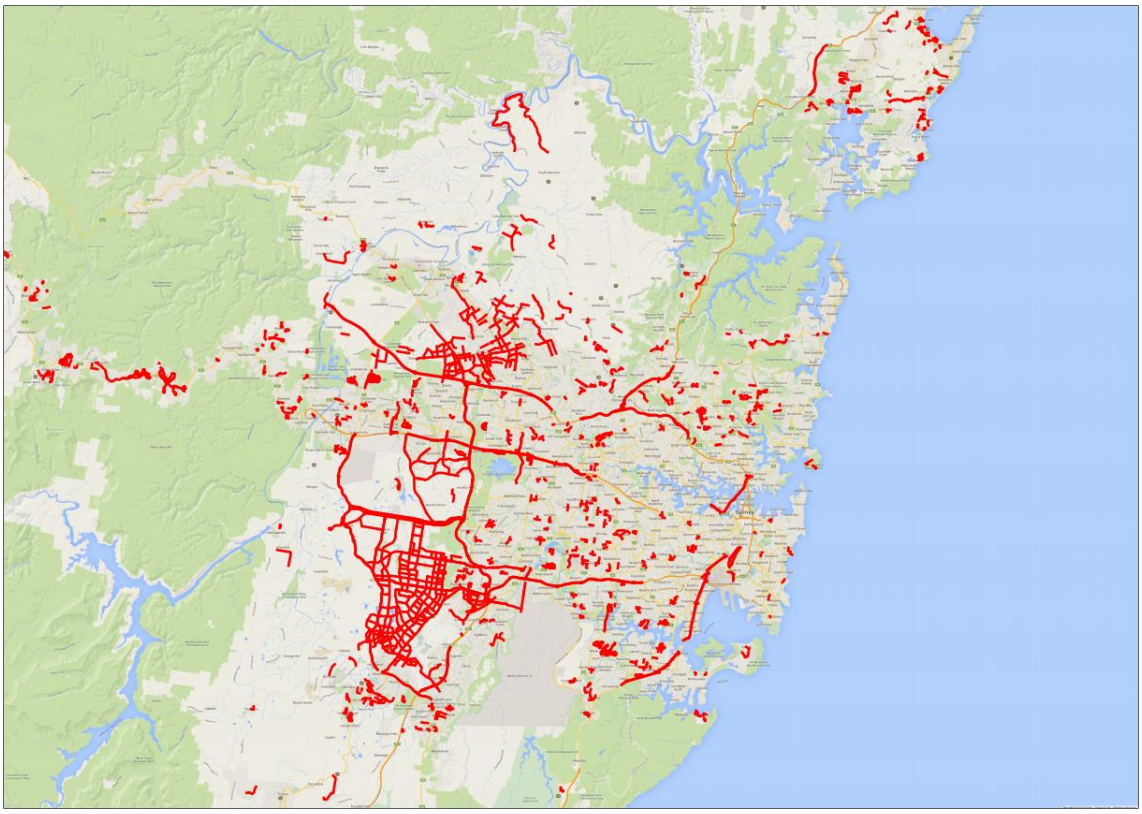
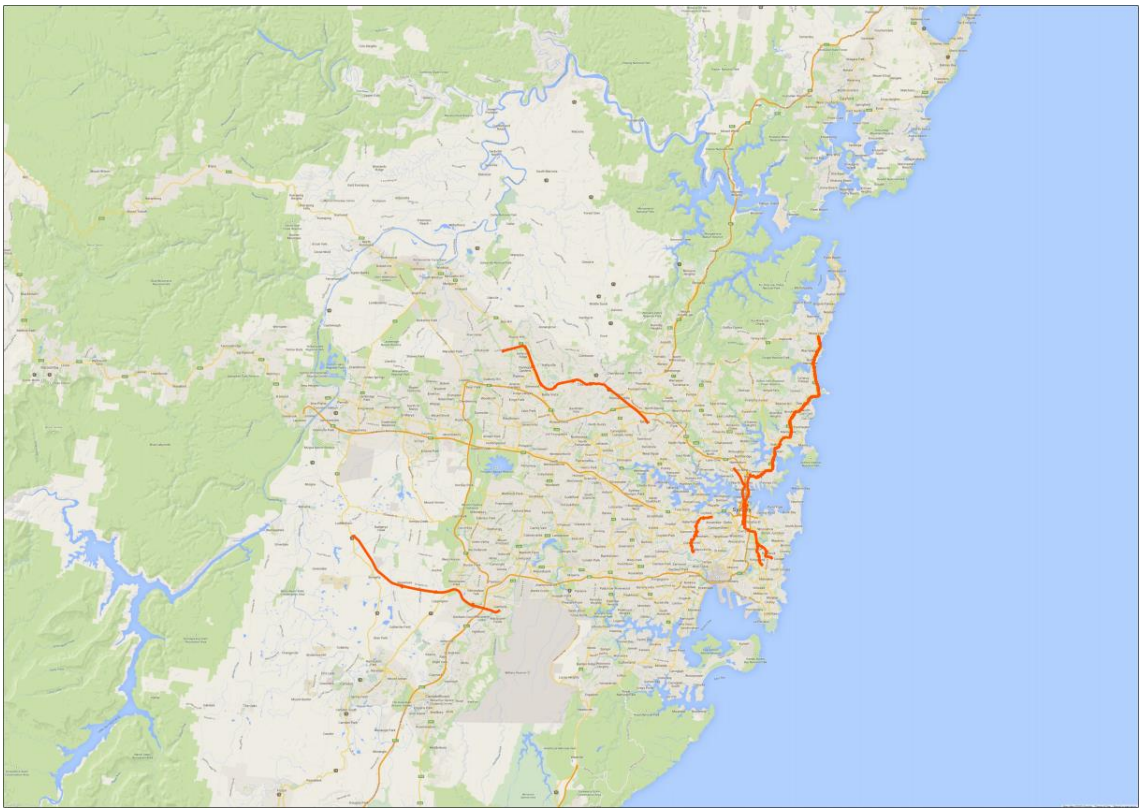


FIGURE 24 PT PROJECTS INCLUDED UNTIL 2041



4 CONCLUSION

In the future Sydney will be bigger, busier and more crowded city. The metropolis is projected to grow to accommodate around 6.2 million people by 2031, and 8.5 million by 2061. Traffic volumes will have grown, and the congestion clogging Sydney will have worsened. WestConnex is a series of projects designed to upgrade and link two existing motorways in Sydney's south west (the M5) and west (the M4). The combined cost of the project is $15 billion. However, Sydney's traffic congestion will worsen with or without WestConnex, with the project making only minor differences to Sydney's traffic.

Sydney's road network will experience significant capacity constraints by 2026. The modelling confirms the WestConnex proposal will not improve access to the Sydney CBD. Like other parts of the Global Economic Corridor, the CBD is already congested and has little parking available.

Traffic flows on parts of Parramatta Road will increase by over 20 per cent as vehicles avoid paying the toll on the M4 and M4 eastern extension. This finding is consistent with the WestConnex Delivery Authority's own assessment presented in the M4 Widening Environmental Impact Statement and with the traffic flow impacts observed when the M4 toll was removed in 2010. Parramatta Road will take more traffic in the future, not less. Traffic growth on Parramatta Road will clearly jeopardise the government's planned urban renewal and population growth along this corridor.

The M5 East will, despite the completion of the New M5, remain the preferred route connecting to airport, port and the city. The New M5 will not provide a more attractive route to these key destinations and will not relieve congestion on the M5 East. Traffic volumes on the M5 East will continue to increase by up to 25 per cent, leading to increased congestion and peak spreading.

The traffic from the New M5 will flow into the St Peters area via an interchange on the site of the Alexandria landfill. By 2021 over 31,000 vehicles a day will be using this interchange, increasing to over 55,000 vehicles by 2041. These vehicles will flow onto the local road network, impacting on residential and commercial areas, and increasing congestion in the CBD-airport corridor. This will impact the viability of urban renewal areas such as Green Square and Ashmore, reducing future housing potential.

The modelling contained within this report has provided a better understanding of the impacts relating to WestConnex. It has also raised areas for further investigation. The northern extension (including the Western Harbour Tunnel) and southern extension to WestConnex are vital for generating traffic for WestConnex Stage 3 but are currently outside the $15 billion price tag. As such, the WestConnex project potentially locks Sydney into a series of large scale road projects. Should the costs as well as the benefits of these extensions be attributed to WestConnex? Or would they been financed separately from first three stages of WestConnex, with the benefits similarly excluded?

From available information, Stage 1 is initially funded by government and then sold to finance Stage 2 and 3. However, more recent announcements have indicated Stages 1 and 2 are to be delivered concurrently. The length of time government holds and operates WestConnex, the concessions (tolls and length) for a private operator and the private sectors appetite for risk will determine if WestConnex is a value for money investment for NSW.

The role that tolls on existing roads can play in managing future Sydney's traffic demand should be evaluated. The introduction of pricing mechanisms was included as part of the NSW Long Term Transport Master Plan. Congestion pricing uses tolls to alter demand and has been shown to substantially affect behaviour and reduce traffic congestion. Rather than increasing road capacity by building new road infrastructure, can congestion on the existing network be better managed through price mechanisms?

APPENDIX

WestConnex infrastructure

WestConnex (Figure 8) will link the M4 to the M5 and will be built in three stages:

- Stage 1 (Figure 26), this stage includes the M4 widening from Church St and the M4 extension to Annandale with on and off ramps at Wattle St.
- Stage 2 (Figure 27), this stage includes the widening of the M5 east tunnel and a link from the M5 to Campbell Rd (Green Square and Ashmore precincts). It will also include the upgrade of Campbell Rd and Euston Rd, and a new bridge on Alexandra canal connecting Campbell Rd with Bourke Rd.
- Stage 3 (Figure 28), this stage will connect Stages 1 and 2. The main access points to the existing network will be via Canal Rd (Green Square) and City West Link (Annandale and surrounding suburbs).

FIGURE 25 WESTCONNEX

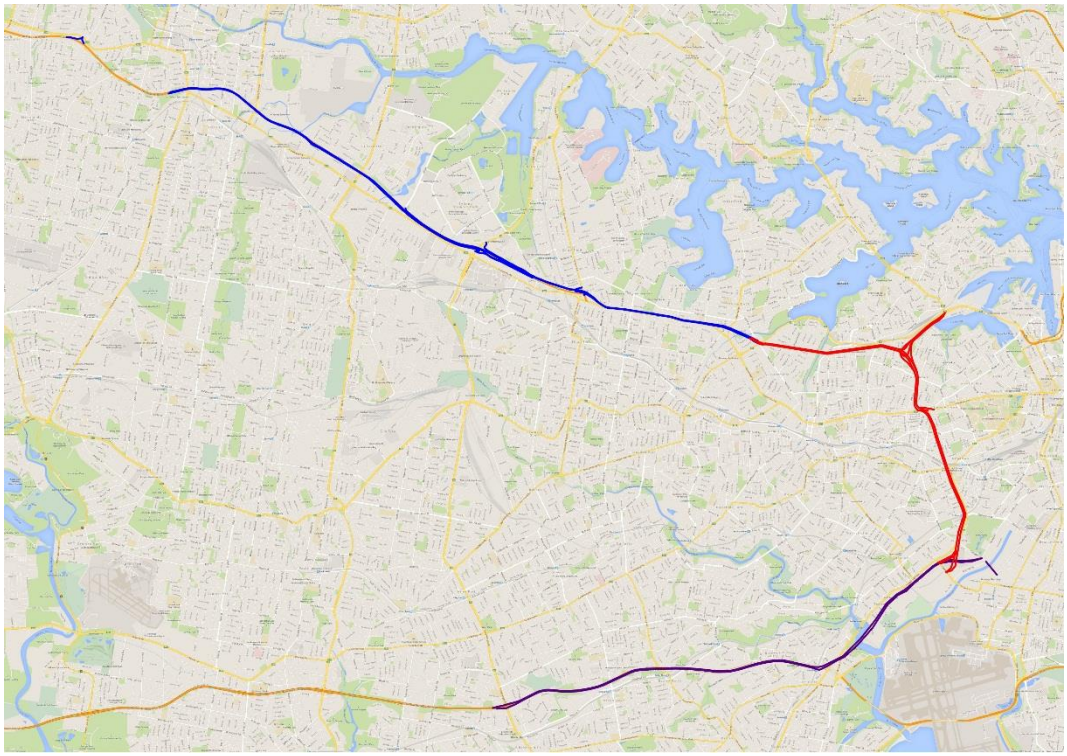


FIGURE 26 WESTCONNEX STAGE 1

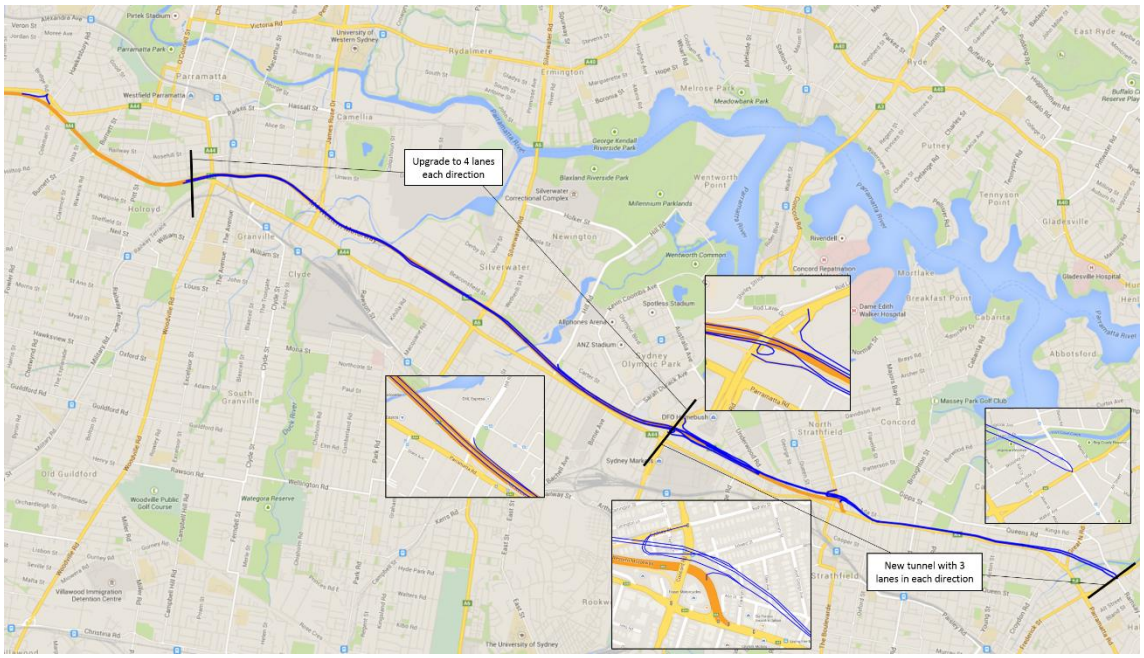


FIGURE 27 WESTCONNEX STAGE 2

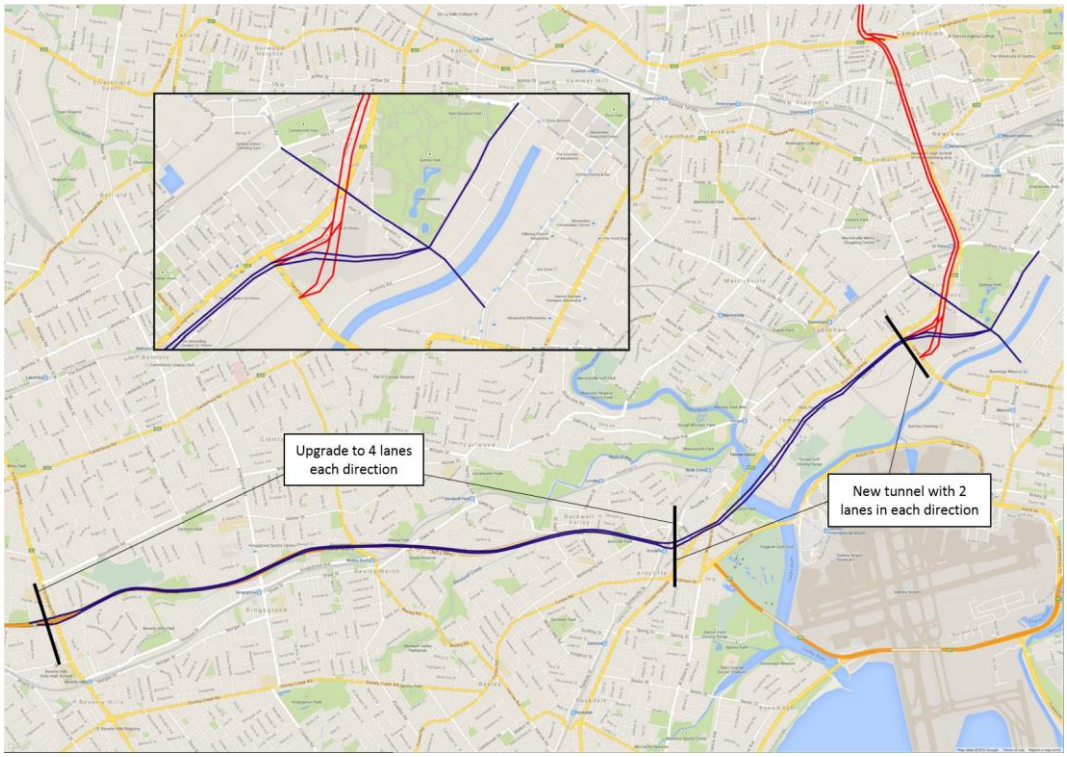
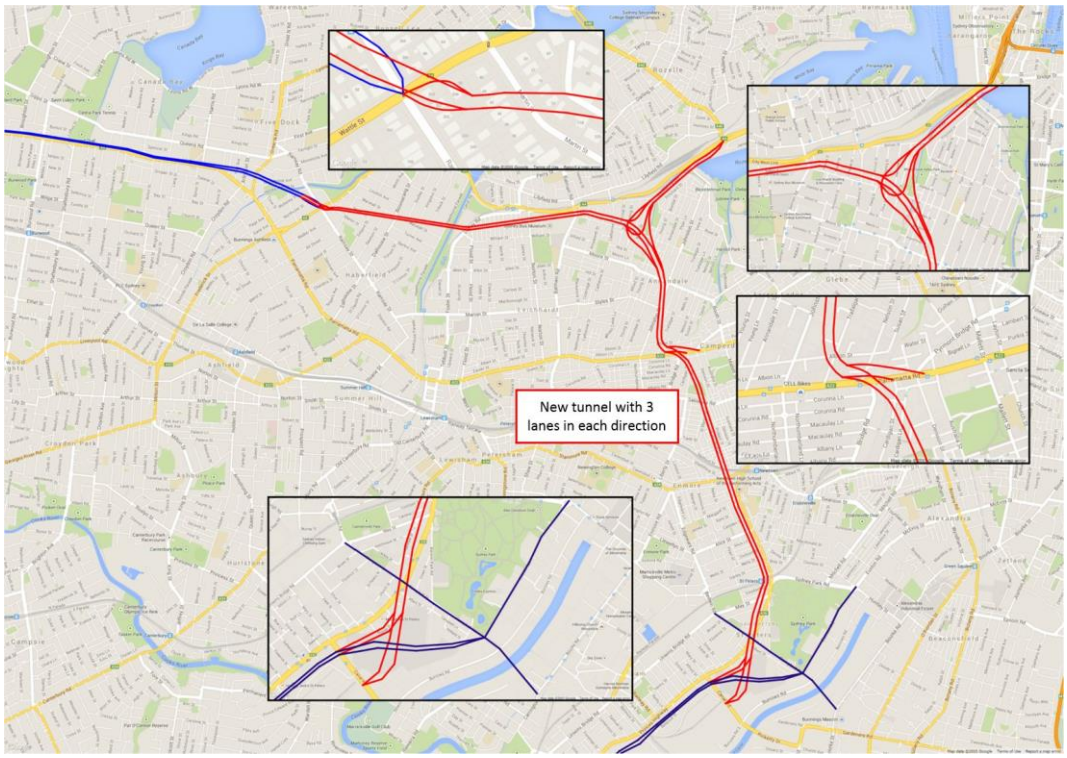


FIGURE 28 WESTCONNEX STAGE 3



WestConnex Tolling Point

In Figure 29 to Figure 31 the WestConnex alignment and tolled sections are shown.

FIGURE 29 WESTCONNEX ALIGNMENT

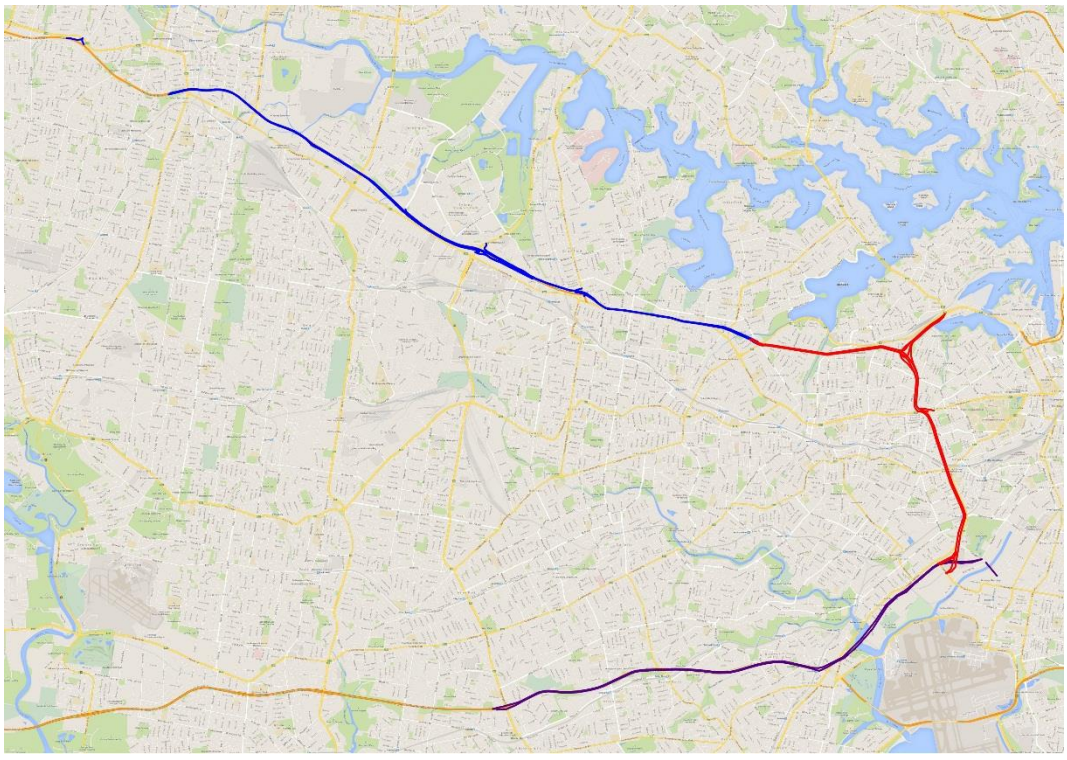


FIGURE 30 WESTCONNEX STAGE 1 ALIGNMENT AND TOLLED SECTIONS

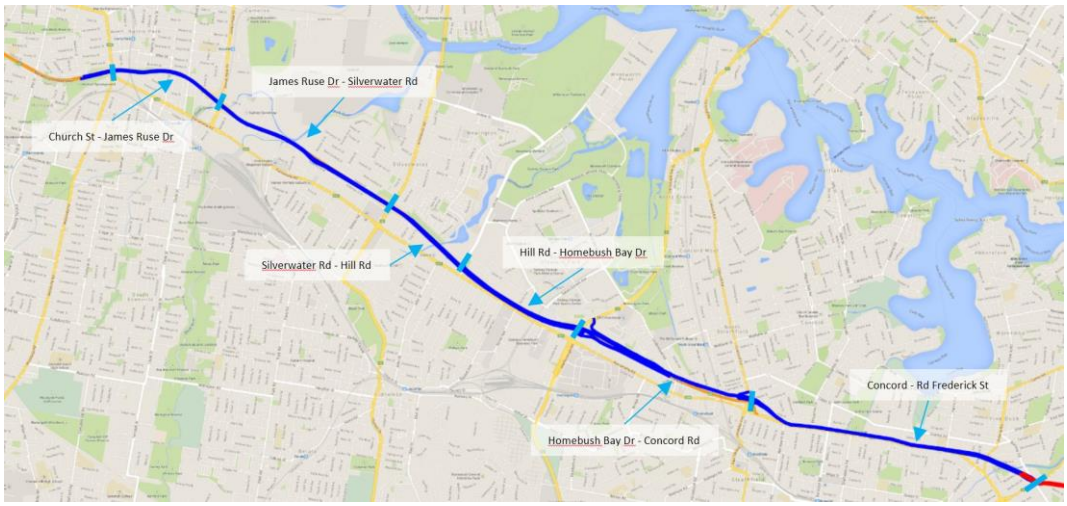


FIGURE 31 WESTCONNEX STAGE 3 ALIGNMENT AND TOLLED SECTIONS

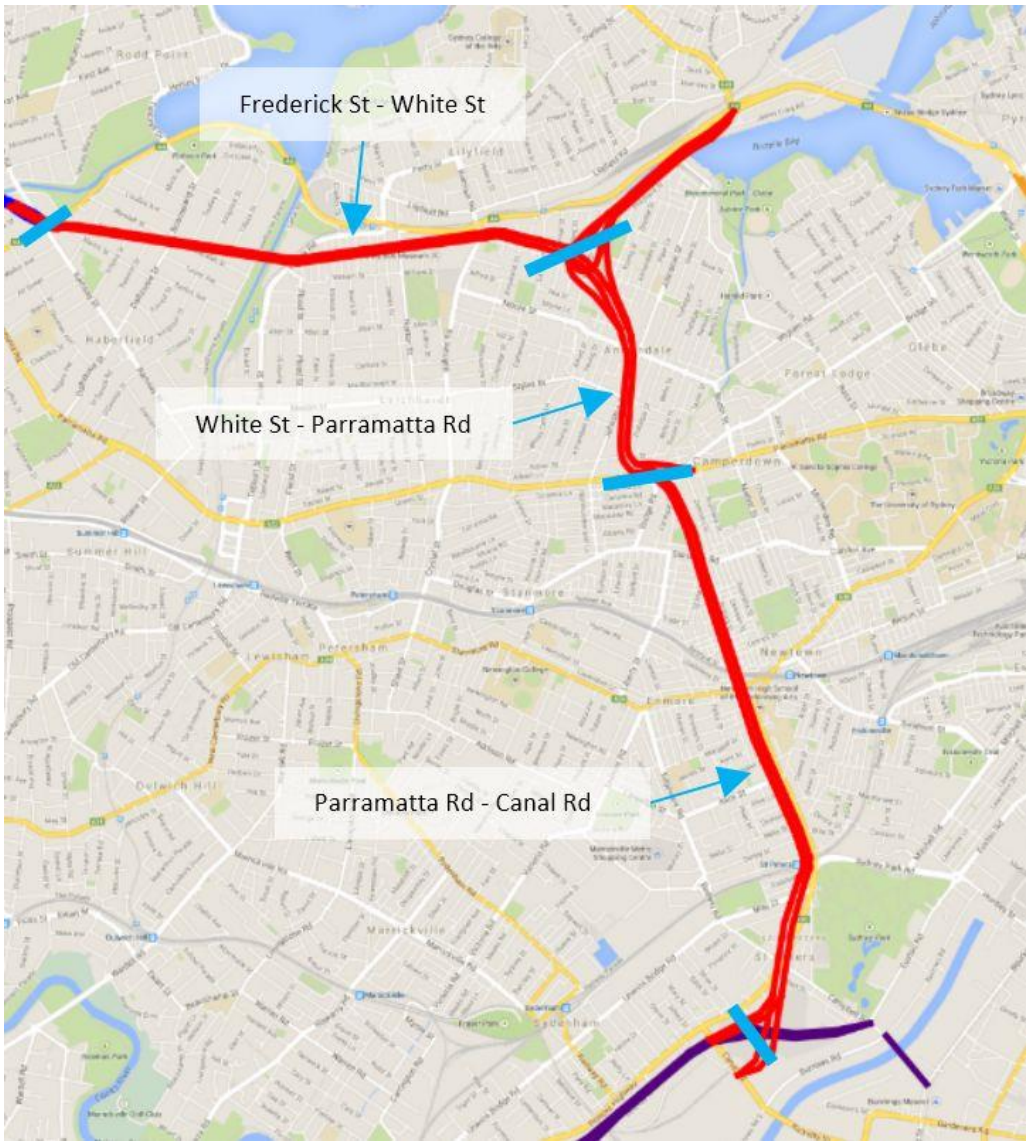
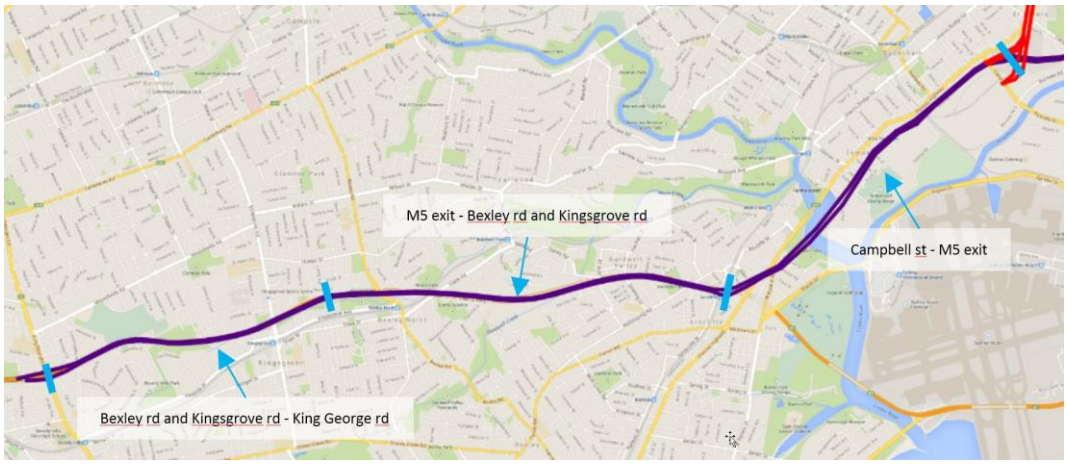


FIGURE 32 WESTCONNEX STAGE 2 ALIGNMENT AND TOLLED SECTIONS



Contact us

CANBERRA

Level 6, 39 London Circuit
Canberra ACT 2601

+61 2 6263 5940
sgsact@sgsep.com.au

HOBART

Unit 2, 5 King Street
Bellerive TAS 7018

+61 (0)439 941 934
sgstas@sgsep.com.au

MELBOURNE

Level 5, 171 La Trobe Street
Melbourne VIC 3000

+61 3 8616 0331
sgsvic@sgsep.com.au

SYDNEY

209/50 Holt Street
Surry Hills NSW 2010

+61 2 8307 0121
sgsnsw@sgsep.com.au

SGS Economics & Planning